

Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan



June 2024

RDP-MU35 PHCC Region

Milestone 3b



We acknowledge the Noongar people as Traditional Custodians of this land and pay our respects to all Elders past and present

This report is to be referenced as:

PHCC (2024) *Biodiversity and Agricultural Natural Capital Emergency Preparedness and Response Plan 2024*

Document History

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Abbreviations

BCoE	Bushfire Centre of Excellence
BGPA	Botanic Gardens and Parks Authority (includes Kings Park)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DFES	Department of Fire and Emergency Services
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
KWRC	Kanyana Wildlife Rehabilitation Centre
LEMC	Local Emergency Management Committee
LGA	Local Government Authority
PBFD	Psittacine Beak and Feather Disease
PEC	Priority Ecological Community
PHBG	Peel-Harvey Biosecurity Group
PHCC	Peel-Harvey Catchment Council
PMC	Peel Marsupial Care
NHT	National Heritage Trust
MNES	Matters of National Environmental Significance
MWR	Mandurah Wildlife Rehabilitation
NR	Nature Reserve
NRM	National Resource Management
SEMC	State Emergency Management Committee
SES	State Emergency Services
T&P	Threatened and Priority
TEC	Threatened Ecological Community
WA	Western Australia
WASR	Western Australian Seabird Rescue
WRP	Western Ringtail Possum

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1 Background

At global, national and local scales, there is a need to enhance preparedness and response to natural disasters, including their impact on biodiversity and agricultural natural capital assets. Disaster scenarios are expected to increase as temperatures increase, rainfall becomes more variable, and the frequency and intensity of extreme events increase under a changing climate. There are many examples across the globe and nationally where preparedness and response to disasters was either insufficient, too slow or ill-informed, leading to a greater loss of biodiversity assets and inability to mitigate the full impact of natural disasters. One such example includes the Black Summer fires of 2019/20 in eastern Australia, which significantly impacted natural values on an unprecedented scale, including nationally important Koala populations. Thousands of animals, birds, reptiles and invertebrates were lost directly in the fires, and in days to months following – enhanced preparedness may have reduced this impact.

Ensuring the survival of species, places and systems helps to preserve key ecosystems services which profoundly affect human well-being. Disaster preparedness bolsters the resilience of ecosystems, enabling them to recover and persist following catastrophic events. Preparation and response contribute to stronger regional economies through sectors such as tourism and agriculture.

PHCC is committed to developing and incorporating an Emergency Preparedness Response Plan (herein referred to as the ‘Plan’ or ‘EPRP’), so that we can improve how we prepare and respond to natural disasters to minimise impacts, in an aim to prevent similar declines from natural disasters.

The Plan is built on the lessons learned during historical disasters, including the 2019-20 Black Summer bushfires and, more locally, the 2016 Yarloop Fires that burnt 69,000 ha, destroyed more than 160 farms and homes, and resulted in the loss of life. The Yarloop fires seriously impacted biodiversity assets, landholders and their agricultural assets. Today, the legacy of this event is still evident, and PHCC has been actively involved in post-fire recovery and response with these landholders since 2016. Insights from this devastating event, and other local disasters, are woven into this Plan. It also draws from PHCC’s regional planning documents such as Natural Asset Prioritisation, Bindjareb Boodja Landscapes: A Strategy for Natural Resource Management in the Peel-Harvey Region, Western Australia and Plans developed for the Regional Land Partnerships Program. Other recent disasters that have occurred outside of the Catchment (i.e., Polyphagous shot-hole borer: recorded for the first time in east Fremantle in August 2021 with now hundreds of trees infected or dead; Avian influenza) are considered in the Plan.

The Plan aligns with and contributes to actions embedded within the Threatened Species Action Plan 2022-32 (DCCEE 2022) and the initiatives and outcomes of the Natural Heritage Trust (NHT), by addressing vulnerability from climate change and extreme weather events in biodiversity and high value agricultural assets. The Plan also aligns with other key documents, initiatives and actions, including:

- Western Australia’s Climate Adaptation Strategy (DWER 2022)
- DAFF’s Climate-Smart Agriculture Program to build resilience to climate change in the agricultural sector (DAFF 2024)
- Biodiversity and Environmental Strategies for local and surrounding areas (e.g., City of Mandurah 2024)
- Australian Government Biosecurity and Agricultural Response Plan – AUSBIOAGPLAN (DAFF 2022)
- DBCA Corporate Policy Statement No. 26 Climate Action August 2023
- DBCA Regional Conservation Plans (unpublished)
- The Forest Management Plan 2024-2033 (DBCA)
- Native Vegetation Policy for Western Australia (DWER 2022)

- Wheatbelt Region Drought Resilience Plan (2024 in prep) Wheatbelt Development Commission and Department of Primary Industries and Regional Development
- State Support Plan – Animal Welfare in Emergencies (2024 in prep) DFES (State EM Policy Branch) and
- State Hazard Plan – Fire (under review 2024, DFES).

2 Objectives of this Plan

The objectives of this Plan are to improve preparedness for, and response to, emergency events, through better integration of biodiversity and agricultural natural capital assets in emergency planning and response. This in turn is aimed to minimise impacts on biodiversity and agricultural assets. This includes efforts to enhance the resilience of biodiversity and agricultural assets by recognising the risks and threats posed by natural disasters and undertaking planning to improve outcomes through actions and management before, during (to the extent possible) and after events, to support recovery.

3 Scope

The scope of the Plan is limited to the boundaries of the Peel-Harvey surface water catchment (the “Catchment”) and includes identification of disaster scenarios, disaster susceptibility, preparedness actions and responsibilities but, unless already funded or underway elsewhere, not their implementation. It does not include all emergency preparedness and response actions that individual landholders are responsible for (e.g. cleaning gutters and drains to prepare for the bushfire season) and instead focuses on broad actions to reduce risk to the asset/s. More specific information about how individual landholders can prepare for and respond to emergencies is provided on the DFES website: <https://www.dfes.wa.gov.au/hazard-information/>.

The majority of the Catchment is rated as having low capacity for disaster resilience ([Disaster Resilience Index \(bnhcrc.com.au\)](https://bnhcrc.com.au)) and there is a growing need to enhance community preparedness for natural disasters. These communities are associated with a governance environment that may be limited by the capacity of organisations to adaptively learn, transform and adjust to complex change, including that related to natural hazards. These communities may not have the benefit of research organisation presence and innovative commercial firms and levels of local economic development support may be limited. (Australian Institute for Disaster Resilience - [Disaster Risk Reduction Collection | Knowledge Hub \(aidr.org.au\)](https://aidr.org.au)).

This EPRP relates to hazards and emergency management arrangements in the Catchment and identifies public authorities and other organisations/groups with roles and responsibilities under these. This EPRP is consistent with the *Emergency Management Act 2005* (WA) Act, *Emergency Management Regulations 2006* (WA) and the State Emergency Management Policy, as well as emergency management plans developed by local councils and organisations.

PHCC recognise the challenges in narrowing a list of biodiversity assets when the Catchment is large and within a global biodiversity hotspot. A prioritisation approach that considered Matters of National Environmental Significance (MNES) assisted with asset identification and listing, however, this approach was limited by the data that was publicly available. For example, there has been limited survey effort and limited publicly available data for the Jarrah Forest, waterways and Indigenous Heritage sites that are not yet formally registered. Determining the emergency preparedness and response actions for these three important assets with limited MNES data available, is outside the scope of this Plan, despite their biodiversity and Indigenous significance. This is discussed further in Section 5.

4 Role of RDP in Emergency Preparedness and Response

To understand PHCC's role in emergency preparedness and response, it is important to initially consider the overarching State Emergency Management legislative and policy framework, which consists of:

- State Emergency Management Legislation (i.e. Emergency Management Act 2005 (WA) Act, Emergency Management Regulations 2006 (WA)),
- State Emergency Management Policy and Plan (Statutory),
- State Hazard and Support Plans (Statutory),
- State EM Procedures and Guidelines (Procedural and Information).

The State Emergency Management Plan (SEMC 2021) is the strategic framework for emergency management in Western Australia and clearly sets out the hazard management structure and describes the relationship between emergency management agencies, although these agencies are limited to hazard management and combat agencies and support organisations (Figure 1).

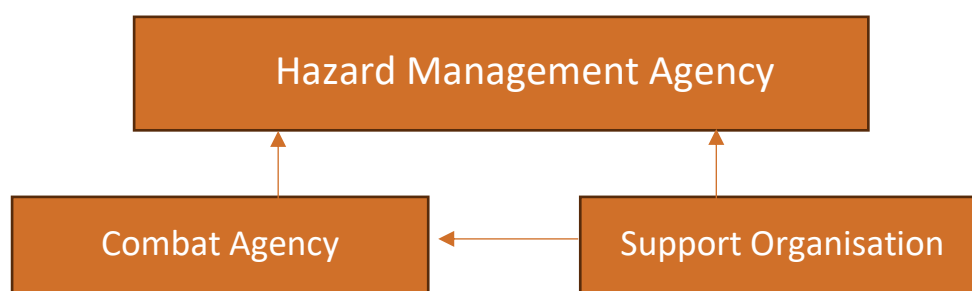


Figure 1: Hazard Management Structure

PHCC is not designated within this framework, however, as the Regional Delivery Partner for the Region, PHCC aims to continue to work with local governments, DBCA, DFES, DPIRD, DWER, DAFF and similar to ensure key biodiversity and agricultural assets within the Catchment are identified, with actions outlined that will help to protect or recover these assets from disasters.

With more than two decades of experience working with biodiversity and agricultural assets in the Catchment, PHCC has extensive environmental knowledge and networks that will enable PHCC to assist with the protection of assets through on-ground works and community engagement activities. Through the review and development of PHCC's NRM Plan (*Bindjareb Boodja Landscapes*; PHCC 2024), PHCC has ensured that our stakeholder's priorities have been considered and where appropriate, align with those of the Australian Government. Where resources allow, PHCC will continue to work with communities to ensure there is education and awareness-raising around emergency preparedness and capacity to provide support for on-ground recovery actions.

Although PHCC's role in supporting emergency preparedness and response in our management unit is limited by resourcing, PHCC have several important RLP projects with resources to draw from, including projects to protect and restore the Peel-Yalgorup Ramsar System, Banksia and Tuart Woodland, Numbat's and Black Cockatoo's.

PHCC staff are trained, knowledgeable and skilled in understanding NRM issues throughout the Catchment. PHCC are able to rapidly assemble these skills and experience of the organisation before, during and after natural emergencies. Refer Appendix 2 for example, "Farm Planning in a Fire Prone Landscape".

5 Identification of Management Unit Assets and Susceptibility

The Catchment covers an area over 10,000 square kilometres, with diverse ecosystems, land use and stakeholders. There are well over five hundred environmental assets and hundreds of agricultural assets within the Catchment, therefore, it was necessary to condense the asset list to better manage the task within the timeframes provided. To identify and prioritise environmental and agricultural assets, as well as their susceptibility to a range of disasters, PHCC draws from decades of experience working in our Catchment and a range of spatial data and reports.

Datasets related to MNES were used to prioritise assets including formally registered Aboriginal Heritage. It does not include sites that are not formally registered, and it is acknowledged this is a limitation to the Plan. There is a great need for improved identification and mapping of important Indigenous sites in the Catchment. Mandjoogoordap, meaning ‘meeting place of the heart’, is the original name of Mandurah given by First Nations People. The Bindjareb Noongar people have managed the estuary or Djilba for over 50,000 years and their Dreamtime stories demonstrate their extended connection to country. Most waterbodies, rivers and woodlands would have been, and continue to be, significant to Indigenous People. Sites with low or no Aboriginal Heritage values (e.g. Lake Mealup in Table 1) mean there are no formally registered sites within the asset and does not indicate actual significance to First Nations People. Instead, low/no Aboriginal Heritage scores is likely more indicative of the need for more cultural heritage surveys within the asset.

The Catchment includes ~350,000ha of native forest as part of the Jarrah Forest Bioregion, and Northern Jarrah Forest Subregion, some of which is recognised as old growth forest. The Jarrah Forest Bioregion provides refugia for thousands of species, with hollow-bearing trees providing suitable habitat for three endemic southwest species of black cockatoo. The Northern Jarrah Forest and waterways within it are important for a multitude of reasons, being incredibly biodiverse, globally unique and high social and cultural value. Despite its significance, the Jarrah Forest has not been included in this Plan due to lack of data to effectively prioritise the site. E.g., there are few TECs and threatened flora recorded within the Jarrah Forest, but this is due to low survey effort or data not being publicly available. The Jarrah Forest has been subject to extensive disturbance including mining and logging for > 200 years, and it is at risk from further clearing and degradation from mining, impacts from invasive species, disease, and climate change including reduced rainfall and increased fire intensity and frequency. These factors make the Jarrah Forest highly susceptible to emergency scenarios, particularly bushfire, heatwave/drought and disease, such as Myrtle Rust.

As there is limited MNES data available for the Jarrah Forest, waterways and unregistered Indigenous Heritage sites, emergency preparedness and response actions for these assets have not been presented in this Plan despite their biodiversity and Indigenous significance.

5.1 Identification of Biodiversity and Environmental Assets

The priority assets included in the Plan was informed by strategic Natural Resource Management Plans including, but not limited to, *Bindjareb Boodja Landscapes* (PHCC 2024) and Biodiversity and Environmental Strategies for local and surrounding areas (e.g. City of Mandurah 2024). The identification of priority assets was also informed by stakeholders that assisted with Plan development.

While there are many hundreds of species in the Catchment that are listed as threatened or priority (examples are shown in Figure 2 below), the list has been narrowed to include only the species known to occur at sites with many Matters of National Environmental Significance (MNES). Biodiversity assets were identified and prioritised by MNES under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), with biodiversity values determined using the following spatial datasets (references for these datasets are provided in Section 13):

- TECs/PECs (number and area)
- Threatened and priority flora and fauna
- Indigenous and National Heritage
- Migratory Species Habitat (includes shorebirds)
- Regional southwest Ecological Linkages/Corridors (Molloy et al. 2009): No. of linkages that intersect site
- Ramsar Wetlands
- Black Cockatoo Breeding Sites with 12km buffer around known breeding sites
- Sites of Historical Investment (includes previous works supported by PHCC and DBCA)

Most of the above datasets are publicly available, except for Black Cockatoo Breeding Sites, Sites of Historical Investment and Predictive Climate Modelling. References for spatial data above are provided in Section 13.

PHCC's prioritisation approach provides a robust and quantifiable means to assess environmental and ecological values. The result of this prioritisation assessment is provided in Table 1, which identifies sites of highest environmental values, or sites with greatest numbers of MNES intersecting or adjacent to the site. The output from this spatial analysis supports findings from historical on-ground works at each of the sites.

The top environmental assets are listed below (Table 1), as well as the MNES associated to each asset. Only the MNES that are *known* to occur within each of the biodiversity asset is presented in Plan.

Table 1: Sites in the Catchment with high biodiversity and MNES values. References and datasets used to ascertain MNES values are provided in Section 13.

Asset Name	No. of TECs/ PECs	TEC/PEC area (Ha)	WA T&P Herbs	T&P Flora	T&P Fauna	Migratory Species	Black Cocky Breeding/ Roosting	Ecological Linkages	Ramsar	No. of investments
Dryandra Woodland NP	1	18,041	86	8	20	6	1	8	0	286
Lake Mealup	1	24	0	0	3	31	0	1	1	31
Lake McLarty	1	5	3	0	32	52	0	1	1	87
Austin Lakes & Robert Bay	5	308	25	18	11	54	0	1	1	21
Geogrup and Black Lakes	2	117	4	1	11	32	0	3	1	4
Thrombolites Lake Clifton	2	597	0	1	8	29	0	1	1	55
Nine Mile NR	1	209	0	3	1	10	0	1	0	19
Lowlands NR	2	1044	11	13	5	9	1	1	0	53
Treasure Block	3	1147	0	3	4	27	10	4	0	20
Kooljerranup NR	5	625	20	21	5	52	0	1	1	36
Yalgorup Lakes System	4	2243	53	17	22	68	2	7	1	83
Marlee Reserve	4	36	0	0	5	16	7	1	1	12



Figure 2: Examples of biodiversity and natural assets, top left clockwise, numbat in Dryandra Woodland National Park, Firewood Banksia flowering in Banksia Woodlands TEC and great egret within the Ramsar site (photos K.Bettink).

5.2 Identification and Summary of Agricultural Assets

There are two broad agricultural areas in the Catchment:

- the Hotham-Williams in the Wheatbelt region and
- the Swan Coastal Plain, including the Harvey Water and Myalup Irrigation areas (Figures 3 and 4).

Hotham-Williams Area

The sub-catchments of the Hotham and Williams rivers are one of the two main agricultural ‘powerhouses’ of the Region, and include the districts of Boddington, Wandering, Williams and Cuballing. Together, these areas form the highest and geologically oldest part of the Region. They are characterised by rolling hills, steepest close to the jarrah forest, and becoming more gentle to flat towards the top of the catchments.

Most of the area is zoned for rural land use, comprising 76% or 435,086 ha in total. Areas are currently and planned for mining extraction (including the Newmont Boddington Goldmine and South32 Worsley Alumina operations at Boddington, Quindanning and Marradong), although 36% of the area is within granted mining tenements. The Hotham-William area includes the productive Wheatbelt zone, which generates approximately \$129 million annually in agricultural production.

Approximately 33% of the subregion is vegetated, with the largest areas of native vegetation being Dryandra Woodland National Park and areas of forest in the west. Dryandra Woodland is one of the most important sites identified in the MNES assessment (Table 1) due to the high number of threatened and priority fauna and historical investment.

Harvey Water Irrigation Area (Swan Coastal Plain)

The Swan Coastal Plain is largely held in freehold ownership and used for broadscale and intensive agriculture, rural residential estates, equestrian estates and residential areas. Agriculture is a significant part of the social and economic fabric and is worth at least \$195.4 million p.a. and includes beef grazing, dairy, poultry, vegetable growing and hay production (PHCC 2024). Within the Swan Coastal Plain the Harvey Water and Myalup Irrigation areas stretch from Waroona in the north to Dardanup in the south and includes the following key water assets, which Harvey Water is licenced to draw water from; Wellington Dam, Drakesbrook Weir, Waroona Dam, Logue Brook, Harvey Dam and the Wokalup Pipe-head (Figure 4). Only the Waroona, Yarloop and Harvey areas occur within the Catchment, hence these areas are included in the identification and prioritisation of agricultural assets. The Harvey Water Irrigation Area includes broad, flat areas of wetland with farms and mixed land use that is undergoing significant change from urban development and resource extraction.



Figure 3: Examples of agriculture assets, top shows landholders attending a pasture demonstration field day and base, showing cattle in the Harvey Water Irrigation Area (photos: PHCC).

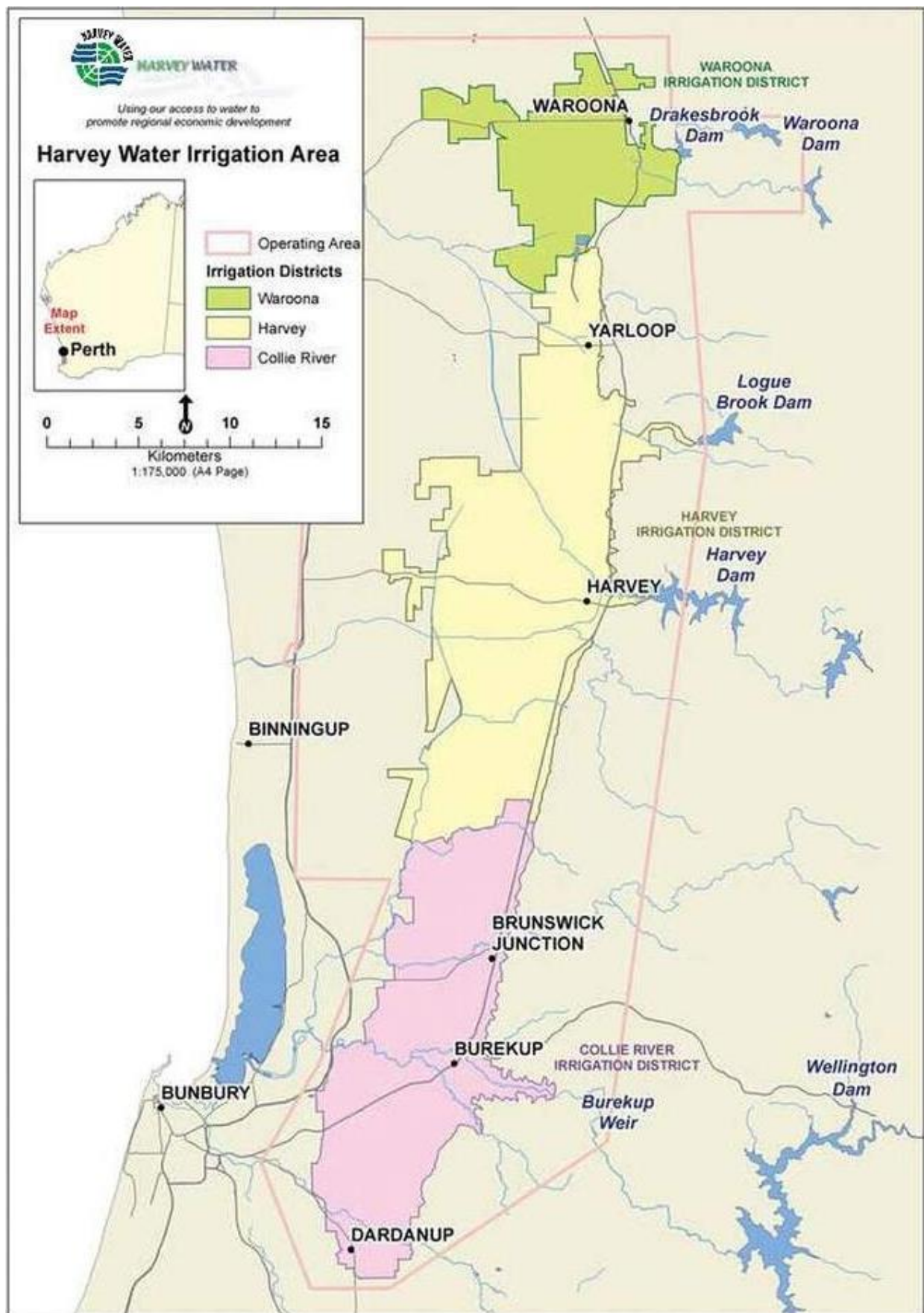


Figure 4: The Harvey Water Irrigation Area. Irrigation districts Waroona and Harvey occur within the Catchment (Source - <https://www.harveywater.com.au/location-map.html>).

Water for the Harvey Water Irrigation Area is sourced from local dams through a licensing agreement with the Department of Water and Environmental Regulation and delivered through gravity flow in a network of channels and pipes to the Harvey and Waroona (and Collie River) districts. The Harvey Water Irrigation Area is approximately 400 km² in area and has around 100 km² under permanent irrigation for dairy farming, beef grazing, and to a lesser extent, horticulture.

Supplying water to this 112,000 hectare footprint produces significant regional economic benefits, generating \$100 million gross value annually from agriculture and horticulture. Harvey Water's 716 irrigator members and 309 non-member customers receive a sustainable and efficient water supply for agriculture, industrial, mining, construction, hobby farming, garden, fire attenuation and community use (Harvey Water 2021). Protecting these agricultural areas, and the interconnected gravity fed pipes and channel systems, will be increasingly important under climate change as local agricultural industries become increasingly dependent on the Harvey Water Irrigation System.

Prioritisation of agricultural sites

The agricultural properties within the Hotham-Williams and Harvey Water Irrigation Districts span vast areas and landscapes. To reduce these areas into more manageable units in terms of emergency preparedness and response, PHCC include the following attributes and datasets to assist with further prioritisation of agricultural sites (most of this data is sourced from data.wa.gov.au):

- Potentially arable land: Potentially Arable Land (DPIRD-026)
- Agricultural capability layers, e.g. dryland cropping or grazing: Land Capability - Grazing (DPIRD-032)
- Agricultural Areas (LGATE-228)

5.3 Identification of Emergency Scenarios

The Plan considers the most likely disaster scenarios for biodiversity and agricultural assets in the Catchment.

To determine the most likely disaster scenario for the Catchment, PHCC reviewed the historical disasters listed on the Disaster Assist website (<https://www.disasterassist.gov.au/>) and interviewed local landholders, relevant agencies and other organisations about historical disasters that have impacted environmental and agriculture assets. The disaster scenarios for the Peel-Harvey Region are a subset of the 28 hazards listed by the State Emergency Management Committee (Figure 5), and include bushfire, drought, floods, heatwaves, cyclones/severe storms and diseases.

In recognition of the susceptibility of the Wheatbelt region to drought, particularly after the extended drought of the first half of 2024, the Wheatbelt Development Commission, with DPIRD, are developing a Wheatbelt Region Drought Resilience Plan. This plan focuses on resilience in key areas including water, agricultural systems and landscapes.

The Plan does not include disaster scenarios that are highly unlikely for the Catchment, such as radiation escape and space re-entry debris. The most likely disaster scenarios for the Catchment include all historical disasters that have occurred in WA and reported on the Australian Disaster Resilience Knowledge Hub (<https://knowledge.aidr.org.au/disasters/>). State Risk Profile Fact Sheets (SEMC 2023) were used to determine the most likely hazard scenarios for WA. Although drought is not listed as a hazard by SEMC, drought is a significant risk for bushland areas in southwestern WA and has therefore been included in the list of hazards.




























 Air crash	 Gas supply disruption	 Marine search
 Animal or plant pests or diseases	 HAZMAT: release of chemical, radiological or other hazardous materials capable of causing harm to persons, property, or the environment	 Marine transport emergency
 Biological substance: release of biological substance capable of causing harm to persons, property, or the environment		 Radiation escape from a nuclear-powered warship
 Collapse	 Heatwave	 Rail crash
 Cyclone	 Hostile act	 Road crash
 Earthquake	 Human epidemic	 Space re-entry debris
 Electricity supply disruption	 Land search	 Storm
 Fire	 Liquid fuel supply disruption	 Terrorist act
 Flood	 Marine oil pollution:	 Tsunami

Figure 5: The 28 prescribes hazards in Western Australia (SEMC 2023).

Drawing on the above points (5.1 – 5.3), along with any other relevant information and data, an assessment of the individual assets' current susceptibility (e.g. high, moderate, low) to the emergency scenario/s and why is provided in Tables 2a and 2b. An asset already facing many threats that is difficult to protect from an emergency scenario is considered more susceptible than an asset that has fewer threats and is easier to protect.

5.4 Threatened Flora and Ecological Communities

There are several Threatened Ecological Communities (TECs) and hundreds of threatened flora within the Catchment. Within the assets listed in Table 1, there are at least 10 TECs, including:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain - Critically Endangered (EPBC Act). Located at Nine Mile NR, Austin Bay and Roberts Bay, Goegrup and Black Lakes, Kooljerrenup NR, Lake McLarty, Lake Mealup, Lowlands NR, Marlee Reserve, Treasure Block and Yalgorup Lakes.
- Banksia Woodlands of the Swan Coastal Plain ecological community - Endangered. (EPBC Act) Often occurs alongside Tuart Woodlands at the sites mentioned above.
- Clay Pans of the Swan Coastal Plain – Critically Endangered (EPBC Act). Small and scattered distribution. Occurs at Austin Bay, Roberts Bay, and Kooljerrenup NR.
- Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion – Critically Endangered (EPBC Act). Occurs at Austin Bay and Roberts Bay, Goegrup and Black Lakes, Lake McLarty, Lake Mealup, Thrombolites, Treasure Block and Yalgorup Lakes.
- Subtropical and Temperate Coastal Saltmarsh – Vulnerable (EPBC Act) Occurs at Austin Bay and Roberts Bay, Kooljerrenup NR and Lake McLarty.
- Eucalypt Woodlands of the Western Australian Wheatbelt – Critically Endangered (EPBC Act)
- Empodisma peatlands of southwestern Australia – Endangered (EPBC Act) Occurs at Lowlands NR, Marlee Reserve and Yalgorup Lakes.
- Thrombolite (microbialite) Community of a Coastal Brackish Lake – Critically Endangered (EPBC Act). Occurs at the thrombolites site at Lake Clifton and Yalgorup Lakes.
- Sedgeland in Holocene dune swales of the southern Swan Coastal Plain – Endangered (EPBC Act). Occurs at Yalgorup Lakes.
- Mount Saddleback Heath Communities – P1 (Biodiversity Conservation Act WA 2016). Only found in the Jarrah Forest.

Regarding threatened flora, there are several rare orchids and *Synaphea* occurring in scattered populations of low numbers, including:

- Three species of *Diuris*, including *D. drummondii* (Tall Donkey Orchid), *D. micrantha* (Dwarf Bee-orchid) and *D. purdiei* (Purdie's Donkey Orchid). Located at Austin Bay and Roberts Bay, Goegrup and Black Lakes, Yalgorup Lakes, Kooljerrenup NR and Lake McLarty.
- Two *Drakaea* species: *D. elastica* (Glossy-leafed Hammer Orchid) and *D. micrantha* (Dwarf Hammer-orchid), recorded at Austin Bay and Roberts Bay, Nine Mile NR, Goegrup and Black Lakes, Lowlands NR and Marlee Reserve,
- *Caledonia huegelii*, or Grand Spider Orchid. Occurs at Nine Mile NR, Kooljerrenup NR, Lowlands NR and Marlee Reserve.
- Two species of *Synaphea*, including *S. stenoloba* (found at Dryandra) and *Synaphea* sp. *Fairbridge Farm* (D.Papenfus 696) (at Kooljerrenup NR).

Eucalyptus argutifolia, or Yanchep Mallee, is listed as vulnerable and occurs at the thrombolites site and the Yalgorup Lakes.

The emergency scenarios and susceptibility of all Threatened flora and ecological communities listed above is provided in Table 2a, except for Empodisma peatlands of southwestern Australia as it may occur around Yalgorup Lakes, Lowlands and Marlee Reserve but is not yet formally identified or mapped. Mount

Saddleback Heath Communities are also excluded from Table 2a as this is a Priority 1 community restricted to the Jarrah Forest.

Table 2a: Emergency Scenarios and susceptibility of biodiversity assets (threatened flora and ecological communities).

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
All orchids in the Peel-Harvey Catchment. Includes the following species: <i>Caladenia huegelii</i> <i>Diuris micrantha</i> <i>Diuris purdiei</i> <i>Diuris drummondii</i> <i>Drakaea elastica</i> <i>Drakaea micrantha</i> These species are recorded at Nine Mile NR, Kooljerrenup NR, Lowlands NR, Marlee Reserve, Austin Bay and Roberts Bay, Goegrup and Black Lakes, Yalgorup Lakes,	Bushfire	Fire that occurs during May to Dec can impact survival and reproduction. Australian orchids do not produce a seed bank, so are reliant on re-sprouting post fire. Susceptibility to severe bushfire is unknown.	High	Inappropriate fire regimes impact orchid reproduction, especially if it occurs during flower (summer). These species are already facing many threats from land clearing, pests and weeds.
	Flood	Prolonged flooding can impact survival and the reproductive cycle. Small populations are known to be susceptible to stochastic events, and less likely to recover post event.	Medium	Flooding is unlikely during flowering periods and on sandy soils. Population is disjunct and low in numbers. Species already face many threats.
	Heatwave/ Drought	Prolonged drought can impact survival and reproduction, through reduced flowering and pollination. Terrestrial orchids are reliant on Autumn and Winter rain for seedling recruitment. Small populations are known to be susceptible to stochastic events, and less likely to recover post drought event.	High	Low individual numbers and a disjunct population mean recovery is unlikely without intervention. Lower number of flowering plants with low rainfall.
	Pests and Disease	<i>Phytophthora cinnamomi</i> can severely impact Woodlands where orchids occur, reducing suitable habitat.	Medium	Although orchids are not highly susceptible to Phytophthora, the habitat they occur in is highly susceptible.
<i>Synaphea stenoloba</i> (Dryandra) and <i>Synaphea</i> sp. Fairbridge Farm (Kooljerrenup NR)	Bushfire	<i>Synaphea</i> sp. are known to resprout after fire, but inappropriate regimes can impact regeneration.	High	Bushfires are expected to increase in frequency and intensity under climate change. Has a restricted range and very low population numbers.
	Flood	<i>Synaphea</i> deteriorate following flooding, with long time changes in flooding regimes likely to impact population viability.	Low	Flooding is unlikely on the sandy soils they occur on.
	Heatwave/ Drought	Stress from prolonged drought can impact on flowering and propagation. Prolonged drought can cause local extinctions.	Medium	Species have low seed set and seed viability. Drought impedes seed production further.
	Pests and Disease	Insect galling of fruit and flowers is common and may affect the species' ability to reproduce. Species are also susceptible to	Medium	Species is already impacted by weeds and pests, particularly grazing from rabbits. Has relatively high tolerance to

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
		insect scale. Mildly susceptible to <i>Phytophthora cinnamomi</i> .		dieback disease from <i>P. cinnamomi</i> (DBCA 2018).
<i>Eucalyptus argutifolia</i> (Yalgorup Lakes and Thrombolites area)	Bushfire	The Yanchep Mallee is relatively tolerant of fire as it is known to coppice from root stock after fire. While fire resistant, the species is not immune to fire devastation (DEWHA 2008).	High	Vegetative resprouting occurs following fire. Lack of fire management may have detrimental impact on the species due to its small population size and clustered distribution.
	Flood	A flood has the potential to exacerbate erosion in the reserve and reduce availability of habitat and food resources, and displace species who are not well adapted to waterlogged, aquatic or semi-aquatic conditions.	Low	Unlikely to occur given the sandy soils, although species health may deteriorate post flood.
	Heatwave/ Drought	Eucalypts are relatively drought tolerant with large tap roots, however, the current drought has resulted in significant tree death and decline in overstorey species in the area.	High	Yanchep Mallee grows on slopes or gullies close to the summits of limestone ridges, where soils are shallow and well drained, which can exacerbate the impact of drought.
	Pests/Disease	Implement the management plan for the control and eradication of feral goats. <i>Phytophthora cinnamomi</i> causing dieback.	Medium	Susceptibility to dieback is unknown for this species, but other Eucalypts are susceptible.
Banksia Woodland TEC and Tuart Woodland TEC	Bushfire	A bushfire has the potential to destroy the habitat of these TECs and damage soil and water quality. Post event, there would be an increased risk of weeds and invasive species, erosion, spreading contaminants and overall loss of biodiversity and ecosystem function.	High	These TECs are highly susceptible to bushfire. There are limited natural barriers (e.g. rivers or rocky outcrops), there is a significant amount of accumulated fuel and there has been limited controlled burns in the area for the last several years.
	Flood	A flood has the potential to exacerbate erosion and sedimentation in the TEC, destroy habitat and displace species who are not well adapted to aquatic or semi-aquatic conditions.	Low	These TECs are less susceptible to flood, due to sandy soils they occur on. Many of the plants in Banksia and Tuart TEC are somewhat flood resistant.
	Heatwave/ Drought	Many overstorey species are groundwater dependent and extended drought that reduces groundwater levels can quickly kill overstorey species. This increases fuel load and fire risk, weeds and pests, reduces	High	Most overstorey species are groundwater dependent and cannot tolerate extensive periods of drought. Drought reduces groundwater level, leading to widespread death of the mid-overstorey species

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
		biodiversity and ecosystem function.		including Jarrah, Banksia and Sheoak. Asset is already fragmented. Drought increases weeds.
	Pests and Disease	Plant diseases and pests, including <i>Phytophthora cinnamomi</i> , Myrtle rust and Polyphagous shot-hole borer have the potential to kill tree species and decimate Woodlands and ecosystem function.	High	Many species common to these TECs are considered indicator species for Phytophthora dieback, as they are highly sensitive to the plant disease. The disease is already widespread and rapidly spread through soil disturbance.
Clay Pans of the Swan Coastal Plain	Bushfire	Fire in Clay Pans should be very infrequent (min 15-20 years, DPAW 2017a). Presence of weeds increases fire risk. Fire is not part of the ecology of this wetland community.	Medium	Generally inundated for half of the year. Some species do not recover after fire (i.e., <i>Pericalymma ellipticum</i>). Fire exacerbates impacts from climate change.
	Flood	Although Clay Pans are temporarily inundated during winter, excessive flooding may alter plant communities.	Low	Increased depth or period of inundation may cause salt accumulation near the surface, which also increases weeds.
	Heatwave/ Drought	Clay Pans are vulnerable to drought as they rely on filling and drying at appropriate times each year. Hydrological changes will impact plant composition.	High	Altered hydrology and increasing salinity is reducing resilience to drought. Many weeds and pests (pigs). Claypans threatened by illegal access and rubbish dumping.
	Pests and Disease	Phytophthora disease particularly affects Proteaceae and Myrtaceae families that are floristically and structurally dominant in some areas of the clay pan communities. Pig control is essential at Clay Pan sites.	Medium	Not all species are susceptible (woody species are but monocotyledons generally have low susceptibility). Water logging can increase disease growth and spread.
Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	Bushfire	Population occurs in the area burnt by the 2019 and 2022 bushfires. Sustained frequent burns are detrimental (DBCA 2022).	High	Community is under threat from too frequent fires, exacerbating other threats. Shallow soils can lead to hotter fires.
	Flood	Excessive flooding causes erosion and can alter plant communities.	Low	Flooding is unlikely given the community occurs
	Heatwave/ Drought	Drying climate leads to hotter fires, intensifies threats and degrade the community. Drought frequency is expected to increase.	High	More frequent drought will make the community susceptible to other threats. Skeletal soils exacerbate impacts from drought.

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
	Pests and Disease	Community is not sensitive to Phytophthora, but may be sensitive to Myrtle rust and Armillaria sp. While Polyphagous Shot-hole Borer has not been recorded in the community, some <i>Melaleuca</i> are susceptible (DCCEEW 2023).	Medium	Occurs on very well drained soils with few species susceptible to dieback. Other threats make the community vulnerable to disease & pests.
Subtropical and Temperate Coastal Saltmarsh	Bushfire	Coastal saltmarsh vegetation is not well fire-adapted and fire is lethal to many species. Invasive problem species (e.g. <i>Juncus</i> and <i>Baumea</i> sp.) may have highly flammable fuel loads.	Medium	Susceptibility is reduced as the community occurs in wet ecosystems, however, many species are not adapted to fire
	Flood	Can alter tidal restriction leading to habitat loss and invasive species.	Low	The community has many existing threats, particularly pests and weeds.
	Heatwave/ Drought	Heatwave and drought can directly affect vegetation and fauna through increased temperature and insufficient water in the environment. May affects aquatic and vegetation. Water temperature causes a wide range of antagonistic and synergistic effects on other environmental factors. Higher water temperature also increases the risk of invasive species.	High	Increased water temperature also produces other deleterious effects on water quality including stratification, reduced dissolved oxygen, increased biological and chemical oxygen demand, and reduced tolerance to other stressors such as toxins and pollutants. The community is already facing significant threats from weeds and pest
	Pollution	Pollution and litter from stormwater or dumping of waste can smother the community and introduce heavy metals or organic chemicals. Oil spills are a major potential threat.	Medium	Coastal saltmarsh is susceptible to excess nitrogen from land runoff, which can change species distribution, stimulate algal growth and encourage weeds.
	Storm	Severe storm events present severe threats to Coastal Saltmarsh, potentially resulting in landward retreat, transgression by mangroves, fragmentation and loss of habitat or function.	Medium	Storm frequency & severity expected to increase. Community occurs along coastal areas, with little protection from storm events.
	Pests and disease	Ecosystem prone to mosquitos, sandflies and mudflat invertebrates, which increases competition for resources and facilitated further introduction of parasites and disease.	Medium	System is already facing threats from feral animals (goats, pigs, deer, rabbits) and the predatory mosquito fish (<i>Gambusia holbrooki</i>). Soil acidification can increase fish and shellfish kills.
	Bushfire	The main concern for natural remnants in the wheatbelt is a lack of fire or too long intervals	High	System has several obligate seeder species that require fire to stimulate germination,

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
Eucalypt Woodlands of the Western Australian Wheatbelt		between fire events. Some wheatbelt Woodland tree species with smooth bark trees (Wandoo, Salmon gum) that can be killed by even low scorch fires (DoE 2015).		however, plants will be killed if fires occur before plant maturity and seed set.
		Altered fire regimes may induce a complete change in the type of vegetation, an example being the report by Hopkins and Robinson (1981) that a single fire converted eucalypt woodland into mallee heath, a situation that persisted for at least forty years.	High	Too frequent and intense fires will kill many plant species in this TEC.
	Flood	Community occurs on low lying riparian, floodplain or wetland systems, thus is prone to flooding. Flooding can displace native species and increase erosion.	Medium	Many tree species are tolerant of floods, although, flooding may increase salinity, which is exacerbated by the extensive fragmentation and degradation already experienced by the woodlands from clearing and other threats (DoE 2015).
	Heatwave/ Drought	Many overstorey species are groundwater dependent and extended drought that reduces groundwater levels can quickly kill overstorey species. This increases fuel load and fire risk, weeds and pests, reduces biodiversity and ecosystem function.	High	As above, the impact of drought is exacerbated by existing threats (weeds, pests, land clearing) and high soil salinity.
	Pests and Disease	Plant susceptibilities and dieback surveys indicate that dieback could impact the westernmost parts of the Wheatbelt Woodland area.	High	Several plant groups in this community are highly susceptible to Phytophthora dieback, including banksia family (Proteaceae), heath family (Epacridaceae) and pea family (Fabaceae). Jarrah are also susceptible. Disease is most prevalent in wet soils.
	Pollution	Nutrient enrichment of topsoils occurs through deposits of livestock dung within native vegetation remnants and adds to any nutrient enrichment problems that occur due to fertilisers	Medium	Many native species that occur within the community are sensitive to elevated soil nutrients caused by runoff from nearby artificial fertilisers applied to crops and pastures (DoE 2015).
Thrombolite (microbialite)	Bushfire	A bushfire in the fringing vegetation would result in	High	Lake Clifton already has reduced water inflow, and

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
Community of a Coastal Brackish Lake (Lake Clifton)		terrestrial ash and debris entering the waterway. This may cause physical and chemical impacts to thrombolites and water quality which will affect aquatic and littoral organisms.		water quality is impacted. Thrombolites may be sensitive to smothering from terrestrial ash and debris.
	Flood	Floods can cause inundation of low-lying areas and result in terrestrial sediment and debris entering the wetlands. This may cause physical damage to habitat and substrate through erosion and deposition and may introduce water quality stressors including suspended and dissolved solids, nutrients, pollutants, biological and chemical oxygen demand, and stratification in the water column. The lake is at high risk of acid sulfate soil disturbance.	Medium	Lake Clifton is already suffering lack of freshwater inflows and heavy flooding or storms is unlikely to cause long term impact. Poor water quality in the short to medium term is likely to cause cumulative impact to the biomass in the Lake system.
	Heatwave/ Drought	Can directly affect aquatic vegetation and fauna through increased temperature and insufficient water in the environment which affects aquatic fauna (mobility, feeding, predation, parasitism, metabolism, reproduction, hatching, mortality), thrombolite condition and vegetation (metabolism, reproduction, nutrient availability).	High	Increased water temperature also produces other deleterious effects on water quality including stratification, reduced dissolved oxygen, increased biological and chemical oxygen demand, and reduced tolerance to other stressors such as toxins and pollutants. Water temperature causes a wide range of antagonistic and synergistic effects on other environmental factors.
	Pests and Disease	Introduced aquatic species (e.g. paddle crab, slipper limpet, yabby, carp, tilapia, water hyacinth, salvinia) have the potential to displace, outcompete or predate on native species, destroy habitat and introduce pathogens that will harm native species.	Medium	There is some surrounding urban development, industry and recreational activity that are potential sources of pests and diseases. Black Bream, although naturally occurring in waterways connected to the marine environment, should be controlled and eradication from Lake Clifton (DEWHA 2010).
		Migratory birds may be susceptible to avian influenza and other pathogens and may also contribute to their global spread.	Medium	Migratory shorebirds have not yet contracted avian influenza, but it is possible given their long flights, interaction with other birds, and outbreaks of avian influenza in Australia.

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
	Pollution	Pollution and sedimentation can smother and destroy thrombolites. People visiting Lake Clifton can crush or trample thrombolite structures (recently observed with people taking photos of the aurora).	High	A major drain, carrying stormwater and excess ground water runs into the lake from residential areas, posing a continuing threat of inputs of excessive nutrients and other pollutants.
	Storms	Severe weather may cause heavy rain, strong winds, storm surge and localised flooding, resulting in physical damage, erosion and sediment mobilisation, undercutting structures and dislodging vegetation.	Medium	Climate change is driving an increase in the frequency of severe weather including storms and cyclones; some models predict that cyclones will track further south in the future. Lake Clifton is a large body of water that could be impacted by storms.
Ramsar Wetlands	Pests or diseases	Introduced aquatic species (e.g. paddle crab, yabby, carp, tilapia, water hyacinth, salvinia) have the potential to displace, outcompete or predate on native species, to destroy habitat or to introduce pathogens that will harm native species. Migratory birds may be susceptible to avian influenza and other pathogens and may also contribute to their global spread.	High	Highly modified catchment with areas of intense agriculture, industry, urban development, and recreational activity that are potential sources of pests and diseases.
	Cyclones or Storm	Severe weather may cause heavy rain, strong winds, storm surge and localised flooding, resulting in physical damage, erosion and sediment mobilisation, undercutting structures and dislodging vegetation.	High	Climate change is driving an increase in the frequency of severe weather including storms and cyclones. Impacts may be exacerbated by topography and bathymetry (the large extent and shallow depth) of wetlands and reduced water quality.
	Heatwave/ Drought	Drought can directly affect aquatic vegetation and fauna through increased temperature and insufficient water in the environment. Drought will cause increase water temperature which affects aquatic fauna and vegetation (metabolism, reproduction, nutrient availability). Drought can also reduce water levels, exposing sessile aquatic organisms to desiccation and increasing risk of dolphin strandings.	High	Increased water temperature also produces other deleterious effects on water quality including stratification, reduced dissolved oxygen, increased biological and chemical oxygen demand, and reduced tolerance to other stressors such as toxins and pollutants. Higher water temperature also increases the risk of introduced species impacting native ecosystems and species.

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
	Fire	A bushfire in the vegetation adjacent to the wetlands would result in terrestrial ash and debris entering the waterway. This may cause physical and chemical impacts to water quality which will affect aquatic and littoral organisms.	High	The wetlands already have reduced surface water, and water quality is impacted. Adding terrestrial ash and debris as well as contaminated stormwater would cause cumulative impact to the biomass in the wetland system.
	Flood	A flood would cause widespread inundation of low-lying areas adjacent to the wetlands, resulting in terrestrial sediment and debris entering the wetlands. This may cause physical damage to habitat and substrate through erosion and deposition and may introduce water quality stressors including suspended and dissolved solids, nutrients, pollutants, biological and chemical oxygen demand, and stratification in the water column.	Medium	The wetlands are already suffering from lack of freshwater inflows, so heavy rain and flooding from cyclones or storms is unlikely to cause a long-term impact. Physical damage and poor water quality in the short to medium term is likely to cause cumulative impact to the biomass in the wetland system.

5.5 Threatened Fauna

The Catchment supports a range of aquatic and terrestrial threatened fauna species and populations.

The Estuary and surrounding Ramsar System and waterways provide important habitat for migratory shorebirds, many of which are threatened including, but not limited to:

- *Arenaria interpres* - Ruddy Turnstone (Vulnerable)
- *Calidris acuminata* - Sharp-tailed Sandpiper (Vulnerable)
- *Calidris canutus* - Red Knot (Vulnerable)
- *Calidris ferruginea* - Curlew Sandpiper (Critically Endangered)
- *Calidris tenuirostris* - Great Knot (Vulnerable)
- *Charadrius leschenaultii* - Greater Sand Plover (Vulnerable)
- *Charadrius mongolus* - Lesser Sand Plover (Endangered)
- *Limosa lapponica menzbieri* - Northern Siberian Bar-tailed Godwit (Endangered)
- *Limosa limosa* - Black-tailed Godwit (Endangered)
- *Numenius madagascariensis* - Eastern Curlew (Critically Endangered)
- *Sternula nereis* – Australian Fairy Tern (Vulnerable)
- *Tringa nebularia* - Common Greenshank (Endangered)

All these migratory shorebirds have been recorded at several of the Ramsar sites listed throughout the Plan, in particular Austin Bay and Roberts Bay, Geogrup and Black Lakes, Kooljerrenup NR, Lake McLarty, Lake Mealup, Thrombolites area and Yalgorup Lakes. These sites also include several threatened non-migratory shorebirds including the Australasian Bittern (*Botaurus poiciloptilus* - Endangered) and Australian Painted Snipe (*Rostratula australis* – Endangered).

Declared a National Park in 2023, Dryandra is a 28,000ha key stronghold for some of Australia's rarest and most vulnerable terrestrial wildlife, including the numbat, woylie, redtail phascogale, chuditch or western quoll and the mound-building malleefowl. Numbers of numbats have increased at Dryandra in recent years due to the Department of Biodiversity, Conservation and Attractions Western Shield program, as well as value-adding projects such as the NLP2 Numbat Neighbourhood and Saving Native Species Dryandra Woonta projects, delivered by PHCC. The Department's Western Shield program, which has been operating for 25 years and works to protect WA's native wildlife through broadscale management of introduced predators, including foxes and feral cats, has achieved significant conservation outcomes for many vulnerable native species in Dryandra. Dryandra also supports two fenced predator proof exclosures, the Numbat Woylie Sanctuary and on a satellite block part of the National Park and Barna Mia, a predator-proof animal sanctuary where the public can see rare and protected wildlife, including numbats, in their nocturnal environment. With a high proportion of threatened mammal species and significant investment to protect these species, Dryandra is an important biodiversity asset and investment area for the PHCC. These rare and unique species have been included in the Plan (Table 2b), along with the three Black Cockatoos that occur across the Catchment, particularly in the Banksia and Tuart Woodland, and the Jarrah Forest.

Note that the Greater Bilby has not been included in the list of assets, despite their occurrence within Barna Mia, as there are no known naturally occurring populations in the Catchment. Individuals were released into Dryandra outside of the fenced exclosures and survived for approximately 12 years but did not persist, largely suspected due to predation from foxes and/or feral cats. Greater Bilby's are somewhat resilient to the negative impacts of wildfires as they can dig and retreat to deep burrow (up to 2m deep), however, they are highly susceptible to predation from foxes and cats.

Table 2b: Emergency Scenarios and susceptibility of biodiversity assets (threatened fauna).

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
Black Cockatoos (includes Forest Red-tailed, Carnaby's and Baudin's Black Cockatoos)	Bushfire	Fires can reduce or remove food availability for Black Cockatoos. Fire is also a threat to mature individual Marri, jarrah, Tuart and Banksia species. Once lost, it can take minimum of 7/8 years for these food resources to become available. Fire can destroy large hollow-bearing nest trees, reducing breeding resources and intern affecting population viability. Hollows can take 150+yrs to form. Cockatoos do not use fire affected hollows (i.e. with charcoal). Fire can also reduce freshwater availability and quality, otherwise essential for cockatoo survival.	High	Improved knowledge of important habitats for foraging and breeding sites coupled with some improvements to prescribed burning techniques has reduced impacts in some areas (i.e. reducing the extent and intensity of bushfires) but in a drying and warming climate in southwest WA the susceptibility remains high.
	Heatwave/ Drought	Heatwaves with drought can cause significant stress and result in death in individual birds and or entire flocks. For example, after some very hot days, over 200 Carnaby's from at least two separate flocks were found dead on the ground. Investigations revealed they had likely died from heat stress. This was exacerbated by	High	Drought and extended dry periods were experienced in the first half of 2024 and are expected to increase in the southwest of WA, particularly in the northern areas of the Catchment. Black Cockatoos Drought and heatwaves exacerbate the loss of foraging

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
		loss of local water resources. Extended drought reduces the capacity of tree species to set seed, reducing habitat and therefore breeding success, which has been proved to have occurred previously in Carnaby's Black Cockatoo. Drought can impact tree recruitment, which exacerbates the impacts of other threats.		resources due to other causes, largely vegetation clearing and degradation.
	Pests and Disease	Dieback diseases such as Phytophthora and Myrtle Rust can significantly impact nesting and foraging resources. Feral bees, and introduced other bird species (particularly corellas, pink and grey galahs, sulphur crested cockatoos) take over nesting hollows, displacing black cockatoos. Cockatoos are susceptible to psittacine beak and feather disease – PBFD, and possibly avian flu. A relatively recent issue, Carnaby's Hindlimb Paralysis Syndrome (ChiPs mortality), resulting in death or paralysis of affected cockatoos, is thought to be a result of contact with agricultural pesticides or similar products in breeding areas.	High	Susceptibility to PBFD and avian flu is unknown. Habitat is highly fragmented and impacted by pests & <i>Phytophthora</i> dieback disease. Excessive land clearing continues to reduce habitat. Exposure to agricultural products leading to ChiPs has been increasing due to displacement and reduced availability of forage and water resources. Changes in climate and habitat, and lack of control of introduced species have been exacerbating the displacement of breeding.
Migratory Wetland Birds , including: <i>Arenaria interpres</i> , <i>Calidris acuminata</i> , <i>Calidris canutus</i> , <i>Calidris ferruginea</i> , <i>Calidris tenuirostris</i> , <i>Charadrius leschenaultia</i> , <i>Charadrius mongolus</i> , <i>Limosa lapponica menzbieri</i> , <i>Limosa limosa</i> , <i>Numenius madagascariensis</i> , <i>Tringa nebularia</i> .	Bushfire	Fires reduce or remove catchment vegetation and riparian and on occasion, instream/aquatic habitats and water quality. Increase exposure to predators due to loss of vegetation cover and roosting trees.	Medium	Birds are migratory and can fly between wetlands. When one lake is impacted, they can go to another wetland. While birds are more mobile than many terrestrial species, and in a localised event may relocate to other wetland systems, in a large bushfire event, there may be impacts to networks of wetlands, resulting in fewer opportunities to move to other sites. Those other sites may have existing pressures on resources such as other birds foraging. Water quality dictates the health, diversity and abundance of the aquatic and other food resources of migratory shore birds, and any deterioration in water quality can impact these resources, especially if it is a large bushfire event with catchment

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
				wide run-off of nutrients and sediments.
	Flood	Reduces water quality and increase sedimentation, impacting availability of food resources and habitat, depending on severity.	Medium	Birds are migratory and can fly between wetlands. When one lake is impacted, they can go to another wetland, however in large floods multiple wetlands would be affected.,
	Heatwave/ Drought	Reduces water levels, with complete drying of wetlands and waterways. Impacts water quality (increase temperature, evaporation, decreases dissolved oxygen for invertebrates and fish etc as food resources) and increases water temperature for heat stress and can exacerbate invasive species. Repeated drying and wetting, and prolonged exposure to oxygen can release acid sulfates in substrates, increasing acidity and release of toxic heavy metals such as iron and aluminium, altering ecosystems. Can cause loss/degradation of riparian and instream vegetation condition, with reduce filtering and buffering.	Medium	If migratory birds arrive and there is no water in wetlands, they are unlikely to make the long return trip home. Drought changes timing of mudflat habitat. In the event of a heatwave/drought in the catchment, it will likely be a greater regional event, often southwest wide, meaning these species have few options to relocate to other suitable habitats.
	Pests and Disease	Migratory birds may be susceptible to avian influenza, currently undergoing a large outbreak worldwide impacting both shorebirds and domestic bird species, and other pathogens, and may also contribute to their global spread.	High	Not yet observed in migratory wetland birds, but other wild bird species, and is highly possible. Highly modified catchment with intense agriculture, industry, urban development, and recreational activity that are potential sources of pests and diseases.
Non-migratory Shorebirds and Wetland Birds, including; <i>Botaurus poiciloptilus</i> , <i>Rostratula australis</i> and <i>Sternula nereis nereis</i> .	Bushfire	Intense and frequent bushfires in wetlands reduces the density and cover of vegetation that forms core habitat for these species. Wetlands have lost vegetation habitat due to summer fires and drying of wetlands.	Medium	Bushfires are predicted to increase around wetland habitat. These wetlands and surrounding vegetation are already under threat from pests, weeds and nutrient toxicity.
	Flood and Cyclones or Storms	Can result in deaths, injuries and displaced birds. Reduces water quality, food resources and habitat, depending on severity. Floods nesting grounds.	Medium	Birds can nest on shorelines highly susceptible to elements, storm surges, etc. Flooding occurred at Lake McLarty when swans had nested, resulting in mortality.
	Heatwave/ Drought	Can result in stress and mortality. Reductions in water level in and	High	Droughts will likely exacerbate the already extreme

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
		around wetlands reduces the quality and quantity of breeding habitat and drought refuges, also increasing exposure to predators. Increase soil temperature can lead to shorebirds abandoning their nest.		fluctuations in wetland habitat. Seasonal wetlands will also experience reduced inundation periods, increasing the risk of wildfire at these sites.
	Pests and Disease	Avian influenza and other pathogens reduce population numbers. Cats and foxes are key threats to shorebirds. Dogs predate on eggs and chicks.	Medium	Shorebird nesting areas already face significant threat from pests (foxes/cats). Nests occur on exposed shorelines. Susceptibility to avian flu is unknown.
	Pollution	Pollution is a key cause of decline in many of shorebird species due to direct impacts, and/or changes in habitat. Wetland birds depend on fish, frogs, and invertebrates including freshwater crayfish species for food. Pollution impacts the food supply chain.	Low	Pollution events are rare, or often poorly documented.
Mallee fowl	Bushfire	Large fires are a threat to Mallee fowl individuals and populations, that may result in loss of entire local populations. Fire removes vegetation and the food resources. Mallee fowl depend on ground litter which can take a long time to establish after fire. Fire increases the susceptibility of mallee fowl to predators, particularly feral cats and foxes, through removing of cover.	High	Some improved knowledge of bird locations and active and historical nest sites coupled with improved burning regimes at Dryandra may reduce some impacts, but there are knowledge gaps as to where birds are active. The susceptibility remains high.
	Flood	Flood is unlikely to pose a threat.	Low	Mallee fowl habitat does not occur in floodplain areas.
	Heatwave/ Drought	Reduced water availability and increased fire threat. While woodland bird species may survive extended heat and drought due to being adapted to semi-arid conditions, the impacts of climate change will see unprecedented heat and drought conditions, resulting in loss of birds and breeding, with numbers will decline, with populations progressively restricted to drought refuges.	High	Being adapted to semi-arid environments, Mallee fowl can cope with minimal water, however, changes under climate change could exceed the species physiological thresholds. Droughts can make fire more frequent and intense, increasing the threat to the birds and their habitat.
	Pests and Disease	Species may be susceptible to avian flu (unknown). Introduced predators (cats, foxes, pigs), competition for food (rabbits, sheep, goats) contribute to their decline.	Medium	There is no information on disease in wild Malleefowl populations although the species is susceptible to a range of common diseases in

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
				captive situations and may also be susceptible to exotic diseases.
Woylie	Bushfire	Direct mortality and injury. Destruction of habitat (particularly understorey species) and loss of food resources (fungi). Increased susceptibility to predators, particularly foxes and feral cats. Loss of breeding individuals and genetic diversity.	High	Woylie shelter under low lying vegetation and forage on fungi, both are sensitive to fires. Woylies are highly susceptible to predation from foxes and feral cats.
	Flood	Unlikely to occur in habitat.	Low	Unlikely in Dryandra.
	Heatwave/ Drought	Feeds on fungi and many fungi have strong associations with rainfall and temperature. Increases risk of catastrophic bushfire.	Medium	Nocturnal species that doesn't need to drink often but has specialised diet and optimal habitat occurs further south in southwest WA in higher rainfall regions Rainfall has declined in Dryandra at least 20% since the 1970s and continues to decline, changing habitat structure and food availability.
	Pests and Disease	Diseases including Toxoplasmosis contributed to population crash (similar to that which occurred in the early 2000). Makes them more vulnerable to predation.	High	High cat and fox presence in farmland around Dryandra, with these species causing direct loss due to predation, as well as increased risk of parasites and disease transfer, particularly from feral cats. Low population numbers increase susceptibility. A population crash in early 2000's has implicated disease as the agent (Wayne 2009).
		<i>Photophthora cinnamomi</i> and Myrtle rust causing decline in understorey species.	Medium	Occurs in two areas of Dryandra with potential to spread further. More mapping is required. Surveillance and biosecurity not necessarily in place for Myrtle rust.
Numbat (<i>Myrmecobius fasciatus</i>)	Bushfire	Direct mortality and injury, as evidence in Perup in 2022. Numbats feed exclusively on termites. Food resources rapidly decline if the dead wood on the ground is burnt. Increased susceptibility to predators, particularly foxes and feral cats. Loss of breeding individuals and genetic diversity.	High	Small distribution, confined to one reserve (Dryandra area) within Catchment, and small population size (>500 individuals remain), surrounded by agricultural farmland with limited connectivity to refuge areas. Fires can escape adjacent agriculture properties or risk of

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
				recreational user campfires within reserve escaping.
	Flood	Unlikely to occur in habitat.	Low	Unlikely in Dryandra.
	Heatwave/ Drought	Numbats reach maximum body temperature rapidly in summer, and higher temperatures result in less foraging time. Exclusive termite diet, with termite abundance related to moisture, result in less food availability, impacting body condition and viability of populations. Increased susceptibility to parasites and diseases through stress. Decline in vegetation health and cover increasing predator risk.	High	Species is diurnal and cannot readily avoid daytime temperatures. Only 1 of only 2 naturally occurring populations, with the Dryandra population being among the most northern in WA, and therefore at risk to extreme heatwave/drought. Under climate change (increased temperatures) may exceed physiological thresholds of species.
	Pests and Disease	Fatal infestation of acanthocephalan parasite documented by DPaW (2017c).	Medium	Suspected to have caused decline in Numbat numbers, but more research is needed.
		Predation from cats and foxes, leading to loss of individual numbats and viability of populations. Has resulted in extinction of populations.	High	Key threat to Numbats, being in the critical weight range for mammals. Foxes and cats occur at high numbers in surrounding farmland.
Red-tailed Phascogale <i>(Phascogale calura)</i>	Bushfire	Direct mortality and injury. Reduced habitat quality and availability. Increased susceptibility to predators, particularly foxes and feral cats. Loss of breeding individuals and genetic diversity.	High	Arboreal species that depend on tree hollows. Current scarcity of wood hollows, that would be further reduced in fire.
	Flood	Unlikely to occur in habitat.	Low	Unlikely in Dryandra.
	Heatwave/ Drought	Reduced food resources as they are mostly carnivorous. Prey are impacted by drought.	Medium	Nocturnal species can avoid daytime temperatures but is known to be vulnerable (TSS 2016). Heatwaves expected to increase within habitat range.
	Pests and Disease	Introduced pests competing for resources and predating upon Phascogales (cats and foxes).	High	Foxes and cats are common in areas on habitat. Few pest control programs undertaken.
Chuditch	Bushfire	Direct mortality and injury, although are generally more mobile than the other mammal species listed. Habitat destroyed by fire, particularly understorey species and ground level tree hollows. Increased susceptibility to predators, particularly foxes and feral cats. Loss of breeding individuals and genetic diversity.	High	Fires in the region are expected to increase under climate change. Fires often escape nearby farmland or risk of recreational user campfires within reserve escaping. Surrounded by agricultural farmland with limited connectivity to refuge areas.

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
		Loss of prey biomass, particularly large invertebrates.	High	
	Flood	Unlikely to occur in habitat.	Low	Unlikely in habitat range.
	Heatwave/ Drought	Loss of prey, particularly invertebrates. Under climate change (increased temperatures) may exceed physiological thresholds of species.	Medium	Nocturnal species can avoid daytime temperatures, but food resource may decline.
	Pests and Disease	Predation from feral cats and foxes that also compete for food resources. Possible disease and parasite transfer including toxoplasmosis particularly from feral cats.	High	High cat and fox population in surrounding farmland.
Western Ringtail Possum, Ngwayir	Bushfire	Direct mortality and injury. All intensities of fire, and intensity or frequent fires destroy critical habitat, including nesting hollows and foraging. WRP depend on older Peppermint Trees that have higher nutrient content in leaves. Increased susceptibility to predators, particularly foxes and feral cats. Loss of breeding individuals and genetic diversity.	High	Habitat is highly fragmented and expected to decline under climate change & land clearing. High pest presence, particularly foxes, rabbits & cats.
	Flood	Flood is unlikely to pose a major threat, although it may see minor displacement and restriction on movement and dispersal, noting the relatively small home range of the species.	Low	WRP habitat does not generally occur in floodplain areas. some lower lying or drainage lines may be affected however as WRP is an arboreal species this is unlikely to impact susceptibility.
	Heatwave/ Drought	Loss of canopy density and condition of food trees. Drought stress and death is frequently observed (DPaW 2017b).	High	WRP are sensitive to drought-induced stress. Models predict a 60% reduction in WRP habitat by 2050 (Molloy et al. 2013)
	Pests and Disease	<i>Phytophthora cinnamomi</i> , <i>Armillaria</i> root disease and Myrtle Rust impacts food species (Peppermint and Eucalypt trees). Cats cause population loss by predation and from toxoplasmosis infection.	High	High presence of pests, including foxes and cats. Many habitat plant species susceptible to dieback disease. Drying climate exposes WRP to more physiological diseases.
Carter's Freshwater Mussel	Bushfire and Flood	Reduction in size of pools available as suitable habitat causing mortality and loss of viability and genetic diversity of population. Run-off from burnt or flooded areas reduces water quality, causing population crash. Loss of riparian and instream vegetation increasing evaporation and water	Medium	Species has low temperature and salinity threshold for survival. Survival is limited by availability of dissolved oxygen & moisture (TSS 2018). Bushfire and floods expected

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why – reason for susceptibility
		temperatures. May be susceptible to firefighting foams.		to increase under climate change.
	Heatwave/ Drought	Drought reduces suitable habitat by increasing water temperature and salinity and reducing size of pools, causing mortality and stress, and increasing predation risk. Reduces lateral and longitudinal connectivity between habitats, particularly core habitat refuge pools. These can also increase acidification and salinity through high temperatures and evaporation rates exceeding species' thresholds.	High	Water quality is already very poor at many sites in waterways and wetlands in the Swan Coastal Plain and Jarrah Forest. Species has narrow temperature range for survival. Temperatures increasing and reduced rainfall expected under climate scenarios. Has a fragmented distribution, with the catchment near its northern most distribution.
	Pests and Disease	Pigs and stock readily trample habitat, crushing and killing as well as predating Mussels. These species also reduce water quality, through increasing turbidity and nutrients	High	Juveniles in particular are vulnerable to fish immunity and predation by benthic macroinvertebrates.
	Pollution	As a filter feeder is highly susceptible to water contaminants. Shell deformity and death. Anoxic conditions from nutrient pollution causing abortion of embryos or adult death (Walker et al. 2013).	High	As a benthic filter-feeder, the species is likely to be vulnerable to pollution, such as heavy metals, which may have lethal or sub-lethal effects (TSS 2018).

5.6 Emergency Scenarios and Susceptibility of Agricultural Assets

The agricultural assets of the catchment are subject to similar emergency scenarios to the natural and biodiversity assets. Threats to the two key assets identified as part of this plan, the Hotham-Williams (high productivity zones) and Harvey Water Irrigation Areas and their susceptibility are outlined in Table 2c.

Table 2c: Emergency Scenarios and susceptibility of Agricultural assets.

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
Hotham-Williams (high productivity zones) and Harvey Water Irrigation Areas.	Bushfire	Large fire on farms destroy vegetation cover and expose soils to erosion from wind and rainfall runoff. Erosion subsequently results in loss of soil fertility.	High	Much of the region is subject to high bushfire risk due to climate and flammability of vegetation, and a drying and warming climate. Crops grown in the region are highly flammable. Fires are difficult to manage and control given the exposed landscape and little tree cover.
		Damage to stock and feed, as well as infrastructure such as irrigation, sheds/buildings, silage, grain storage areas.		
		Destroys/damages stock shelterbelts and water sources.		
		May destroy underground pipes if fire is high intensity.	Medium	
	Flood	Flooding of drains, rivers and lakes erodes soils, including soil condition. Loss of topsoils, resulting in temporary period of reduced farm productivity.	Medium	Flooding has caused extensive damage in the Wheatbelt in 2017. Large floods generally occurs every 20 years, but may increase in frequency under climate change. Flood risk is exacerbated by high salinity soils.
		Debris removal and clean up.		
		Displaced or killed stock. Stock feed ruined. Fences damaged.		
		Lack of availability of stock feed (pasture or stored).		
	Floods can disperse weeds.	Medium	Can be mitigated with appropriate weed control.	
Heatwave/ Drought	Extended drought directly impacts productivity through loss/poor pasture growth. Can reduce water supply for stock and irrigation. Stock losses, reduced body condition leading to reduced reproduction. Reduced soil moisture. Low rainfall can increase soil salinity.	High	Heatwaves and drought are becoming more frequent and severe. Planning for increased on farm resilience, including increased on-farm water storage, reducing evaporation from dams, appropriate pasture selections, retaining/establishing stock shelterbelts etc can help mitigate the risk.	

Asset	Emergency Scenario	Why it poses a threat	Susceptibility	Why
	Pests and Disease	May impact ability to use soils due to quarantine restrictions (e.g. fire ants). Foot and mouth disease reducing productivity of cloven-hoofed stock. Avian bird flu may also impact livestock.	Medium	Consequences would be high but the likelihood of it occurring is relatively low if biosecurity measures are in place and effective. Few historical disease outbreaks in the region.

6 Asset Preparedness

6.1 Preparedness Actions for Protecting Biodiversity Assets

Preparedness actions that could be undertaken for each biodiversity asset to reduce the threat of relevant emergency scenarios (such as bushfires, drought, floods, cyclones, diseases, and pests) including where the action would need to be undertaken and who could undertake (or is undertaking) the action are detailed within this section.

PHCC have included case studies or examples of where these actions have been previously undertaken, including any resourcing or funding implications, in the management unit (see Appendix 1 and 2 for relevant case studies on helping local communities recover from the Waroona fires, greening the farm after fire and dieback treatment in Banksia Woodland TEC).

Preparedness actions vary with emergency scenario, type of biodiversity asset and location. For example, preparedness actions for biosecurity threats at Ramsar sites should be designed to reduce the impact from introduced aquatic species (i.e., paddle crab, slipper limpet, yabby, carp, tilapia, water hyacinth, salvinia, etc), while biosecurity threats at Banksia sites is more likely to be from plant disease (i.e., *Phytophthora cinnamomi* and Myrtle rust), insects (e.g., Polyphagous shot-hole borer) and invasive plant species (particularly woody weeds). For all biosecurity threats, early detection and rapid response is crucial for control and eradication. For this reason and despite differences in asset threats and responses, monitoring and assessment is a unifying preparedness action for all assets. PHCC may potentially assist with monitoring and assessment, given staff skill sets in environment assessments as we have long-term monitoring plots across the Catchment, and plan to add monitoring under future projects. PHCC follows emergency reporting protocols recommended by DPIRD (including reporting on their MyPestGuide Report Application) when new biosecurity threats are identified.

Vegetation management is another common preparedness action across most assets and can include weed control, planting drought and fire-resistant species around sensitive sites and, in some instances, fuel reduction. These are activities that PHCC have skills and experience in and can potentially provide technical and on-ground assistance with, through our related RLP projects. For other assets, particularly Ramsar sites and waterways, state legislation and policy change are required to effectively prepare assets for the emergency scenarios provided in Tables 3a and 3b.



Figure 6: (left) Greencard Dieback Training, demonstrating field-based disease prevention through foot cleaning station and (right) treatment of Dieback using phosphite injection into trunk of Banksia species.

Although outside of the scope for this EPRP, it should be noted that the approach to each action must be tailored to consider constraints and opportunities at each. For example, a controlled burn in the context of protecting people and property is very different to a controlled burn required to mitigate risk of fire in Banksia Woodland. In the context of protecting biodiversity assets within the Catchment, 'controlled burn' refers to low intensity, cool burns that are appropriately located and timed to consider survival strategies and reproductive stages of species present.

Shared responsibility is a central principle in contemporary emergency management, recognised in international frameworks and emergency committees (SEMC 2023). PHCC is committed to sharing and using our knowledge and continuing to engage with our community and government agencies, to better protect our biodiversity assets from emergencies, many of which are expected to increase in intensity and frequency for the region under a changing climate.

Table 3a: Preparedness actions and emergency scenario for threatened flora and ecological communities, along with who is best placed to undertake the action and whether action is currently underway.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
All threatened orchids in the Peel-Harvey Catchment. Includes the following species: <i>Caladenia huegelii</i> <i>Diuris micrantha</i> <i>Diuris purdiei</i> <i>Diuris drummondii</i> <i>Dreakea elastica</i> <i>Dreakea micrantha</i>	Bushfire	Develop and embed actions to address bushfire threats including appropriate burning regimes with technical orchid specialists and relevant agents, noting cool burning is not appropriate for every site with higher fuel loads. Cool burns should generally outside of orchid flowering times (for most species this will be Dec to May).	Where high fuel loads occur.	BGPA, DBCA, DFES, Landholders.	Somewhat. Cool burns are undertaken, but generally not focused on orchid populations.
		Maintain firebreaks to protect populations, particularly when flowering. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations.	DBCA, BGPA, LGAs other land managers, landholders.	Yes, fire breaks are generally well maintained as they are subject to regulation, but may not be specifically designed to protect orchid populations.
		Ensure all known populations are surveyed and mapped, data available to relevant agency/landholder.	Known locations.	DBCA, PHCC, local government, industry.	Partial. Further survey and mapping is required in some areas.
		Undertake research and monitoring to better understand fire impact and effectiveness of mitigation measures.	Known locations.	DBCA, BGPA.	Yes, Curtin Uni and BGPA are researching orchid response to prescribed burns.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
	Flood and Drought	Undertake genetic diversity study to inform seed collections and restoration and ensure that genetic diversity is captured for ex situ collections and future translocation.	Known locations	BGPA, Mines (Alcoa and South32).	Yes, BGPA are undertaking genetic studies.
	Pests and Disease	Treat infected Woodland with for Phytophthora and install limestone tracks to prevent spread.	Known dieback locations	DBCA, PHCC, LGA's Landholders.	Not specifically for orchid conservation. Phosphite treatment occurs in infected Woodlands.
<i>Synaphea stenoloba</i> (Dryandra) and <i>Synaphea</i> sp. Fairbridge Farm (Kooljerrenup NR)	Bushfire	Maintain firebreaks. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DBCA, DFES, LGAs, landholders.	Yes, fire breaks are generally well maintained as they are subject to regulation, but may not be specifically designed to protect populations.
		Weed control to reduce fuel load. Weeds can readily suppress early plant growth.	Known locations	DBCA, LGA's PHCC, Landholders.	Yes, DBCA and PHCC have projects underway.
		Develop fire management strategy. Mild fire in appropriate intervals may assist regeneration.	Known locations	DBCA.	Yes, currently underway.
	Heatwave/ Drought and Flood	Collect seed and cutting material to assist recovery.	Known locations	BGPA, Winjan Rangers, Alcoa.	Partial. Alcoa were collecting seed, but recently ceased.
	Pests and Disease	Surveillance and inspection of plants for signs of disease, insect galling or fungus on leaves.	Known locations	Landholders, DBCA.	No.
		Susceptibility of <i>Synaphea</i> to <i>P. cinnamomi</i> is unknown. Research is required (DPAW 2016).	Known locations	BGPA, DBCA.	No
<i>Eucalyptus argutifolia</i> (Yalgorup Lakes and Thrombolites area)	Bushfire	Identify appropriate intensity and interval of fire to promote seed germination, seedling survival and/or vegetation regeneration.	Known locations	DBCA, Industry, (Alcoa).	No. Some historical research undertaken by Alcoa, but more is needed.
		Controlled burns, firebreaks and weed control to mitigate risk. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DBCA, DFES, LGAs, Landholders.	Yes, subject to funding.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
	Heatwave/ Drought	Research to understand water and temperature thresholds for seed germination and survival.	Known locations.	Industry (Alcoa), BGPA.	No.
		Collect and store seed to assist recovery.	Known locations	Mines, Winjan Rangers.	No.
		Investigate options for linking, enhancing or establishing additional populations.	Known locations	PHCC, DBCA.	No.
	Pests/Disease	Myrtle rust, <i>Phytophthora cinnamomi</i> , <i>Armillaria</i> and other galls & cankers. Control pests and weeds.	Known locations	DBCA, PHBG, PHCC, Landholders.	Some weed control undertaken by DBCA and landholders. More work is needed.
		Community awareness raising.	Ex-situ	PHBG, DPIRD, PHCC.	Yes.
Banksia Woodland TEC and Tuart Woodland TEC	Bushfire	Maintain fire breaks. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DBCA, Landholders.	Yes. Fire breaks are generally well maintained as they are subject to regulation, but may not be specifically designed to protect TEC.
		Weed control	Known locations	DBCA, PHCC, LGA's, Landholders.	Yes in some sites, subject to resources
		Implement burning regimes based on Approved Conservation Advice & research recommendations (min 8-16 yrs for Banksia TEC; Wilson et al 2012).	Known locations	DBCA, LGA's Landholders.	Yes. DBCA undertake prescribed burns in these TECS, however, some evidence suggests these are currently occurring too frequently to maintain ecological values.
		Establish buffer zone of 60 m past the canopy.	Known locations	DBCA, LGA's, Landholders.	No.
	Heatwave/ Drought	Control grazing and weeds to mitigate the threat.	Known locations	DBCA, PHCC, Landholders.	Yes.
	Pests and Disease	Practise recommended hygiene procedures to avoid the spread of dieback diseases (e.g. <i>Phytophthora</i>)	Known locations	DBCA, PHCC, LGA's, Landholders.	Yes, in some sites. Greencard training and other hygiene measures are encouraged.
		Fencing to exclude pests.	Around TEC boundary	PHCC, DBCA, LGAs, Landholders.	Yes, in some sites

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
		Install limestone tracks around diseased areas to restrict traffic and disease spread.	Known locations around dieback	DBCA.	Yes, this is DBCA's preferred approach to prevent spread of dieback in Reserves.
Clay Pans of the Swan Coastal Plain	Bushfire	Maintain fire breaks and control weeds. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DBCA, DPLH, LGAs, PHCC.	Yes. Fire breaks are generally well maintained as they are subject to regulation, but may not be specifically designed to protect TEC.
		Fire exclusion – fire is not generally appropriate for this community.	Known locations	DBCA, LGAs	Yes, partial. This is not always possible in wildfire scenarios
	Flood	Investigate hydrological processes that maintain the community, especially the water levels, quality and seasonal patterns of inundation. Use this data to help design buffers to protect hydrological processes.	Known locations	BGPA, DBCA.	No.
	Heatwave/ Drought	Avoid any changes to hydrology that may result in changes to the natural hydrological regime of the clay pans, groundwater water table levels and subsequent increase or decrease in run-off.	Known locations	DBCA, PHCC, Landholders, LGA's, DWER.	Yes, generally, although more work is needed.
	Pests and Disease	Develop and implement hygiene protocols to protect sites with <i>Phytophthora cinnamomic</i> , and prevent introduction of new pests and diseases, including Myrtle rust.	Known locations	PHCC, DBCA.	Yes, partial. Information and reporting on Myrtle Rust distributed by DPIRD.
		Pest control should be ongoing (pig, fox, rabbit, cat).	Known locations	PHCC, DBCA.	Yes, at some sites. Subject to funding.
Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	Bushfire and Heatwave/ Drought	Investigate the most cost-effective options for restoring landscape function, including assisted regeneration of priority areas and buffering, connecting and protecting existing remnants.	Known locations	PHCC.	No.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
		Maintain fire breaks	Known locations	DBCA	Yes. DBCA maintain fire breaks.
		Weed control to reduce fuel load.	Known locations	DBCA	Yes. DBCA undertake weed control.
		Protect from direct damage and prevent and restore 200m buffer zones around asset.	Known locations	DBCA	No. DBCA to construct new trails and rehabilitate existing trails.
	Pests and Disease	Monitor for new pest animal, invasive species and pathogen incursions (e.g. myrtle rust, honey fungus). Continual reappraisal is needed of the evolving potential arrival pathways, and measures for prevention and early detection.	Known locations	DBCA.	No.
Subtropical and Temperate Coastal Saltmarsh	Bushfire	Exclude saltmarsh from controlled burning programs and ensure controlled burns in areas surrounding the community are contained. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DFES, DBCA, LGA's Landholders	Yes, partially.
		Investigate measures to facilitate recovery of the community post-fire, especially the recovery of fire intolerant species such as succulent chenopods.	Known locations	BGPA, Universities.	No.
		Ensure grazing by livestock post fire is excluded.	Known locations	DBCA, Landholders.	Partially.
		Develop and implement management practices/fire control methods in upper saltmarsh areas.	Known locations	DFES, DBCA, Landholders.	Partially.
	Heatwave/ Drought	Ensure ongoing connection to the tidal regimes, through removal/mitigation of barriers, diversion drains, prevention of new works that would cause obstructions.	Known locations	DBCA, LGAs, DWER, landholders	Yes, at some sites.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
		Install vegetation buffer zones around community to minimise disturbance.	Known locations. Riparian zones.	DBCA, LGAs, PHCC.	Some. More work is required.
	Pests and Disease	Avoid further reintroduction of predatory mosquito fish.	Known locations	DBCA, LGAs, DWER, UWA.	Yes. UWA have even developed a robotic fish to scare away Gambusia.
		Implement agricultural best practise measures to minimise nutrient (e.g. nitrogen and phosphorus) run-off in Coastal Saltmarsh areas (DCCEEW 2013).	Riparian zones	DPIRD, Landholders, PHCC.	Yes, but more work is needed.
	Storm and Flood	Changes to tidal regime or tidal connection may lead to habitat loss, invasion of weeds or modification of ecological function. Control of other threats is critical.	Known locations	DBCA, DWER.	Yes at some sites.
Eucalypt Woodlands of the Western Australian Wheatbelt	Bushfire	Maintain firebreaks and undertake weed control frequently. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DBCA, LGA's, PHCC, Landholders.	Yes. Fire breaks are generally well maintained as they are subject to regulation but may not be specifically designed to protect TEC. Weed control is undertaken at some sites.
		Establish a large buffer zone for the community, that is 40 m from the edge of a patch (DoE 2015).	Edge of known locations	DBCA	Most remnants are heavily impacted by highly invasive weeds.
		Research is needed into how the community responds to and recovers from fire.	Known locations	BGPA, DBCA.	No.
	Heatwave/ Drought	Support revegetation of degraded patches and enhance connectivity.	Known locations	PHCC, DBCA, LGA's, Landholders.	Yes, at a small number of sites, though significant additional work is needed.
	Pollution	Prevent pesticide or herbicide spray drift from agricultural lands adjacent to a patch.	Known locations	Landholders, DWER.	Yes, though more work is needed, particularly from landholders.
	Pests and Disease	Monitor for weeds and diseases including <i>Phytophthora</i> and Myrtle Rust.	Known locations	DBCA, DPIRD, PHCC, Landholders.	Yes, partial

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
Thrombolite (microbialite) Community of a Coastal Brackish Lake	All	Establish long-term monitoring to assess impact.	Known locations	DWER, DBCA, PHCC.	Yes, though more monitoring is needed.
	Bushfire	Maintain firebreaks and undertake weed control.	Known locations	DBCA, PHCC, Landholders.	Yes.
	Heatwave/ Drought	Protect vegetation and control pests.	Strategic locations.	DBCA, PHCC, DWER.	Yes, but more effort required during drought.
	Pests and Disease	Monitor for introduced aquatic species (e.g. paddle crab, slipper limpet, yabby, carp, tilapia, water hyacinth & salvinia) and pathogens.	Strategic locations.	DBCA, DWER, PHCC, LGA.	Yes, but more effort required.
	Pollution	Reduce salinity and nutrient levels of Lake Clifton.	Known locations	DBCA, DWER, PHCC	Yes.
Ramsar Wetlands	Pests or Disease	Routinely monitor for introduced aquatic species, foxes, pigs and rabbits.	Known locations	DWER, DBCA, PHCC, PHBG, LGA's.	Yes.
	All	Community engagement to increase awareness of Ramsar significance, threats and restoration.	Strategic locations	PHCC, LGA's.	Yes, PHCC holds many targeted events, including the Wetlands Weekender Festival.
		Monitor for changes in salinity and nutrient levels.	Known locations	PHCC, DWER.	Yes, long-term programs currently underway.
		Protect riparian vegetation.	Known locations	DBCA, PHCC, DWER.	Yes.
	Bushfire	Vegetation management, including weed control. Prohibited and restricted burning times for landholders due to seasonal conditions.	Riparian zones	PHCC, DBCA, LGA's.	Yes DBCA and PHCC have projects underway.
		Maintain firebreaks	Riparian Zones	DBCA, DFES	Yes.

Table 3b: Preparedness actions and emergency scenario for threatened fauna, along with who is best placed to undertake the action and whether action is currently underway.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
Black Cockatoos (includes Forest Red-tailed, Carnaby's and Baudin's Black Cockatoos)	Bushfire	Low intensity, cool prescribed burns at appropriate scales and intervals, in appropriate areas to reduce fuel load and wildfire intensity.	Banksia & Tuart TEC particularly in areas of critical habitat and where	DFES, DBCA, LGA's, Landholders.	Yes, at some sites. DBCA undertake prescribed burns at some. Woodland sites.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
			breeding trees occur.		
		Construct low fuel buffers and as appropriate fire breaks around areas of critical habitat, roosting and breeding sites	Known breeding tree and roost sites and areas of critical habitat	DFES, DBCA, LGAs Landholders.	Yes, fire breaks are generally well maintained as regulatory responsibility. Some knowledge gaps still exist in breeding sites
		Install cockatubes and improve habitat.	Known habitat locations.	LCSJ, PHCC, DBCA, Landholders.	Yes, cockatubes are installed and monitored. Weed control undertaken.
	Heatwave/ Drought	Install water stations that provide clean, fresh potable water. Increase knowledge of roost and breeding sites	Known locations.	PHCC, LGAs, Murdoch University, LGA's, Landholders.	Yes, 3 cocky troughs installed to date under and other water stations installed. Under PHCC's Black Cockatoo Project. More required across the catchment in key locations based on roost and breeding areas.
	Pests and Disease	Psittacine beak and feather disease, polyoma virus, Hindlimb Paralysis Syndrome. Chips and Chlamydia sp. all have the potential to impact Black Cockatoos.	Sample symptomatic and dead birds where they occur.	Murdoch University, Perth Zoo.	Yes, partial. Various research projects from Murdoch University.
Migratory Wetland Birds , including: <i>Arenaria interpres</i> , <i>Calidris acuminata</i> , <i>Calidris canutus</i> , <i>Calidris ferruginea</i> , <i>Calidris tenuirostris</i> , <i>Charadrius leschenaultia</i> , <i>Charadrius mongolus</i> , <i>Limosa lapponica menzbieri</i> , <i>Limosa limosa</i> , <i>Numenius madagascariensis</i> , <i>Tringa nebularia</i> .	Bushfire	Weed control and maintain fire breaks.	Known locations	PHCC, DBCA, LGA's.	Yes.
	Flood	Increase extent of riparian zone vegetation, particularly woody species.	Riparian zones	PHCC, DBCA, LGA's.	No. Some historical work but more needed.
	Heatwave/ Drought	Increase quality and extent of riparian zone vegetation and control weeds.	Known locations	PHCC, DBCA, LGA's.	Yes.
	Pests and Disease	Research susceptibility to avian flu and beak and feather.	Ex-situ and known locations	Birdlife.	Yes.
		Community awareness raising.	Ex-situ	Birdlife, PHBG.	Yes.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
		Test of deceased or sick birds.	Ex-situ	Birdlife.	No, but Birdlife have plans to test shorebirds for disease.
Non-migratory Shorebirds and Wetland Birds, including; <i>Botaurus poiciloptilus,</i> <i>Rostratula australis</i> and <i>Sternula nereis nereis</i> .	Bushfire	Weed control and maintain fire breaks.	Known locations	PHCC, DBCA, LGA's.	Yes.
	Flood	Increase extent of riparian zone vegetation, particularly woody species.	Riparian zones	PHCC, DBCA, LGA's.	No. Some historical work but more needed.
	Heatwave/ Drought	Increase quality and extent of riparian zone vegetation and control weeds.	Known locations	PHCC, DBCA, LGA's.	Yes.
	Pests and Disease	Community awareness raising.	Ex-situ	PHBG	Yes.
		Research susceptibility to avian flu and PBFD. Test dead birds.	Ex-situ and known locations	Birdlife.	Yes.
Mallee fowl	Bushfire and Heatwave/ Drought	Increase knowledge of locations of active and historical mounds, and sightings of birds. Undertake cool, low intensity, prescribed burns to reduce wildlife avoiding active mounds, at appropriate scales and intervals.	At known locations.	DBCA, DFES, Landholders.	Yes. Within Dryandra and on private land.
		Maintain firebreaks. Prohibited and restricted burning times for landholders due to seasonal conditions.	Boundary of nesting sites.	DBCA, landholders.	Yes. Within Dryandra and on private land as regulatory responsibility.
		Build resilience and improve habitat.	At known locations.	DBCA, PHCC, Mallee Fowl Working Groups, Landholders.	Yes, but not specifically for Malleefowl. More needs to be done specifically for the species.
	Pests and Disease	Collect baseline data on the disease status of Malleefowl populations.	At known locations.	DBCA.	No.
Woylie	Bushfire and Heatwave/ Drought	Adhere to best fire management practices and maintain fire breaks and access.	At known locations.	DFES, DBCA, Landholders.	Yes, but more action is needed. State Support Plan – Animal welfare being drafted.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
		Improve telecommunication coverage for the area for rapid response and monitoring.	Dryandra and surrounds.	DFES	No.
		Increase community awareness around camping and campfires.	Dryandra and surrounds.	DBCA.	Yes, but more action and signage needed.
	Pests and Disease	Weed and pest control.	At known locations.	Narrogin Naturalist Group, DBCA, PHCC.	Yes, but more action is needed.
Numbat	Bushfire and Heatwave/ Drought	Maintain fire breaks. Prohibited and restricted burning times for landholders due to seasonal conditions.	Dryandra and surrounds.	DFES, DBCA, landholders.	Yes. State Support Plan – Animal welfare being drafted
		Cool, low intensity burns at appropriate scales (small scale), intensity and frequency, while protecting fallen logs.	At known locations. Dryandra and surrounds.	DFES, DBCA.	Yes.
		Vegetation management, including weed control.	At known locations. Dryandra and surrounds.	DBCA, PHCC.	Yes, but more action is needed.
	All	Plan for intensive feral animal control (ground shooting, felixer traps, ground trapping) to address increase in predator threat.	At known locations. Dryandra and surrounds.	DBCA, PHCC, Landholders.	Yes, but more action is needed.
	Pests and Disease	Awareness raising within the community	At known locations. Dryandra and surrounds.	PHCC.	Yes, but more action is needed.
		Follow hygiene management plans for plant diseases.	At known locations. Dryandra and surrounds.	DBCA, PHCC, Landholders.	Yes.
Red-tailed Phascogale	Bushfire and Heatwave/ Drought	Maintain fire breaks. Prohibited and restricted burning times for landholders due to seasonal conditions.	At known locations.	DFES, DBCA.	Yes. State Support Plan – Animal welfare being drafted.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
		Cool, low intensity burns, while protecting hollow bearing trees.	At known locations.	DFES, DBCA.	Yes.
	Pests and Disease	Awareness raising within the community	At known locations.	PHCC.	Yes, but more action is needed.
		Follow hygiene management plans for plant diseases.	At known locations.	DBCA, PHCC, Landholders.	Yes.
Chuditch	Bushfire and Heatwave/ Drought	Maintain fire breaks. Prohibited and restricted burning times for landholders due to seasonal conditions.	At known locations.	DFES, DBCA.	Yes. State Support Plan – Animal welfare being drafted.
		Cool, low intensity burns, while protecting hollow bearing trees.	At known locations.	DFES, DBCA.	Yes.
	Pests and Disease	Plant more <i>Gastrolobium</i> sp.	At known locations	DBCA, PHCC.	No.
		Awareness raising within the community	At known locations	PHCC.	Yes, but more action is needed.
		Follow hygiene management plans for plant diseases.	At known locations	DBCA, PHCC, Landholders.	Yes.
Western Ringtail Possum, Ngwayir	Bushfire	Follow fire management guidelines for western ringtail possums (Wayne 2006) and for Tuart Woodlands. Prohibited and restricted burning times for landholders due to seasonal conditions.	Known locations	DFES, DPaW, DBCA, Landholders.	Yes. DBCA and DFES undertake controlled burns. State Support Plan – Animal welfare being drafted.
		Establish a buffer zone of 60 m past the canopy.	Known locations	DBCA, LGA's, Landholders.	No.
	Heatwave/ Drought	Install water stations and habitat boxes (must be monitored/maintained).	Known locations	PHCC, LGA's, Landholders.	Yes, but more action is needed.
	Pests and Disease	Pest control for foxes, cats and rabbits.	Known locations	PHCC, DBCA, LGA's, Landholders.	Yes, but more action is needed.
Carter's Freshwater Mussel	Bushfire	Maintain firebreaks and undertake weed control to protect riparian zone vegetation.	Known locations	DFES, DBCA, PHCC, Landholders.	Yes.

Asset	Emergency Scenario	Preparedness Actions	Where	Who	Is action currently underway?
	Flood	Maintain hydrological flows and monitor water quality within habitat.	Known locations	DWER, Water Corporation.	Yes, but not enough. More action is needed.
	Heatwave/ Drought	Maintain hydrological flows through environmental water provisions, including water releases and supplementing specific refuge pools. Monitor flow, water depths and water quality within habitat. Monitor populations. Retain and enhance shade trees along riparian zone.	Known locations	DWER, DBCA, PHCC, DPLH, Harvey River TaskForce, Landholders.	Partial – releases have occurred in the Serpentine River to maintain ecological values at Lowlands NR, but not beyond this area where population occur. Groundwater allocations need to be reviewed.
	Pests and Disease	Pest control for pigs and foxes.	Known locations	DBCA, Murdoch University, PHCC Landholders.	Yes.
		Fencing to exclude stock from waterways.	Known locations	PHCC, Landholders.	Partial, in some areas. More work needed.

6.2 Preparedness Actions for Protecting Agricultural Natural Capital Assets

Preparedness actions for agricultural assets are provided in Table 4. Farmers manage vast areas of land including significant areas of remnant vegetation and biodiversity assets. There are gaps in support, skills and knowledge building for our farming community which will lead to further decline in the health of natural assets, particularly with impacts of a changing climate. Some of the identified actions to protect agricultural assets include awareness raising and capacity building within the community, advocating for change in legislation to better protect assets, modelling and weather forecasting and supporting sustainable management of land resources, conserving and recovering biodiversity. This can include implementing on-ground works such as vegetation management (including weed control), fire breaks and recovering biodiversity on-farm and planting drought tolerant species such as native perennial pasture and legume species. This will have positive flow-on effect by building resilience to a changing climate, improving linkages and waterways.

PHCC have included case studies or examples of where these actions have been previously undertaken, including any resourcing or funding implications, in the management unit (see Appendix 1-2 for relevant case studies on helping local communities recover from the Waroona fires and greening the farm after fire).

Table 4: Preparedness actions and emergency scenarios for each agricultural asset, along with who is best placed to undertake the action and whether action is currently underway.

Asset Name	Emergency Scenario	Preparedness Actions	Where	Who (best placed)	Is action currently underway?
Hotham-Williams (high productivity zones)	Pests or diseases	<p>Biosecurity plans and quarantine, measures, pest and disease surveillance, inspections</p> <p>Improving soil health to increase plants natural resilience to pests and diseases and improve soil biology to control pathogens</p> <p>Increasing native habitat to attract birds and insects to control insect pest species</p>	At known locations	DPIRD, PHCC, landholder	<p>Yes, PHCC have and will continue to deliver sustainable agriculture/soil health workshops and projects to farmers within the Peel-Harvey region.</p> <p>The Sustainable Agriculture Facilitator will continue to support farmers and increase awareness of opportunities e.g. Future Drought Fund, Emissions Reduction Fund and other sustainable agriculture initiatives to build resilience on farm.</p>
	Heatwave/ Drought	<p>Implement actions identified in Wheatbelt Region Drought Resilience Plan relating to water and agriculture systems. Awareness raising within the community.</p> <p>Harvest bans and total fire bans/vehicle movement bans to reduce incurrence of fire in the system.</p>	Across entire asset area	<p>DPIRD, Wheatbelt Development Commission.</p> <p>DFES, LGA's.</p>	<p>Partial. Plan is in development in June 2024.</p> <p>Currently in place and ongoing throughout summer period.</p>
		<p>Planting drought tolerant species and native perennial species.</p> <p>Improving soil health/increasing soil carbon and water-holding capacity by increasing diversity in pasture and cover crop species, cover cropping, and practising rotational grazing.</p> <p>Implementing landscape rehydration practices on farm in improve soil moisture and build soil carbon.</p>	Across entire asset area.	DPIRD, PHCC, landholders.	<p>Yes, PHCC have and will continue to deliver sustainable agriculture/soil health workshops and projects to farmers within the Peel-Harvey region.</p> <p>The Sustainable Agriculture Facilitator will continue to support farmers and increase awareness of opportunities e.g. Future Drought Fund, Emissions Reduction Fund.</p>

Asset Name	Emergency Scenario	Preparedness Actions	Where	Who (best placed)	Is action currently underway?
	Flood	<p>Planting vegetation in and around dams, and utilising dam covers to reduce evaporation.</p> <p>Increasing native vegetation for livestock shelter and to improve soil carbon.</p> <p>Flood risk mapping up to date. Flood evacuation plans.</p> <p>Implement preparedness actions in State Support Plan – Animal Welfare in Emergencies.</p>	Across entire asset area	DFES, DPIRD, LGA's, SES.	Yes.
	Fire	<p>Vegetation management including firebreaks, prescribed burning fire management and response plans for properties/larger areas. Prohibited and restricted burning times for landholders due to seasonal conditions.</p> <p>Planting fire-retardant tree species as a barrier around key infrastructure.</p> <p>Weed control to reduce non-native grasses in remnant vegetation.</p>	Across entire asset area.	Landholders, DFES, LGA's.	Yes, local governments may publish a notice under section 33 of the Bush Fires Act requiring fire breaks to be prepared and maintained for a set period as well as other measures such as asset protections zones. Can vary restricted and prohibited burning periods where seasonal conditions warrant.
Harvey Water Irrigation Areas	Pests or diseases	<p>Biosecurity plans and quarantine, measures, pest and disease surveillance, inspections.</p> <p>Improving soil health to increase plants natural resilience to pests and diseases and improve soil biology to control pathogens.</p> <p>Increasing native habitat to attract birds</p>	At known locations	<p>DPIRD</p> <p>DPIRD, PHCC, landholder.</p>	<p>Yes.</p> <p>Yes, PHCC have and will continue to deliver sustainable agriculture/soil health workshops and projects to farmers within the Peel-Harvey region.</p> <p>The Sustainable Agriculture Facilitator will continue to support farmers and increase awareness of opportunities e.g. Future</p>

Asset Name	Emergency Scenario	Preparedness Actions	Where	Who (best placed)	Is action currently underway?
		and insects to control insect pest species.			Drought Fund, Emissions Reduction Fund.
	Heatwave/ Drought	<p>Consider soil treatments/ amendments.</p> <p>Implement actions identified in Wheatbelt Region Drought Resilience Plan relating to water and ag systems.</p> <p>Planting drought tolerant species and native perennial species.</p> <p>Improving soil health/increasing soil carbon and water-holding capacity by increasing diversity in pasture and cover crop species, cover cropping, and practising rotational grazing.</p> <p>Planting vegetation in and around dams, and utilising dam covers to reduce evaporation.</p> <p>Increasing native vegetation for livestock shelter and to improve soil carbon.</p>	Across entire asset area.	DPIRD, Wheatbelt Development Commission.	<p>Partial. Plan is in development in June 2024.</p> <p>Yes, PHCC have and will continue to deliver sustainable agriculture/soil health workshops and projects to farmers within the Peel-Harvey region.</p> <p>The Sustainable Agriculture Facilitator will continue to support farmers and increase awareness of opportunities e.g. Future Drought Fund, Emissions Reduction Fund.</p>
	Flood	<p>Flood risk mapping up to date. Flood evacuation plans.</p> <p>Implement preparedness actions in State Support Plan – Animal Welfare in Emergencies.</p>	Across entire asset area.	DFES, LGA's.	Partial. State Support Plan – Animal welfare being drafted.
	Fire	Vegetation management including firebreaks, prescribed burning fire management and response plans for properties/larger areas. Prohibited and	Across entire asset area	Landholders, DFES, LGA's.	Yes, local governments may publish a notice under section 33 of the Bush Fires Act requiring fire breaks to be prepared and maintained for a set period as well as other measures such as asset protections

Asset Name	Emergency Scenario	Preparedness Actions	Where	Who (best placed)	Is action currently underway?
		restricted burning times for landholders due to seasonal conditions. Planting fire-retardant tree species as a barrier around key infrastructure.			zones. Can vary restricted and prohibited burning periods where seasonal conditions warrant.

7 Asset Response and Recovery Actions

7.1 Response and Recovery Actions for Protecting Biodiversity Assets

Response actions that could be undertaken for each biodiversity asset to respond to the relevant emergency scenarios (such as bushfires, drought, floods, storms, diseases and pests) are outlined below, including where/when the action would need to be undertaken and who could undertake the action (See Tables 5a for threatened community and flora, and 5b for threatened fauna response and recovery actions).

For all biodiversity assets, monitoring and assessment of impacts is important as the emergency events unfolds, and may need to continue long after the event has occurred, particularly for biosecurity issues. Where possible, the focus should be on protecting the most sensitive areas within the asset and, for example, these may include areas of high historical investment (i.e., within Dryandra would include the Numbat-Woylie Sanctuary and Barna Mia enclosures or areas where high numbers of threatened fauna have been recorded (maps provided in Appendix 3 and 4).

Provision of water stations for wildlife is an important response action during and after heatwaves or drought and where resources have allowed, PHCC, in collaboration with others has funded installations of water stations for native fauna (Black Cockatoo's, smaller bird species, marsupials and microbats).

PHCC is one of the few organisations that support dieback treatment in Banksia and Tuart Woodlands in the Catchment. Due to the costs associated with treating Phytophthora dieback, DBCA and local councils tend to opt for limestone tracks to prevent disease spread, rather than the more effective but costly approach of Phosphite treatment. In the case of emergency pest and disease outbreaks that impact native flora and fauna, PHCC can, with resourcing, support pest control and disease treatment at identified biodiversity assets.

Learning from the 2019/20 Black Summer Bushfires, wildlife rescue is a critical but often overlooked response action required to protect assets during and after emergencies, particularly following bushfire, flood and drought. There are several wildlife rescue groups within the Catchment that have been included in stakeholder engagement and it is clear that these groups are often under-resourced or under-utilised in emergency scenarios.

Following severe events such as bushfire, PHCC visits landholders we have previously worked with to better understand site condition and suitable response actions over time (Figure 7).



Figure 7: Private property site visit with PHCC staff showing waterway on the Swan Coastal Plain following large bushfire event in February 2020.

Table 5a: Response actions for threatened flora and ecological communities, along with who is best placed to undertake the action and whether action is currently underway.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
All threatened orchids in the Peel-Harvey Catchment. Includes: <i>Caladenia huegelii</i> <i>Diuris micrantha</i> <i>Diuris purdiei</i> <i>Diuris drummondii</i> <i>Dreakea elastica</i> <i>Dreakea micrantha</i>	Bushfire	Fire suppression and protect habitat (particularly during flowering). Avoid using chemical retardants.	Known locations	DBCA, DFES, LGAs, Industry.
		Avoid mechanical damage of plants as they can occur alongside tracks.	Known locations	DBCA, Industry.
	Heatwave/Drought, Flood, Pollution	Assessment of impact.	Known locations	BGPA, Mines.
	Pests and Disease	Ensure disease hygiene standards are followed.	Known dieback locations	DBCA, LGAs, PHCC.
After event has occurred				
	All listed in plan	Rapid assessment of impacts	Known impact sites	BGPA, DBCA.

All threatened orchids in the Peel-Harvey Catchment.		Plan and implement restoration	Known impact sites	BGPA, DBCA.
		Propagation using seed and mycorrhiza collected pre-event.	Ex-situ: BGPA	BGPA.
		Translocation to boost population.	Known impact sites	BGPA, DBCA, LGA's, Landholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
<i>Synaphea stenoloba</i> (Dryandra) and <i>Synaphea</i> sp. Fairbridge Farm (Kooljerrenup NR)	Bushfire	Fire suppression protecting individuals from mechanical damage.	Known locations	DBCA, DFES, Landholders.
	Flood, Drought/heatwave, Pests and diseases, Pollution	Monitor health of plants, collect material for storage and future propagation (subject to permits)	Known locations	BGPA, Winjan Rangers, Mines.
After event has occurred				
	Bushfire, Flood, Drought/heatwave, Pollution	Rapid assessment of impact.	Known impact sites	BGPA, DBCA.
		Plan and implement restoration	Known impact sites	BGPA, DBCA.
		Undertake targeted weed control	Known impact sites	DBCA, LGA's Landholders.
	Pests and Disease	Monitor for impacts, including scale insect damage on stressed or dead individuals	Known impact sites	DBCA, LGA's Landholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
<i>Eucalyptus argutifolia</i> (Yalgorup Lakes and Thrombolites area)	Bushfire	Suppress fire while avoiding unnecessary clearing during works	Known impact sites	DFES, DBCA.
		Restrict access	Known impact sites	DBCA, DFES.
	Heatwave/Drought, Flood, Pests and diseases, Pollution	Monitor for impacts	Known impact sites	DBCA, PHCC, LGA's, Landholders.
		Weed and pest control and fencing to exclude stock and restrict access.	Known locations	DBCA, PHBG, PHCC, LGA's, Landholders.
After event has occurred				
	Bushfire, Heatwave/Drought, Flood, Pests and diseases, Pollution	Rapid assessment of impacts	Known impact sites	DBCA, LGA's.
		Plan and implement restoration.	Known impact sites	DBCA, LGA's, PHCC.
		Reduce the impact of other threats (weed and pest control).	Known impact sites	DBCA, LGA's, PHCC.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Banksia Woodland TEC and Tuart Woodland TEC	Bushfire	Suppress fire and protect asset.	Known impact sites	DBCA, DFES.
	Heatwave/Drought, Flood, Pollution	Protect sensitive areas.	Known impact sites	DBCA, DFES, LGA's, Landholders.
		Monitor/assess impacts.	Known impact sites	DBCA, LGA's, PHCC, Landholders.
		Wildlife rescue.	Known impact sites	PMC, MWR, DBCA, Landholders.
	Pests or disease	Treatment to remove or control pests or disease (includes Phosphite spray & tree injects for <i>Phytophthora</i>).	Known impact sites	DBCA, LGA's, PHCC, Landholders.
After event has occurred				
		Rapid assessment of impact.	Known impact sites	DBCA, LGA's, PHCC, Landholders.
		Plan for restoration (may include revegetation, pest and disease control and habitat nest boxes).	Known impact sites	DBCA, LGA's, PHCC, Landholders.
		Monitor impact on vegetation	Known impact sites	DBCA, PHCC.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Clay Pans of the Swan Coastal Plain	Bushfire	Suppress fire while avoiding unnecessary clearing during works.	Known impact sites	DFES, DBCA.
	Drought/heatwave, Flood, Pollution	Protect vegetation and hydrological function.	Known impact sites	DBCA, LGA's, DWER, Landholders.
	Pests and Disease	Treatment to remove or control pests or disease (i.e. Phosphite spray & tree injections for <i>Phytophthora</i>).	Known impact sites	DBCA, LGA's, PHCC, Landholders.
After event has occurred				
Clay Pans of the Swan Coastal Plain	Heatwave/Drought, Flood, Pests and diseases, Pollution	Assess impact on flora.	Known impact sites	DBCA.
		Investigate, monitor and manage water quality and hydrology.	Known locations	DBCA, DWER.
		Implement weed and pest control.	Known impact sites	DBCA, LGA's.
		Protect Clay Pans from physical damage.	Known impact sites	DBCA.

		Ongoing mapping & monitoring of habitat critical for survival.	Known locations	DBCA.
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Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	Bushfire	Suppress fire while avoiding unnecessary clearing during works.	Known locations	DFES, DBCA.
		Protect most sensitive areas and do not exacerbate other threats.	Known locations	DBCA.
	Heatwave/ Drought	Maintain fire breaks and control weeds and pests.	Known locations	DBCA.
	Pests and Disease	Practice good biosecurity hygiene to avoid spreading weeds or pathogens such as <i>Armillaria</i> sp.	Known locations.	DBCA.
After event has occurred				
	Heatwave/Drought, Flood, Pests and diseases, Pollution	Plan for restoration.	Known impact sites	DBCA.
		Rapid assessment of impact.	Known impact sites	DBCA.
		Limit visitor access.	Known impact sites	DBCA.
		Stock exclusion.	Known impact sites	DBCA, Landholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Subtropical and Temperate Coastal Saltmarsh	Bushfire	Extinguish fire and protect sensitive areas.	Known locations	DFES, DBCA, Landholders
		Monitor/assess impacts.	Known locations	DFES, DBCA, Landholders.
	Pests and Disease	Monitor for invasion by exotic species, including <i>Spartina</i> (has potential to invade WA saltmarshes).	Known locations	DBCA, DWER.
		Monitor surrounding waterways for invasive aquatic species.	Riparian zones	DPAW, Landholders, PHCC.
	Storm and Flood	Control water and nutrient run-off.	Known locations	DBCA, DWER.
After event has occurred				
		Plan for restoration.	Known impact sites	DBCA.
		Rapid assessment of impact.	Known impact sites	DBCA.

Subtropical and Temperate Coastal Saltmarsh	Heatwave/Drought, Flood, Pests and diseases, Pollution	Monitor and control outcompeting weed species, such as Juncus sp and wheat grass.	Known impact sites	DBCA.
		Ongoing monitoring of eutrophication of adjacent wetlands.	Known impact sites	DBCA.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Eucalypt Woodlands of the Western Australian Wheatbelt	Bushfire	Controlled burns and maintain firebreaks.	Known impact sites	DBCA, DFES, Landholders.
	Flood	Monitor/assess impacts.	Known locations	DBCA, PHCC.
	Heatwave/ Drought	Protect and maintain hydrological regimes.	Known locations	PHCC, DBCA, LGA's, Landholders.
	Pollution	Control nutrient run-off from adjacent farmland.	Known locations	DPAW, Landholders.
	Pests and Disease	Practice dieback and disease hygiene management.	Known locations	DBCA, PHCC, DPAW, Landholders.
		Pest control (foxes, cats, rabbits, pigs).	Known impact sites	DBCA, PHCC, Landholders.
After event has occurred				
Eucalypt Woodlands of the Western Australian Wheatbelt	Heatwave/Drought, Flood, Pests and diseases, Pollution	Rapid assessment of impact.	Known impact sites	DBCA, LGA's, PHCC, Landholders.
		Plan for restoration (may include revegetation, pest and disease control and habitat nest boxes) and targeted pest control	Known impact sites	DBCA, LGA's, PHCC, Landholders.
		Monitor impact on vegetation recovery	Known impact sites	DBCA, PHCC.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Thrombolite (microbialite) Community of a Coastal Brackish Lake. Occurs at Lake Clifton only.	Bushfire	Suppress fire and maintain fire breaks. Avoid physical damage to riparian zone and Thrombolites.	Known impact locations	DBCA, DFES, Landholders.
	Heatwave/ Drought	On-going monitoring of water quality (salinity, sedimentation, pH, etc).	Known locations	PHCC, DBCA, DWER.
	Pests and Disease	Control and eradicate Black Bream from Lake Clifton (DEWHA 2010).	Known impact sites	DWER.

		Control invasive aquatic species (e.g. paddle crab, slipper limpet, yabby, carp, tilapia, water hyacinth, salvinia)	Known impact sites	DBCA.
	Pollution	Rapid assessment of impact.	Known impact sites	DWER, DBCA.
		If pollution is an oil-spill, use water curtain to contain spill.	Known impact sites	DWER, DBCA.
		Community awareness raising about nutrient runoff from adjacent land.	Ex-situ and known locations	PHCC.
After event has occurred				
Thrombolite (microbialite) Community of a Coastal Brackish Lake.	Heatwave/Drought, Flood, Pollution	Rapid assessment of impacts.	Known impact sites	DWER.
		Plan for restoration of riparian zones and within Lake Clifton.	Known impact sites	DWER, DBCA.
		Reinstate and protect hydrological regimes. Be water wise!	Known impact sites and surrounding land	DWER, Landholders.
		On-going water quality monitoring.	Known locations	DWER, PHCC.
		Undertake further research into the biology, distribution and ecological requirements of the Thrombolite community, including groundwater influx & relative impacts of threats.	Known locations and ex-situ.	DWER, PHCC.
		Community awareness raising.	Known locations and ex-situ.	PHCC.
	Pests and Disease	Monitor and control outcompeting weed and pest species.	Known impact sites	DWER, PHCC.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Ramsar Wetlands	Bushfire	Suppress fire and maintain fire breaks. Avoid physical damage to riparian zone and wetlands.	Known impact locations	DBCA, DFES, Landholders.
	Heatwave/Drought	On-going monitoring of water quality (salinity, sedimentation, pH, etc).	Known locations	PHCC, DBCA, DWER.
	Pests and Disease	Control and eradicate invasive aquatic species (e.g. paddle crab, slipper limpet, yabby, carp, tilapia, water hyacinth, salvinia), as well as foxes, cats, rabbits and pigs.	Known impact sites	DWER, DBCA, PHCC.
	Pollution	If pollution is an oil-spill, use water curtain to contain spill.	Known impact sites	DWER, DBCA.

		Community awareness raising about nutrient runoff from adjacent land.	Ex-situ and known locations	PHCC.
After event has occurred				
Ramsar Wetlands	All	Rapid assessment of impacts.	Known impact sites	DWER.
		Plan for restoration of riparian zones and water quality.	Known impact sites	DWER, DBCA, PHCC.
		Reinstate and protect hydrological regimes. Be water wise!	Known impact sites and surrounding land	DWER, Landholders.
		On-going water quality monitoring.	Known locations	DWER, PHCC.
		Community awareness raising.	Known locations and ex-situ.	PHCC.
	Pests and Disease	Monitor and control outcompeting weed and pest species.	Known impact sites	DWER, PHCC.

Table 5b: Response actions for threatened fauna, along with who is best placed to undertake the action while the event is occurring and after the event has occurred.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Black Cockatoos (includes Forest Red-tailed, Carnaby's and Baudin's Black Cockatoos)	Bushfire	Suppress fires and protect known key habitat sites particularly breeding sites, roost trees and water stations	Known impact locations	DFES, DBCA, landholders.
		Prevent nesting trees from being felled during fire suppression	Known nest tree locations.	DFES, DBCA, private landholders.
		Protect installed cockatubes.	Known impact locations	DFES, DBCA, private landholders.
		Monitor/assess impacts. Recover directly and indirectly impacted birds (burns, smoke etc) for treatment	Known impact locations	DBCA, Perth Zoo, Wildlife rescue, Kanyana, Kaarakin, PHCC, Birdlife, Murdoch University Harry Butler Institute
	Heatwave/ Drought	Install water stations, temporary or permanent	Key locations identified in Conservation Action Plans, within 1km of roost and breeding sites, areas of high bird activity	PHCC, LGA's, Landholders.
		Rescue dehydrated birds	Known impact locations	Perth Zoo, Kaarakin, DBCA, MWR.

	Pests and Disease	Test deceased and symptomatic birds	Known impact locations	Perth Zoo, Murdoch University, Kaarakin, DBCA
After event has occurred				
Black Cockatoos (includes Forest Red-tailed, Carnaby's and Baudin's Black Cockatoos)	Heatwave/Drought, Flood, Pests and diseases, Pollution	Rapid assessment of impact	Impact sites	DBCA, Birdlife, Rescue groups, PHCC.
		Plan for restoration of habitat trees and food species.	Known impact locations	DBCA, LGAs, PHCC, Birdlife, Landholders
		On-going pest control, particularly for feral bees that can take over hollows.	Known impact locations	PHCC, DBCA, LGA's, Landholders.
		Repair and install Cockatubes and water stations.	Known impact locations	PHCC, DBCA, LGA's, Landholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Migratory Wetland Birds , includes all species listed in Tables 2b and 3b.:	Bushfire	Extinguish fire and avoid mechanical damage at known locations.	Known impact locations	DFES, DBCA.
	All	Protect most sensitive areas.	Known locations	DBCA, LGA's, PHCC.
		Monitor to assess impacts.	Known locations	DBCA, PHCC, Birdlife.
		Bird rescue	Known locations	DBCA, WASR.
	Pests and Disease	Test dead birds.	Known impact locations	Birdlife, Murdoch University.
After event has occurred				
Migratory Wetland Birds	Bushfire	Mitigate impacts from foam retardants.	Known impact locations	DBCA.
	All	Plan for restoration	Known locations	DBCA, PHCC, Birdlife.
		Pest control (particularly foxes & cats)	Known locations	DBCA, PHCC, LGA's.
	Pests and Disease	Test dead birds.	Known impact locations	Birdlife, Murdoch University.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Non-migratory Shorebirds and Wetland Birds , including;	Bushfire	Extinguish fire and avoid mechanical damage at known locations.	Known impact locations	DBCA.
	Heatwave/ Drought	Install tents/houses	Known locations	DBCA, Birdlife, PHCC.

<i>Botaurus poiciloptilus</i> , <i>Rostratula australis</i> and <i>Sternula nereis nereis</i> .	All	Protect most sensitive areas.	Known locations	DBCA, LGA's, PHCC.
		Monitor to assess impacts.	Known locations	DBCA, PHCC, Birdlife.
		Bird rescue.	Known locations	DBCA, WASR.
	Pests and Disease	Test dead birds.	Known impact locations	Birdlife, Murdoch University.
After event has occurred				
Non-migratory Shorebirds and Wetland Birds	Bushfire	Mitigate impacts from foam retardants.	Known impact locations	DBCA.
	Heatwave/ Drought	Install and maintain tents/houses	Known locations	DBCA, Birdlife, PHCC.
	All	Plan for restoration	Known locations	DBCA, PHCC, Birdlife.
		Pest control (particularly foxes & cats)	Known locations	DBCA, PHCC.
	Pests and Disease	Test dead birds.	Known impact locations	Birdlife, Murdoch University.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Mallee fowl	Bushfire	Suppress fires and protect known nesting sites (both from fire and mechanical damage during works).	Known impact sites	DFES, DBCA.
	Heatwave/drought, Flood, Pollution, Pests and Diseases	Monitor/assess impacts	Known impact sites	DBCA, PHCC, Birdlife.
		Bird rescue. Test dead birds.	Known impact locations	Birdlife and rescue groups
After event has occurred				
Mallee fowl	Heatwave/Drought, Flood, Pests and diseases, Pollution	Rapid assessment of impact	Known impact sites	DBCA, PHCC.
		Plan for restoration – focus understorey regeneration.	Known impact sites	DBCA, PHCC.
		Ongoing monitoring to assess impacts	Known impact sites	DBCA, PHCC.
		Ongoing bird rescue and testing as needed.	Known impact sites	Birdlife.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Woylie (<i>Bettongia penicillata ogilbyi</i>)	Bushfire	Controlled burns and maintain fire breaks, while avoiding mechanical damage to vegetation where possible	Known impact sites	DBCA, DFES, Landholders.

	Drought/heatwave	Rescue injured individuals.	Known impact sites	DBCA, KWRC, Kanyana
	Pests and Disease	Control foxes, feral cats and pigs.	Known impact sites	DBCA, PHCC, Landholders.
After event has occurred				
Woylie <i>(Bettongia penicillata ogilbyi)</i>	Heatwave/Drought, Flood, Pests and diseases, Pollution	Rapid assessment of impact	Known impact sites	DBCA, PHCC.
		Plan for restoration – focus understorey regeneration.	Known impact sites	DBCA, PHCC.
		Control pests – foxes, cats, pigs.	Known impact sites	DBCA, PHCC, Landholders.
		Ongoing distribution surveys and mapping	Known locations	DBCA, PHCC.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Numbat (<i>Myrmecobius fasciatus</i>)	Bushfire	Suppress fire and maintain fire breaks.	Known locations	DBCA, DFES, Landholders.
		Protect/rake around known ground hollows or hollowed logs with termites.	Known locations	DBCA, PHCC, Landholders.
	Pests and Disease	Research and monitoring required on endo-parasites and ecto-parasites and pathogens particular to each population.	Known locations	Dr Tony Friend is collecting/testing deceased numbats. Numbat Taskforce.
		Practice disease hygiene standards for parasites, pathogens and dieback diseases (<i>P. cinnamomi</i>). Treat diseases where possible.	Known locations	DBCA, LGA’s, PHCC, Landholders. All stakeholders.
After event has occurred				
Numbat (<i>Myrmecobius fasciatus</i>)	Heatwave/Drought, Flood, P	Plan for restoration. Replace nesting logs or artificial structures.	Known impact locations	PHCC, DBCA, LGA’s, Landholders.
		Consider translocations if required – Perth Zoo have a breed for release program.	Ex situ and known locations	DBCA, Wildlife handlers, Perth Zoo.
		Connect remnant patches and protect existing corridors and waterways.	Known locations	DBCA, PHCC, LGA’s, Landholders.
		Outreach and working with landholders around Dryandra to protect remnant vegetation on farms. Education on keeping nesting hollows for numbats.	Known locations	PHCC, LGA’s, Landholders.

		Rapid assessment and ongoing monitoring.	Known locations	Numbat Taskforce
		Planting <i>E. Wandoo</i> and <i>Gastrolobium</i> (linked to high numbat and woylie presence - foxes and cats can be killed by secondary poisoning from <i>Gastrolobium</i>).	Known locations	DBCA, PHCC, School groups.
		Research and adopt fire regimes to enhance <i>Gastrolobium</i> .	Ex-situ and known locations.	DBCA.
	Pests and diseases	Ongoing pest control, particularly foxes and feral cats.	Known locations	PHCC, DBCA
		Ongoing disease hygiene management standards employed.	Known locations.	DBCA, LGA's, PHCC, Landholders. All stakeholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Red-tailed Phascogale (<i>Phascogale calura</i>)	Bushfire	Fire suppression and maintain fire breaks, whilst avoiding mechanical damage to vegetation if possible.	Known impact locations	DBCA, DFES, Landholders.
	Heatwave/ Drought	Vegetation management including weed control.	Known impact locations	DBCA, Mines, LGA's, Landholders.
		Install nest boxes	Known impact sites	PHCC, Landholders.
		Protect existing vegetation and buffer zones.	Known locations	DBCA, LGA's, Landholders.
	Pests and Disease	Pest control – feral cats and foxes.	Known impact sites	DBCA, PHCC, LGA's, Landholders.
After event has occurred				
Red-tailed Phascogale (<i>Phascogale calura</i>)	All	Rapid assessment of impact.	Known locations	DBCA, Mines.
		Plan for restoration. <i>E. wandoo</i> , York gum and She-oaks provide habitat.	Known impact locations.	DBCA, PHCC, LGA's, Landholders.
		Significant gaps in monitoring and mapping. More work is needed.	Known locations	DBCA, Mines.
		Install, monitor and maintain artificial nest boxes.	Known impact locations.	PHCC, Mines, Landholders.
	Pests and Disease	Pest control – feral cats and foxes.	Known impact locations.	DBCA, PHCC, LGA's, Landholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Chuditch (<i>Dasyurus geoffroii</i>)	Bushfire	Fire suppression and maintain firebreaks, while preventing any unnecessary clearing.	Known impact sites	DBCA, DFES.
	All	Rescue injured animals.	Known impact sites	DBCA, KWRC.
		Community awareness raising.	Ex-situ and known locations.	PHCC.
		Protect sensitive areas and surrounding vegetation.	Known impact sites	DBCA, PHCC, Landholders, Mines.
	Pests and Disease	Pest control	Known locations	DBCA, PHCC, LGA's, Landholders.
After event has occurred				
Chuditch (<i>Dasyurus geoffroii</i>)	All	Plan and implement restoration. Consider edge effects and planting Wandoo, She-oaks and <i>Gastrolobium</i> .	Known impact sites	PHCC, DBCA, Mines, LGA's, Landholders.
		Rapid assessment of impact and follow-up monitoring.	Known impact sites	DBCA, PHCC.
		Community awareness raising.	Ex-situ and known locations	PHCC.
		Undertake translocations if necessary	Known locations	DBCA.
	Pests and Disease	Follow-up pest control (feral cats and foxes).	Known impact sites	PHCC, DBCA, LGA's.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Western Ringtail Possum, Ngwayir (<i>Pseudocheirus occidentalis</i>)	Bushfire	Fire suppression and fire breaks, while minimising damage to habitat	Known impact sites	DBCA, DFES, Landholders, rescue and rehabilitation groups
	Heatwave/ Drought	Vegetation management including weed control.	Known impact locations	DBCA, PHCC, LGA's, Landholders.
		Install nest boxes	Known impact sites	PHCC, Landholders.
		Protect existing vegetation and buffer zones.	Known locations	DBCA, PHCC, LGA's, Landholders.
		Rescue and rehabilitate affected animals	Known locations	Rescue and rehabilitation groups
	Pests and Disease	Pest control – feral cats and foxes.	Known impact sites	DBCA, PHCC, LGA's, Landholders.

		Treat dieback disease and restrict visitor access. Employ disease hygiene management standards.	Known impact sites	DBCA, PHCC, LGA's, Landholders.
After event has occurred				
Western Ringtail Possum, Ngwayir <i>(Pseudocheirus occidentalis)</i>	All	Rapid assessment of impact.	Known locations	DBCA.
		Plan for restoration. Peppermint trees, Eucalypts, Banksia and She-oaks provide important habitat.	Known impact locations.	DBCA, PHCC, LGA's, Landholders.
		Significant gaps in monitoring and mapping. More work is needed.	Known locations	DBCA.
		Install, monitor and maintain artificial nest boxes.	Known impact locations.	PHCC, LGA's, Landholders.
	Pests and Disease	Ongoing weed and pest control – feral cats, foxes and rabbits.	Known locations.	DBCA, PHCC, LGA's, Landholders.

Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Carter's Freshwater Mussel	Bushfire	Extinguish fire and protect riparian zone vegetation. Avoid removing trees that shade the waterway.	Known impact site	DBCA, DWER, Landholders.
	All	Prevent banks erosion. Fallen logs placed in waterways can slow erosion and enhance habitat area during floods and drought.	Known impact site	DWER.
		Protect riparian zone vegetation.	Known impact site	DWER, PHCC, DBCA, Landholders.
	Pests and Disease	Exclude stock from habitat area. Pig and fox control is critical.	Known impact site	DWER, PHCC, Landholders.
After event has occurred				
Carter's Freshwater Mussel	All	Rapid assessment of impact.	Known impact site	DWER, PHCC.
		Plan for restoration. Revegetate the banks of waterways with shade trees.	Known impact site	DWER, PHCC, LGA's, Landholders.
		Ongoing monitoring of water quality.	Known locations	DWER, PHCC.
		Significant gaps in monitoring and mapping. More work is needed.	Known locations	DWER, PHCC.
	Pests and Disease	Ongoing pig and fox control. Ongoing stock exclusion from habitat area.	Known locations	DWER, PHCC, LGA's, Landholders.
		Community awareness raising.	Ex-situ	DWER, LGA's, PHCC.

7.2 Response Actions for Protecting Agricultural Natural Capital Assets

Similar to the above, response actions that could be undertaken during and after an event has occurred are shown in Table 6. Following disasters such as bushfire, PHCC reaches out to landholders we've worked with under previous projects to ensure they have the support services in place when needed. This starts with site visits to rapidly assess the impact of the disaster and identify suitable response actions (Figures 7, 8, 9 & 10).

Table 6: Response actions for Agricultural assets, along with who is best placed to undertake the action while the event is occurring and after the event has occurred.

Agricultural Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Hotham-Williams (high productivity zones)	Bushfire	Fire suppression, controlled burning where appropriate.	Across affected areas	DFES
	Flood	Evacuation, mitigation.	Across affected areas	DFES, LGAs
	Heatwave/ Drought	Additional water supply.	Across affected areas	DPIRD
	Pests and Disease	Containment, control, awareness and reporting.	In affected areas	DPIRD
After event has occurred				
Hotham-Williams (high productivity zones)	Bushfire	Clean up, mapping and emergency provision of stock feed. Financial support.	Across affected areas	DFES, DPIRD, SES, LGA's, Wheatbelt Development Commission, Industry groups.
	Flood	Clean up. Emergency feed. Financial support.	Across affected areas	DFES, SES, LGAs, DPIRD Federal/State Government
	Heatwave/ Drought	Additional water supply. Emergency feed. Financial support.	Across affected areas	DFES, SES, LGAs, DPIRD Federal/State Government
	Pests and Disease	Monitor/assess impacts. Emergency feed. Financial support.	Across affected areas	DFES, SES, LGAs, DPIRD Federal/State Government.

Agricultural Asset	Emergency Scenario	Actions	Where	Who
While event is occurring				
Harvey Water Irrigation Areas	Bushfire	Fire suppression, controlled burning where appropriate.	Across affected areas	DFES.
	Flood	Evacuation, mitigation.	Across affected areas	DFES, LGA's.
	Heatwave/ Drought	Additional water supply.	Across affected areas	DPIRD.
	Pests and Disease	Containment, control, awareness and reporting.	In affected areas	DPIRD, PHBG.
After event has occurred				
Harvey Water Irrigation Areas	Bushfire	Clean up, mapping and emergency provision of stock feed. Financial support.	Across affected areas	DFES, SES, LGA's, DPIRD. Federal/State Government.
	Flood	Clean up. Emergency feed. Financial support.	Across affected areas	DFES, SES, LGA's, DPIRD. Federal/State Government.
	Heatwave/ Drought	Additional water supply. Emergency feed. Financial support.	Across affected areas	DFES, SES, LGA's, DPIRD. Federal/State Government.
	Pests and Disease	Monitor/assess impacts. Emergency feed. Financial support.	Across affected areas	DFES, SES, LGA's, DPIRD. Federal/State Government.



Figure 8: Property site visit following bushfire in Peel-Harvey Catchment



Figure 9: Darren Doherty delivering Farm Planning in a Fire Prone Landscape for PHCC



Figure 10: Richardson Property Site Visit following bushfire in Feb 2020

8 Community/Stakeholder Engagement

Preparing and responding to emergencies within natural and agricultural areas is as much about working with people as it is about the environment. This includes providing direct and practical support to groups and individuals such as local government, community groups, Aboriginal people and farmers. People who are engaged and involved in preparing and responding to disasters have a benefit and impact far beyond their local patch. These benefits are not only environmental, but also social and economic.

Just as the health of the Catchment inspires and guides the work that we do, so too does our community and their aspirations to restore and protect our natural environment and agriculture. As the bridging organisation between community and governments in natural resource management (NRM), PHCC is committed to building local capacity to protect our soils, rivers, estuary and wetlands, Ramsar assets and biodiversity.

PHCC will inform, consult, involve, collaborate or empower others, as outlined in PHCC's Community Participation Plan (https://peel-harvey.org.au/wp-content/uploads/2021/06/2019_CPP_endorsed.pdf) to achieve our vision for the protection and enhancement of the catchment's natural assets and communities, we are committed to working in partnership with all sectors of our community, including stakeholders listed within this document.

PHCC also acknowledge that we are not emergency responder experts and have limited capacity to respond to natural disasters, therefore, our stakeholder approach commenced with an initial knowledge gathering stage to ensure all key stakeholders were identified (Figure 11). Our final communications plan for this Plan was presented to the Australian Government as part of deliverable 2c.

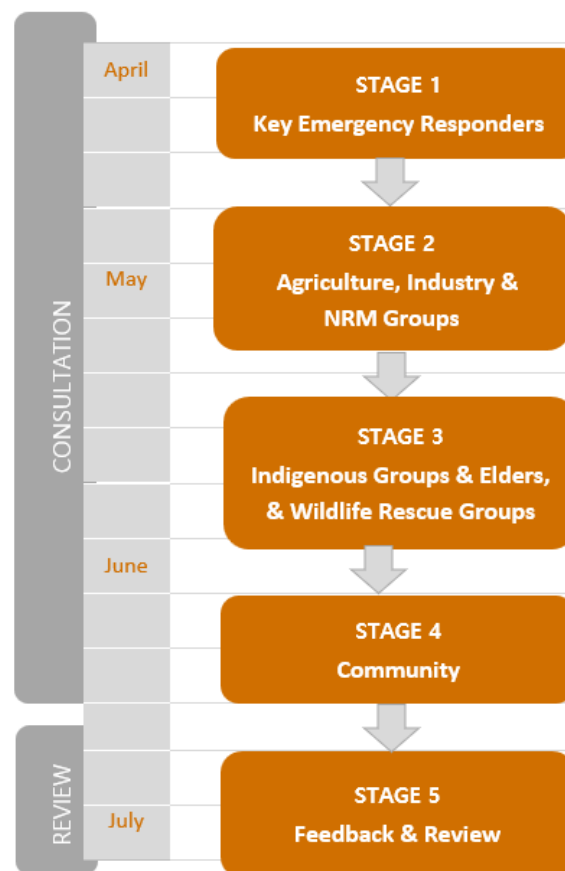


Figure 11: PHCC's stakeholder engagement approach involves five stages of engagement.

8.1 Supporting Government

PHCC is providing support to Commonwealth and State Government efforts to incorporate biodiversity and agricultural natural capital assets into emergency response management and planning systems to guide future responses to extreme events.

PHCC is achieving this by:

- identifying and mapping biodiversity and agricultural natural capital assets within the region;
- collaborating with the Western Australian State Government agencies/committees that have a key role in emergency response and recovery planning to raise awareness of identified natural capital assets and embedding them in local emergency response and recovery planning;
- referring to and utilising information from the Australian Government Disaster Resilience Knowledge Hub to support the need for an EPRP and gain a better understanding of the disaster resilience capacity of communities, and actions that may be taken to improve resilience; and
- raising public awareness of the Emergency Preparedness and Response Plan and associated activities and opportunities relevant to the wider community using social media, PHCC website, targeted outreach, and e-newsletter communications.

9 Legal Framework

Emergency management in Western Australia is administered through the *State Emergency Management Framework* (Figure 12; SEMC 2023b). The Framework, comprised of legislation, policy, plans, procedures, and guidelines, outlines the roles and responsibilities of organisations for emergency management. It also provides a holistic governance structure for the effective management of emergencies.

Emergency management in Western Australia is underpinned by a common set of principles:

- Risk management approach
- Shared responsibility for resilience
- All-hazards approach
- Graduated approach
- All-agencies coordinated and integrated approach
- Continuous improvement
- Community engagement
- Integrated information management.

The design of the Plan considers and aligns with these principles. PHCC's role in delivering emergency management preparedness and response actions is outline in Section 4 above.

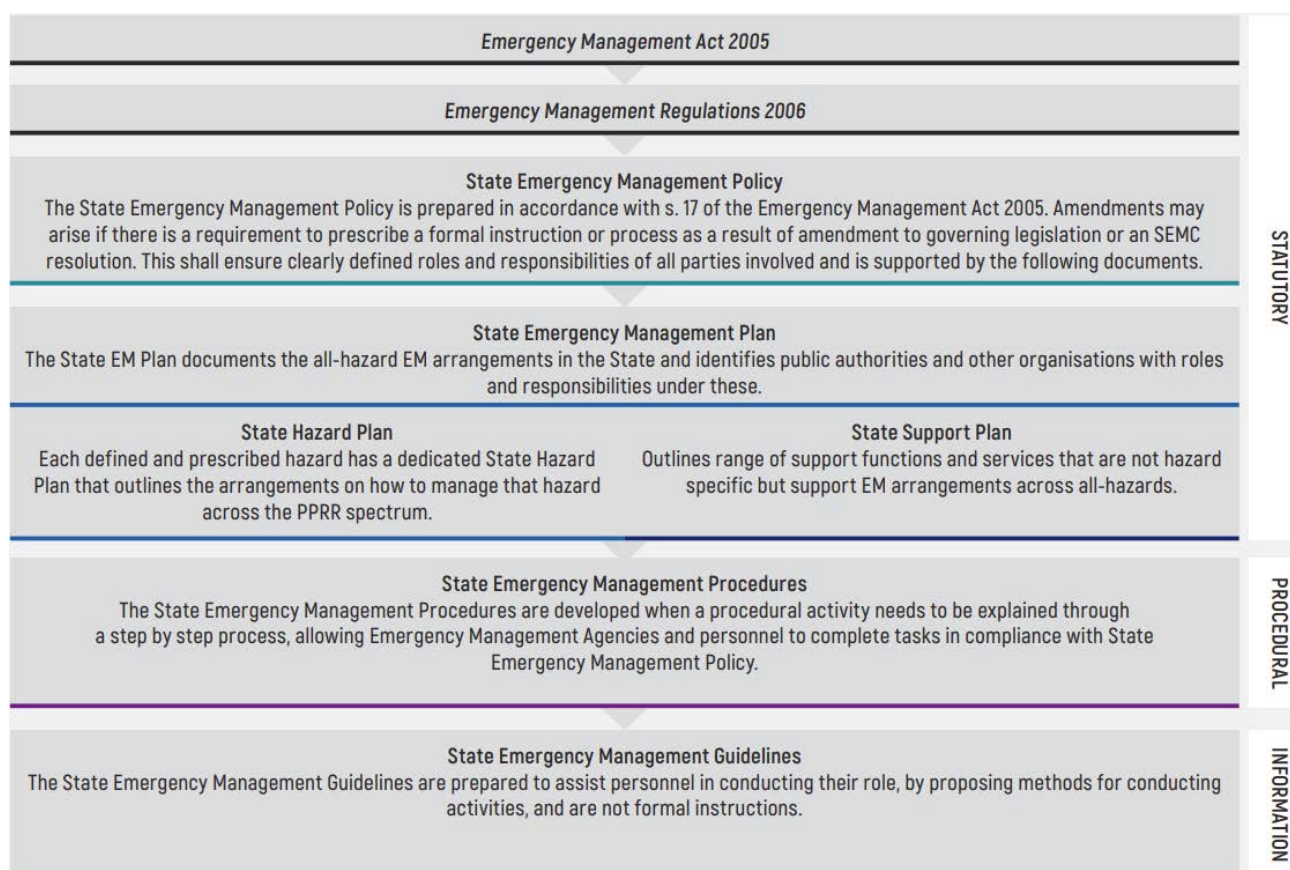


Figure 12: The State Emergency Management Framework for Western Australia

9.1 Workplace Health and Safety (WHS)

PHCC is committed to the health and safety of all workers (including volunteers, contractors, stakeholders and all others). To minimise the risk of injury and unwellness, PHCC have developed an overarching WHS Plan and Manual which has been considered to conform with the requirements of the Deed (on 28/02/2024 by the Australian Government) as part of the RLP tendering process in 2023. These documents can be provided upon request.

PHCC's Work Health and Safety Plan 2023 - 2028 and Workplace Health and Safety Management System Manual provides the framework for managing occupational health and safety across the organisation. The Management team will ensure a Safe Work Method (SWM) Register is maintained and reviewed annually, with modifications being incorporated when and where appropriate.

The SWM Register records and prioritises WHS risks to the business. The current SWM Register is located in the on-line WHS System, which reports on all incidents. This enables PHCC to:

- Identify and minimise all hazards and risks to health, safety and wellbeing
- Minimise the harm of the event and assess by eliminating and effecting controlling risks
- Proactively reduce the risk of an event re-occurring
- Complete corrective actions identified
- Meet compliance reporting requirements
- Identify new legislative or regulatory requirements

The Program is underpinned by PHCC's Occupational Health and Safety Strategy and Policy, supported by a range of policies and procedures, conditions of employment and relevant processes which enable employees to manage operational requirements within their personal needs and workplace obligations.

10 Risk Management Including Mitigation Strategies

This section outlines the key overarching risks associated with the implementation of the asset preparedness/response actions and how they can be mitigated. The risks in delivering this Plan are outlined in Table 7, including risks to safety and security (e.g. exposure to pollutants), further ecosystem destruction (brought on by the response actions), public communication, maintaining channels of communication with emergency services and technological reliance.

Table 7: Overarching risks associated with delivering activities specified in the EPRP, along with the likelihood of risk using the risk rating matrix and subsequent control strategies to reduce the risk.

Risk	Likelihood	Consequence	Risk Rating	Control strategies	Residual Risk
Safety and security of worker onsite or offsite.	Unlikely	Major	High	Ensure all staff are aware of and understand their responsibilities. Ensure staff safety procedure is prepared and implemented. Ensure workers comply with all relevant work safety processes and procedures, including their responsibilities when travelling out of mobile phone range.	Moderate
Unintended ecosystem destruction caused by emergency response actions.	Unlikely	Moderate	Moderate	Preparedness and response actions have been designed to minimise risk to the environment and builds on decades of experience in reducing threats to ecosystems and species. Follow-up monitoring ensures the impact of works is assessed and evaluated.	Low
Resources are not adequate to implement this Plan.	Unlikely	Moderate	Moderate	A partnership approach is used through State and Local Emergency Management Committees, and with contactors and stakeholders undertaking preparedness and response actions. Actions have been designed to complement existing funding and programs with the Australian Government. Additional funding should be sought to implement the Plan in its entirety.	Low
Emergency Services are unaware of the Plan.	Unlikely	Moderate	Moderate	PHCC participates in LEMC meetings and has developed a community engagement plan that ensures all identified Stakeholders receive a copy of the Plan and are provided opportunities for input and feedback.	Low
The Plan is not implemented by emergency services organisations.	Unlikely	Moderate	Moderate	Emergency services are made aware of the Plan and of PHCC's role in Plan implementation. Following an emergency event, PHCC will contact stakeholders identified in Tables 3-6, to ensure action is taking place. Seek additional funding to implement the Plan if needed.	Low

11 Monitoring and Data

This section outlines the nature of data collected (or utilised) as part of this Plan and how it was handled. It includes data used to map the location of sites that have high Matters of National Environmental Significance (MNES) values and data used to map the distribution of threatened species and ecological communities. It also includes data to map the two broad Agricultural assets in the Peel-Harvey Catchment.

11.1 Location of Biodiversity Assets

Biodiversity assets include Threatened Ecological Communities (TECs) and Threatened Species. DCCEEW's online Protected Matter Search Tool (<https://pmst.awe.gov.au/>) was used to initially identify biodiversity assets at bushland and Ramsar sites in the Peel-Harvey Catchment. The Protected Matters Search Tool identified over 100 threatened or migratory species in the Catchment. PHCC developed a prioritisation approach that identified bushland and Ramsar sites with high MNES values (more information provided in Section 5.1) from these. The attributes that were used to identify sites with high MNES include the datasets outlined in Section 5.1, with detailed references provide in Section 13. These datasets include:

- Threatened ecological communities, threatened flora and threatened fauna
- Indigenous and National Heritage
- Migratory Species and Marine Species (includes shorebirds)
- Ecological Linkages/Corridors (Molloy et al. 2009)
- Ramsar Wetland / system
- Black Cockatoo Breeding Sites with 10km buffer around known breeding sites
- Sites of Historical Investment (includes previous works supported by PHCC and DBCA)

These datasets are publicly available in the form of shapefiles from the Australian Government (<https://www.data.wa.gov.au/>), except for the Black Cockatoo Breeding Sites and Sites of Historical investment. These datasets are sourced and stored internally and include results from monitoring and on-ground works completed under previous programs funded by the Australian Government, including national and regional landcare programs.

The location of significant sites with high MNES is provided in Appendix 3. The location of threatened flora, fauna and ecological communities covered in this Plan is provided in Appendix 4. A full multi-jurisdictional inventory of biodiversity assets in the Peel-Harvey Catchment is provided in Appendix 5.

11.2 Location of Agricultural Assets

Agricultural Assets were identified and mapped using the following spatial datasets (maps of Agricultural assets are provided in Appendix 6:

- Harvey Water Irrigation Districts (HARWA-002)
- Harvey Water Pipelines (HARWA-001)
- Agricultural capability layers, e.g. dryland cropping or grazing: Land Capability - Grazing (DPIRD-032)
- Agricultural Areas (LGATE-228)

PHCC have incorporated knowledge and results from extensive monitoring and farms and bushland site visits following past emergency events, particularly fire (Figure 13).



Figure 13: PHCC monitoring post-fire regrowth following a severe bushfire in the Catchment

12 Key Contacts

A full list of stakeholders/key contacts is provided in the Table 8 and includes the organisation and their relevant role/s. PHCC is maintaining an engagement register which includes the date, time, type of interaction, organisation, name of participants, purpose of engagement and number of community groups and Indigenous attendees at each engagement. This information is presented in Appendix 6.

Table 8: Identified Stakeholder list, including the organisation name and role.

Organisation	Role
DAFF: Dept. of Agriculture, Fisheries and Forestry	DAFF work to enhance agricultural, fisheries and forestry industries. They manage biosecurity risks to Australia to protect our agricultural industries and way of life. From biosecurity dog handlers to researchers and scientists, as well as regulators, program administrators and policy advisers, DAFF staff have diverse skills and experience related to the managing emergency preparedness and response actions for Agricultural assets. DAFF provide information on biosecurity risks via their farm biosecurity website (https://www.farmbiosecurity.com.au/).
DBCA: Dept. of Biodiversity, Conservation and Attractions	DBCA is the key department that manages Forests and Crown Reserves in Western Australia. They bring together DPaW, Botanic Gardens and Parks Authority, Zoological Parks Authority and biodiversity and conservation to protect our Reserves. They have a direct role in protecting communities and assets from emergency scenarios such as bushfire and provide a high level of scientific research and monitoring. PHCC has a close relationship with DBCA and provides frequent support for on-ground works to protect our biodiversity assets. DBCA also run Western Shield, WA's largest conservation program for threatened fauna at Dryandra.
DFES: Dept. of Fire and Emergency Services	DFES' purpose is to support the WA community to prepare for disasters and protect them against the unpredictability of natural hazards and emergency incidents. DFES has an extensive network of more than 26,000 volunteers who generously donate their time to deliver essential emergency services to the WA community. DFES collaborates with local communities and other government agencies to prevent, prepare for, respond to, and recover from natural hazards.
DPIRD: Dept. of Primary Industries and Regional Development	DPIRD's role is to grow and protect Western Australia's agriculture and food sector. They support all aspects of food and fibre production at each stage of the supply and value chains. The department has a pivotal role in helping to look after the productive capacity of our precious soil and water resources and world-class biosecurity system, and minimise the impact of climate variability. Their long-term commitment to biosecurity has helped maintain WA's relative freedom from pests and diseases and earned its

	reputation as a world-class producer of clean, safe and premium products. They create surveillance and diagnostic programs for detecting & controlling pests and diseases.
DWER: Dept. of Water and Environmental Regulation	As the primary water and environmental regulator, DWER plays a crucial role in managing and overseeing the state's environmental and water resources. During emergencies like fires and floods, DWER provides essential support to emergency services, the Bureau of Meteorology, and local governments and other agencies. DWER is mandated to promptly address pollution incidents and hazardous materials (HAZMAT) emergencies under the Emergency Management Act and State Emergency Plan. Their Environmental Response Unit collaborates closely with the Department of Fire and Emergency Services and local governments. Their tasks include monitoring air quality, gathering evidence, and preventing firefighting runoff from contaminating waterways. They also offer guidance, technical assistance, and field support during pollution and HAZMAT incidents. Additionally, DWER is responsible for operating and maintaining water measurement infrastructure, leading flood modelling efforts, and offering expert advice on flood risks to emergency services. After significant floods, DWER restores critical monitoring networks, evaluates waste management and contamination risks, and can expedite approvals for replacing essential infrastructure.
BCoE: Bushfire Centre of Excellence	The BCoE is an educational hub where bushfire management personnel can come together for training and learning. Their dedicated team also examines bushfire knowledge research across the globe, from traditional fire practices of Aboriginal Australians to contemporary bushfire management practiced internationally. The Centre is the first of its kind in Australia and is located in the Shire of Murray's Peel Business Park, about an hour south of Perth. The local Bindjareb people have embraced the establishment, sharing old traditional and new fire practices and beliefs to create a stronger future.
LEMC: Local Emergency Management Committee	The LEMCs core function, managed by local government, is the development, review and testing of the Local Emergency Management Arrangements (LEMA). LEMA set out the local government's policies, strategies, and priorities for emergency management.
DEMC: District Emergency Management Committee	The role of DEMC is to help establish and maintain effective emergency arrangements in their district. DEMCs focus on risk in their district and provide guidance and information to the Local Emergency Management Committees (LEMCs) in the emergency management district.
SEMC: State Emergency Management Committee	SEMCs play a key role in setting the strategic emergency policy framework in Western Australia, including facilitating consultation and coordination between emergency management stakeholders. The SEMC manages the Emergency Management Act 2005 and the Emergency Management Regulations 2006.
PHBG: Peel-Harvey Biosecurity Group	The PHBG is a not-for-profit organisation perfectly placed within local communities to help promote and support biosecurity incursion activities and awareness. The PHBG have developed a reputation within the local community as the 'go to' for pest information and an avenue to report pests. The PHBG can easily incorporate awareness raising activities within its annual seasonal calendar of events while assisting in the sharing and promotion of awareness campaigns within our local area. These activities together can support the monitoring and reporting of new incursions. The PHBG is recognised by the Minister for Agriculture and Food under the Biosecurity and Agriculture Management Act 2007.
Local Government Authorities: City of Mandurah Shire of Collie Shire of Serpentine-Jarrahdale Shire of Murray Shire of Waroona Shire of Boddington Shire of Wandering Shire of Cuballing Shire of Harvey Shire of Narrogin Shire of Pingelly Shire of Williams Shire of Wickepin	LGA's are responsible for localised services including emergency management such as response and recovery. They have a legislative role to assist with local planning and preparation for emergency events. This involves leading the preparation of Local Emergency Management Plans and coordinating Local Emergency Management Committee meetings involving local emergency-management agencies. LGA's also have a key role in restoration activities while an emergency event is occurring and after an event has occurred. They coordinate on-ground responses to protect the biodiversity assets identified in this Plan. PHCC has a close relationship will all LGA's in the Catchment, and frequently engage with them to undertake preparedness and response actions on Council and private land. They also have a key role in community awareness raising.
NRM Sub-catchment/Landcare: Perth NRM South Coast NRM Southwest NRM Wheatbelt NRM NACC	NRM groups in the Peel-Harvey catchment are mostly independent, community based, not-for-profit organisations committed to the long-term environmental protection and enhancement of the region. They inspire, support and work with the community to preserve ecosystems and species, for the sustainability of the environment in the Catchment. They are motivated groups that raise community awareness and undertake on-ground works to protect the environment from emergencies and threats.

Rangelands Leschenault Catchment Council Landcare Serpentine Jarrahdale	
Friends of Groups: Friends of Lake McLarty Lake Mealup Preservation Society Lake Clifton Herron Landcare Group Mandurah Envr. & Heritage Group Williams Landcare Group Friends of the Boddington Reserve Central South Naturalists Club	Friends of groups are volunteer based environmental groups in the Peel-Harvey Region. They undertake landcare, bushcare and waterway care to protect and restore natural areas. They help to care for bushland on local nature reserves and lakes through planting of native seedlings, weeding, pest control, monitoring and other activities. They work to improve the health and habitat values of biodiversity assets. A list of all Friends of Groups in the Peel-Harvey Region is provided on the Landcare WA website: https://www.landcarewa.org.au/network/
Indigenous Groups: Winjan Bindjareb Boodja Rangers Bindjareb Elders Wilman (Dryandra) People Corp. Inc. Wilman Elders Harvey Aboriginal Corporation	Indigenous groups in the Peel Harvey Catchment have a key role in preparing and responding to emergency events and can provide a vital conduit between Indigenous communities and emergency management structures. The intrinsic strength of Indigenous communities are powerful resources that are often overlooked during emergency events, despite their long history of withstanding extreme events. The Indigenous Groups listed here include Noongar Rangers with valuable skills to assist with emergency recovery (i.e., weed and pest control, revegetation, installation of habitat boxes, monitoring) and have worked alongside PHCC and other agencies to heal Woodlands and Waterways. They also include trained firefighters.
Mining and Industry: Alcoa (Pinjarra and Wagerup) South32 Newmont	A considerable portion of biodiversity assets occur within mining tenements. All these mines have emergency mitigation plans, that also extend beyond tenement boundaries. Through the stakeholder engagement process, the Shire of Murray have identified Mines as a key resource for bushfire mitigation and they frequently assist with extinguishing fires that occur beyond tenement boundaries. Mines also employ researchers and scientists and have extensive experience monitoring environmental responses after emergency events.
Wildlife Rescue Groups: DBCA (see above) Mandurah Wildlife Rehabilitation Kaarakin Black Cockatoo Centre Peel Marsupial Care (Mandurah, Waroona, Herron, Boddington) WA Seabird Rescue	Wildlife Rescue Groups (excluding DBCA) are generally non-for-profit groups run by a team of volunteers. They work tirelessly to rescue and care for sick, injured and orphaned native animals, to actively preserve Australian wildlife and inspire others to do the same. Many of the volunteers are retirees, often sinking their own funds into wildlife rescue activities. These services are often underfunded, and sometime underutilised during emergency event however, their capacity to support emergency response actions is strong and passion driven. Recent stakeholder meetings with wildlife rescue groups have identified the need for a wildlife ambulance and are looking at funding options.
Agricultural Groups: DPIRD (see above) DWER (see above) Peel Alliance Growers Group SJ Farm & Food Alliance (Mundijong) Western Beef Association Southwest Drought Hub (via SWNRM) Wandering Farm Productivity Group	Agricultural grower groups, alliances and associations act to connect farmers in the region to create sustainable, health and prosperous farms and communities. They deliver innovative research and development activities and, in times of emergencies, engage to assist in on-ground outreach and logistics capacity in various ways. Grower groups have been engaged to take on a role in the Esperance 2015 fires and the Yarloop 2016 fires.
Development Commissions: Wheatbelt Development Commission Peel Development Commission South West Development Commission	Development commissions coordinate and promote the economic and social development of the region and partner with government, communities, business and industry on projects to benefit the region. Although Development Commissions do not have a direct role in emergency preparedness and response, they have a wide network of business and industry contacts that can be drawn from to enhance capacity for emergency response. Following recent fires in the Wheatbelt, Emergency Services Minister Stephen Dawson recently announced the appointment of Wheatbelt Development Commission Chief Executive Rob Cossart as District Recovery Coordinator (DRC) to the Wheatbelt, to better support communities recovering from the aftermath of catastrophic bushfires that hit the Wheatbelt region in February. He will also chair a District Recovery Coordination Group that will be established to ensure targeted support is delivered to fire-affected communities.
Landholders, community members and volunteers	Approximately half the bushland in the Peel-Harvey Catchment with TECs/PECs and threatened species is within private ownership. Managing emergency risk is a shared responsibility and landholders are legally responsible for managing hazards on their property. Our community is incredible connected and capable. They are able to muster small teams rapidly to assist with emergency preparedness and response actions. They are responsible for maintaining firebreaks, managing vegetation to reduce risk, using and maintaining firefighting equipment and ensuring adequate supply of water for firefighting purposes. They can assist with works such as invasive plant/animal control, revegetation, waterway monitoring and improving farming practices at a local scale.

There are a range of other organisations that play an important role in emergency management but are less involved in biodiversity and agricultural natural-capital preparedness, response and recovery. This includes ambulance services, St John, Australian Red Cross, Western Australia Police Force, Health Support Services, St John of God, Department of Communities and Western Australian Department of Health, plus a range of environmental volunteer groups, to name only a few.

13 Spatial Data References

Reference list for all spatial data used to prioritise sites:

- TECs/PECs: 01-0223EC_PeelHarvey_PHCC_Boundaries
- Threatened and priority flora and fauna:
 - FaunaSearch_PHCC
 - 64-0523FL_TPFL
 - 64-0523FL_WAHerb
- Indigenous and National Heritage:
 - Aboriginal_Heritage_Places_DPLH_001 (Retired)
 - Aboriginal_Cultural_Heritage_Register_DPLH_099
- Migratory Species Habitat (includes shorebirds)
- Ecological Linkages/Corridors (Molloy et al. 2009): EcoLinkages_lines_140526
- Bush Forever Sites
- Ramsar Wetland / system:
 - RamsarWetlands
 - Ramsar_Extension_2008
- Black Cockatoo Breeding Sites:
 - FaunaSearch_PHCC_LeRoy6520_WTBC_breeding_data_restricted_2020(draft)
 - FaunaSearch_PHCC_LeRoy6520_FRTBC_breeding_data_restricted_2020(draft)
 - FaunaSearch_PHCC_LeRoy6520_BC_roost_data_restricted_2020(draft)
- Shorebirds and Wetlands Birds: BirdLife Australia (2024). Birddata Platform Extract (<https://birddata.birdlife.org.au/>). BirdLife Australia, Melbourne. Generated on 26-06-2024.
- Reserves:
 - Reserves_LGATE_227
 - Lands_of_Interest_DBCA_012
 - Legislated_Lands_and_Waters_DBCA_011
- Tenure_PHCC_LGATE_226
- Vegetation:
 - swan_bioplan_peel_regionally_significant_natural_areas_epa_dec2010
 - AllSCP1994Plotlocations
- Sites of Historical Investment (includes previous works supported by PHCC and DBCA)
- Harvey Water Irrigation Districts (HARWA-002): <https://catalogue.data.wa.gov.au/dataset/harvey-water-irrigation-districts>
- Harvey Water Pipelines (HARWA-001): <https://catalogue.data.wa.gov.au/dataset/harvey-water-pipelines>
- Potentially arable land: Potentially Arable Land (DPIRD-026)
- Agricultural capability layers, e.g. dryland cropping or grazing: Land Capability - Grazing (DPIRD-032)
- Agricultural Areas (LGATE-228)

14 Other References

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DBCA (2018) Dwellingup Synaphea (*Synaphea stenoloba*) Interim Recovery Plan. Interim Recovery Plan No. 388. Department of Biodiversity, Conservation and Attractions, Western Australia. Available at <https://library.dbca.wa.gov.au/static/Journals/080548/080548-388.pdf>

DCCEEW (2023) Approved Conservation Advice for Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion, Department of Climate Change, Energy, the Environment and Water, Commonwealth of Australia, Canberra. Available at <https://www.environment.gov.au/biodiversity/threatened/communities/pubs/182-conservation-advice.pdf>

DCCEEW (2022) *Threatened Species Strategy Action Plan 2022–2032*, Department of Climate Change, Energy, the Environment and Water, Canberra, September. CC BY 4.0.

DCCEEW (2013) Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s266B), Conservation Advice for Subtropical and Temperate Coastal Saltmarsh. Canberra, Department of Climate Change, Energy, the Environment and Water. Available at <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/118-conservation-advice.pdf>.

DEWHA (2010) Approved Conservation Advice for Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton). Canberra, ACT: Department of the Environment, Water, Heritage and the Arts. Available at: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/96-conservation-advice.pdf>.

DEWHA (2008) Approved Conservation Advice for *Eucalyptus argutifolia* (Yanchep Mallee). Canberra: Department of the Environment, Water, Heritage and the Arts. Available at <http://www.environment.gov.au/biodiversity/threatened/species/pubs/24263-conservation-advice.pdf>.

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DPaW (2017b) Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58. Department of Parks and Wildlife, Perth, WA. Available at <https://www.dcceew.gov.au/sites/default/files/documents/recovery-plan-western-ringtail-possum.pdf>

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Molloy, S., Davis, R. & Van Etten, E. (2013) Species distribution modelling using bioclimatic variables to determine the impacts of a changing climate on the western ringtail possum (*Pseudocheirus occidentalis*; Pseudocheiridae). *Environmental Conservation*, 41 (2): 176-186.

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Yeatman, G. & Groom, C. (2012) National Recovery Plan for the Woylie *Bettongia penicillata*. Wildlife Management Program No. 51. Department of Environment and Conservation, Perth. Available at <https://www.dcceew.gov.au/sites/default/files/documents/bettongia-penicillata-ogilbyi.pdf>

APPENDIX 1: Relevant Case Studies

Case study available at https://peel-harvey.org.au/wp-content/uploads/2019/01/Case-Study-24_Fire-Recovery.pdf

CASE STUDY 024

2016-2018



Helping local communities recover after fire Waroona NRM & Fire Recovery Support Project

The Waroona NRM and Fire Recovery Support Project is a two-year initiative to assist and support those within the Shires of Waroona and Harvey impacted by the massive wildfire of 2016. The fire had a significant impact on a number of local communities and burnt over 72,000 ha of native forest, bushland and farmland, including 426 farms covering 33,000 ha.

The Project has been designed and delivered by the PHCC to support the community to restore farmlands and natural areas damaged in the fires, and increase community skills, knowledge and confidence in fire recovery land management practices. Over 230 farmers, school students and other community members have been directly involved in the Project since 2016. This includes

the project's devolved grant program that has assisted 20 landholders to rehabilitate 1000 hectares of farmland and on-farm vegetation. A further 800 hectares of farmland has received improved sustainable agricultural management through the implementation of regenerative agriculture practices by landholders.

Fire Recovery Workshops and Field Days have been held to provide practical land management advice to fire-affected landholders, complemented by other activities, such as planting days, to engage the wider community in restoration of fire-affected areas. In numerous ways the Project is helping both people and the land recover and heal from this devastating fire, a process which will continue for many years to come.

FUNDING PROGRAM

State NRM Community Capability Grant

PHCC PROGRAM

Supporting Sustainable Agriculture in the Peel-Harvey

PHCC PROJECT

Waroona NRM and Fire Recovery Support

FUNDING

Community Capability Grant	\$120,000
Community Action Grant 2017*	\$55,000
Community Action Grant 2018*	\$55,000

* in partnership with Shire of Waroona via State NRM funding

REGIONAL COVERAGE



Ramsar Wetlands
Coastal Plain

STAKEHOLDERS

Shire of Waroona, Shire of Harvey, Coolup LCDC, Shire of Murray, State NRM Office, Harvey River Restoration Taskforce, Peel-Harvey Biosecurity Group

BENEFICIARIES

Landholders (predominantly farmers) within the 2016 Waroona fire scar; communities of Waroona and Harvey shires

PROJECT MANAGER

Megan LeRoy

STEERING COMMITTEE

Andy Gulliver, Jan Star, Marilyn Gray, Darralyn Ebsary, Rob Summers, Jane O'Malley, Kim Wilson, Luke Rogers



"The Shire of Waroona, on behalf of the fire affected community, are grateful of the support received through the PHCC "Waroona NRM & Fire Recovery Support project". This project has enabled us to continue to rebuild confidence and provide the support and guidance needed to rebuild this devastated community and the environment back to its pre fire state. Whilst there is still many years of work to be done to get the community back to a sense of normality, support of these types of initiatives are critical in building community resilience and capability into the future."

" Dave Gossage, Shire of Waroona Fire Recovery Officer "

KEY ACHIEVEMENTS

- New community networks created that connect people, provide support and foster sharing of experiences and information
- Fire recovery grants for on-ground works awarded to 20 properties (1000ha) with a total of \$110,000 for land restoration
- Improved sustainable agricultural management practices over 800 ha
- *Bushfire Recovery and Resilience Community Workshop*
- *After the Fire* property planning workshop for sustainable agriculture
- *After the Fire* Field Day/Bus tour
- *Wildflower Walk* – Aitken Rd Reserve, Yarloop
- *Great Morri Plant Out* partnership project – tree planting within Reserves surrounding Yarloop burnt in the fire; 500 students from metropolitan Carbon Schools Project planted 20,000 plants over 4 weeks in June 2017
- Engagement of local Noongar people in project events
- Youth engagement in *Bird Nest Building Workshop*

LOCATION

Fire affected localities within the Shires of Waroona and Harvey

PUBLIC AWARENESS

Articles in local media including Harvey Reporter (Students keen to bring back the birds)

FUTURE ACTIVITIES

Noongar training/engagement in landcare; articles in local newsletters; building community led landcare; supporting sustainable agriculture activities through a workshop and field day.

CASE STUDY 037
2016-2019



- REGIONAL GOALS**
- People
 - Biophysical
 - Knowledge

Greening the Farm after a Fire

Wildfires can have a devastating impact on farms, farming communities and natural resources. The Waroona-Yarloop Fire of 2016 was no exception and burnt 33,000 ha of farmlands in the Peel-Harvey Catchment, causing many landholders to rethink current farming and vegetation management practices.

The impacts of wildfire include exposure of topsoil, loss of pasture and seed stores, proliferation of weeds and feral animals, and loss of wildlife habitat.

One farmer in the coastal Peel-Harvey catchment, Phil Cumow, responded to the challenge by implementing a new management system across paddocks and on-farm vegetation.

Mr Cumow purchased the property in 2013 and not long after began rejuvenating and reseeding paddocks. In January 2016 the Waroona-Yarloop wildfire swept across the property destroying native vegetation, farm infrastructure and summer pasture. Mr Cumow's story was familiar, with an estimated 414 farms throughout Waroona,

Yarloop, Harvey and surrounding districts heavily impacted by the fire.

In the months following the fire Mr Cumow utilised the support of the Peel-Harvey Catchment Council (PHCC) and funding partners to participate in workshops and field days. His approach was to not only improve production levels of grazing areas, but to protect, restore and expand areas of native vegetation that were located on the farm. He used a combination of sustainable agriculture, regenerative farming, and natural resource management techniques to restore and "green" his farm, and make the property more resilient to future fires and natural disasters.

Since 2016, shelterbelts of local native species have been installed, remnant vegetation protected and restored, and riparian corridors have been rehabilitated. In total, sixteen (16) hectares of vegetation has been established and protected on the farm, with careful consideration of emergency access and ongoing management of weeds and fuel loads.

FUNDING PROGRAM

Australian Government's National Landcare Program
WA Government's State NRM Program

PHCC PROGRAM

Supporting Sustainable Agriculture in the Peel-Harvey

PHCC PROJECT

Waroona Fire Recovery & NRM

FUNDING

National Landcare Program
State NRM Program
Shire of Waroona
Harvey River Restoration Taskforce

REGIONAL COVERAGE



Coastal Plain

STAKEHOLDERS

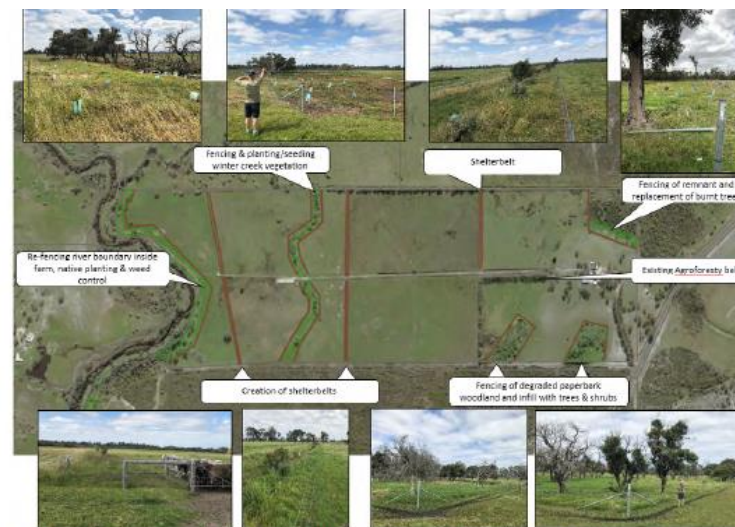
Shire of Waroona; Harvey River Restoration Taskforce

BENEFICIARIES

Fire-affected Farming Community

PROJECT MANAGER

Megan LeRoy



Aerial view of property showing exclusion fencing (brown) and rehabilitation areas (green cross-hatch), with photo inserts showing on-ground work.

KEY ACHIEVEMENTS

On-farm vegetation management includes:

- Re-alignment of river corridor fencing within the property and rehabilitation of river foreshores to improve riverbank stability and wildlife habitat; Adequate emergency access points have been provided to these areas, and crash-grazing is used to manage weed and fuel loads
- Creation of five (5) native vegetation shelterbelts between paddocks, to reduce the impact of prevailing easterly winds
- Fencing off a winter creek, and rehabilitation with both tubestock seedlings and direct seeding. This 1.5 ha revegetated area provides a wildlife corridor between the local nature reserve, Coronation Reserve, and other remnant vegetation to the north of the farm
- Fencing off two degraded paperbark woodland remnants, and infill planting with native shrubs and trees
- Fencing off 1.8 hectares of eucalypt woodland in north-east corner of the property, where the fire killed many mature jarrahs; replanting of this area with mixed species native vegetation
- Selective herbicide control of grassy weeds in revegetation areas until native shrubs/trees are established enough to crash graze
- Crash grazing fenced remnant vegetation areas

prior to revegetation, and as required to reduce fuel loads once seedlings are can withstand grazing pressure

Pasture, paddock and infrastructure improvements include:

- Removal of shallow winter only watering points and replacement with reticulated water troughs in each paddock, located away from high fire risk areas
- Rotational cell and strip grazing practices across all paddocks
- Whole Farm Nutrient Mapping soil testing to customise fertiliser blends; this resulted in a reduction in fertiliser rate and increased stock carrying capacity
- Replacement of all fire equipment fittings to metal
- Design and construction of new farm buildings to provide greater protection against wildfire
- Garden design, including use of fire retardant plants, utilized around the homestead

Years on from the devastating fire event, Mr Cumow has a highly productive hay and cattle property, with parts of the property under managed native vegetation. Areas of on-farm vegetation have protected river and creek banks, provide shelterbelts against prevailing summer easterly winds, and enable wildlife to use and move across the farm.



- REGIONAL GOALS
- People
 - Biophysical
 - Knowledge

Banksia Dieback

Dieback is a plant disease affecting hundreds of thousands of hectares of natural bushland and forest in the south-west of Western Australia. It can have devastating impacts for Banksia Woodland Threatened Ecological Community, due to the susceptibility of many native plant species including Banksia's Hakea's, Eucalypts and Grass-Trees. The World for Woodland Project has supported phosphite treatments at several remnant Banksia Woodland patches infected with dieback, including the Kingia Thompson Bushland (a privately owned 100-hectare patch of remnant native woodland located approximately 65 km south of Perth in the Shire of Serpentine-Jarrahdale, Western Australia).

Phosphite treatments at the Kingia Thompson Bushland began in 2010 and are on-going. Treatments are expensive but, with repeat financial contributions from the World for Woodlands Project, the Woodland is in a state of recovery. Several patches that were once bare due to dieback are returning with dense vegetation and young Banksia's recruiting. With fewer tree-deaths and a regenerating understorey, phosphite treatments have been critical for controlling dieback at the Kingia Thompson Bushland. This project has been a collaborate effort with landholders, Landcare SJ, Glevan Consulting and the Peel-Harvey Catchment Council

FUNDING PROGRAM

Australian Government's National Landcare Program

PHCC PROGRAM

Threatened Ecological Communities

PHCC PROJECT

World for Woodlands - Banksia Project

FUNDING

National Landcare Program

\$1.12M total

REGIONAL COVERAGE



PROJECT MANAGERS

Mel Durack, Karen Bettink, Corrine Duncan

STEERING COMMITTEE

Paddi Creevey, Sue Fyfe, Amanda Batt, Veronica Metcalf, Rob Harris

STAKEHOLDERS

- Landholders and Community Members
- Landcare SJ
- Local Governments
- DBCA

COLLABORATION

Landcare SJ

ACTIONS/ACTIVITIES

95ha with in-kind contributions



APPENDIX 2: Example of Training “Farm Planning in a Fire Prone Landscape

Farm Planning in a Fire Prone Landscape

Train the Trainer: Farm Planning Extension Program

commencing Tuesday August 3, 2021



Peel-Harvey Catchment Council and Regrarians® are proud to be partnering in the delivery of a Farm Planning and Train the Trainer package for Farmers and NRM Professionals.

Registrations close **July 5**, please contact your Regional Representative (details overleaf)

Phase 1 involves participation in the 13 week online REX® program (a comprehensive “Live” Online Farm Planning Package) and a bonus two week online training program for pre-post fire management planning. Phase 2 offers the opportunity to build extension skills through a specially applied approach – the onsite ‘pre-post’ fire management training workshop. The package also includes a year of online support and follow up, all delivered by Darren J. Doherty and the team at Regrarians®.

Register your interest now
limited sponsored places available!

Phase 1 Online Training

REX® Farm Planning Training Program & exclusive Fire prevention, mitigation and recovery strategies (valued at \$1,000*)

Step 1: Online Farm Planning Training - 13 weeks 2 x 3 hours/week (recorded to review or if a session is missed)

Commencing Tuesday August 3 (Tues/Fri weekly) and concluding October 29. REX® Farm Planning Program (including water management). Full details at http://www.regrarians.org/product/phcc-training_program/

Step 2: Regrarians® Pre-post Fire Management Planning, prevention, mitigation and recovery strategies

Dates to be determined to best fit participant seasonal commitments

Phase 2 Onsite Workshop

Train the Trainer: Pre-Post Fire Extension Program (valued at \$1,060*)

Step 3: Onsite 5 day Workshop - Participatory train the trainer program for NRM Professionals (the trainees), and their partnered Farmers, who have completed Steps 1 and 2 in partnership with an NRM Professional.

Dates to be confirmed March/May 2022

*value is per team (one NRM professional and one farmer)

More details overleaf....

Farm Planning in a Fire Prone Landscape

Train the Trainer Pre-Post Fire Extension Program

delivered by
Darren Doherty of Regrarians®

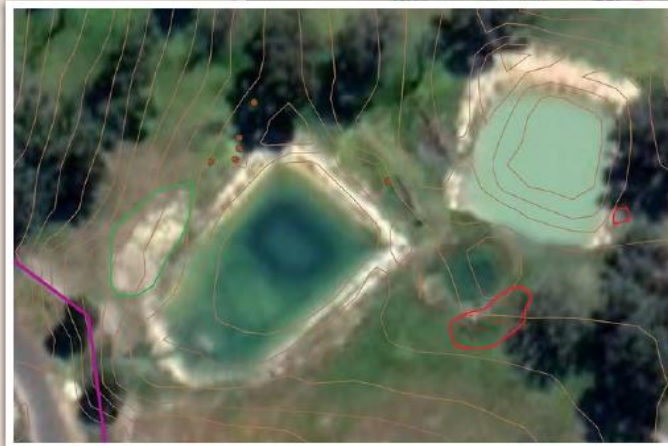
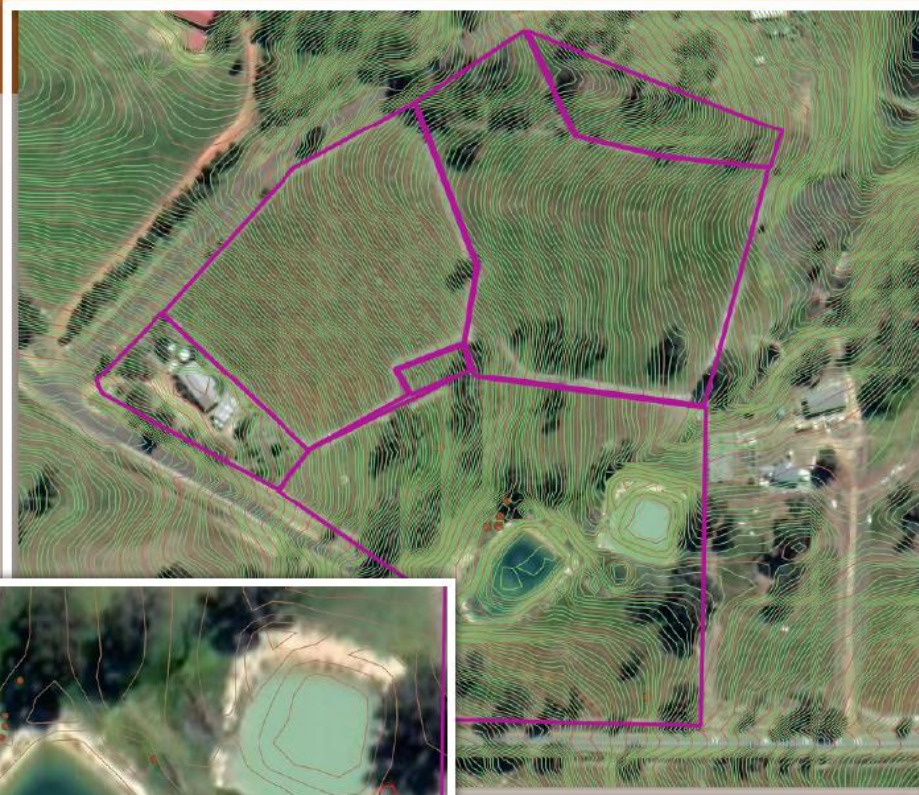
September 12 to 16

Pre-Post Fire Extension Program – Phase 2 Onsite workshop with Darren Doherty will be held Tuesday September 13 to Friday September 16.

You are welcome to attend both the morning and afternoon sessions, or just the afternoon site visits, and on any or all of the days.

Please RSVP to victoria.brockhurst@peel-harvey.org.au or 63698801 advising dates and who will be attending by Wednesday August 17th – this will assist with logistics and catering planning

Please see the program over the page.



Train the Trainer Pre-Post Fire Extension Program

Tuesday September 13 - Friday September 16

Onsite (4 day) Workshop - Participatory train the trainer program for NRM Professionals (the trainees), and their partnered Farmers.

	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	<i>NRM Officers/Trainees and Farmers</i>	<i>NRM Officers/Trainees and Farmers</i>	<i>NRM Officers/Trainees and Farmers</i>	<i>NRM Officers/Trainees and Farmers</i>
MORNING	9am to 12noon ROC* applied to Calnan's REX (Waroona CRC - 10 Henning St, Waroona)	9am to 12noon ROC* applied to Ford property (Waroona CRC - 10 Henning St, Waroona)	9am to 12noon ROC* applied to Hardie property (Boddington CRC - Boddington Old School, 20 Bannister Road)	9am to 12noon ROC* applied to "Kalga" Richardson REX (Serpentine-Jarrahdale CRC - 2 Paterson Street Mundijong)
AFTERNOON	1pm to 4pm Field trip Calnan property (348 Rodgers Rd, Uduc)	1pm to 4pm Field trip Ford Property (1321 Buller Road, Waroona)	1pm to 4pm Field trip Hardie Property (<i>"Hollingwood"</i> Wandering)	1pm to 4pm Field trip Richardson property (<i>"Kalga"</i> 762 Mundijong Rd Mardella)
EVENING	7pm to 9pm Darren Doherty of Regrarians® public presentation Farm Planning: Before & After Fire, Planning & Management (Waroona CRC) <i>This is based on the Two Week "Fire" online component of REX - a refresher session if you wish to attend. We also hope to stream it live.</i>			



*Regrarians Open Consultancy

APPENDIX 3. Maps of significant sites with high MNES values

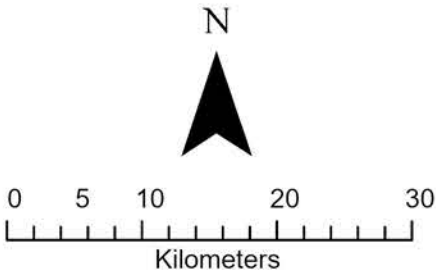
PHCC Assets Overview

Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan

Legend

Asset Name

- Austin Lakes and Roberts Bay
- Dryandra Woodland NP
- Geogrup and Black Lakes
- Kooljerranup
- Lake McLarty
- Lake Mealup
- Lowlands
- Marlee Reserve
- Nine Mile
- Thrombolites Lake Clifton
- Treasure Block
- Yalgorup Lakes System
- PHCC Official Boundary



Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 19/05/2024
User: Colleen Archibald



PHCC Working Together
Peel-Harvey Catchment Council

Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors, Map layer by Esri

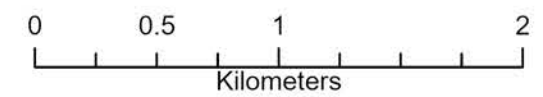
**Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan**



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- Aboriginal Cultural Register
- PHCC_Assets
- Threatened and Priority Ecological Communities

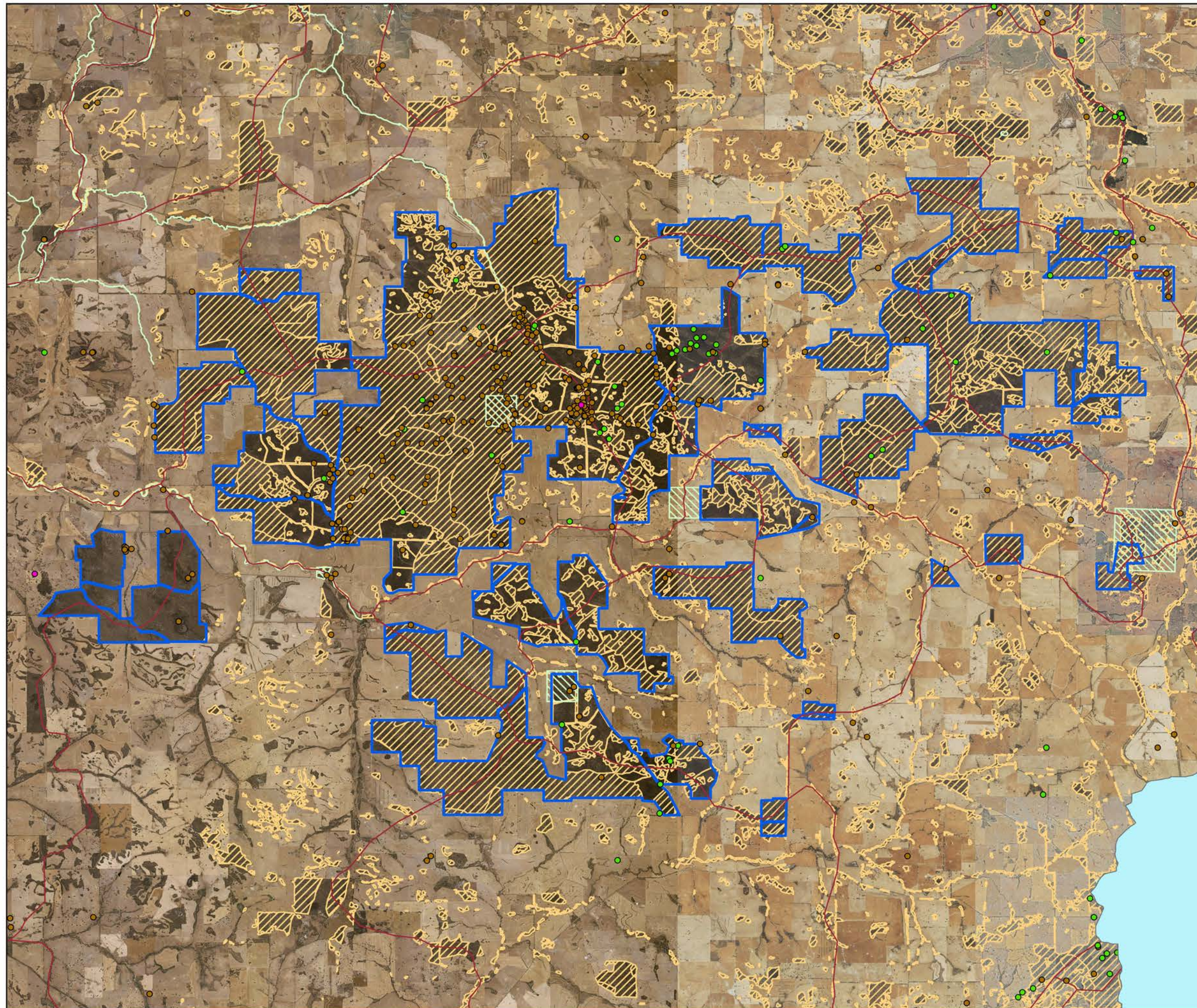
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Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

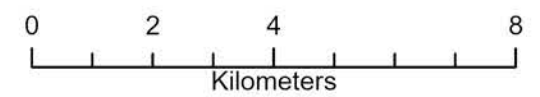
Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- Aboriginal Cultural Register
- PHCC_Assets
- Threatened and Priority Ecological Communities

N



Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N

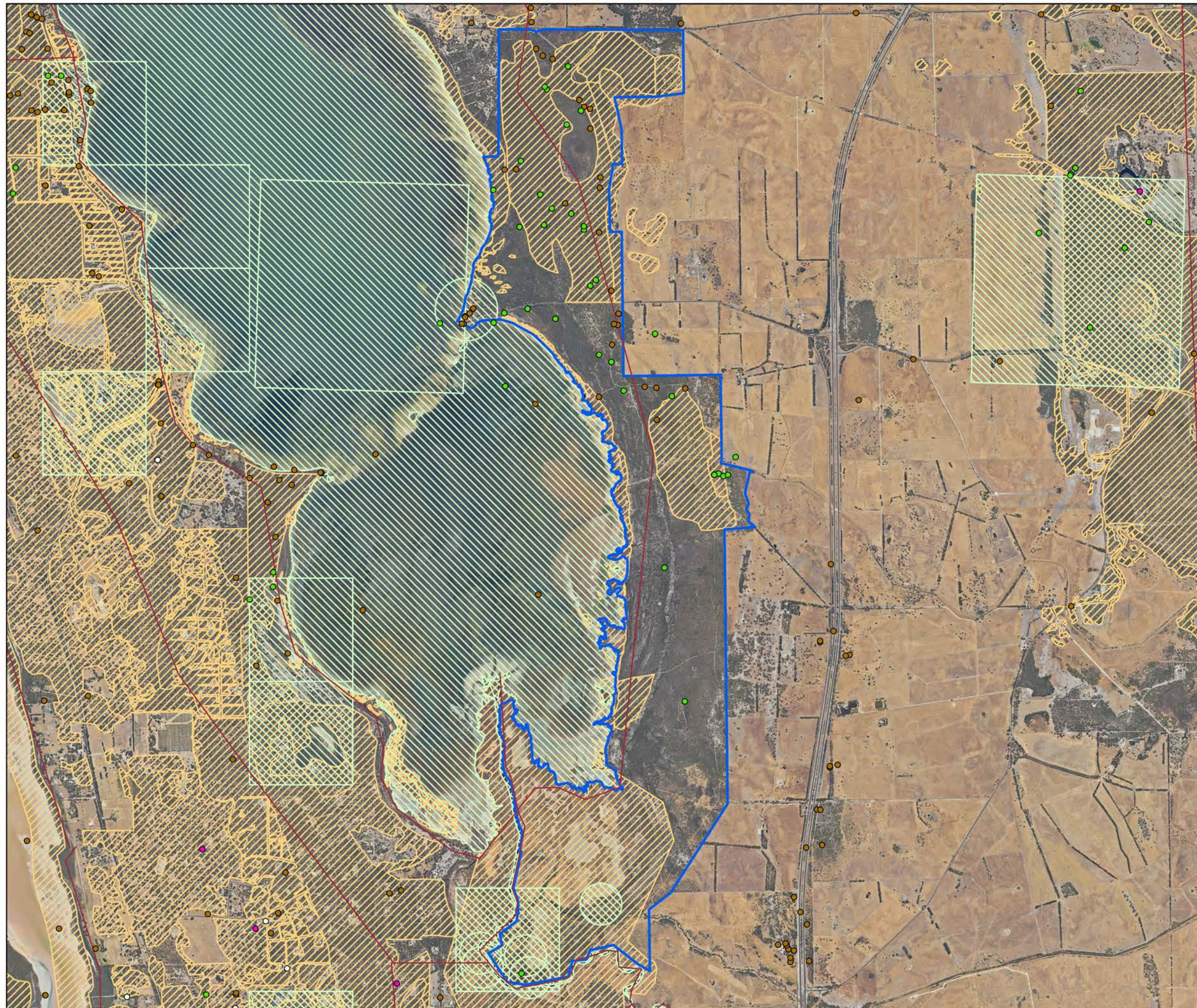


0 0.45 0.9 1.8
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- Aboriginal Cultural Register
- PHCC_Assets
- Threatened and Priority Ecological Communities

N



0 0.5 1 2
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald



Legend

FRTBC Breeding Data

WTBC Breeding Data

BC Roost Data

Threatened and Priority Fauna

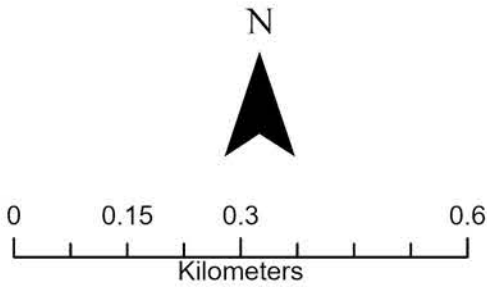
Threatened and Priority Flora

Eco Linkage lines

Aboriginal Cultural Register

PHCC_Assets

Threatened and Priority Ecological Communities



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 21-May-24 User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N

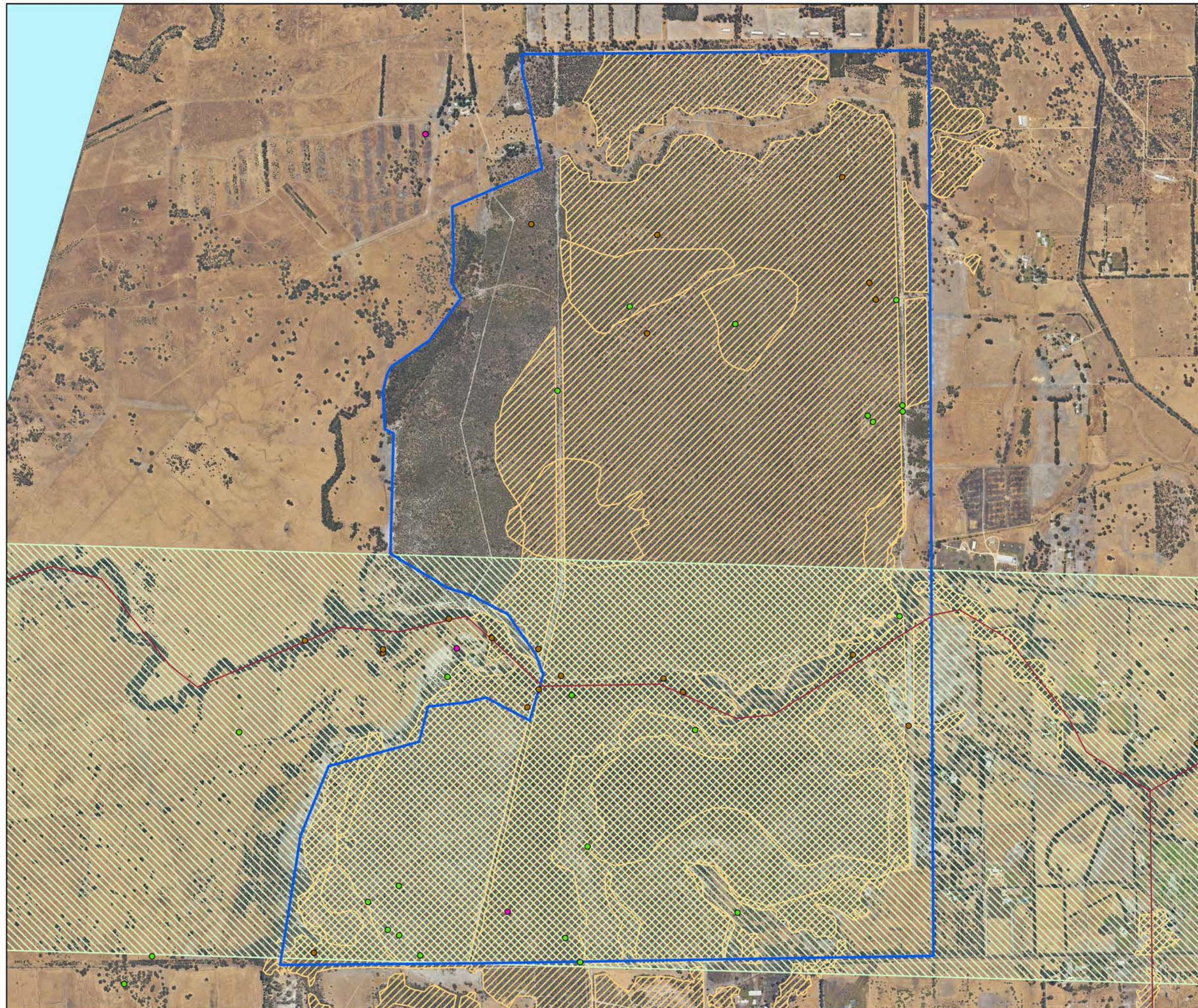


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Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
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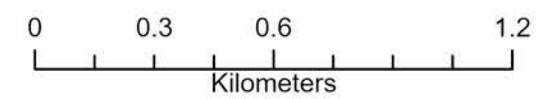
Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N



Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N

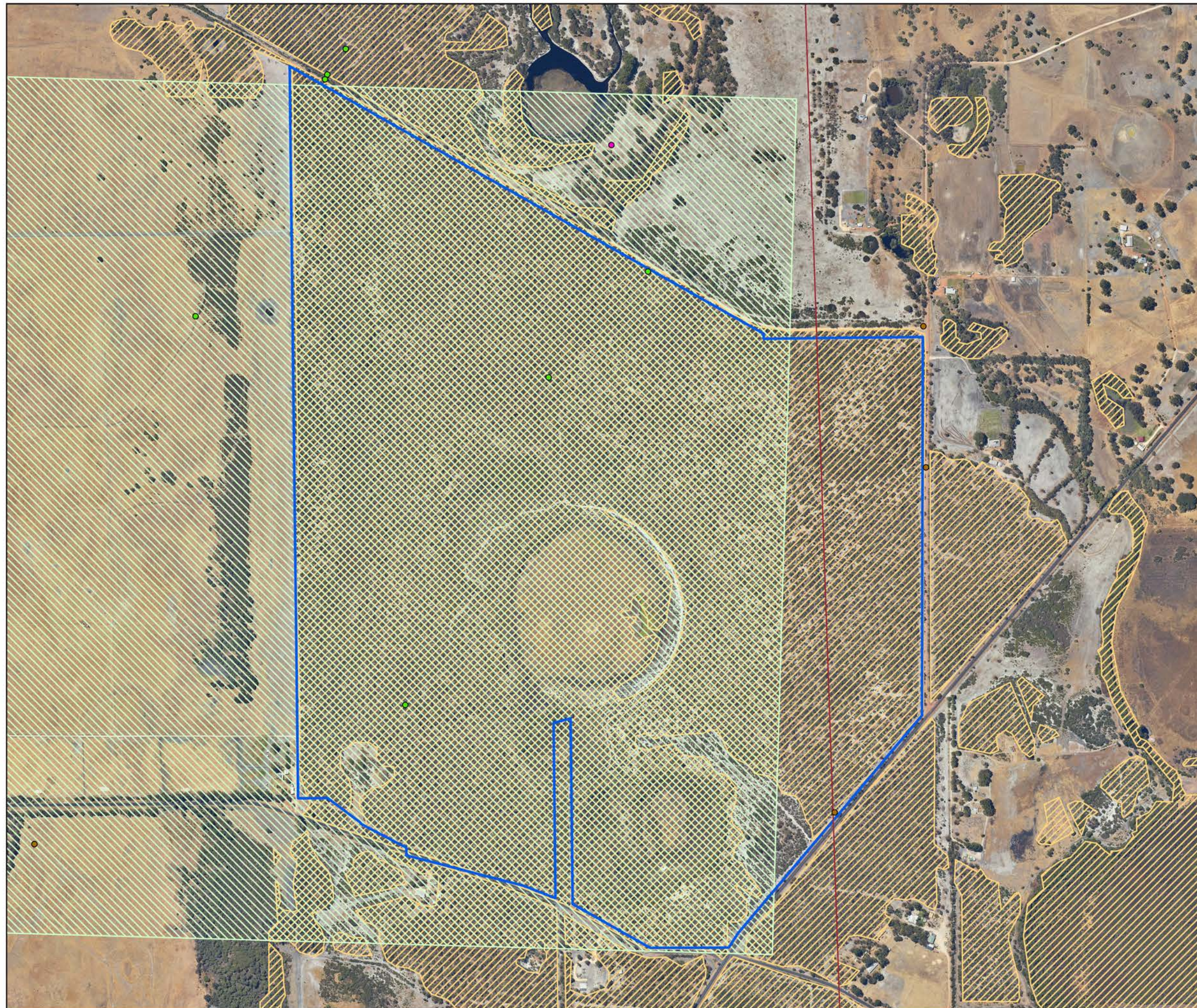


0 0.05 0.1 0.2
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
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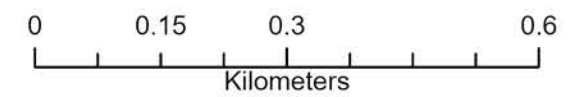
Date: 11-Jun-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N



Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N



0 1.25 2.5 5
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

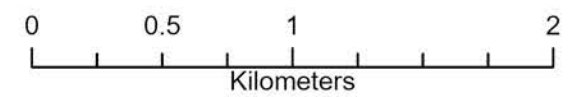
Date: 21-May-24
User: Colleen Archibald



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N

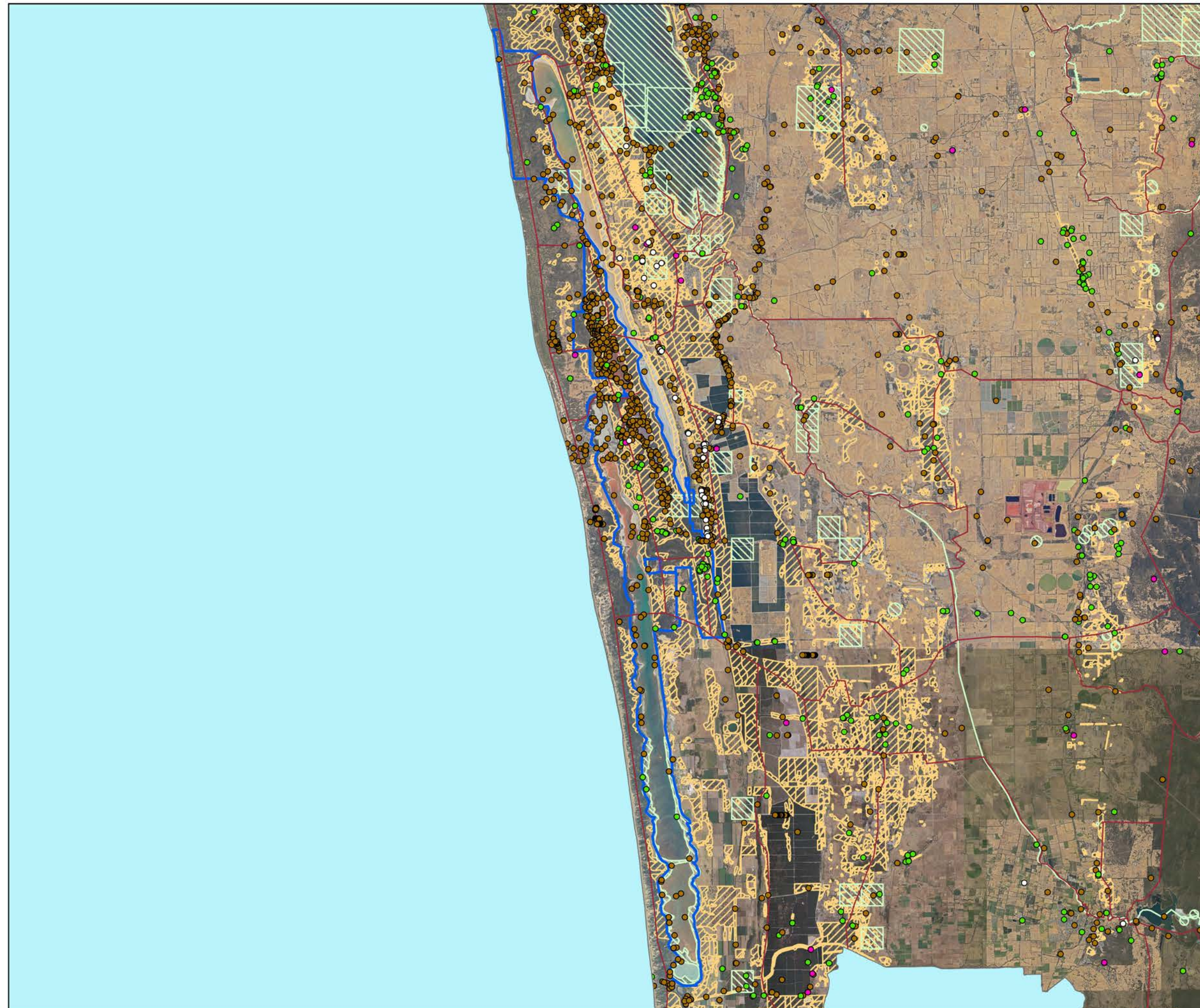


Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald

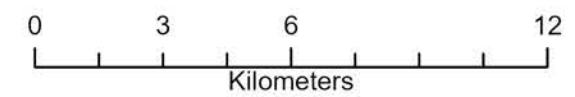
Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



Legend

- FRTBC Breeding Data
- WTBC Breeding Data
- BC Roost Data
- Threatened and Priority Fauna
- Threatened and Priority Flora
- Eco Linkage lines
- ▨ Aboriginal Cultural Register
- ▭ PHCC_Assets
- ▨ Threatened and Priority Ecological Communities

N



Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 21-May-24
User: Colleen Archibald

APPENDIX 4: Maps of Biodiversity Assets in the Peel-Harvey Catchment

PHCC Priority Threatened Ecological Communities

Peel-Harvey Catchment Council Natural Heritage Trust Emergency Preparedness and Response Plan

Legend

PHCC_Assets

PHCC TEC

NAME

- Banksia Woodlands
- Claypans
- Coastal Saltmarsh
- Honeymyrtle shrubland (see next map)
- Stromatolite Lake Clifton (see next map)
- Tuart Woodlands
- Wheatbelt Woodlands

N



0 5 10 20 30
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

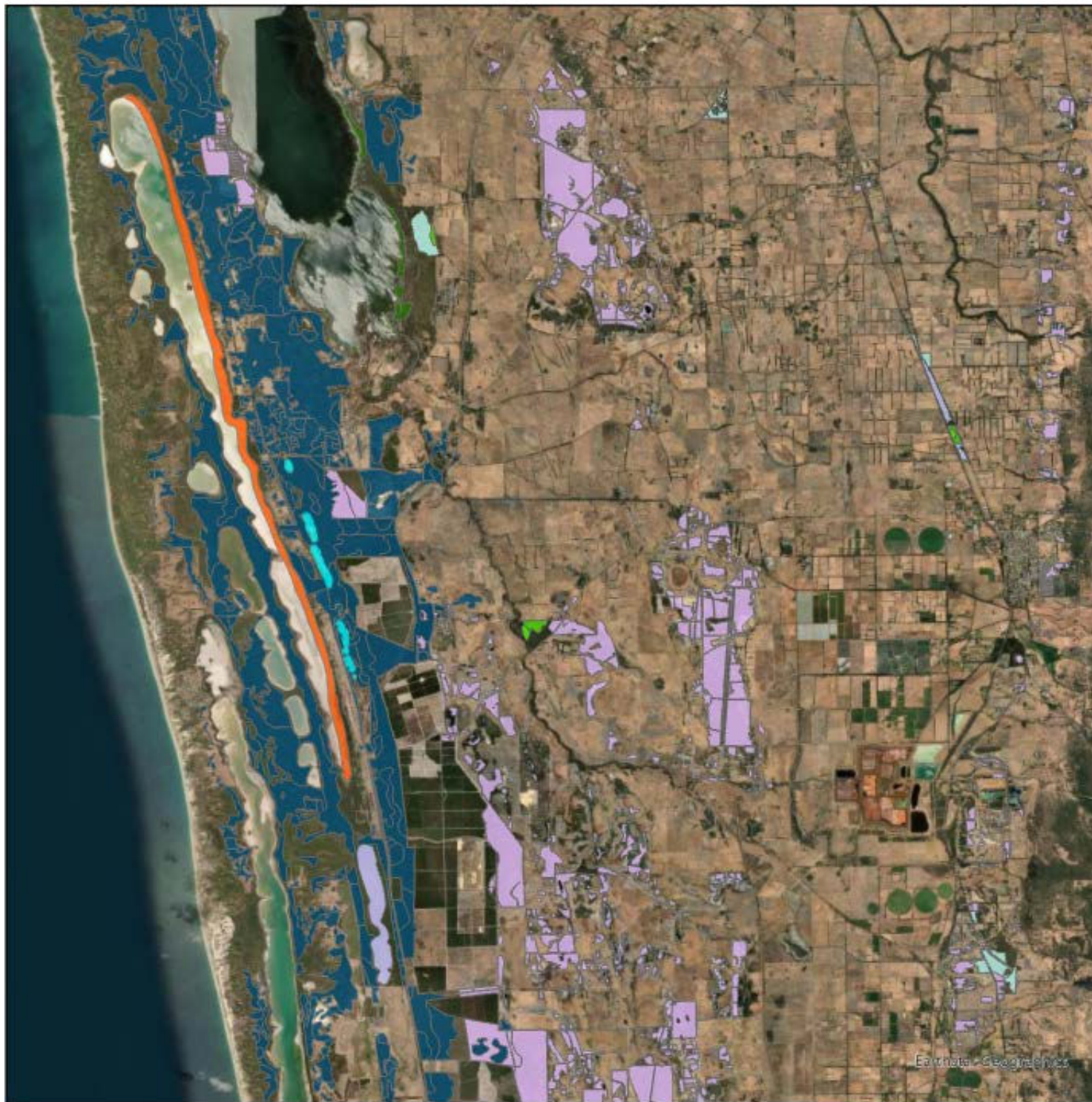
Date: 16/06/2024
User: Colleen Archibald

Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS



PHCC Working
Together

Peel-Harvey Catchment Council



Peel-Harvey Catchment Council Natural Heritage Trust Emergency Preparedness and Response Plan

Legend

Threatened Ecological Communities (TECs)

- Banksia Woodlands of the SCP
- Claypans
- Subtropical and Temperate Coastal Saltmarsh
- Stromatolite like freshwater microbialite community (Lake Clifton)
- Tuart Woodlands and Forests of the SCP
- Honeymyrtle shrubland on limestone ridges of the SCP Bioregion

0 2.5 5 10 Kilometers



Data Sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 20/05/2024
User: Corrine Duncan

PHCC Selected Threatened Flora

Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan

Legend

- Taxon
- Caladenia huegelii
 - Diuris drummondii
 - Diuris micrantha
 - Diuris purdiei
 - Drakaea elastica
 - Drakaea micrantha
 - Eucalyptus argutifolia
 - Synaphea sp. Fairbridge Farm (D. Papenfus 696)
 - Synaphea stenoloba
 - <all other values>
 - PHCC_Assets



Data sourced from Data WA
© Landgate (2024)

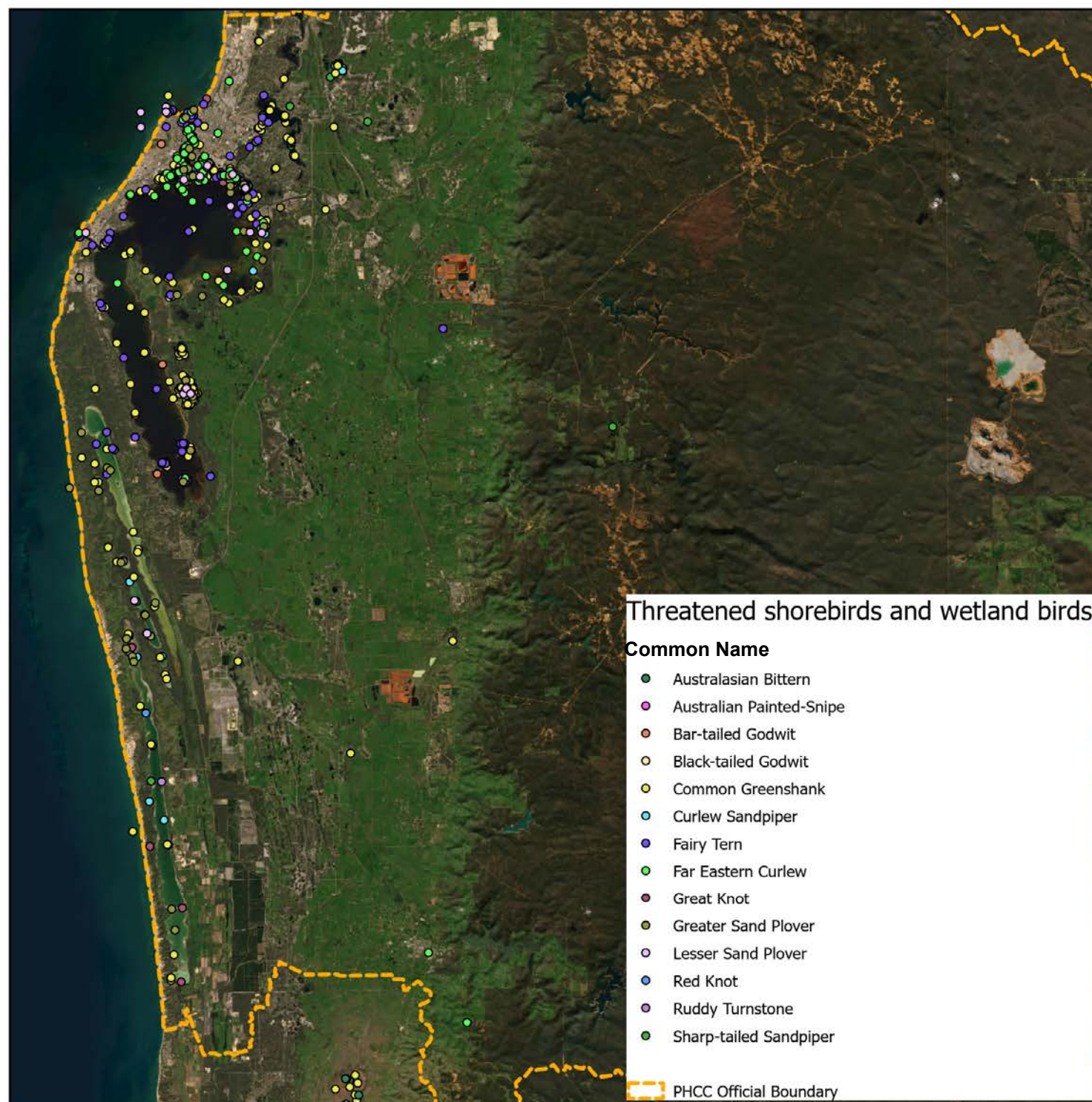
Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 16/06/2024
User: Colleen Archibald



PHCC Working
Together
Peel-Harvey Catchment Council

Peel-Harvey Catchment Council Natural Heritage Trust Emergency Preparedness and Response Plan



0 5 10 20 Kilometers

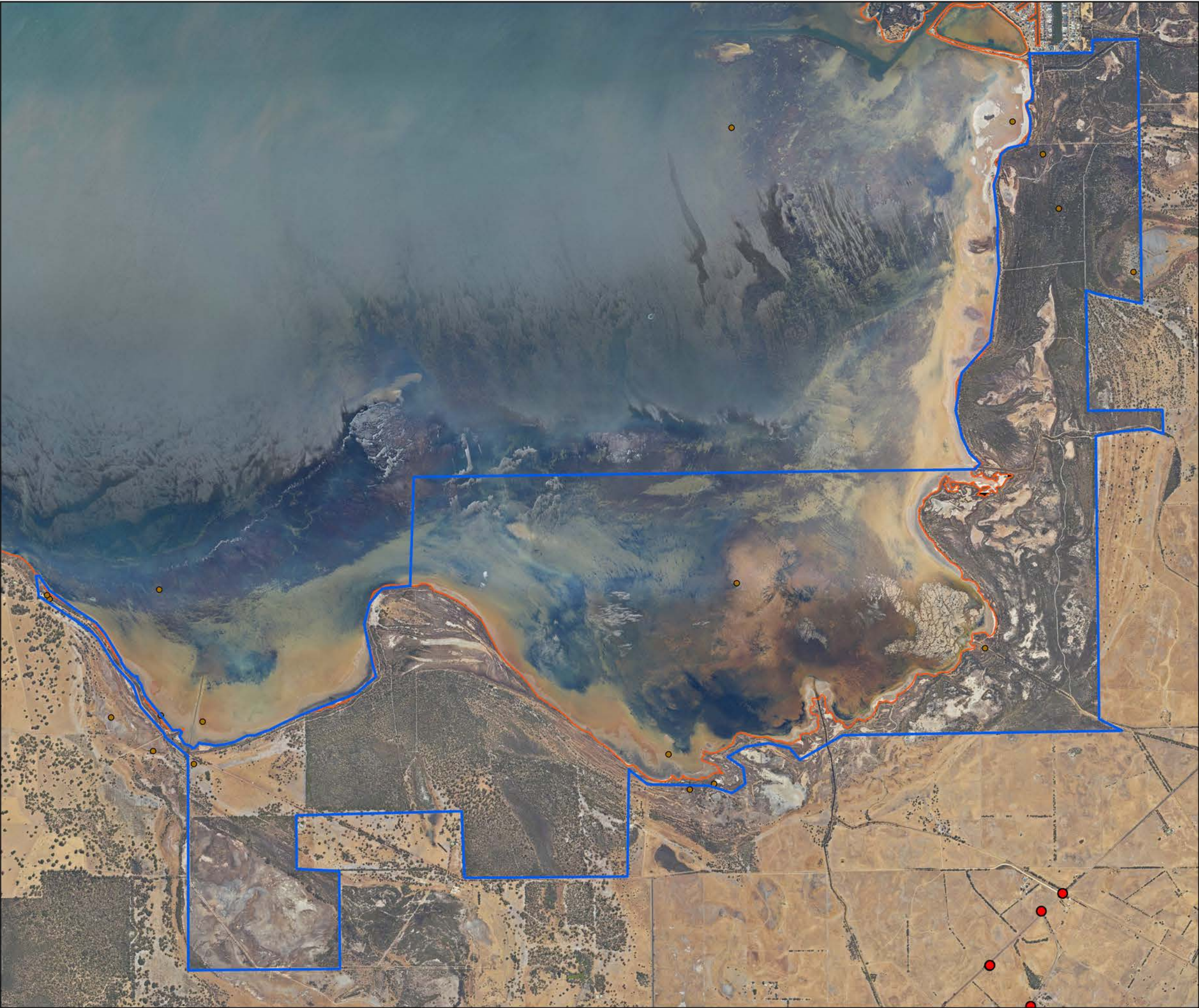


Data Sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 28/06/2024
User: Corrine Duncan

Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



Legend

PHCC_Assets

Threatened Fauna
Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

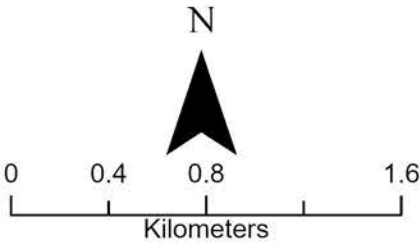
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

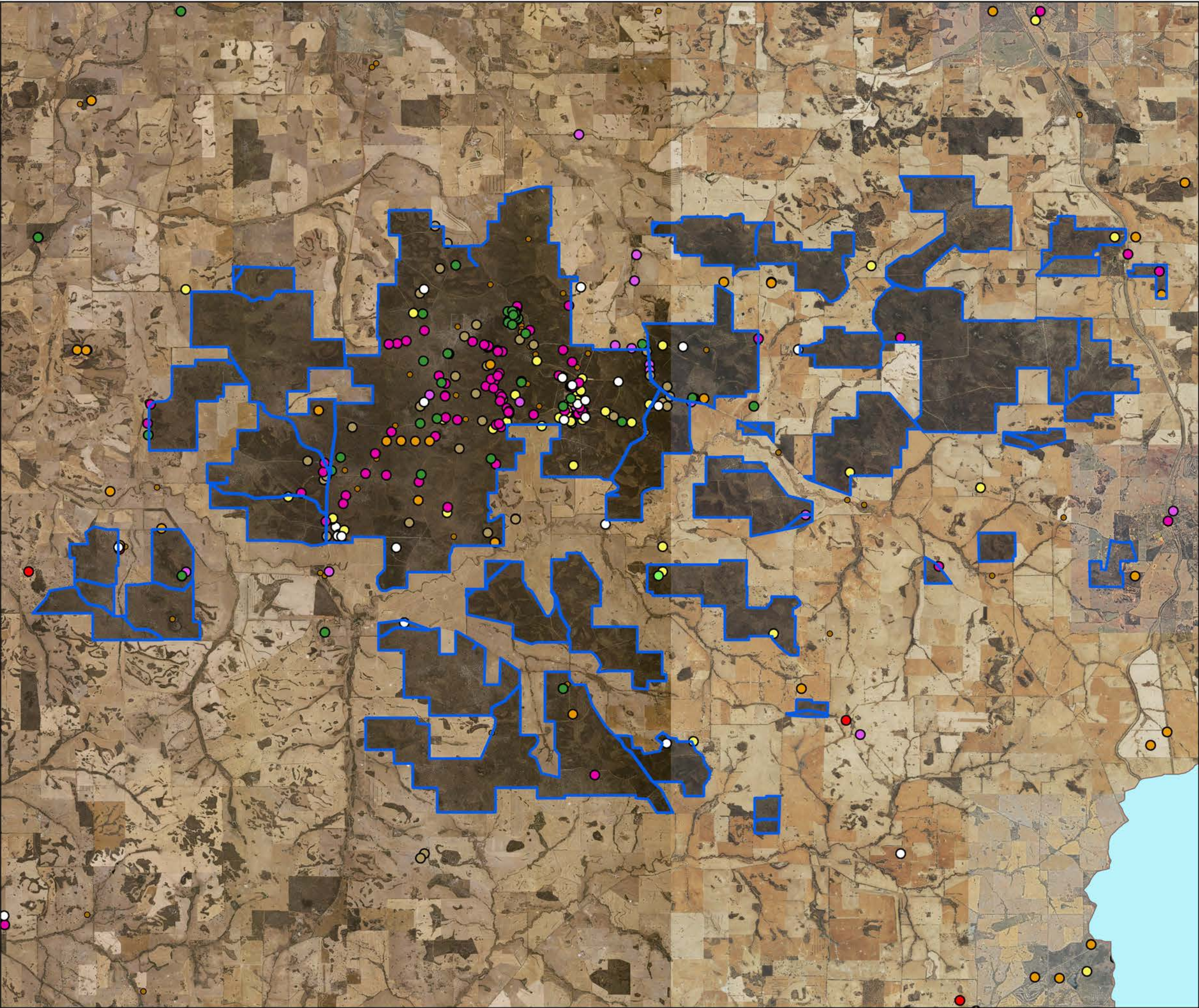
<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald



Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



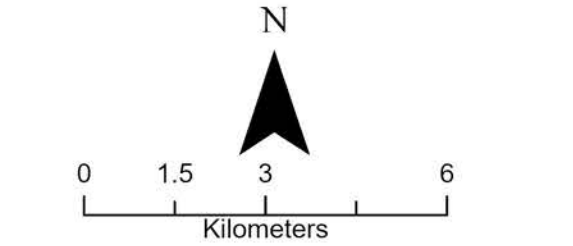
Legend

PHCC_Assets

Threatened Fauna

Common Name

- Baudin's cockatoo
- Carnaby's cockatoo
- Carter's freshwater mussel
- chuditch, western quoll
- forest red-tailed black cockatoo
- malleefowl
- numbat, walpurti
- red-tailed phascogale, kenngoor
- western ringtail possum, ngwayir
- white-tailed black cockatoo
- woylie, brush-tailed bettong
- <all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald



Legend

PHCC_Assets

Threatened Fauna
Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

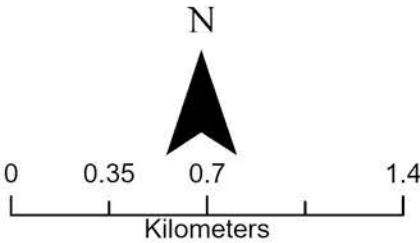
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald

Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



Legend

PHCC_Assets

Threatened Fauna
Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

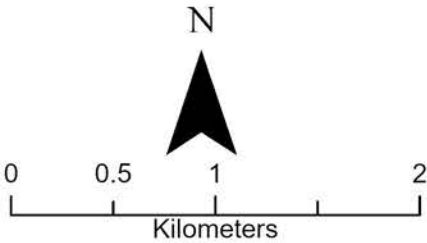
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald





Legend

PHCC_Assets

Threatened Fauna

Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

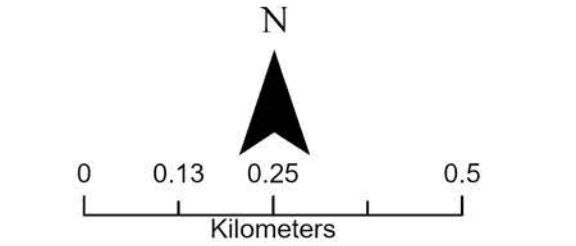
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald



Legend

PHCC_Assets

Threatened Fauna

Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

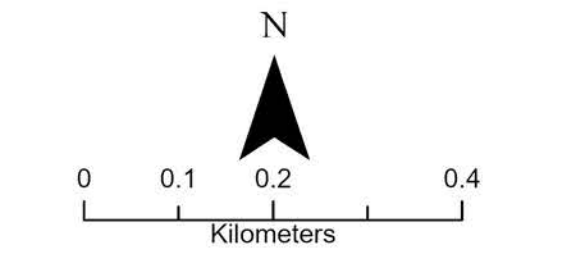
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald



Legend

PHCC_Assets

Threatened Fauna

Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

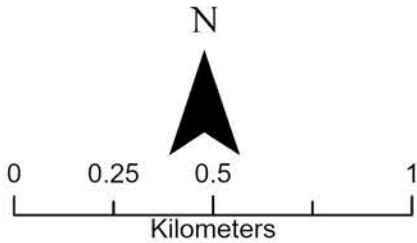
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald



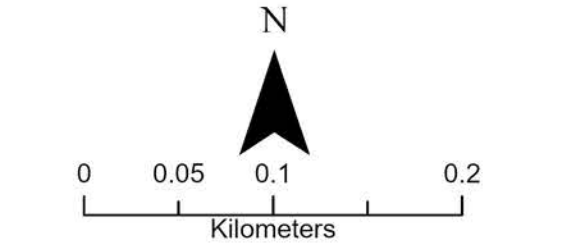
Legend

PHCC_Assets

Threatened Fauna

Common Name

- Baudin's cockatoo
- Carnaby's cockatoo
- Carter's freshwater mussel
- chuditch, western quoll
- forest red-tailed black cockatoo
- malleefowl
- numbat, walpurti
- red-tailed phascogale, kenngoor
- western ringtail possum, ngwayir
- white-tailed black cockatoo
- woylie, brush-tailed bettong
- <all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald

Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



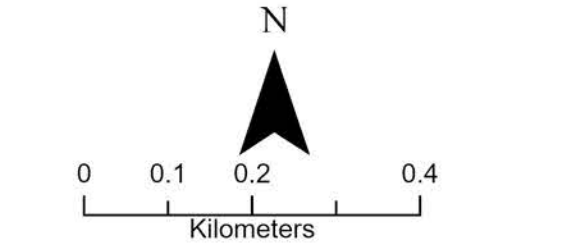
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PHCC_Assets

Threatened Fauna

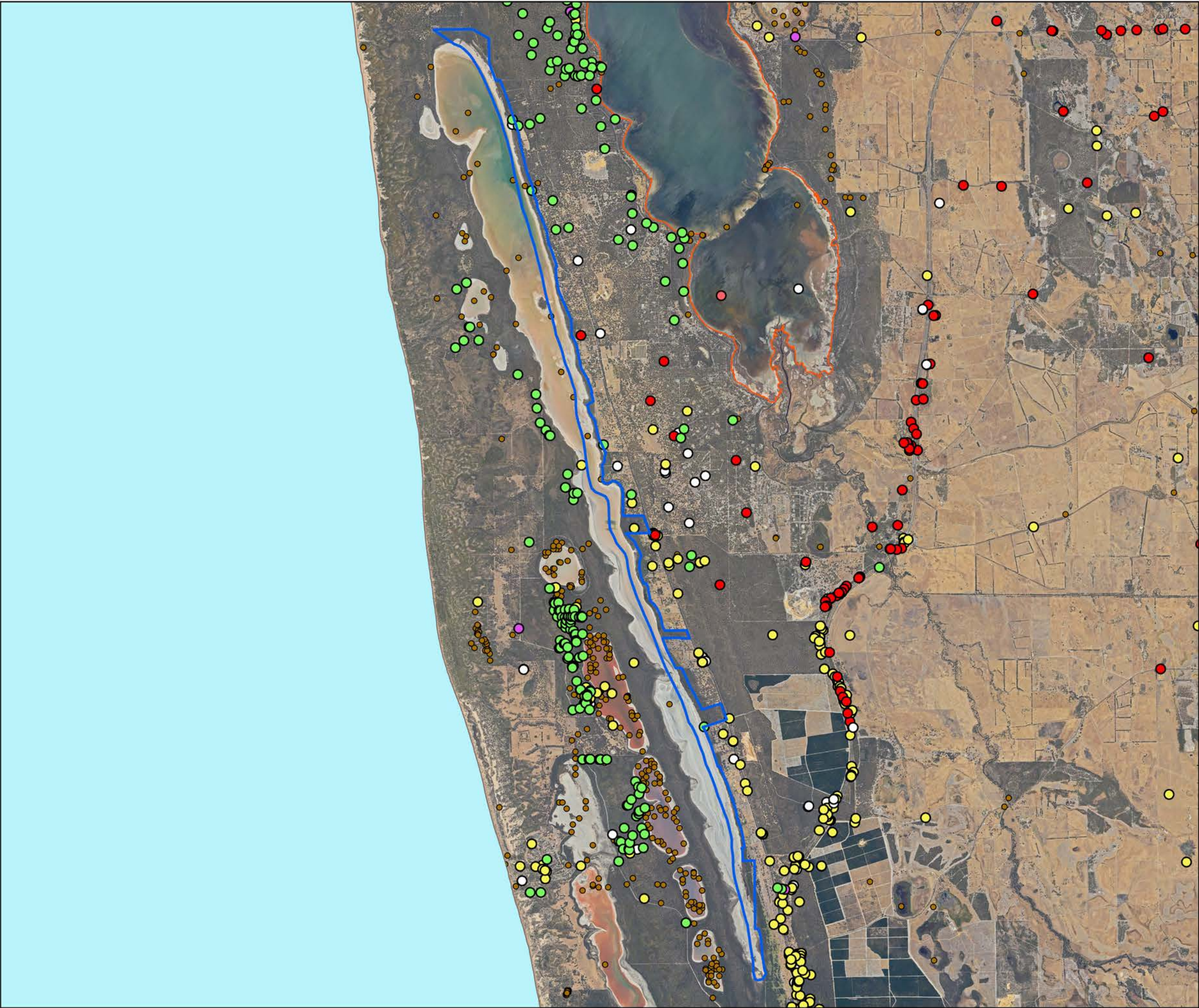
Common Name

- Baudin's cockatoo
- Carnaby's cockatoo
- Carter's freshwater mussel
- chuditch, western quoll
- forest red-tailed black cockatoo
- malleefowl
- numbat, walpurti
- red-tailed phascogale, kenngoor
- western ringtail possum, ngwayir
- white-tailed black cockatoo
- woylie, brush-tailed bettong
- <all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald

Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



Legend

PHCC_Assets

Threatened Fauna
Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

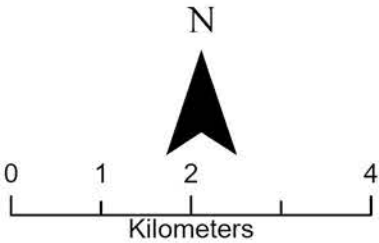
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

woylie, brush-tailed bettong

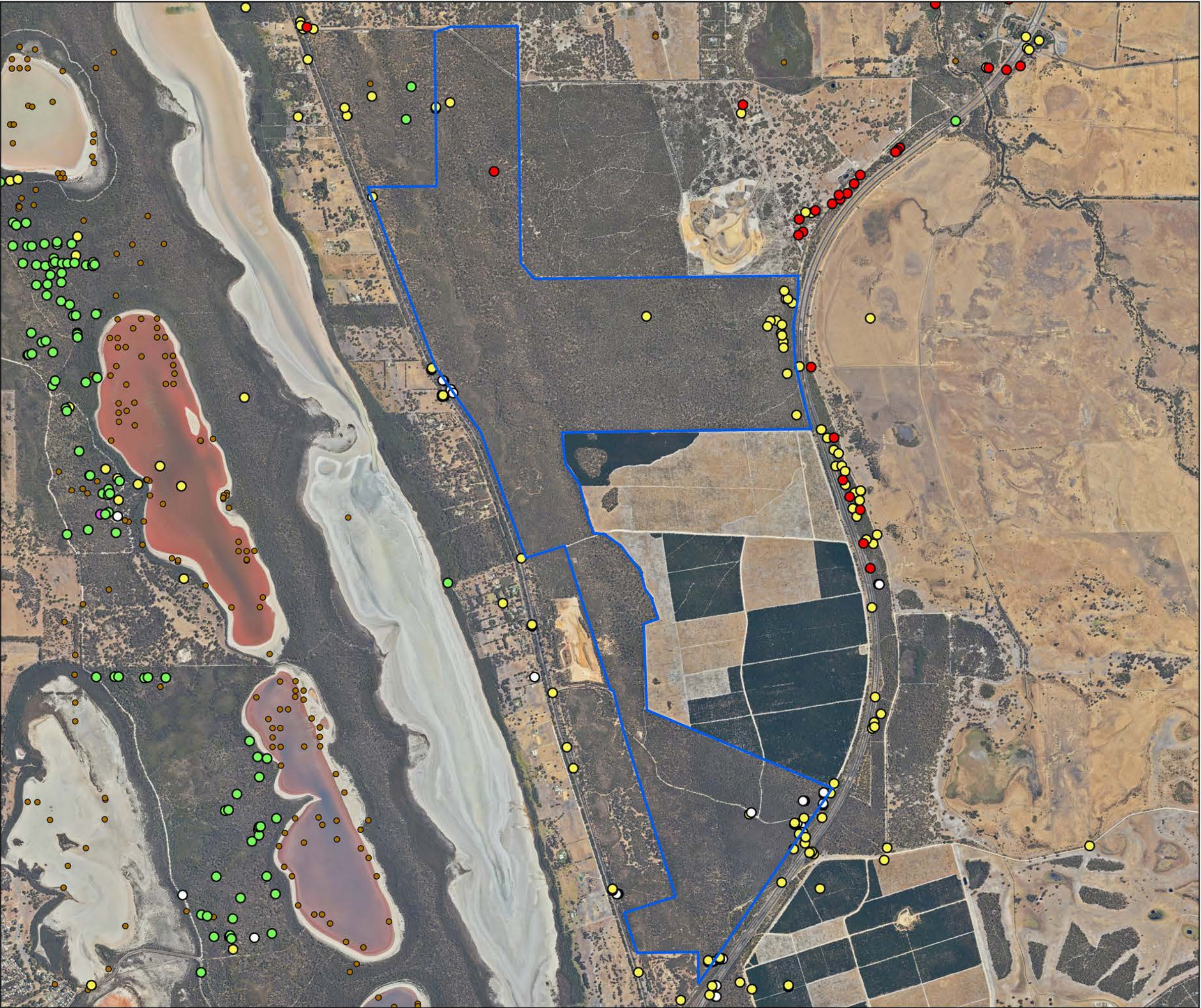
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Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald



Peel-Harvey Catchment Council
Natural Heritage Trust
Emergency Preparedness
and Response Plan



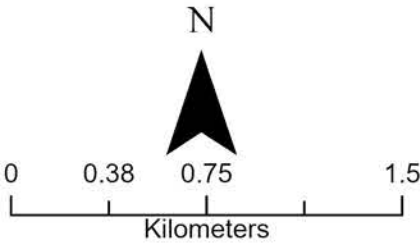
Legend

PHCC_Assets

Threatened Fauna

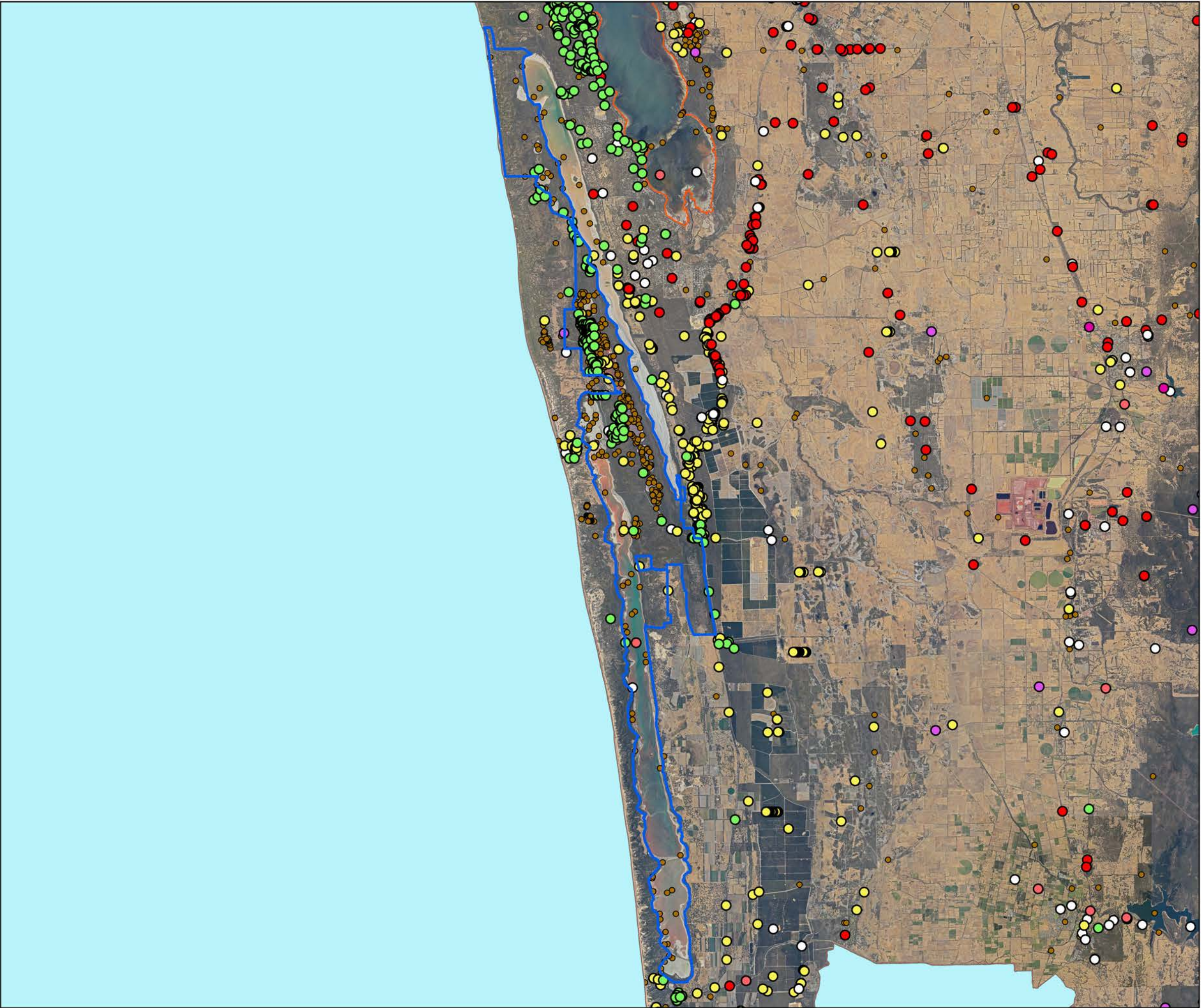
Common Name

- Baudin's cockatoo
- Carnaby's cockatoo
- Carter's freshwater mussel
- chuditch, western quoll
- forest red-tailed black cockatoo
- malleefowl
- numbat, walpurti
- red-tailed phascogale, kenngoor
- western ringtail possum, ngwayir
- white-tailed black cockatoo
- woylie, brush-tailed bettong
- <all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald





Legend

PHCC_Assets

Threatened Fauna

Common Name

Baudin's cockatoo

Carnaby's cockatoo

Carter's freshwater mussel

chuditch, western quoll

forest red-tailed black cockatoo

malleefowl

numbat, walpurti

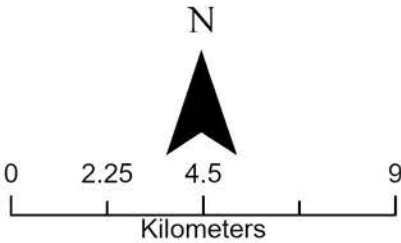
red-tailed phascogale, kenngoor

western ringtail possum, ngwayir

white-tailed black cockatoo

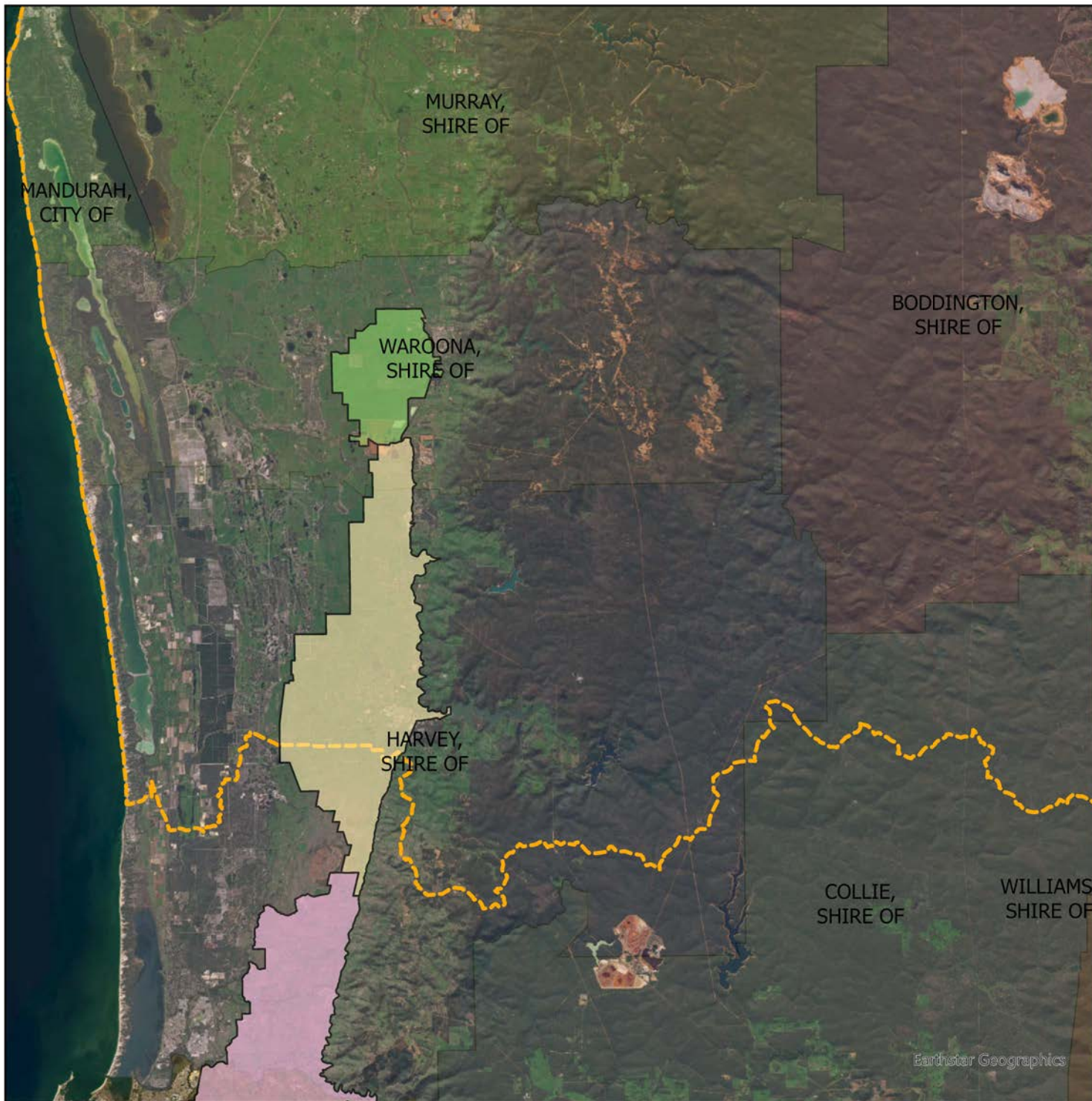
woylie, brush-tailed bettong

<all other values>



Data sourced from Data WA © Landgate (2024)
Spatial Reference Name: GDA2020 MGA Zone 50
Date: 18-Jun-24 User: Colleen Archibald

APPENDIX 5: Maps of Agricultural Assets in the Peel-Harvey Catchment



Peel-Harvey Catchment Council Natural Heritage Trust Emergency Preparedness and Response Plan

Havey Water Irrigation Districts

-  Collie River
-  Harvey
-  Waroona
-  PHCC Official Boundary

0 5 10 20 Kilometers



Data Sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50



Date: 20/05/2024
User: Corrine Duncan



PHCC Agricultural Land

PHCC
Natural Heritage Trust
Emergency Preparedness
and Response Plan

Legend

-  PHCC_Assets
-  Agricultural Areas (LGATE-228)

N



0 2 4 8 12
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA
Zone 50

Date: 26/06/2024
User: Colleen Archibald



PHCC Working
Together
Peel-Harvey Catchment Council

PHCC Land Capability - Dryland Cropping

Peel-Harvey Catchment Council Natural Heritage Trust Emergency Preparedness and Response Plan

Legend

PHCC_Subsystems

PHCC_Assets

Land Capability - Dryland Cropping (DPIRD-031)

A2: 50-70% high capability

B1: >70% moderate to high capability

B2: 50-70% moderate to high capability

C1: 50-70% low capability

C2: >70% low capability

N

0 3.5 7 14 21
Kilometers

Data sourced from Data WA
© Landgate (2024)

Spatial Reference
Name: GDA2020 MGA Zone 50

Date: 25-Jun-24
User: Colleen Archibald



PHCC Working
Together

Peel-Harvey Catchment Council

Esri, TomTom, Garmin, Foursquare, FAO, METI/NASA, USGS

APPENDIX 6: Multi-jurisdictional Inventory of Assets in the Peel-Harvey Catchment

Note that the data provided in the multi-jurisdictional inventory of biodiversity asset is sourced from DCCEE's Species Profile and Threats Database. References and data found at <https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>

Species ID	Scientific Name	Common Name	Class	Jurisdiction	Legislation to Protect Asset	Threatened Category	Description of extent
Biodiversity Assets							
67034	<i>Calyptrorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo, Karrak	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	Although there are other Red-tailed Black-Cockatoos in Australia, the Forest Red-tailed is the only one found in southwest Western Australia forests. Found from Albany to Perth and in some western parts of the wheatbelt region.
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
87737	<i>Zanda latirostris</i>	Carnaby's Black Cockatoo	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Carnaby's Black-Cockatoos occur only in south-western Western Australia, between Cape Arid and Kalbarri, in the wheatbelt.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
87736	<i>Zanda baudinii</i>	Baudin's Black-Cockatoo	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Baudin's Black-Cockatoos occur only in south-western Western Australia, between Albany and Perth. This species can be found in different parts of their distribution depending on the time of year.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
872	<i>Arenaria interpres</i>	Ruddy Turnstone	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The Ruddy Turnstone is widespread within Australia during its non-breeding period of the year (Bamford et al. 2008), including from Tasmania in the south to Darwin in the north and many coastal areas in between.
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Endangered	
874	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Locally throughout the catchment with significant numbers at Lake McLarty, Austin Bay and northern Peel Estuary.
855	<i>Calidris canutus</i>	Red Knot	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The Red Knot is common in all the main suitable habitats around the coast of Australia, but is less numerous in south-west Australia than elsewhere. The Red Knot has a worldwide distribution, breeding at a range of locations right around the Arctic, then migrates to non-breeding areas that extend to southernmost parts of Americas, Africa, Europ and Australasia. Locally at Harvey Estuary South, Lake McLarty, Austin Bay, Nairns, and Creery.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020	Endangered	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Endangered	
856	<i>Calidris ferruginea</i>	Curlew Sandpiper	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia rather than migrating north. In Western Australia, they are widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division, but are more sparsely distributed between Carnarvon and Dampier Archipelago. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Critically Endangered	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Critically Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Critically Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Endangered	
862	<i>Calidris tenuirostris</i>	Great Knot	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The Great Knot has been recorded around the entirety of the Australian coast, with a few scattered records inland. Within Australia, WA has the highest recorded numbers of birds. The Great Knot breeds in north-east Siberia and migrates south. The Yellow Sea supports about 80% of the East Asian-Australasian Flyway (the Flyway) Great Knot population on its northward migration. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Critically Endangered	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Critically Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Critically Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Vulnerable	
877	<i>Charadrius leschenaultii</i>	Greater Sand Plover	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The Greater Sand Plovers that occur in Australia migrate from breeding areas in the Gobi Desert in Mongolia and adjacent areas of southern Siberia and north-western China. The migratory route of the Greater Sand Plover is more westerly than other shorebirds that visit Australia and would be affected by global threats. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Vulnerable	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Vulnerable	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Vulnerable	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Vulnerable	
879	<i>Charadrius mongolus</i>	Lesser Sand Plover	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Within Australia, the Lesser Sand-Plover is widespread in coastal regions, and has been recorded in all states. It mainly occurs in northern and eastern Australia, in south-eastern parts of the Gulf of Carpentaria, western Cape York Peninsula and islands in Torres Strait, and along the entire east coast, though it occasionally also occurs inland. The species has also been recorded on Lord Howe Island, Norfolk Island and Christmas Island, Indian Ocean. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Vulnerable	
86432	<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	During the non-breeding season, the distribution of L. l. menzbieri is predominantly in the north of Western Australia and in south eastern Asia. In Western Australia it is widespread around the coast, from Eyre to Derby. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Critically Endangered	
845	<i>Limosa limosa</i>	Black-tailed Godwit	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	The Black-tailed Godwit is found in all states and territories of Australia, however, it prefers coastal regions and the largest populations are found on the north coast between Darwin and Weipa. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud. Found locally in Ramsar 482 wetlands.
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Critically Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Vulnerable	
847	<i>Numenius madagascariensis</i>	Eastern Curlew, Far Eastern Curlew	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	Far eastern curlews are endemic to the East Asian – Australasian Flyway. The species breeds in Siberia and far eastern Russia but, during the non-breeding season, most of the population occurs in Australia. Within Australia, far eastern curlews have a mostly coastal distribution; they are rarely recorded inland. The species is found in all states and territories, but is most prominent in the north, east, and south-east regions, including Tasmania. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Critically Endangered	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Critically Endangered	
				TAS	Threatened Species Protection Act 1995 (Tas)	Endangered	
832	<i>Tringa nebularia</i>	Common Greenshank, Greenshank	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. It is found in Europe, Africa, Asia, Melanesia and Australasia. Found locally in Ramsar 482 wetlands.
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Endangered	
				Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	In Australia, the Australasian Bittern occurs from south-east Queensland to south-east South Australia as far as the Adelaide Region, southern Eyre Peninsula, Tasmania and in the south-west of Western Australia. In Western Australia, the Australasian
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	

Species ID	Scientific Name	Common Name	Class	Jurisdiction	Legislation to Protect Asset	Threatened Category	Description of extent
1001	<i>Botaurus poiciloptilus</i>	Australasian Bittern	Bird	VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Critically Endangered	Bittern was formerly widespread in the south-west, however, following range declines throughout the 1900s, it is now likely that it only occurs on the western coastal plain between Lancelin and Busseton, in the southern coastal region from Augusta to the east of Albany and inland to some wetlands in the Jarrah forest belt, with small, isolated populations in swamps around Esperance.
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Endangered	
				ACT	Nature Conservation Act 2014 (ACT)	Endangered	
77037	<i>Rostratula australis</i>	Australian Painted Snipe	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	The Australian Painted Snipe has been recorded at wetlands in all states of Australia. Not found locally in recent years, but may occur.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Critically Endangered	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				QLD	Nature Conservation (Animals) Regulation 2020 (Qld)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Endangered	
				ACT	Nature Conservation Act 2014 (ACT)	Endangered	
82950	<i>Sternula nereis nereis</i>	Australian Fairy Tern	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia; occurring as far north as the Dampier Archipelago near Karratha. The Fairy Tern is distributed in a large geographic range between Australia, New Zealand and New Caledonia. Found locally in Ramsar 482 wetlands.
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
				TAS	Threatened Species Protection Act 1995 (Tas)	Vulnerable	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
934	<i>Leipoa ocellata</i>	Malleefowl	Bird	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The original distribution of Malleefowl covered much of the southern half of the continent from the west coast to the Great Dividing Range in the east and was widespread in every mainland state except Queensland. Within the past century the range of Malleefowl has contracted, particularly in arid areas and at the periphery of its former range. The Malleefowl is found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee (recorded at Dryandra).
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Vulnerable	
				SA	National Parks and Wildlife Act 1972 (SA)	Vulnerable	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Critically Endangered	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Endangered	
66844	<i>Bettongia penicillata ogilbyi</i>	Woylie	Mammal	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Formerly very widespread, woylies once occupied most of the Australian mainland south of the tropics. Populations were decimated by the introduction of foxes and cats. By 1970, woylies remained in only four subpopulations in south-west Western Australia: Dryandra Woodland, Tutanning Nature Reserve, and two within the Upper Warren region.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
				SA	National Parks and Wildlife Act 1972 (SA)	Rare	
294	<i>Myrmecobius fasciatus</i>	Numbat	Mammal	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Records of the species are scattered across a wide arc stretching from western New South Wales and south-eastern South Australia, north to the southern border of the Northern Territory and across to the south-west of Western Australia. Following significant range contraction with the introduction of cats and foxes, the only remaining original numbat subpopulations are at Dryandra Woodland and the Upper Warren area.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Extinct	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Extinct	
316	<i>Phascogale calura</i>	Red-tailed Phascogale, Red-tailed Wambenger	Mammal	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	Extant populations of the Red-tailed Phascogale are restricted to remnants of native vegetation throughout the wheat belt of south-western Western Australia. Prior to agricultural expansion in the 1800s, the Red-tailed Phascogale was widespread throughout Western Australia and was previously found in most arid and semi-arid regions of Australia. However, it suffered a significant range contraction following European settlement and is now known to occur only in the central and southern wheatbelt areas of Western Australia an area which receives an annual rainfall of between 350 and 600 mm.
				WA	Biodiversity Conservation Act 2016 (WA)	Conservation Dependent	
				VIC	Flora and Fauna Guarantee Act 1988 (Vic)	Vulnerable	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Extinct	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Extinct	
330	<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	Mammal	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The chuditch formerly ranged across nearly 70 percent of the continent, occurring in every mainland State and Territory, however, a drastic decline in numbers and a contraction of range has occurred since that time. In Western Australia, the species was still abundant in the wheatbelt in 1907, but had disappeared from coastal areas north of Geraldton by this time. The major portion of the remaining natural populations occur in small densities in jarrah (<i>Eucalyptus marginata</i>) forests and woodlands in the south-west corner of WA.
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
				SA	National Parks and Wildlife Act 1972 (SA)	Endangered	
				NT	Territory Parks and Wildlife Conservation Act 1976 (NT)	Extinct	
				NSW	Biodiversity Conservation Act 2016 (NSW)	Extinct	
25911	<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum, Ngwayir	Mammal	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	Pre-historic range extended from Geraldton on the west coast of WA to the about 200km west of the WA/SA border. Today, it has a patchy occurrence along the SW coast of WA and inland populations around Harvey and Collie River.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
86266	<i>Westralunio carteri</i>	Carter's Freshwater Mussel	Mollusk	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	Patchily distributed in freshwater streams, rivers, reservoirs and lakes within 50-100 km of the coast, from Moore River/Gingin Brook southward to the Kent River, Goodga River and Waychinicup River east of Albany. Occurs in sandy/muddy sediments of
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
7309	<i>Caladenia huegelii</i>	King Spider-orchid, Grand Spider-orchid	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	The King Spider-orchid occurs in scattered localities within 20 km of the coast, from the Upper Swan and Gnarup areas north of Perth, through suburban Perth and southwards to Gracetown and the Scott River in the Margaret River area of Western Australia.
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
55082	<i>Diuris micrantha</i>	Dwarf Bee-orchid	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	Dwarf Bee-orchid is known from seven populations, from east of Kwinana and south towards the Frankland area, Western Australia.
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
12950	<i>Diuris purdiei</i>	Purdie's Donkey-orchid	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Purdie's Donkey-orchid occurs in Western Australia, from Perth south to near the Whitcher Range, within the Swan (Western Australia) Region.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
4365	<i>Diuris drummondii</i>	Tall Donkey Orchid	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	There are 12 populations known between Perth and Walpole, south-west Western Australia. Recently, two populations have been identified within the city of Bunbury, the first on council-managed land, and the second on private land.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
16753	<i>Drakaea elastica</i>	Glossy-leaved Hammer Orchid, Glossy-leaved	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Drakaea elastica is currently known only from the Swan Coastal Plain over a range of approximately 350 km between Cataby in the north and Busseton in the south. The species grows on bare patches of sand
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	
56755	<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	The Dwarf Hammer-orchid is known from 32 small, scattered populations from Perth to Albany, with secure populations in Frankland National Park. May not flower annually, so is difficult to detect.
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
66311	<i>Synaphea stenoloba</i>	Dwellingup Synaphea	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	The Dwellingup Synaphea is endemic to the Swan Coastal Plain of Western Australia. It is known from 11 subpopulations south of
				WA	Biodiversity Conservation Act 2016 (WA)	Endangered	
24263	<i>Eucalyptus argutifolia</i>	Yanchep Mallee	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	Yanchep Mallee is endemic to Western Australia, where it is found between Wanneroo and Guilderton in the Perth area, and at La
				WA	Biodiversity Conservation Act 2016 (WA)	Vulnerable	
82881	<i>Synaphea</i> sp. <i>Fairbridge Farm</i> (<i>D. Papenfus</i> 696)	Selena's Synaphea	Plant	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	Selena's Synaphea is endemic to the Pinjarra Plain of Western Australia. It is known from five subpopulations south of Perth from
				WA	Biodiversity Conservation Act 2016 (WA)	Critically Endangered	

Species ID	Scientific Name	Common Name	Class	Jurisdiction	Legislation to Protect Asset	Threatened Category	Description of extent
118	Subtropical and Temperate Coastal Saltmarsh		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	This Coastal Saltmarsh community occurs within a relatively narrow margin of the Australian coastline, within the subtropical and temperate climatic zones south of the South-east Qld, along the southwest coast of WA and coastlines in NSW, VIC, TAS and SA.
174	Empodisma peatlands of southwestern Australia		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	Empodisma peatlands predominantly occur in the Warren and Southern Jarrah Forest bioregion. These occurrences are typically within 50km of the Warren bioregion but isolated occurrences may occur further north and east.
131	Banksia Woodlands of the Swan Coastal Plain ecological community		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Endangered	The Banksia Woodlands ecological community is largely restricted to the Perth and Dandaragan subregions of the Swan Coastal Plain bioregion , from around Jurien Bay in the north to Dunsborough in the south. The ecological community also extends into immediately adjacent areas on the Whicher and Darling escarpments.
121	Clay Pans of the Swan Coastal Plain		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	The Clay Pans of the Swan Coastal Plain occur within the South West Botanical Province (SWBP) of Western Australia. The community is restricted to the Swan Coastal Plain bioregion, except for six small clay pans in the Jarrah Forest bioregion.
182	Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	Honeymyrtle shrublands occurs only in southwest WA. It is known from a small number of locations in the Swan Coastal Plain Bioregion.
153	Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	The Tuart woodlands and forests occur on the Swan Coastal Plain in Western Australia, from Jurien, approximately 200 km north of Perth, to the Sabina River, near Busselton, 225 km south of Perth.
128	Eucalypt Woodlands of the Western Australian Wheatbelt		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	The WA Wheatbelt Woodlands ecological community is endemic to south-western WA. It occupies a transitional zone between the wetter forests associated with the Darling Range and the southwest coast, and the low woodlands, mallee and shrublands of the semi-arid to arid interior.
96	Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)		TEC	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	Critically Endangered	The Lake Clifton thrombolite community is restricted to Lake Clifton, situated within the Yalgorup National Park, and is the northernmost lake in the Peel-Yalgorup Lakes System, which consists of several hypersaline and brackish lakes.
36	Peel-Yalgorup System (Ramsar Wetlands - 482)		Ramsar Wetlands	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	n/a	The Peel-Yalgorup site is large and complex. The wetlands within the site include the Peel Inlet and Harvey Estuary, Yalgorup Lake System, McLarty Lake System and Goegrup and Black Lakes.
AGRICULTURAL ASSETS							
	Hotham-Williams (Wheatbelt - high productivity zones) AND Harvey Water Irrigation Area	Agriculture	WA	Commonwealth	Environment Protection and Biodiversity Conservation Act 1999	n/a	The EPBC Act and regulations are Australia's main national environmental legislation. They provide a way for us to protect and manage nationally and internationally important plants, animals, habitats and places.
					Environmental Protection Act 1986 (Part V and IV)	n/a	The Environmental Protection Authority is established under Part II of the Environmental Protection Act 1986. The Act provides for "the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing.
					Biosecurity and Agriculture Management Act 2007	n/a	The main purposes of the BAM Act and its regulations are to: Prevent new pests, weeds and diseases from entering Western Australia, manage the impact and spread of pests already present in the state, safely manage the use of agricultural/veterinary chemicals and facilitate standards for safe and quality agricultural products.
					Animal Welfare Act 2002	n/a	The Animal Welfare Act 2002 provides the legal framework for ensuring that all animals in Western Australia have appropriate standards of care. The Act intends to promote and protect the welfare, safety and health of animals, ensure the proper care and management of all animals in accordance with accepted standards and reflect the community's expectation that people who are in charge of animals will ensure that they are properly cared for.
					Exotic Diseases of Animals Act 1993	n/a	An Act to provide for the detection, containment and eradication of certain diseases affecting livestock and other animals, and for incidental matters.
					Soil and Land Conservation Act 1945	n/a	DPIRD carries out the Act's administrative services for land drainage, clearing, land degradation assessment, compliance, covenanting and Land Conservation District Committees.The functions of the Act also include the mitigation and prevention of land degradation, promotion of soil conservation and educating landholders and the general public about sound land management.
					The Rights in Water and Irrigation Act 1914 (RIWI) and Rights in Water and Irrigation Regulations 2000	n/a	This Act and Regulation protects the state's water resources and promotes the sustainable and efficient use of water. RIWI licensing is active in all proclaimed areas and for all artesian groundwater wells throughout the state. The Harvey Water Irrigation District is proclaimed under our RIWI Act but the infrastructure is Harvey Water's (and its customers).
					Waterways Conservation Act 1976	n/a	An Act to make provision for the conservation and management of certain waters and of the associated land and environment. Declared waterways management areas are protected and managed under the Act.