City of Gosnells

Southern and Canning River Confluence Foreshore Management Plan 2021 - 2025

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D1	June 2021	New Document	MG/SH	BC	Draft for client review and comment
V2	June 2021	Additional information and amendments based on Stakeholder input	SH	BC	Superseded
V2.1	July 2021	Minor amendments	SH	BC	Released

Executive Summary

Natural Area Consulting Management Services (Natural Area) was contracted by the City of Gosnells to prepare a Foreshore Management Plan for a portion of the Southern and Canning River Confluence. The site exists between Burslem Drive bridge and Corfield Street in the suburb of Thornlie, within the City of Gosnells, and covers an area of 10.3 ha.

A detailed flora and basic fauna survey was undertaken by Natural Area in April and May 2021 to assist with the preparation of this plan; these surveys identified additional information regarding site specific vegetation types, vegetation condition and threatening processes. This information guides the recommended revegetation, site preparation and weed control management aspects of this plan.

Survey activities found that the site contains:

- an area of approximately 2.6 ha that has undergone extensive rehabilitation, including weed control and revegetation by the Armadale Gosnells Landcare Group between 2016 and 2020. This has greatly enhanced these portions of the site, with these areas now including varying strata layers consisting of native vegetation
- one threatened flora species *Grevillea thelemanniana* and one Priority 3 flora *Carex tereticaulis,* which have been planted during previous revegetation activities
- two vegetation types, with *Eucalyptus rudis* and *Melaleuca rhaphiophylla* Woodlands being the dominant vegetation type
- vegetation condition ranging from Good to Completely Degraded, with majority in Degraded condition and with little to no native understory species
- three areas of steep slopes that require erosion control before revegetation, one of which requires further investigation regarding feasibility
- six weed suites (based on weed treatment), majority widespread throughout the site
- four Declared Pest/WoNS species, three with localised populations one widespread throughout the waterway.

This report recommends the revegetation of 4.8 ha of the site, starting upstream and working downstream, following intense weed control and site preparation works that have been separated into four zones. This plan incorporates a detailed schedule of recommended revegetation dictated by appropriate habitats. There is heavy emphasis on weed control due to the invasiveness and densities of presenting weeds and the high level of permanent moisture.

A detailed costing is included in the plan for the four years of revegetation activities, with the cost for the program being $683,783 (ex. GST) in constant value terms. The indicative costing for year 1 (2021/22) is $106,450.00 (ex. GST). In the long term, effective weed control in this wetland environment will be crucial to the success of revegetation.

Contents

1.0 Introduction

Natural Area Consulting Management Services (Natural Area) was contracted by the City of Gosnells to undertake a detailed flora and vegetation survey (including weed mapping) and a basic fauna survey, to inform the preparation of this four-year Foreshore Management Plan to restore a portion of the Southern and Canning River Confluence (the Confluence) in Thornlie. Survey outcomes were used in the preparation of this Foreshore Management Plan to guide ongoing future environmental restoration works and to enhance the natural area in a staged approach, starting upstream and working downstream. Improving the quality of the Confluence will aid in enhancing numerous ecological factors including fauna habitat, ecological linkage to adjacent bushland, riparian vegetation that in turn can improve water quality, and site amenity for passive recreational users of the site. Reduction of threatening processes in the Confluence will also mitigate impacts downstream through reduction of weeds, rubbish, and nutrient runoff into the Southern River.

1.1 Location

The site includes a portion of the Southern River and its buffer zone with a south to north direction of flow into the Canning River. It covers approximately 10.3 ha and is located between Burslem Drive Bridge and Corfield Street within the City of Gosnells, with the Confluence existing within the suburbs of Thornlie to the north-west and Gosnells to the south-east (Figure 1). Bound by an existing shared footpath and boardwalk circuit, various urban spaces and structures are located in the immediate vicinity of the site, including the South Metropolitan TAFE Thornlie Campus, Canning River, public recreational spaces and residential properties.

1.2 Tenure and Land Use

The site is comprised of land controlled by the Western Australian Planning Commission (WAPC) as well as land under the management of the City of Gosnells and the Department of Planning, Lands and Heritage (DPLH) (Figure 2). The northernmost portion of the site directly adjoins land managed by the Department of Biodiversity, Conservation and Attractions (DBCA) [Swan River Trust].

The City of Gosnells works with the Department of Biodiversity, Conservation and Attractions (DBCA) rivers and estuaries branch (Swan River Trust) regarding on-ground management and improvement of areas within the Swan and Canning River development control area (Figure 2). The site is reserved as Parks and Recreation under the Metropolitan Region Scheme and Town Planning Scheme No. 6, with the designated purpose being "Public Recreation" (City of Gosnells, 2021a).

The Confluence is within the Thornlie/Gosnells River Regional Open Space reserve, a dog exercise area that is separated into seven lots owned by either the State of Western Australia or the WAPC (Table 1 and Figure 2) (City of Gosnells, 2021a). The majority (54.3 %) of land within the site boundary is owned by the State and is managed by the City of Gosnells. The remaining land (45.7 %) is controlled by WAPC with 3.6% managed by DPLH and 42.1 % managed by WAPC (Table 1 and Figure 2).

Table 1: Land Management and ownership of Lots within the site boundary

Tenure	Land Management	Lot Number	Area within site	
			(m^2)	(%)
State of WA	DPLH	151	3,197	3.2
		153	446	0.4
		Sub total	**3,643**	**3.6**
WAPC	WAPC	201	42,749	42.1
		Sub total	**42,749**	**42.1**
State of WA	City of Gosnells	2729	8,014	7.9
		3267	45,940	45.3
		2772	1,040	1.0
		4018	100	0.1
		Sub total	**55,094**	**54.3**
		Total	**101,486**	**100**

1.3 Objectives

The objectives of this Foreshore Management Plan are to provide a 4 year plan for restoration and ongoing management (including implementation and indicative costings) with revegetation in a staged approach commencing upstream and extending downstream. The objectives of this Plan are to restore the site to a natural environment that:

- Contains 80% endemic vegetation of varying strata layers.
- Improves the quality of water entering the Canning River.
- Provides habitat and micro-climates for a range of native fauna.
- Produces a system that is tolerant to high and low water flows.
- Promotes natural regeneration and is resilient to weed invasion.

1.4 Legislation, Policies and Guidelines

The site is protected under the *Swan and Canning Rivers Management Act 2006* and the *Swan and Canning Rivers Management Regulations 2007,* encompassing the Swan and Canning Rivers and associated land to ensure the ecological community and amenities benefit. This legislation requires development of updated strategic documents, annual reports and management plans outlining factors such as key issues, priorities and strategies associated with the enhancement of the Swan and Canning Rivers. The *Swan Canning River Protection Strategy* is the current relevant strategic document available (Swan River Trust, 2015). The DBCA are currently developing a plan *Canning, Southern and Wungong Rivers Restoration and Protection Plan* in conjunction with other stake holders but it has not been released yet (City of Gosnells, pers. comm.)

The City of Gosnells Council Policy 6.2.2 and its relevant guidelines provide clear standards, objectives and implementation relating to the retention, rehabilitation and revegetation of natural areas (City of Gosnells, 2020a and 2021b). The Policy and guidelines have been developed for proponents required to prepare and

implement natural area management plans through development conditions. The City strives to meet the standard of the Policy and guidelines for its own sites as best as possible. The City's Policy CP 1.1.4 *Enhancing The Canning And Southern Rivers* states that the City will support the environmental enhancement of the rivers, aesthetic improvement that draws visitors to the river and increased community education about the ecology, environment, cultural history and heritage of the rivers (City of Gosnells, 2020b).

1.5 Community Involvement

The Armadale Gosnells Landcare Group (AGLG) is a non-for-profit community led organisation, who are focused on restoring and enhancing the catchment areas of the Upper Canning, Southern and Wungong Rivers falling within the City of Armadale and the City of Gosnells. The group also provides a platform for engagement and education of several diverse community groups, including school students, corporate volunteers and others (AGLG, 2021).

AGLG actively managed the survey site under *the Southern River Foreshore Rehabilitation – D/S of Fremantle Road Bridge 2017 – 2020* Riverbank project. AGLG commenced intensive foreshore rehabilitation works at the site in December 2016 through Riverbank Proactive Grant funding administered by the DBCA. The work undertaken through the grant funding concluded in 2020. The AGLG was instrumental in administering all on ground works, financial management and reporting for this project. Figure 1 defines the areas where this rehabilitation work was undertaken by AGLG (Plate 1). The works undertaken in these areas included fencing, intensive weed control and revegetation.

AGLG rehabilitated approximately 2.6 ha of the site over the four years, including planting over 70,000 plants. Although there were some losses over the four years, the revegetation has greatly enhanced the site, with these portions now including varying strata layers of native vegetation. At the conclusion of the rehabilitation project the AGLG noted successes such as a steady decline in the weed seed bank and soil amelioration in drier sites.

One of the outcomes sought from the Riverbank project at the southern end of the site was to restore the site to a sufficient standard to facilitate the transfer of Lots 151 Chilcott Gardens and Lot 153 Spencer Road from the Department of Planning, Lands and Heritage (DPLH) to the City of Gosnells' management. The City of Gosnells is still in discussions with DPLH and DBCA about formally transferring management of these Lots to the City.

Plate 1: AGLG revegetation areas within The Confluence

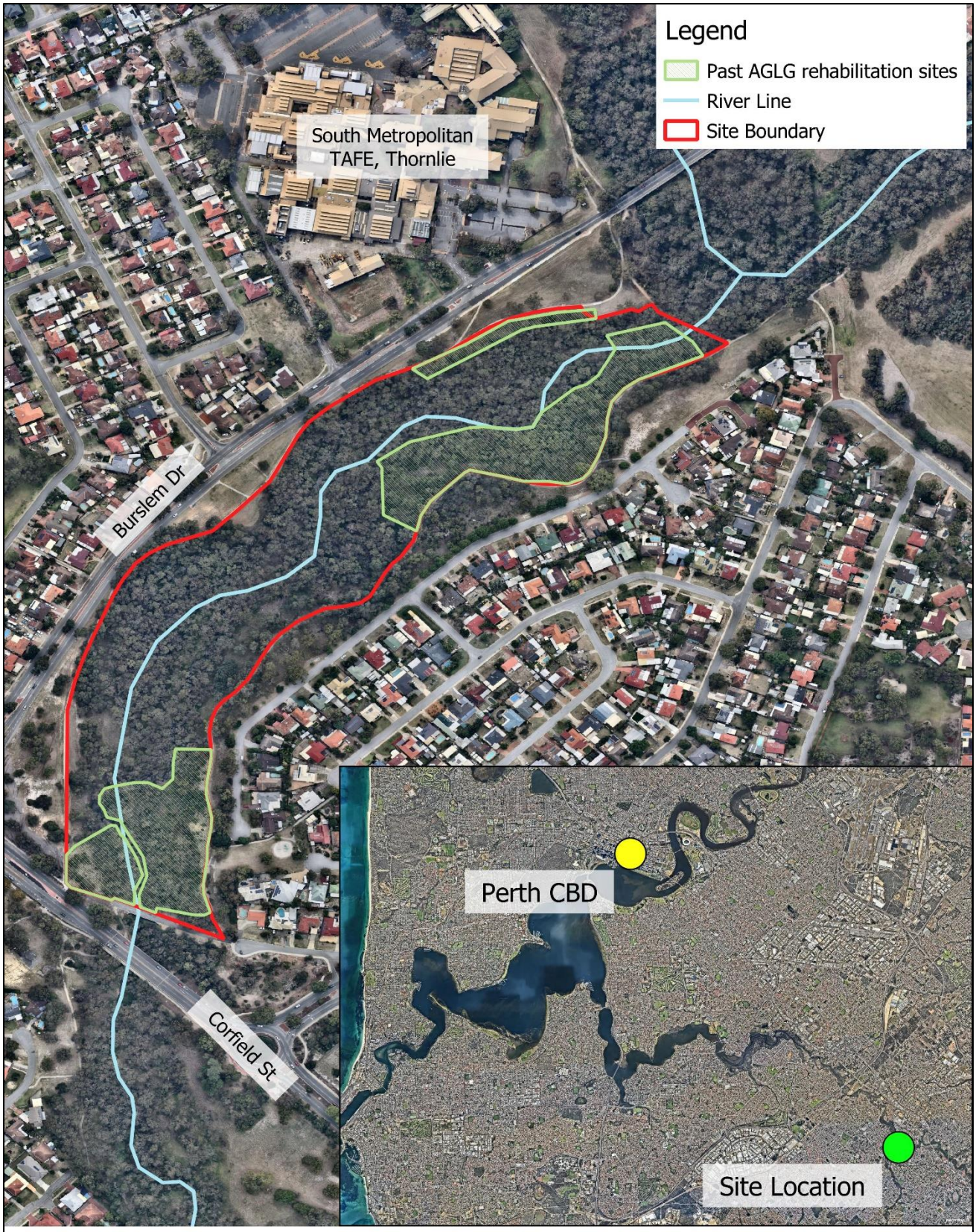


Figure 1:
Site Boundary
Southern and Canning River Confluence, Thornlie

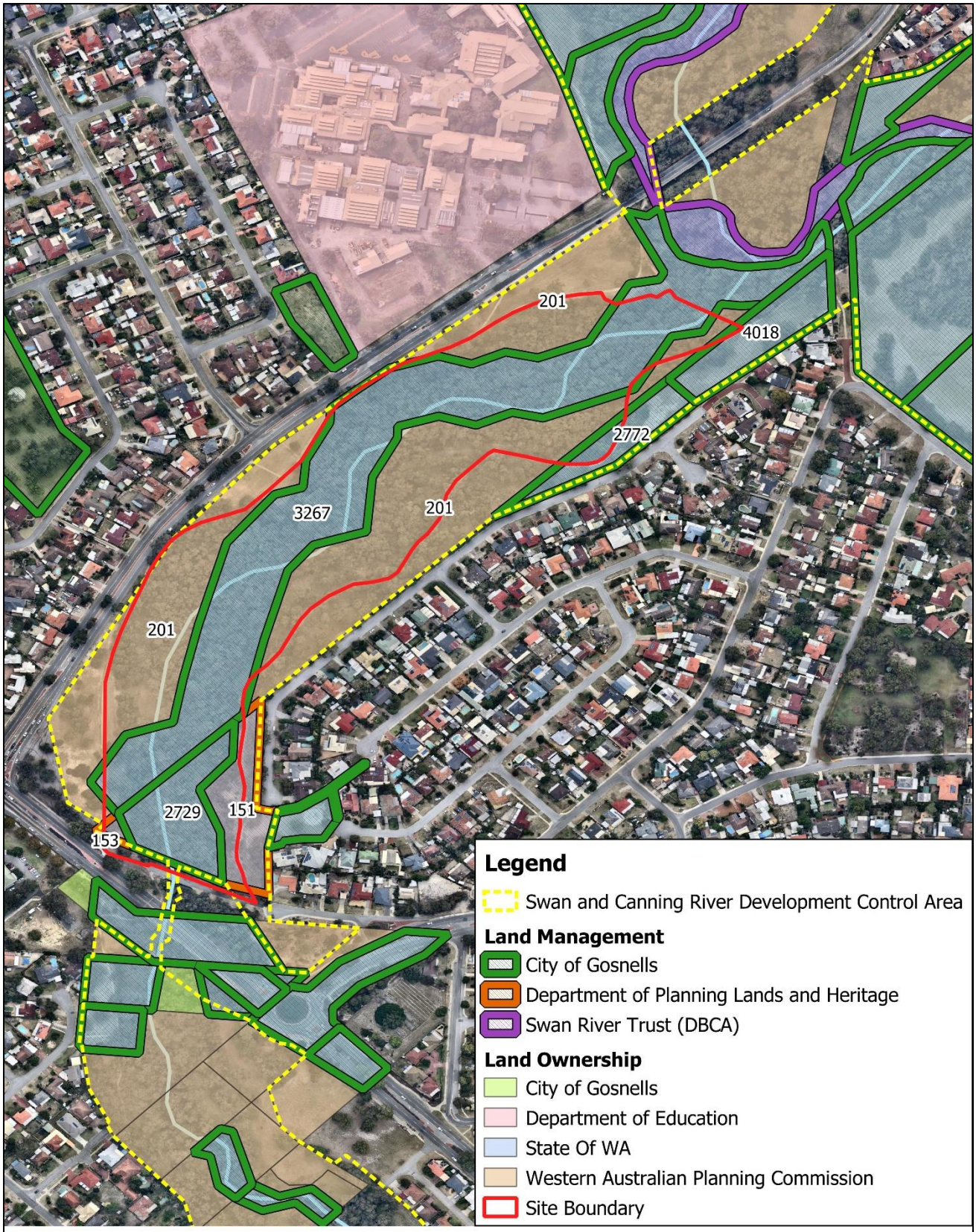


Figure 2:
Land Tenure and Management
Southern and Canning River
Confluence, Thornlie

2.0 Methodology

2.1 Desktop and Literature Review

The desktop survey included reviewing online databases to gather contextual knowledge and determine preliminary site characteristics including:

- likely native and non-native flora and fauna species present
- current extent of native vegetation
- general floristic community types
- likely presence of threatened or priority flora and fauna species
- likely presence of any threatened or priority ecological communities.

The following databases were accessed to obtain relevant information:

- NatureMap (Department of Biodiversity, Conservation and Attractions (DBCA), 2021a)
- Protected Matters Search Tool (Department of the Agriculture, Water and Environment (DAWE, 2021)
- FloraBase (DBCA, 2021b)
- Threatened and priority flora, fauna, and ecological community database searches (DBCA, 2021c).

Conservation code definitions for the State and Commonwealth and the data relating to conservation significant species from database searches were summarised into field reference guides to aid with on-ground flora and fauna surveys (Appendix 1).

2.2 On-ground Methodology

Natural Area botanists Sharon Hynes and Kylie Sadgrove undertook the on-ground detailed flora and vegetation survey and basic fauna assessment on the 21 April and the 17 to 19 May 2021, with key data recorded using Mappt software on a handheld tablet. Quadrat data is provided in Appendix 2 with flora and fauna species lists provided in Appendix 3 and Appendix 4, respectively.

2.2.1 Flora Survey

Flora and Vegetation

The flora and vegetation survey was conducted in accordance with *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority (EPA), 2016), and included a desktop review of literature and databases. Samples were collected, or photographs taken of unfamiliar species to enable later identification.

Flora survey activities included:

- setting out a total of six 10 x 10 m quadrats across the two vegetation types present
- photographing each quadrat in the north-west corner and recording GPS coordinates using GDA94 datum
- recording landscape characteristics including soil types/colour, aspect, slope, surface rock, topography and drainage using a modified recording sheets based on the NAIA templates developed for the Perth Biodiversity Project
- determining leaf litter depth, percentage cover, and percentage of bare ground

- recording percentage cover, height and life form for each flora species in the quadrats
- recording vegetation type including dominant over, middle and understorey species (Table 2) and condition using the scale attributed to Keighery (Table 3) (EPA, 2016)
- the use of GPS to map significant species and boundaries of differing vegetation type and condition
- recording evidence of disturbance, such as fire.
- noting infrastructure, amenities and recreation areas
- noting threatening processes.

Weed Mapping

Weed mapping was conducted in accordance with requests by the City of Gosnells to create weed suites (based on treatment type) with percentage of cover recorded as per the *Standard Operating Procedure - Techniques for mapping weed distribution and cover in bushland and wetlands* (Department of Environment and Conservation, 2011), samples were collected, or photographs taken of unfamiliar species to enable later identification.

Monitoring activities included:

- traversing the sites recording location and densities of introduced flora using three cover classes:
  - <5%
  - 6 – 75%
  - 76 – 100%
- mapping of weed species in groups according to their treatment types, with declared pest and weeds of national significance (WoNS) mapped separately.

2.2.2 Vegetation Type

The vegetation type was determined using the structural classes described in *Bush Forever Volume 2* (Government of Western Australia, 2000), and according to dominant over, middle and understorey species. A description of the various structural classes is provided in Table 1.

Table 2: Vegetation structural classes

Life Form/Height Class	**Canopy Percentage Cover**			
	100 – 70%	**70 – 30%**	**30 – 10%**	**10 – 2 %**
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10 – 30 m	Closed forest	Open forest	Woodland	Open woodland
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland
Tree Mallee	Closed tree mallee	Tree mallee	Open tree mallee	Very open tree mallee
Shrub Mallee	Closed shrub mallee	Shrub mallee	Open shrub mallee	Very open shrub mallee
Shrubs over 2 m	Closed tall scrub	Tall open scrub	Tall shrubland	Tall open shrubland
Shrubs 1 – 2 m	Closed heath	Open heath	Shrubland	Open shrubland
Shrubs under 1 m	Closed low heath	Open low heath	Low shrubland	Low open shrubland

Life Form/Height Class	Canopy Percentage Cover			
	100 – 70%	**70 – 30%**	**30 – 10%**	**10 – 2 %**
Grasses	Closed grassland	Grassland	Open grassland	Very open grassland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland

Source: Government of Western Australia, 2000

2.2.3 Vegetation Condition

Vegetation condition was assessed using the rating scale attributed to Keighery in *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016) (Table 3). Table 3 provides a description of the rating scale.

Table 3: Vegetation condition ratings

Category		Description
1	Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
3	Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds, partial clearing, dieback and grazing.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
6	Completely Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: EPA, 2016

2.2.4 Fauna Survey

The fauna survey was conducted in accordance with *Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020) and included a desktop review of literature and databases. Field survey activities included:

- recording opportunistic fauna sightings along with recording evidence of their presence in the form of:
  - scats
  - tracks
  - diggings
  - burrows, dens and warrens
  - runnels (vegetative tunnels)
  - calls.
- photographs were taken of potential fauna presence indicators and individual species observed where possible to do so.

2.2.5 Limitations

Several limitations associated with both desktop and on-ground flora and fauna surveys exist, including:

- database searches only provide an indication of what flora species may be present, with on ground surveys required to confirm those present
- information on flora species provided on some databases include out-of-date species names, meaning that names need to be checked for currency
- herbarium records are largely limited to vouchered specimens
- plant species flower at different times and are not always able to be identified
- on-ground surveys indicate species present at the time of the assessment, with species flowering at different times not always able to be identified
- not all species flower every year
- the differing databases are reliant on information submitted via various reporting mechanisms, so all records of a particular species or ecological community within a specified area may not be complete
- some fauna species are highly mobile and may utilise the site as part of their range but may not be present within the site at the time of the survey
- certain fauna species are shy, difficult to observe or active at different times of the day and may not be observed even though they are present on site
- the surveys were undertaken outside the optimal time for flora surveys in the South West of Western Australia which is spring
- some areas in the centre of the Confluence were inaccessible due to the depth of water and high density of woody weeds.

Despite these limitations, Natural Area estimates that 80 – 90% of flora species within the survey area were identified.

3.0 Existing Environment

3.1 Regional Context

According to the Interim Biogeographical Regionalisation of Australia (IBRA), Perth is located within the Swan Coastal Plain region and covers the low-lying area that exists between the coastline and the Jarrah Forest region on the Darling Scarp to the east. The Swan Coastal Plain comprises of two major divisions, namely Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain. The site is located approximately 15 km west of the Jarrah Forest within the Perth Coastal Plain subregion and is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales (Mitchell, Williams and Desmond, 2002)

3.2 Climate

The climate experienced in the area is Mediterranean, with dry, hot summers and cool, wet winters. According to the Bureau of Meteorology (Perth Airport, Station ID 009021, 2020):

- average rainfall is 730.9 mm pa, with the majority falling between May and August
- average maximum temperatures range from 20.1 ^{o}C in winter to 30.7 ^{o}C in summer, with the highest recorded maximum being 44.5 ^{o}C
- average minimum temperatures range from 8.97 ^{o}C in winter to 16.4 ^{o}C in summer, with the lowest recorded minimum being -0.7 ^{o}C
- predominant wind directions include morning easterlies and westerly sea breezes during summer months, with an average wind speed of 16.4km/h and gusts of more than 100 km/h.

3.3 Topography and Soils

According to the Natural Resource Information (NRInfo) Map, four soil types that are predominantly sandy exist within the site boundary (Department of Primary Industries and Regional Development (DPIRD), 2021c) (Table 4). Majority of the site is covered with the EnvGeol Ms4 Phase along the river and its banks (Figure 3). The topography ranges from 2 to 10 m Australian Height Datum (AHD) rising from the Southern River at the centre of the site up the banks to the south-east and north-west (DPIRD, 2021b) (Figure 3). It was noted that localised areas particularly the higher elevations on the north-east boundary of the site does contain dumped sand, and fill soils with building rumble, blue metal and other building spoil present.

Table 4: Soil type descriptions

Code	Soil Type	Description
213PjSWMs4	EnvGeol Ms4 Phase	SANDY SILT - light yellow brown, blocky, mottled, some fine to medium-grained sand, soft when moist, variable clay content
213Pj__S10	EnvGeol S10 Phase	SAND - as S8 as relatively thin veneer over sandy clay to clayey sand, of eolian origin
213Pk__Cms	EnvGeol Cms Phase	SANDY SILTY CLAY - pale brown
212Bs__S8	EnvGeol S8 Phase	SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted of eolian origin

(Source: DPIRD, 2021c)

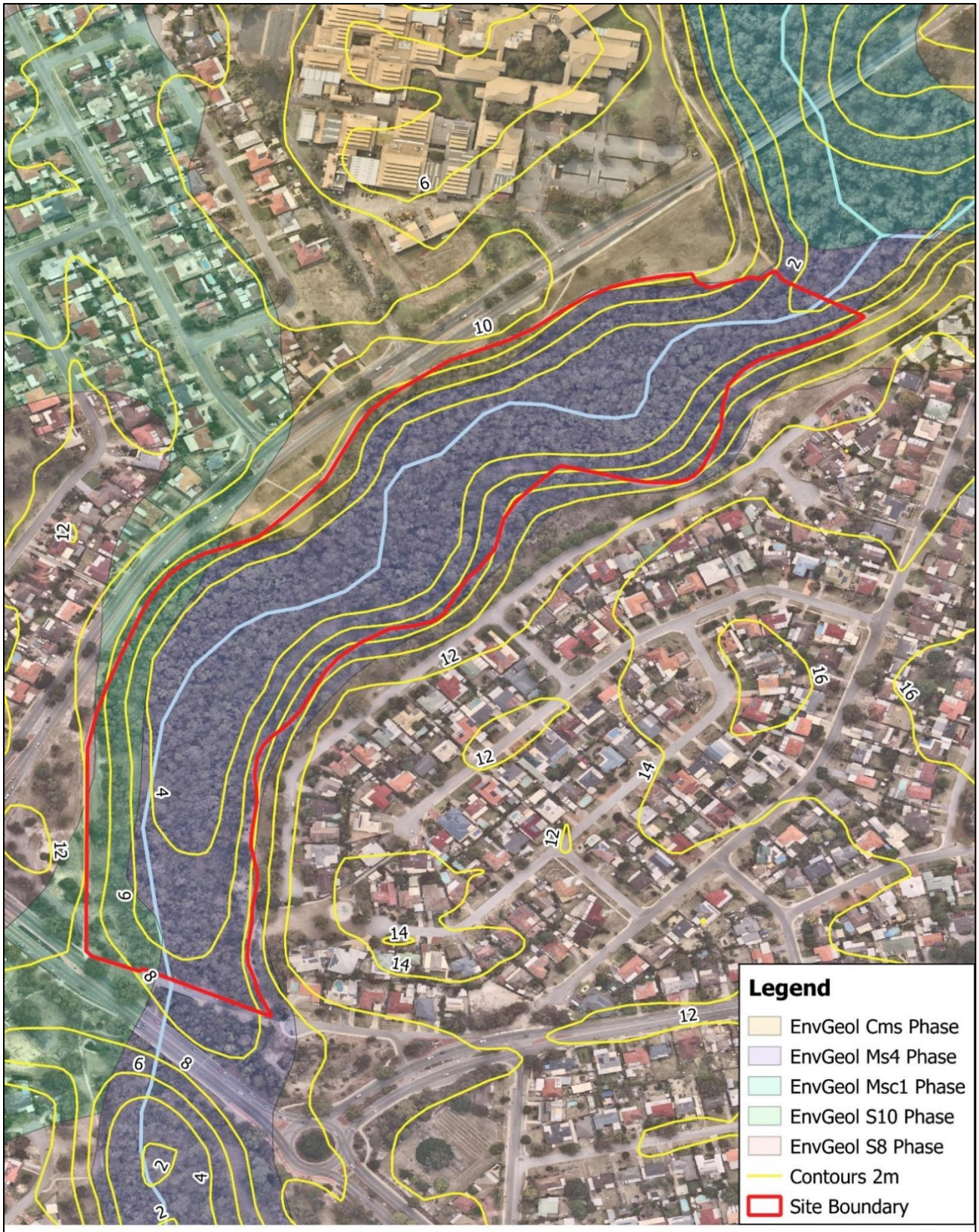


Figure 3:
Soils and Contours
Southern and Canning River
Confluence, Thornlie

3.4 Vegetation Complex

One vegetation complex occurs within the survey area, namely the Swan Complex. This complex occurs along areas of the Swan and Canning River and is described as being dominated by a woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* with *Casuarina obesa* and *Melaleuca cuticularis* occurring within localised low open forests (Heddle, Loneragan and Havel, 1980). Few undisturbed areas of this complex remain as a result of early settlement of the south-western corner of Western Australia, with 13.57% remaining on the Swan Coastal Plain and only 15.58% of this being present within the City of Gosnells (Government of Western Australia, 2019a).

3.5 Ecological Linkages

The Southern and Canning River Confluence is recognised as being part of two regionally significant contiguous bushland and wetland linkages (Figure 4) outlined by Alan Tingay and Associates (1998) and includes:

- 70 'Southern River – Canning River – Darling Range Regional Park'
- 71 'Canning River – Swan River – Darling Range Regional Park'.

3.6 Bush Forever

The survey site is part of the Bush Forever site 246 (Canning and Southern Rivers, Beckenham to Martin/Kelmscott) and connects downstream with Bush Forever Site 224 (Canning River Regional Park and Adjacent Bushland Riverton to Langford) (Government of Western Australia, 2000) (Table 5 and Figure 4). Bush Forever sites are selected based on seven selection criteria that were used to determine regionally significant bushland areas. Three selection criteria make up Bush Forever Site 246, including

- representation of ecological communities
- rarity
- general criteria.

Table 5: Bush Forever significant selection criteria

Bush Forever Criteria	Comments
Representation of ecological communities	Contains vegetation communities representative of two ecological community including *Corymbia calophylla* Woodland, and *Eucalyptus rudis* and *Melaleuca rhaphiophylla* Woodland.
Rarity	Significant Mammal Species: ▪ Priority 4 Quenda (*Isoodon fusciventer*)
General criteria	Protection of wetland streamline and estuarine fringing vegetation and coastal vegetation

Source: Government of Western Australia, 2000

Other Regionally Significant Attributes

National Trust of Australia (WA) Classification; bushland/naturally vegetated watercourses have particular conservation value in providing habitat for fauna and linkage between larger, more intact areas of bushland; contains open space of regional significance (DCE 1983); contains 1963 m of regionally significant river.

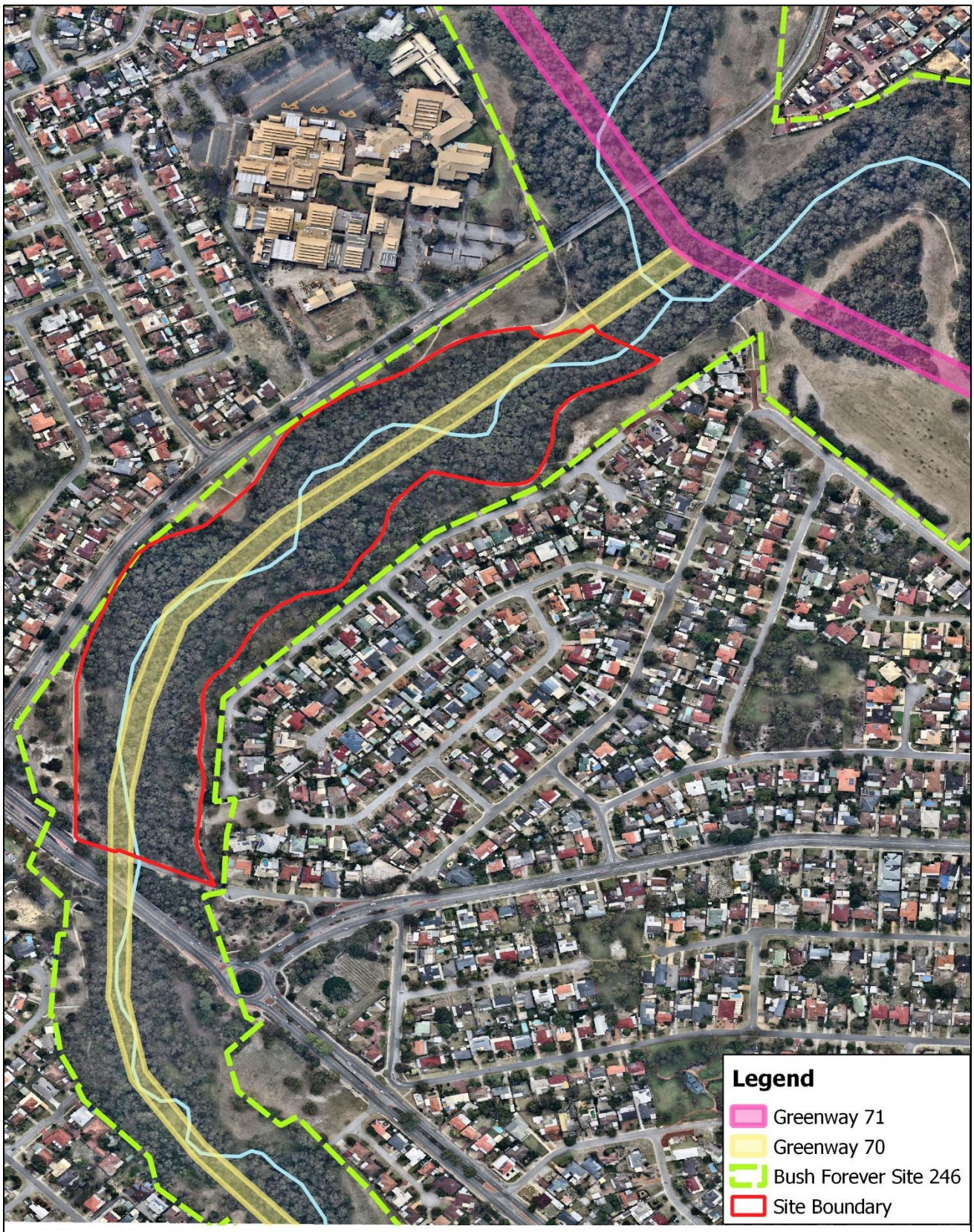


Figure 4:
Ecological Linkages
Southern and Canning River
Confluence, Thornlie

3.7 Aboriginal Heritage

The survey site is located within the Whadjuk (Perth Metropolitan) Region and contains numerous important Noongar sites, of which 15 are state registered and in close proximity to the Confluence (Government of Western Australia, 2019b) (Table 6). Aboriginal heritage sites that are state registered are protected under the *Aboriginal Heritage Act 1972* (WA) and can be listed for a number of reasons, including:

- place of importance and significance
- sacred, ritual or ceremonial sites
- places associated with historical, anthropological, archaeological or ethnographical interest
- where objects are traditionally stored.

Table 6: State registered Aboriginal heritage sites within the City of Gosnells

ID	Name	Type
Within Site		
3511	Southern River	Mythological, Camp, Hunting Place
3536	Swan River	Mythological
3538	Canning River	Mythological, Named Place, Ochre, Water Source
3539	Foreshore Place, Gosnells	Mythological, Water Source
Less than 1 km from site		
3897	Okey Davies Homestead A-D	Artefacts / Scatter
Within 3 - 5 km from site		
4320	Murdoch Road, Canning Vale	Artefacts / Scatter
36929	Yule Brook Mandoorn	Mythological
16717	Frog Dreaming	Artefacts / Scatter, Man-made Structure, Mythological, Natural Feature
18193	Frog Dreaming Creek	Mythological
Approximately 6 km from site		
3264	White Road, Orange Grove	Artefacts / Scatter, Skeletal Material / Burial, Camp
3624	Boundary Road, Wattle Grove	Artefacts / Scatter
3654	Bickley Ridge	Artefacts / Scatter, Man-Made Structure
4342	Brentwood Road, Quarry	Artefacts / Scatter, Quarry
4343	Brentwood Road, Swamp	Artefacts / Scatter
21081	Passmore Street – FS1	Midden / Scatter

Source: Department of Planning, Lands and Heritage (DPLH), 2021

3.8 European Heritage

Four European heritage sites are integrated into the Southern and Canning River Confluence, these too are stage registered. A brief description of these sites is listed in Table 7.

Table 7: State registered European heritage sites within the City of Gosnells

ID	Name	Description
Less than 1 km from site		
13809	Arum Lilies, John Okey Davis Park	Amongst the first European settlers in Gosnells was John Okey Davis and his wife Frances, arriving in October 1829. Granted 7026 acres along the Canning River, his property occupied the present suburbs of Huntingdale, Gosnells and Southern River. The area of the 'John Okey Davis Park' was where the family built a mud-brick home and cultivated the land to grow wheat and vegetables (Monument Australia, 2021).
13817	John Okey Davis Park (including grave)	
13830	Wilkinson's Orchard (fmr) (Almond Trees, Jarrah Tree, John Okey Davis Park)	In 1905, John and Emma Wilkinson purchased five blocks of land on the Canning River previously owned by the late Charles Gosnells. The Wilkinson homestead was built in 1912 and currently houses the City of Gosnells Museum. The Wilkinson's planted an orchard of stone fruit, almonds and citrus, with five orange trees relocated on the grounds of the Museum in 1999. (City of Gosnells, 2021c).
1127	Wilkinson Homestead (City of Gosnells Museum, Orange Tree Farm Museum)	

Source: Government of Western Australia, 2021

3.9 Hydrology

The Southern River Catchment is the largest tributary that enters the Canning River, feeding approximately 36% of its water from an area covering 149 km^2. Approximately 33 km^2 (22%) of the catchment is located within the City of Gosnells, with the remaining area extending through the City of Armadale, from the darling range where Wungong Reservoir and Wungong Brook are a major tributary (Department of Water and Environmental Regulation (DWER, 2019). The Southern River flows permanently with an average flow rate of 14 GL per year (2008 – 2018), only running dry after multiple low rainfall years (DWER, 2019). Nutrient sampling has determined the Southern River has continuously failed to meet long term goals between 2008 and 2018, regarding total nitrogen (1.0mg/L) and total phosphorous (0.1mg/L) levels (DWER, 2019). Producing an average total nutrient level of 1.23mg/L and an average total phosphorous level of 0.143mg/L (DWER, 2019). Water from the catchment originates from areas of various land use with the main area being:

- conservation and natural
- farms
- unused cleared grassed areas
- residential.

The lower section of Southern River wihtin the survey site consists of a multiple use wetland that extends through the Confluence into the Canning River according to the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA, 2021d). The multiple use wetland UFI 15768 extends along Southern River from Southern River Road through to the Confluence and is described as a flat palusplain (DBCA, 2021d). According to the Interactive Groundwater Map, depth to ground water at the Confluence is between 0 m and increasing to 9 m as the river edge rise with ground water salinity ranging between 500 and 1000 mg/L (DWER, 2021a).

There are six main stormwater drainage points entering the site, where freshwater flows into the Confluence as runoff from roads, residential housing and parks and reserves following rainfall events (Figure 5). Glyndebourne Park and Ningalloo Way Reserve run off enters the site from the same drainage points, while Empire Way Reserve run off enters less than 100 m upstream of the site boundary south of Burslem Bridge (City of Gosnells, 2021d). Historical activity within the site has seen the construction of a portion of earth bunding at the north-eastern section of the Confluence, altering the natural flow of water by creating a stagnant pool. Future management of this may be to plant native sedges to out compete the grasses and strip nutrients from the water.

The floodplain mapping tool developed by the Department of Water and Environmental Regulation (2021b) highlights flood levels that have a one in 100 likelihood of occurring in a given year, the floodway rises to an average width of approximately 120 m with a maximum width of approximately 140 m and a maximum depth of depth of 5.73 m (Figure 5).

3.10 Infrastructure and Signage

The Confluence contains minimal infrastructure, amenities and signage (Figure 5). Majority of infrastructure and amenities around the Confluence are located to the north-east of site within John Okey Davis Park. Connected via footpath John Okey Davis Park includes toilets, play-equipment and seating. The existing footpath is in good condition and provides a recreational circuit for various community members. This circuit borders the site and includes two bridges, Fremantle Bridge to the south and a timber boardwalk to the north. One lamp post is located along the timber boardwalk providing lighting to the crossing.

The majority of the site is not fenced, with fencing installed in 2018 on the southern side to separate revegetation area from lawned areas. Two informative signs outlining revegetation efforts are located on the southern side of the Southern River and are easily observed from the footpath. The infrastructure within the site although minimal, allows the community to access the area while nurturing various community values, including:

- conservation
- aesthetic
- educational
- recreational.

Figure 5:
Hydrology and Infastructure
Southern and Canning River
Confluence, Thornlie

3.11 Native Flora and Vegetation

3.11.1 Native Flora

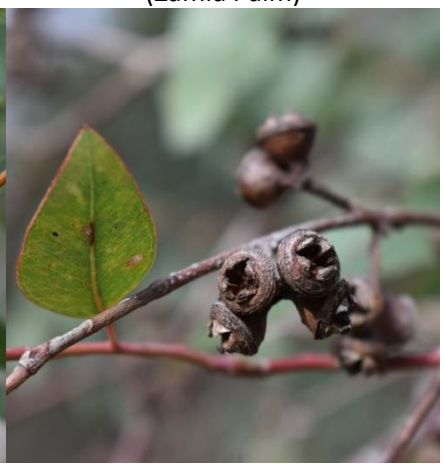
The 2021 survey identified the presence of 144 flora species (taxa) from 45 families. Of these, 71 (49.3%) were native, 10 (6.9%) were recorded as dubious (outside typical native range) and 63 (43.8 %) were introduced (weeds). Weeds are discussed in detail in Section 4.2 (within the Threats Section). A complete flora list is provided in Appendix 3 with examples of flora species recorded provided in Plate 2. The cover for native vegetation strata layers based on our quadrat data within the site was 74% for upper, 2.8% middle storey and 17.9% for understorey (groundcovers). It was noted that the majority of native understorey flora was recorded in the wetter areas in the centre of the site along the Southern River. The revegetation areas did contain higher percentage cover of middle storey natives at approximately 80%.

Typha domingensis
(Typha)

Macrozamia riedlei
(Zamia Palm)

Lepidosperma longitudinale
(Pithy Sword-sedge)

Hakea undulata
(Wavy-leaved Hakea)



Eucalyptus rudis
(Flooded Gum)

Centella asiatica
(Centella)

Plate 2: Examples of native flora species recorded during the 2021 survey

3.11.2 Significant Flora

A review of the DBCA (2021c) database noted six species of threatened or priority flora occur on the Swan Complex within 5 km of the survey site, including:

- *Acacia lasiocarpa* var. *bracteolata* long peduncle variant (P1, WA)

- *Banksia mimica* (T, WA and Cth)
- *Beaufortia occidentalis* (P3, WA)
- *Bolboschoenus fluviatilis* (P1, WA)
- *Carex tereticaulis* (P3, WA)
- *Drosera occidentalis* (P4, WA).

One threatened and one priority species were found to occur within the site boundary, *Carex tereticaulis* (P3) and *Grevillea thelemanniana* (T) listed under the *Biodiversity Conservation Act* (BC Act) *2016* (WA). The *Grevillea thelemanniana* is also listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). These species were planted within the site and were listed on the AGLG planting lists and should be considered in future revegetation efforts depending on their availability.

3.11.3 Vegetation Type

Two vegetation types were recorded within the Confluence, with the site consisting largely of riparian (riverbank vegetation) *Melaleuca rhaphiophylla* and *Eucalyptus rudis* Woodland rising to approximately 5 m AHD where the vegetation transitions into drier lands of *Corymbia calophylla* Woodlands. Vegetation types are described in Table 8 and shown in Figure 6.

Table 8: Vegetation Types at the Southern and Canning River Confluence

Name	Description	Photograph
Corymbia calophylla Woodland 2.8 ha 27.2%	*Corymbia calophylla* Woodland over weedy understory of **Ehrharta calycina* and **Oxalis pes-caprae*, with sparse natives including *Macrozamia riedlei*, *Hardenbergia comptoniana* and *Tricoryne elatior*	
Melaleuca rhaphiophylla and *Eucalyptus rudis* Woodland 7.5 ha 72.8%	*Melaleuca rhaphiophylla* and *Eucalyptus rudis* Woodland over weedy understory of **Paspalum dilatatum* and other weedy grasses, with sparse mixed native sedges and herbs.	

3.11.4 Threatened Ecological Community

A review of the PMST listed by the Department of Agriculture, Water and the Environment (2021) indicated the potential presence of four threatened ecological communities (TEC) listed as either Endangered or Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cth), including:

- Banksia Woodlands of the Swan Coastal Plain
- Clay Pans of the Swan Coastal Plain
- *Corymbia calophylla – Kingia australis* Woodlands on the heavy soils of the Swan Coastal Plain
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain.

The Department of Biodiversity, Conservation and Attractions (2021) database indicate no threatened or priority ecological communities are present within the site boundaries. However, it is important to note presence of several communities of the Priority 3 listed ecological community *Banksia dominated Woodlands of the Swan Coastal Plain IBRA subregio*n occur within 1 km of site boundary and further upstream of Southern River.

Of the two vegetation types recorded on site, including *Corymbia calophylla* Woodlands and *Melaleuca rhaphiophylla and Eucalyptus rudis* Woodlands neither are considered to make up any of the four Threatened Ecological Communities that have the potential to occur.

3.12 Vegetation Condition

Vegetation condition ranged from Good to Completely Degraded, with the majority of the site in Degraded condition (Table 9, Figure 7). The extent of areas in lower condition is due to a high presence of invasive weeds within the river system itself and the periphery, this is a result of historic clearing and land use that has resulted in increased degradation and low native species diversity. Previous revegetation and weed control activity has increased some areas to good condition. Future revegetation areas were selected due to the areas being degraded or completely degraded with some understory infill recommended within previous revegetation areas.

Table 9: Vegetation condition within the survey site

	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded	Total
Area (ha)	0	0	0	2.71	6.85	0.74	10.3
Percent (%)	0	0	0	26.3	66.5	7.2	100

Figure 6:
Quadrat Locations, Fauna Activity and Vegetation Type
Southern and Canning River Confluence, Thornlie

Figure 7:
Vegetation Condition
Southern and Canning River
Confluence, Thornlie

3.13 Native Fauna

A total of ten native fauna species were recorded in the 2021 site assessment of the Confluence, including three birds and four mammals. Examples of species and presence indicators recorded are shown in Plate 3, with a total species list provided in Appendix 4.

Due to the high density of vegetation and inability to traverse the site easily, opportunistic sightings of reptiles and mammals was reduced. The habitat within the Confluence would likely support various species of wetland skinks and amphibians. Multiple reptiles within the family Scincidae were observed during the survey; however, conditions did not allow for species identification. As bird species are highly mobile and some are migratory it is likely that they utilise the area for roosting, foraging or may fly over the sites at different times. Natural Area recommends further surveys to identify the extent of fauna diversity within the Confluence.

The Southwestern Snake Necked Turtle (*Chelodina colliei*) is likely to reside within the Southern and Canning River confluence as it is suitable habitat with previous sightings noted by the AGLG and City of Gosnells (AGLG, n.d). This species requires various habitats as it selects terrestrial sites for nesting, usually with open to minimal vegetation while requiring additional vegetation for protection from predators.

Numerous sightings of the Common Brushtail Possum (*Trichosurus vulpecula* subsp. *vulpecula*) have been recorded since 2016 in the northern section of the Confluence and in the adjacent vegetation along Canning River (iNaturalist, 2020). The Common Brushtail Possum has a home range between 2.4 and 5.4 ha and is prey to owls, dogs, foxes and cats. The distribution of this population is undetermined, however is to likely utilise habitat across the entire Confluence while encountering predators within the area (Mckay & Winter, 1989).

3.14 Significant Fauna

A review of the DBCA (2021c) database has recorded the presence of eight fauna species listed under the BC Act 2016 (WA) that have previously been recorded on the Swan Complex within 5 km from site (Table 10). This includes the threatened Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and threatened Carter's Freshwater Mussel (*Westralunio carteri*) both of which are also listed under the EPBC Act 1999 (Cth), as endangered and vulnerable, respectively. The Priority 4 Quenda (*Isoodon fusciventer*) has been previously sighted by AGLG members with the group noting numerous quenda diggings across site. This species is generally active at night and requires habitat supporting understory vegetation that allows protection from predators.

The Confluence is within the buffer zone of a known breeding areas for the Carnaby's Cockatoo and is less than 5km from known black cockatoo roosting sites (DBCA, 2021d & DBCA, 2021e). During survey activities two *Corymbia calophylla* (Marri) trees had signs of previous feeding activity from Black Cockatoo's as well as presence of the threatened Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) listed under the BC Act 2016 (WA) and as vulnerable under the EPBC Act 1999 (Cth) observed flying overhead (Plate 3).

The Confluence currently provides a range of high to low quality flora species (12) able to provide foraging, roosting or breeding sources for Black Cockatoos (Department of Environment and Conservation (DEC), 2011). These 12 species are either native, invasive (*) or dubious (#, not naturally occurring), including:

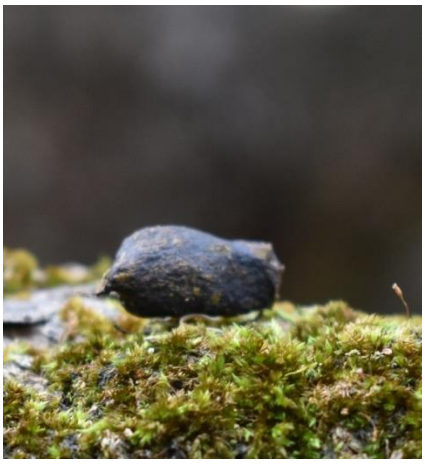
- **Lupinus cosentinii*
- *#Banksia nivea*
- *Banksia attenuata*
- *Banksia dallanneyi*
- *Banksia littoralis*
- *Banksia menziesii*
- *Corymbia calophylla*
- *Eucalyptus rudis*
- *Hakea lissocarpha*
- *Hakea undulata*
- *Hakea varia*
- *Jacksonia furcellata.*

The Carter's Freshwater Mussel (*Westralunio carteri*) has seen a large decline in its range over three generations as a result of secondary salinisation within waterways it inhabits (Klunzinger *et al.*, 2015). Intensive surveying was conducted over coastal freshwater rivers and lakes across the South-West to determine remaining populations, with one such population existing in the Canning River upstream of the Confluence. No surveying has been conducted within the Confluence itself. This species is associated with riparian vegetation, soft and stable sediments and the presence of a host organism to complete the glochidia (larval) form of their lifecycle (Threatened Species Scientific Committee, 2017). Further examination of the biology of this species determined it required an environment with salinity less than 1.6 g L^{-1} and an average total nitrogen level less than 0.69g L^{-1} (Klunzinger *et al.*, 2015, Threatened Species Scientific Committee, 2017). As the nitrogen and salinity levels are both below these levels it is possible for the Carter's Freshwater Mussel to occur in the Confluence.

Table 10: Fauna species previously found on the Swan Complex within 5 km of the survey site

Species Name	Common Name	Conservation Code	
		WA	Cth
Calyptorhynchus latirostris	Carnaby's Cockatoo	T	EN
Westralunio carteri	Carter's Freshwater Mussel	T	VU
Falco peregrinus	Peregrine Falcon	OS	
Isoodon fusciventer	Quenda	P4	
Lerista lineata	Perth Slider	P4	
Oxyura australis	Blue-billed Duck	P4	
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale	OS	
Tringa nebularia	Common Greenshank	OS	

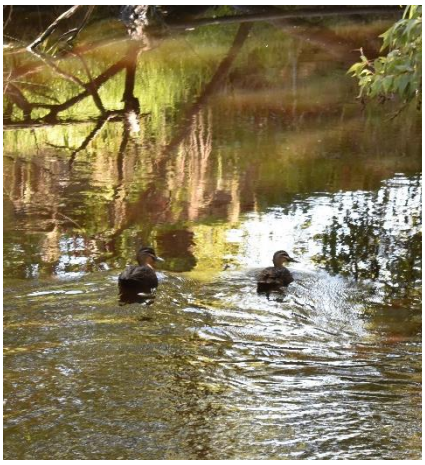
Source: DBCA, 2021c



Common Brushtail Possum (*Trichosurus vulpecula* subsp. *hypoleucus)* scat

Black Cockatoo's Feeding Activity on Marri nuts

Small hollow in Flooded Gum



Pacific Black Duck (*Anas superciliosa*)

Garden Orb (*Eriophora transmarina*)

Purple Swamphen (*Porphyrio porphyrio*)

Plate 3: Fauna species and presence indicators observed within the survey site

4.0 Threats

4.1 Climate Change

Climate change in the south-west of Western Australia is expected to cause increased and more intense storm events, decreased rainfall, sea level rise and increased temperatures (Department of Primary Industries and Regional Development, 2021a). These changes are likely to increase potential for erosion during storm events and increase water stress on plants with increased temperatures and decreased rainfall. This will increase stress on groundwater dependent species and may lead to changes in vegetation complexes and structures therefore affecting fauna habitat. As the Confluence includes wetland ecosystems it is considered more vulnerable to changes in climate, but also provide a cool refuge for species that may be exposed to increased climate changes elsewhere. In the south-west of Western Australia climate change are forecast to include the following impacts (Department of Primary Industries and Regional Development, 2021a):

- Increased temperature by 0.5 – 1.2^{o}C by 2030
- Increase frequency of hot spells
- Increased drought
- Increased evapotranspiration, with evaporation expected to increase by 2.5% by 2030
- Loss of keystone species
- Decreased rainfall of 6% by 2030
- Altered hydrological cycles
- Increase in more intense rainfall event and increase runoff
- Decreased soil moisture that cannot reset with good rainfall seasons or years
- Increased drying out of wetlands, decreased water quality, water runoff and oxygenation of water. Increasing threats to biota between flood events, water dependent species distribution and breeding may change
- Increase in invasive species affecting natural ecosystem processes
- Exacerbate the impacts of other threatening factors.

The best management to protect natural areas from the impacts of climate change is to improve vegetation condition and increase diversity of species to build resilience to individual changes and events. Maintain and enhance ecological linkages to enable movement of fauna and pollinators species throughout the landscape. Implementation of adaptable management strategies to match on-ground site changes.

4.2 Introduce Flora

Weeds are a major threat to the biodiversity of the Southern and Canning River and have the potential to diminish the aesthetic values and alter environmental processes within the site. Of the 144 flora species recorded during the 2021 flora survey, 73 (49%) were dubious or weed species (Plate 4). Using the weed prioritisation process developed by DBCA more than half of the weed species are considered high (49%) or medium impact (10%) (DBCA, 2013). Weed suite mapping grouped weed species by their control methods (refer to Table 12), including:

- Declared Pest (Arum Lily)
- Declared Pests (Woody Weeds)
- Woody weeds

- Geophytes / bulbous weeds
- Invasive grasses (group 1)
- Invasive grasses (group 2)
- Herbaceous weeds (group 1)
- Herbaceous weeds (group 2).

The mapped locations of declared pests, woody weeds, invasive grasses, herbaceous weeds, geophytes and bulbous weeds are provided in Appendix 5.

4.2.1 Significant Weeds

Site assessment activities carried out by Natural Area included consideration of significant weeds present. In the context of the Southern and Canning River Confluence, a significant weed is one that is listed as:

- a weed of national significance (WoNS)
- a declared pest on the Western Australian Organism List (WAOL) under the *BAM Act 2007* (WA) (DPIRD, 2021d).

The introduced species included four Weeds of National Significance (WoNS), including:

- Narrowleaf Cottonbush (*Gomphocarpus fruticosus*)
- Common Lantana (*Lantana camara*)
- Blackberry (*Rubus laudatus)*
- Arum Lily (*Zantedeschia aethiopica*).

These species are also listed as declared pests under the *Biosecurity and Agriculture Management* (BAM) *Act 2007* (WA) and require control by the landowner/manager to reduce abundance and spread of the species.

Queensland Silver Wattle
(*A*cacia podalyriifolia*)

Common Lantana
(**Lantana camara*)

Arum Lily
(**Zantedeschia aethiopica*)

Moth Vine (**Araujia sericifera*) | Virginia Creeper (**Parthenocissus quinquefolia*) | Blackberry (**Rubus laudatus*)

Plate 4: Example of introduced flora species found within the survey site

4.3 Introduced Fauna

Invasive fauna can cause numerous negative impacts on the natural environment, including predation of native fauna, competition for food, water and habitat. A declared pest is listed under the *BAM Act 2007* (WA) and requires control by the landowner/manager to reduce abundance and spread of the species. Four declared fauna species are likely to occur within the Confluence, including:

- Cat (*Felis catus*)
- Rabbit (*Oryctolagus cuniculus*)
- Rainbow Lorikeet (*Trichoglossus haematodus*)
- Fox (*Vulpes vulpes*).

The 2021 survey recorded five introduced fauna species as being present within the Confluence, including the European Honeybee (*Apis mellifera*), Domestic Dog (*Canis familiaris familiaris*), Rabbit (*Oryctolagus cuniculus*) and the Red Fox (*Vulpes vulpes*) (Plate 5). Sightings of the Domestic Dog were on-leash with owners on walking paths. Cats (*Felis catus*) and Rainbow Lorikeet (*Trichoglossus haematodus*) were not recorded within the Confluence.

Species such as the Red Fox, Cat and Domestic Dog when uncontrolled can impact vulnerable native fauna species susceptible to predation, such as the South Western Snake Necked Turtle. The Rainbow Lorikeet and the European Honeybee compete for nesting sites that otherwise can be used by a number of native bird species, including the threatened black cockatoos.

Red Fox (**Vulpes vulpes*) scat

Rabbit (**Oryctolagus cuniculus*) burrow

European Honeybee (**Apis mellifera)* hive in *E. rudis*

Plate 5: Example of introduced fauna species found within the survey site

4.4 Physical Disturbance

Physical disturbance relates to the inappropriate use of an area that leads to a drop in an area's aesthetic values as well as the safety and quality of an environment through activities such as:

- dumping of rubbish and garden waste
- graffiti and vandalism
- trampling of vegetation
- unrestricted domestic dogs.

Physical disturbances within the Confluence were in the form of rubbish dumping and graffiti with the most prominent being the dumping of rubbish, spread throughout the site. Types of rubbish ranged from large items such as tyres, concrete blocks to small items such as wrappers and aerosol cans. These smaller items pose higher risk to the environment as they can pollute the waterway or can be fatal to fauna through ingesting pieces or becoming trapped. Examples of physical disturbance are shown in Plate 6. Natural Area suggests removal of rubbish within the site, as soon as practicable once observed. It was noted that signs present within the site have been vandalised (Plate 6).

4.5 Erosion

Areas with steep slopes experience erosion where there is a lack of vegetation cover present to stabilise the soil. River systems are subject to erosion through natural changes such as hydrological flow. Although erosion is a naturally occurring process within moving waterways, particular events such as storms and high rainfall can lead to increased floodway zones, increased rate of flow and higher risks of erosion.

The Confluence includes areas with sleep slopes that are currently eroded or at risk of erosion, particularly slopes north of the Southern River where stormwater drain culverts are located (Figure 5 and Plate 6). These sections will need to be managed and monitored, with the steepness of the slope presenting management challenges regarding weed control and revegetation.

Rubbish within waterway - tub

Rubbish – Aerosol Can

Graffiti on Informative Sign

Erosion present on the north-west section

Plate 6: Examples of physical disturbance and erosion found within the Confluence

4.6 Acid Sulfate Soils

Acid sulphate soils are naturally occurring soils that contain iron sulphides, primarily in the form of pyrite materials, formed under waterlogged conditions in fresh and saline wetlands around Western Australia. If left in-situ and not exposed to the air, they do not pose a significant risk to humans or the environment. However, when exposed to air, sulphuric acid is formed and can release heavy metals into the surrounding environment (Department of Environment Regulation (DER), 2015).

The Confluence ranges between low and high risk of containing acid sulphate soils. The moderate to high risk exists within the floodplain with low to moderate existing within the drier fringing vegetation above 5 m AHD (DWER, 2021b). Any disturbance of soils through activities such as earthworks, excavation and dredging within the Confluence should first undergo a feasibility study, using the guideline *Identification and investigation of acid sulfate soils and acidic landscapes* (DER, 2015).

4.7 Hydrological Issues

Hydrological issues relate to the quality and flow of water within a system that creates threatening ecological processes affecting the quality of an environment through presence of factors such as:

- nutrients (altering water quality, promoting algal blooms)
- pollutants (altering water quality)

- rubbish and sediments (altering water flow, potential pollutant)
- erosion (change in geology altering water flow and water quality)
- environmental weeds (various water uptake, altering water flow)
- infrastructure (altering water flow).

The Confluence experiences changes in hydrological conditions annually through naturally occurring temporal changes and meteorological events. The hydrological issues affecting water quality and flow within the Confluence include the presence of:

- nutrients
- rubbish
- erosion
- environmental weeds
- infrastructure.

Woody debris and flora are naturally occurring obstacles which contribute to reducing the flow of water within waterways. Rubbish and sediment enter the Confluence from upstream or as run-off from roads, residential housing, parks and reserves. This has the potential to block stormwater drains or enter Southern River polluting the waterway or becoming lodged amongst the natural environment, with the potential to alter water flow and cause negative impacts to aquatic habitat.

Of the six main drainage points entering the site, four to the north are on areas with steep slopes and are currently experiencing or at risk of erosion. With one to the south almost completely blocked with sediment and rubbish (Plate 7). These drainage points and vegetation upstream act as weed and rubbish dispersing vectors into the Confluence, which will likely continue to impact the integrity of the community.

Natural Area recommends that buffer zone species such as sedges and grasses are planted in high flow areas and drainage entry sites, with the intent of preventing loss of soils from these areas, and slowing the rate at which water and sediment enters the waterway and potentially increasing the uptake of excess nutrients.

Damaged and blocked drainage

Various rubbish and debris caught in waterway

High coverage of **Zantedeschia aethiopica* within floodway

Plate 7: Examples of disturbances that impact hydrological flow

4.8 Disease and Pathogens

No evidence of diseases or pathogens was found within the site during 2021 surveys. According to the Public Dieback Map produced by Project Dieback (2021) the survey site has not been assessed for presence of *Phytophthora* spp. (Dieback), although, *Phytophthora cinnamomi* has been confirmed in areas of Empire Way Reserve. This reserve is located less than 300 m from the southern boundary of the site where its storm water is directed into the Confluence entering via the Burslem Bridge.

Dieback is potentially present within the Confluence, although no evidence of disease or decline in vegetation was noted during the survey. This may be attributed to the fact that the vegetation present is not susceptible to *Phytophthora cinnamomi* and therefore vegetation decline in this area would not be an effective assessment method. Natural Area recommends continued monitoring/soil testing for evidence of disease and application of best hygiene practices when entering and leaving site to ensure spread does not occur.

4.9 Nutrients and Pollution

No evidence of high nutrient or pollution levels were noted within the site. Previous monitoring of nutrients within the Southern River catchment noted the water entering the Confluence had consistent levels of total nitrogen and phosphorous higher than then long-term goal (DWER, 2019).

Planting high density of native buffer species (sedges) in areas where water enters the site aids in reducing water flow as well as sediment and rubbish entering the waterway. Regular monitoring and removal of rubbish from the Confluence will also aid in maintaining water quality within the system.

5.0 Rehabilitation Plan

Revegetation activities are recommended to occur in a staged fashion within four zones over a four-year period, beginning upstream and moving downstream. Figure 8 and Table 11 identifies four management zones complimentary to the consequential year focusing primary on weed control and site preparation. Figure 9 and Table 11 identifies seven areas of revegetation separated into their suitable vegetation types (a or b) and areas suitable for installation of educational signage. The feature ID (FID) is the number of the management zones for weed control or the revegetation areas (Table 11). For a more detailed implementation schedule refer to Section 7.0. Activities associated with revegetation include:

- removal of non-endemic vegetation
- site preparation including erosion control and removal of rubbish
- pre-planting weed control
- manual weed control
- installation of tubestock (with TerraCottem) and sedge bags
- post planting weed control
- monitoring
- infill planting, where required.

Table 11: Summary implementation for weed control zones and revegetation areas

Year	FID	Area (m^2)	Comment
Management Zones (Figure 8)			
Year 1	1	30,059	▪ Treatment of all weed suites within Zone 1 ▪ Treatment of woody weed and declared pests across all zones
Year 2	2	26,043	▪ Treatment of all weed suites within Zone 2 ▪ Treatment of woody weed and declared pests across all zones
Year 3	3	21,348	▪ Treatment of all weed suites within Zone 3 ▪ Treatment of woody weed and declared pests across all zones
Year 4	4	25,575	▪ Treatment of all weed suites within Zone 4 ▪ Treatment of woody weed and declared pests across all zones
Total		**103,025**	
Revegetation Areas (Figure 9)			
Year 1	1a	3,747	▪ 1a suitable for community planting ▪ Groundcover infill within AGLG revegetation areas
	1b	5,463	
	2a	1,247	
	2b	721	
Year 2	3a	4,179	▪ 3a / 3b may require erosion matting
	3b	3,640	

Year 3	4a	3,849	▪ 4a suitable for community planting ▪ 5a / 5b may require erosion matting
	5a	2,238	
	5b	4,259	
Year 4	6a	2,365	▪ 6a suitable for community planting ▪ 7a may require erosion matting
	7a	2,438	
Total		**34,146**	

Figure 8:
Management Zones
Southern and Canning River
Confluence, Thornlie

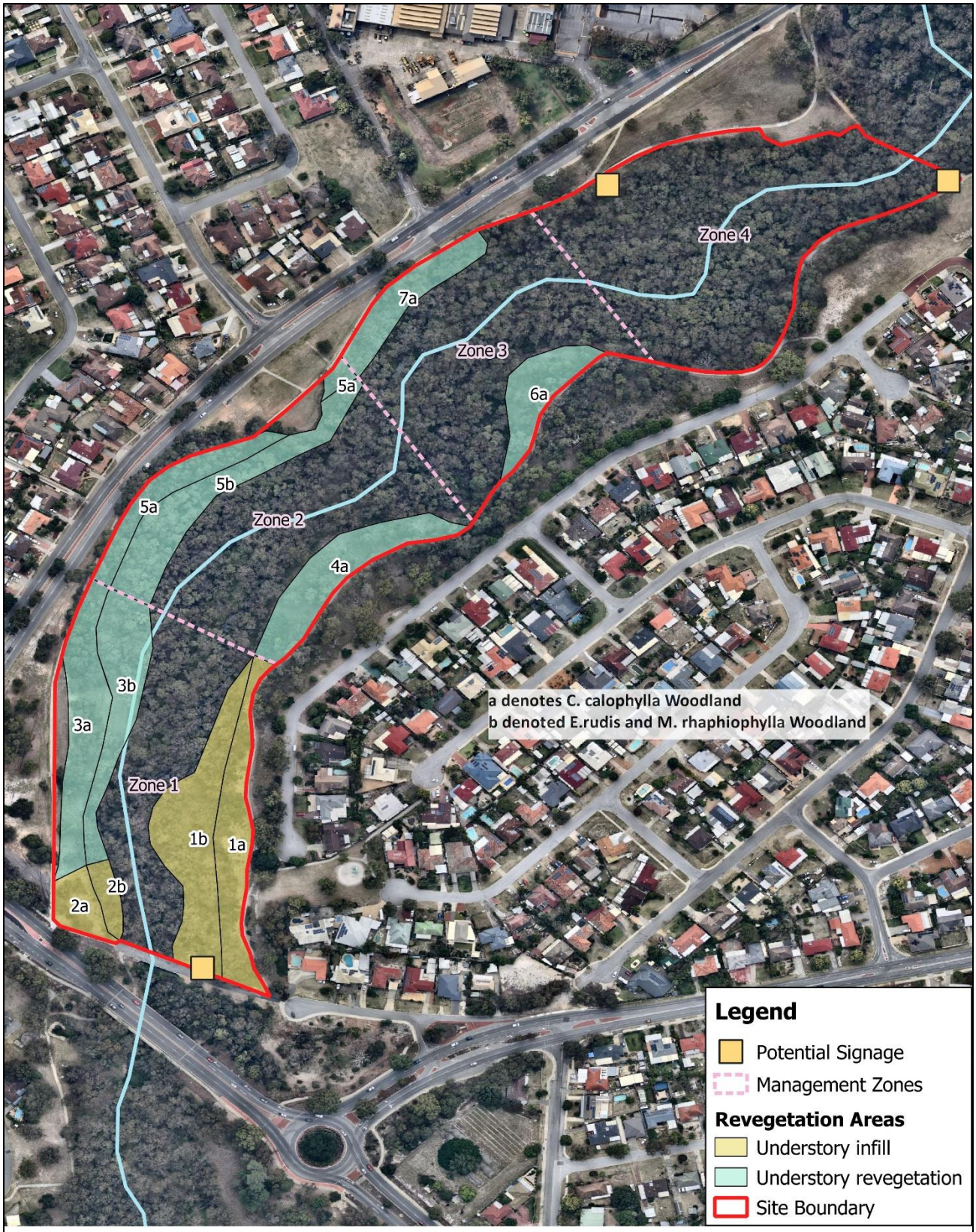


Figure 9:
Revegetation Areas
Southern and Canning River
Confluence, Thornlie

5.1 Site Preparation

5.1.1 Fauna Management

The Confluence provides habitat for an array of organisms living within an urban environment. Rehabilitation of this site will only enhance the resources and ecosystem functions that the Confluence already provides. The diversity of fauna that utilise these resources is undetermined. General enhancement of this section of Southern River will not only increase the habitat and microhabitats available within the site but improve quality downstream. A number of influences can enhance habitat quality, such as:

- increase vegetation cover in middle and understory layers
- increase habitat resources
  - installation of bird and bat boxes
  - planting Black Cockatoo flora species
- decrease feral populations
  - rabbit, cat and fox trapping
  - monitor and control feral bird and European Honey Bee activity

It is recommended that community groups such as the Men's Shed and AGLG be engaged to participate in the building of bird and bat boxes. These boxes should be installed in Marri and Flooded Gum trees on site. Local schools or TAFE groups may also like to be involved in this project and/or informal monitoring of bird/bat boxes and recording other fauna species utilising the Confluence.

5.1.2 Erosion Management

The Riverbank Program listed a number of documents pertaining the management practices for foreshore stabilisation, including erosion control matting. Where erosion control is required Natural Area recommends the application of best management practices be applied (DBCA, 2021f). Two areas within the Confluence have identified current erosion occurring, these areas are recommended to be stabilised with matting prior to revegetation.

Due to the steep slopes and high-water flow events, as well as weed treatment and biomass removal, monitoring areas of potential erosion risk should occur on a regular basis. If an area exhibits further erosion, consideration regarding stabilisation of the soil prior to planting is recommended. Biodegradable matting (Jute or coir) can be useful in erosion mitigation when utilised in conjunction with tubestock planting.

5.1.3 Weed Management

Environmental Considerations for Herbicide Use

The Swan River Trust has a *Guideline SRT/A3 – Pesticide Use Within The Swan Canning Riverpark* that provides guidance for weed control contractors within the site (SRT, 2019). Consideration needs to be given to the use of herbicides in bushland and wetland areas through permitted off-label use by the Australian Pesticides and Veterinary Medicines Authority (APVMA). It is recommended that herbicides such as Metsulfuron and Triasulfuron only be applied when required (ideally no more than one application per annum) at the recommended dose within the site to reduce the potential for residual effect in soils, which can lead to some weed species becoming resistant and result in off-target damage to existing native species and/or poor performance of planted tubestock. Due to the nature of the river system and the fact that inundation levels vary year round, some herbicides are inappropriate to use in these areas as they are water pollutants. Roundup Biactive® is an example of a non-selective herbicide suitable for use near waterways.

The wetting agent Pulse® is not recommended for use within proximity to the waterway and should be substituted with Horticultural Oil where required (AGLG, n.d). The recommended treatment and optimal treatment timing for species is provided in Table 10, with declared pests highlighted in red. Maps of the different weed suites on site are provided in Appendix 5.

Recommended Weed Treatments

This section provides general information regarding recommended treatment types and target species (Table 12). However, information can change as new products come on the market and ongoing research identifies improved treatment methodologies. FloraBase (ttps://florabase.dpaw.wa.gov.au/) and/or other suitable references should be checked regularly to determine preferred treatment methods. Preparatory weed control is recommenced in each stage prior to planting occurring, and as required throughout the rest of the site. It is noted that some weed control has been undertaken by AGLG in areas across the site.

It is recommended that Narrowleaf Cottonbush (*Gomphocarpus fruticosus*), Common Lantana (*Lantana camara*) and Blackberry (*Rubus laudatus*) are treated in the first year to reduce the potential for spread of these species particularly within the waterway, where they can become established and difficult to manage once widespread (refer to Appendix 5 for locations). Blackberry thickets are a high fire risk once established, so control will help reduce the fire fuel load caused by this species.

Invasive grasses such as Kikuyu (*Cenchrus clandestinus*), Couch (*Cynodon dactylon*) and Buffalo Grass (*Stenotaphrum secundatum*) are spread throughout all zones existing in areas within the floodway, this can contribute to higher nutrient loads when it dies off and enters the waterway. These invasive grasses within the floodway are recommended to be treated in summer when these species are actively growing and water levels are at their lowest. They can be treated with herbicides suitable for use near waterways; either Glyphosate Biactive where there is no risk of off-target damage to native species or Fusilade Forte® without the addition of a surfactant where grasses occur amongst natives in areas adjacent to the floodway (Table 12 and Appendix 5).

Table 12: Weed Treatment Types

Treatment Number	Treatment Type	Targeted Species	Application Method
1	Glyphosate Biactive Spray (rated as safe for wetlands)	Annual and perennial grass and broadleaf weeds	Spot spray – non-selective
2	Selective grass herbicide (such as Fusilade Forte® without surfactant so that it is safe for wetlands)	Annual and perennial grasses	Spot spray, or overall spray in broad leaf host situations – selective grass spray
3	Metsulfuron	Annual broadleaf weeds and bulbs	Spot spray – semi selective
4	Glyphosate Biactive glove/ sponge wipe	Arum Lily	Wipe Leaves with sponge prior to or just on flowering; this method produce less off-target damage

Treatment Number	Treatment Type	Targeted Species	Application Method
5	50% Glyphosate Biactive	Woody weeds and trees	Cut and paint or basal bark
6	Manual removal /hand weeding	Carnation Weeds, Fleabane, Pigface, and similar	Gloves required due to caustic sap of Carnation Weed
7	Triasulfuron	Carnation Weeds, Brassicaceae weeds post emergence and other annual	Spot spray - selective

(Source: DBCA, 2021b & Brown and Brooks, 2002)

Recommended Weed Control Methodologies

Specific weed control methodologies for the six weed suites made up of the 63 weed species identified by Natural Area during the 2021 site assessment are provided in Table 13. Chemical weed control activities should be carried out by suitably trained and qualified personnel licensed by the Department of Health. Herbicide usage should always be as per the manufacturer's usage and safety specifications as detailed on labels and Safety Data Sheets (SDS), which can be provided by the manufacturer or downloaded from relevant internet sites.

Weed control each year should focus on the revegetation stages and high (red) and medium (orange) priority weeds highlighted in Table 11. Each weed suite has a recommended reduction in weed cover in order to achieve a total of 20 % weed cover across the entire site (Table 14). Weed maps for the site are provided in Appendix 5.

5.1.4 Biomass Removal

Certain species will require complete physical removal once properly treated to prevent re-establishment and allow for successful revegetation works, particularly those species that have high potential to resprout following treatment/disturbance, as well as material containing seeds (refer to Table 13). Any proposed biomass removal should take into consideration potential damage to surrounding native vegetation and fauna habitat, with some biomass able to be left in-situ if it does not pose a risk of further weed spread, and may benefit the surrounding environment e.g. provision of harbourage and/or habitat for native fauna. The following species will require clearing once treated:

- *Acacia podalyriifolia*
- *Acacia longifolia*
- *Araujia sericifera*
- *Ficus carica*
- *Salix babylonica*
- *Schinus terebinthifolius*
- *Parthenocissus quinquefolia*
- *Phoenix dactylifera*
- *Washingtonia robusta.*

Table 13: Weed Control Methodologies by weed suite. Note treatment types are listed in Table 12

Species Name	Common Name	Timing	Treatment Type	Comment
Woody Weeds				
Ficus carica	Common Fig	Dec to Feb	5 and 6 (seedlings)	Produce suckers when disturbed. Treat and kill prior to removal of biomass
Salix babylonica	Weeping Willow	Dec to Jul		
Schinus terebinthifolius	Japanese Pepper	Dec to Mar		
Lantana camara	Common Lantana	Mar to May		
Parthenocissus quinquefolia	Virginia Creeper	Dec to Mar		
Phoenix dactylifera	Date Palm	All year round	5 and 6 (seedlings)	Chainsaw off foliage apply herbicide to stumps.
Washingtonia robusta	Fan Palm	All year round		
Acacia longifolia	Sydney Golden Wattle	Mar to Aug	5 and 6 (seedlings)	*Araujia sericifera* and *Gomphocarpus fruticosus* – Bag fruit and remove from site
Acacia podalyriifolia	Queensland Silver Wattle	Jan to Sep		
Araujia sericifera	Moth Vine	Oct to Mar		
Gomphocarpus fruticosus	Narrowleaf Cottonbush	Sep to Dec		
Homalanthus populifolius	Bleeding Heart Tree	All year round		
Jacaranda mimosifolia	Jacaranda	Dec to May		
Olea europaea	Olive Tree	Mar to May Oct to Dec		
Ricinus communis	Castor Oil	Dec to May		
Rubus laudatus	Blackberry	Aug to Jan		
Geophytes / Bulbous Weeds				
Oxalis pes-caprae	Soursob	Jun to Jun	1, 4 (+horticultural oil) and 6	Manual removal can spread corms/bulbs
Watsonia meriana var. *bulbillifera*	Bugle Lily	Sep		
Zantedeschia aethiopica	Arum Lily	Jul to Sep		

Species Name	Common Name	Timing	Treatment Type	Comment
Invasive Grasses (1)				
Avena barbata	Bearded Oat	Jul to Oct	1, 2 and 6	Apply herbicide post emergence and pre-flowering
Briza maxima	Blowfly Grass	Jul to Aug		
Bromus catharticus	Prairie Grass	Jun to Sep		
Bromus diandrus	Great Brome	Jun to Aug		
Cenchrus clandestinus	Kikuyu	Nov to Dec		
Cenchrus macrourus	African Feather Grass	Sep to Dec		
Cynodon dactylon	Couch	Nov to Feb		
Ehrharta calycina	Perennial Veldt Grass	Nov to Feb		
Ehrharta longifolia	Annual Veldt Grass	Aug to Oct		
Melinis repens	Natal Grass	Nov to Dec		
Poa annua	Winter Grass	Jun to Oct		
Stenotaphrum secundatum	Buffalo Grass	Nov to Dec		
Invasive Grasses (2)				
Cortaderia selloana	Pampas Grass	Jul to Nov	1, 4 and 6	Slash before applying treatment 1 and 4 *Cortaderia selloana* – Remove and bag flower heads.
Eragrostis curvula	African Lovegrass	Jul to Dec		
Paspalum dilatatum		Nov to Mar		
Herbaceous Weeds (1)				
Atriplex prostrata	Hastate Orache		6	
Symphyotrichum squamatum	Bushy Starwort	Dec to Jan		
Phytolacca octandra	Inkweed	Oct to Dec	1 and 4 (+horticultural oil)	
Rumex crispus	Curled Dock	Sep to Dec		
Chenopodium album	Fat Hen	May to Nov	1 and 6	Slash before flowering
Erigeron bonariensis	Fleabane	Jun to Sep		
Erigeron sumatrensis	Fleabane	Jun to Nov		

Species Name	Common Name	Timing	Treatment Type	Comment
Hypochaeris glabra	Smooth Catsear	May to Sep		
Hypochaeris radicata	Flatweed	Jun to Sep		
Lactuca serriola	Prickly Lettuce	Sep to Nov		
Osteospermum ecklonis	African Veldt Daisy	Jul to Oct		
Bacopa monnieri	Water Hyssop		1 and 6	*Bacopa monnieri* and *Hydrocotyle bonariensis* - Bag and remove biomass from site
Euphorbia maculata		Jun to Sep		
Euphorbia peplus	Petty Spurge	Jun to Sep		
Euphorbia terracina	Geraldton Carnation Weed	Jun to Aug		
Fumaria capreolata	White-flowered Fumaria	Jul to Sep		
Hydrocotyle bonariensis	Coast Pennywort	Oct to Feb		
Lupinus cosentinii	Sandplain Lupin	Jun to Sep		
Oenothera drummondii	Beach Evening Primrose	Jul to Oct		
Pelargonium capitatum	Rose Pelargonium	Jun to Oct		
Physalis peruviana	Cape Gooseberry	Jul to Dec		
Plantago lanceolata	Ribwort Plantain	May to Oct		
Senecio vulgaris	Common Groundsel	Sep to Oct		
Solanum nigrum	Black Berry Nightshade	Jul to Dec		
Sonchus oleraceus	Common Sowthistle	Jun to Aug		
Trifolium angustifolium	Narrowleaf Clover	Jul to Sep		
Herbaceous Weeds (2)				
Cyperus rotundus	Nut Grass	Sep to Dec	4 (+horticultural oil) and 6	
Cyperus tenuiflorus	Scaly Sedge	Sep to Dec		

Source: DBCA, 2021b

Table 14: Recommended reduction in weed cover per weed suite

Weed Suite	Total Area (ha)	Total Area (%)	Reduce coverage (ha)	Reduce coverage (%)	Distribution
Declared Pests (Arum Lily)	3.7	35.5	2.19	60	Widespread in waterway
Declared Pests (Woody Weeds)	0.8	8.2	0.84	100	Localised
Woody Weeds	6.1	59.5	4.91	80	Widespread in waterway
Geophytes and Bulbous Weeds	2.6	25.6	2.38	90	Widespread on upper slopes
Invasive Grasses (1)	6.4	61.8	5.10	80	Widespread on upper slopes
Invasive Grasses (2)	1	9.6	0.99	100	Widespread (Zone 1)
Herbaceous Weeds (1)	7.8	75.7	6.24	80	Widespread throughout
Herbaceous Weeds (2)	0.6	5.5	0.57	100	Localised (Zone 1 and Zone 2)
Total Weeds	**29**	**281**	**23.21**	**19.96**	
Total Site	**10.3**	**100**			

5.2 Planting

Revegetation areas were selected based on the site accessibility and vegetation condition recorded across the site. The areas were selected as they had little to no understorey cover and as such require the most assistance for regeneration. These areas were also easily and safely accessible for any community and volunteer group members that may assist with future planting activities. The central areas require significant weed control for woody weeds and declared pests before revegetation can be undertaken, and as such are not recommended to be revegetated in the life of this plan. Areas of previous revegetation although in good condition require infill planting to meet recommended planting densities. It is recommended the ground cover species are prioritises in order to return varying strata levels to revegetation areas.

Revegetation works are split into seven areas of revegetation and are separated into their suitable vegetation types, either **a** (Dryland - C. calophylla Woodland) or **b** (Dryland / Wetland transition zone - E. rudis and M. rhaphiophylla Woodland) (Figure 9). Sites suitable for community involvement were determined based on access and safety. Planting density for understory species is recommended to be 4 plants per m^2 in dryland areas and 5 plants per m^2 in wetland area, with a further 0.1 tree (canopy species) per m^2 where required (Table 15). It is recommended that areas requiring infill only plant 20% of the total plants required to meet the required planting density. Tubestock should be installed with TerraCottem to aid with survival over drier months.

Revegetation species may be subject to availability, with species able to be substituted for suitable alternatives if they are unable to be sources for planting. As site conditions may be subject to change once weed management has taken place, each zone should be inspected prior to ordering plants and adjustments made based on the presenting conditions. Specific numbers of species should also be prescribed as per the vegetation cover and condition at the time of plant ordering.

Sourcing of Tubestock

It is recommended that tubestock is sourced from a Nursery and Garden Industry Western Australia (NGIWA) accredited nursery and grown from local provenance seed and/or cuttings, hardened off and in good condition prior to planting. Natural Area recommends planting larger sedge bags instead of tubestock to counter the likelihood of birds actively removing individual plants after being planted.

Site Preparation

Site preparation ahead of revegetation works will include:

- removal of rubbish
- weed control
- erosion control
- pest animal control, if required
- installation of temporary fencing, where required.

No soil preparation activities, such as ripping, are required for the sandy loam/clay soils present in the revegetation areas. The use of augers or other planting equipment may be required to assist with planting.

Planting

Planting activities will be carried out after the first significant winter rains, typically from May to July each year, to encourage establishment, in accordance with approved plans. However, wetter areas within the centre of the Confluence may need to be planted later in the year when water has receded. As seasonal rainfall varies each year this will be based on site conditions at the time.

Watering

Watering revegetation within the Confluence is not likely be necessary as the site contains an existing canopy providing protection for understory vegetation and the aim of the revegetation works is to establish a self-sustaining ecosystem. Higher areas of the site will potentially dry out over summer and may require watering in the hotter months.

In an increasingly drying climate, it is common for tubestock planting to be watered on installation and during the first and potentially the second summer to assist with plant establishment, improve seedling survival and reduce water stress over summer months. This can be achieved through periodic watering visits using a mobile watering unit, which has the advantage of being a cost-effective method of delivering water, when needed, directly to required locations. To reduce mortality, watering should occur directly on planting (if planting occurs on a dry day) and once every month during the first two summers (November – February) at a rate of 2 L per plant. However, if plants are suffering drought stress, additional watering may be required.

General Maintenance

General maintenance that will be carried out on an as required basis for a three-year period post planting will include:

- weed control
- rubbish removal
- fence repair
- infill planting
- pest animal control, if required.

Revegetation Species Lists

Revegetation species were selected based on the native flora recorded across the site and additional species that are likely to occur in the two vegetation types, *Corymbia calophylla* Woodland (CcW) and *Eucalyptus rudis* and *Melaleuca rhaphiophylla* Woodland (ErMrW). Plant species prescribed for each revegetation area are provided in Table 15, the indicative number of plantings within each revegetation area are shown in Table 16, 17 and 18.

The Department of Environment and Conservation (2011) developed a list of *Plants Used by Carnaby's Black Cockatoo* and rated them a priority of high to low depending on the resources they provide. Table 18 lists the flora species endemic to the Confluence, their priority rating and suitable vegetation type for revegetation. As the site contains a general healthy overstory, Natural Area suggests planting species that are trees or tall shrubs in low quantity or in areas with little to no upper strata layer.

Table 15: Area, number of plants and vegetation type within each revegetation zone. * Denotes areas suitable for community planting. Vegetation type: a = CcW and b = ErMrW.

Revegetation Area	Area Requiring Revegetation (%)	Area (m^2)	Plant numbers
Year 1			
1a*	20	3,747	3,000
1b	20	5,463	5,500
2a	20	1,247	4,700
2b	20	721	3,400
Subtotal		**11,178**	**16,600**
Year 2			
3a	100	4,179	16,720
3b	100	3,640	18,200
Subtotal		**7,819**	**34,920**
Year 3			
4a*	100	3,849	15,400
5a	100	2,238	9,000
5b	100	4,259	21,300
Subtotal		**10,346**	**45,700**
Year 4			
6a*	100	2,365	9500
7a	100	2,438	9800
Subtotal		**4,803**	**19,300**
	Site Total	**34,146**	**116,520**

Table 16: Revegetation lists for each planting area

Species Name	**Common Name**	**Lifeform**	**Cockatoo Rating**	**a (CcW)**	**b (ErMrW)**	**Year**				**Total plant numbers**
						1	**2**	**3**	**4**	
Acacia alata	Winged Wattle	Shrub		X	X	150	1000	1000	300	2450
Acacia stenoptera	Narrow Winged Wattle	Shrub		X		150	1000	1000	300	2450
Acacia pulchella	Prickly Moses	Shrub		X	X	200	1000	1500	1000	3700
Acacia saligna	Orange Wattle	Tree		X	X	150	500	500	250	1400
Adenanthos cygnorum subsp. *cygnorum*	Common Woollybush	Shrub		X		100	300	300	150	850
Anigozanthos manglesii	Mangles Kangaroo Paw	Perennial Herb		X		300	2000	2000	1000	5300
Astartea leptophylla	River-bank Astartea	Shrub			X	250	500	750	0	1500
Astartea scoparia	Common Astartea	Shrub		X	X	500	500	750	0	1750
Austrostipa elegantissima		Perennial Grass		X	X	50	200	500	500	1250
Austrostipa flavescens		Perennial Grass		X	X	50	200	500	500	1250
Banksia dallanneyi	Couch Honeypot	Shrub	L	X		200	300	500	500	1500
Banksia sessilis var. sessilis		Shrub		X		500	500	1000	1000	3000

Species Name	Common Name	Lifeform	Cockatoo Rating	a (CcW)	b (ErMrW)	Year				Total plant numbers
						1	2	3	4	
Baumea articulata	Jointed Rush	Sedge			X	1000	1750	2000	0	4750
Baumea juncea	Bare Twigrush	Sedge			X	1000	1750	2000	0	4750
Baumea preissii		Sedge			X	1000	1750	1800	0	4550
Calothamnus quadrifidus	One-sided Bottlebrush	Shrub		X	X	200	500	1000	500	2200
Carex tereticaulis (P3)					X					
Centella asiatica	Centella	Perennial Herb			X	750	750	750	0	2250
Conostylis aculeata	Prickly Conostylis	Perennial Herb		X		250	550	1000	1000	2800
Conostylis juncea		Herb				0	250	500	1000	1750
Dianella revoluta		Herb		x		500	500	1000	1000	3000
Eucalyptus rudis	Flooded Gum	Tree	L		X	0	1	0	0	1
Gahnia trifida	Coast Sea-sedge	Sedge			X	400	1750	1500	0	3650
Gompholobium tomentosum	Hairy Yellow Pea	Shrub		X	X	550	318	1000	1000	2868
Grevillea thelemanniana (T)	Spider Net Grevillea			X						
Hakea lissocarpha	Honey Bush	Shrub	M	X		250	400	1000	500	2150

Species Name	Common Name	Lifeform	Cockatoo Rating	a (CcW)	b (ErMrW)	Year				Total plant numbers
						1	2	3	4	
Hakea prostrata	Harsh Hakea	Shrub	H	X		250	500	1000	500	2250
Hakea stenocarpa	Narrow-fruited Hakea	Shrub	M	X		200	500	1000	500	2200
Hakea trifurcata		Shrub	H	X		200	500	500	500	1700
Hakea undulata	Wavy-leaved Hakea	Shrub	H	X		200	500	500	500	1700
Hakea varia	Variable-leaved Hakea	Shrub	M	X	X	250	500	500	500	1750
Hardenbergia comptoniana	Native Wisteria	Shrub (twining)		X	X	150	100	250	250	750
Hemiandra pungens	Snakebush	Shrub		X		100	500	500	500	1600
Hibbertia hypericoides	Yellow Buttercups	Shrub		X	X	150	250	500	500	1400
Hibbertia huegelii		Shrub				100	250	500	350	1200
Hypocalymma angustifolium						0	1000	1000	0	2000
Jacksonia furcellata	Grey Stinkwood	Shrub	M	X	X	100	250	500	250	1100
Jacksonia sternbergiana	Stinkwood	Shrub		X	X	100	250	500	250	1100
Juncus pallidus	Pale Rush	Sedge		X	X	750	1500	2000	0	4250
Juncus subsecundus	Finger Rush	Sedge			X	500	1500	2000	0	4000

Species Name	Common Name	Lifeform	Cockatoo Rating	a (CcW)	b (ErMrW)	Year				Total plant numbers
						1	2	3	4	
Kennedia prostrata	Scarlet Runner	Shrub (twining)		X	X	400	1000	1000	1000	3400
Kunzea glabrescens	Spearwood	Shrub		X	X	200	200	500	1000	1900
Kunzea micrantha		Shrub		X	X	200	250	500	200	1150
Lepidosperma longitudinale	Pithy Sword-sedge	Sedge		X	X	1000	1500	2000	0	4500
Macrozamia riedlei	Zamia	Shrub		X		100	100	100	100	400
Melaleuca preissiana	Moonah	Tree			X	0	1	0	0	1
Melaleuca teretifolia	Banbar	Shrub			X	250	500	500	0	1250
Melaleuca viminea	Mohan	Shrub			X	250	500	500	0	1250
Mesomelaena pseudostygia		Sedge	L	X	X	250	250	150	500	1150
Mesomelaena tetragona	Semaphore Sedge	Sedge	L	X		250	250	100	500	1100
Patersonia occidentalis	Purple Flag	Herb		X		500	650	1000	500	2650
Pericalymma ellipticum	Swamp Teatree	Shrub			X	250	750	1000	0	2000
Pultenaea reticulata		Shrub			X	250	700	1000	0	1950

Species Name	**Common Name**	**Lifeform**	**Cockatoo Rating**	**a (CcW)**	**b (ErMrW)**	**Year**				**Total plant numbers**
						1	**2**	**3**	**4**	
Taxandria linearifolia		Shrub			X	250	750	1000	0	2000
Tricoryne elatior	Yellow Autumn Lily	Perennial Herb		X		200	200	250	200	850
Viminaria juncea	Swishbush	Shrub		X	X	500	750	750	0	2000
Xanthorrhoea brunonis		Shrub		X		100	100	100	100	400
Xanthorrhoea preissii	Balga	Shrub	M	X		100	100	150	100	450
				Total plant numbers		**16,600**	**34,920**	**45,700**	**19,300**	**116,520**

Table 17: Indicative species and numbers per revegetation area for the ErMrW vegetation type

Species Name	Lifeform	Tubestock Numbers			
		Year 1		Year 2	Year 3
		Area 1b	Area 2b	Area 3b	Area 5b
Astartea leptophylla	Shrub	150	100	500	750
Astartea scoparia	Shrub	300	200	500	750
Baumea articulata	Sedge	500	500	1750	2000
Baumea juncea	Sedge	500	500	1750	2000
Baumea preissii	Sedge	500	500	1750	1800
Centella asiatica	Herb	500	250	750	750
Gahnia trifida	Sedge	200	200	1750	1500
Hypocalymma angustifolium	Shrub	-	-	1000	1000
Juncus pallidus	Sedge	500	250	1500	2000
Juncus subsecundus	Sedge	300	200	1500	2000
Lepidosperma longitudinale	Sedge	750	250	1500	2000
Melaleuca teretifolia	Shrub	200	50	500	500
Melaleuca viminea	Shrub	200	50	500	500
Pericalymma ellipticum	Shrub	200	50	750	1000
Pultenaea reticulata	Shrub	200	50	700	1000
Taxandria linearifolia	Shrub	200	50	750	1000
Viminaria juncea	Shrub	300	200	750	750
Sub total		**5,500**	**3,400**	**1,820**	**21,300**
Total			**32,020**		

Table 18: Indicative species and numbers per revegetation area for the CcW vegetation type

Species Name	Lifeform	Tubestock Numbers						
		Year 1		Year 2	Year 3		Year 4	
		Area 1a	Area 2a	Area 3a	Area 4a	Area 5a	Area 6a	Area 7a
Acacia alata	Shrub	50	100	1000	600	400	150	150
Acacia stenoptera	Shrub	50	100	1000	600	400	150	150
Acacia pulchella	Shrub	75	125	1000	900	600	500	500
Acacia saligna	Tree	50	100	500	300	200	125	125
Adenanthos cygnorum subsp. *cygnorum*	Shrub	50	50	300	150	150	75	75
Anigozanthos manglesii	Perennial Herb	150	150	2000	1000	1000	500	500
Austrostipa elegantissima	Perennial Grass	25	25	200	300	200	250	250
Austrostipa flavescens	Perennial Grass	25	25	200	300	200	250	250
Banksia dallanneyi	Shrub	100	100	300	300	200	250	250
Banksia sessilis var. *sessilis*	Shrub	175	325	500	700	300	500	500
Calothamnus quadrifidus	Shrub	100	100	500	700	300	250	250
Conostylis aculeata	Perennial Herb	100	150	550	700	300	500	500
Conostylis juncea	Herb	-	-	250	400	100	500	500
Dianella revoluta	Herb	175	325	500	600	400	500	500
Eucalyptus rudis	Tree	-	-	1	-	-	-	-

Species Name	Lifeform	Tubestock Numbers						
		Year 1		Year 2	Year 3		Year 4	
		Area 1a	Area 2a	Area 3a	Area 4a	Area 5a	Area 6a	Area 7a
Gompholobium tomentosum	Shrub	125	425	318	700	300	500	500
Hakea lissocarpha	Shrub	100	150	400	700	300	250	250
Hakea prostrata	Shrub	100	150	500	700	300	250	250
Hakea stenocarpa	Shrub	75	125	500	700	300	250	250
Hakea trifurcata	Shrub	75	125	500	300	200	250	250
Hakea undulata	Shrub	75	125	500	300	200	250	250
Hakea varia	Shrub	100	150	500	300	200	250	250
Hardenbergia comptoniana	Shrub (twining)	75	75	100	200	50	125	125
Hemiandra pungens	Shrub	50	50	500	300	200	250	250
Hibbertia hypericoides	Shrub	70	80	250	300	200	250	250
Hibbertia huegelii	Shrub	50	50	250	300	200	175	175
Jacksonia furcellata	Shrub	50	50	250	300	200	100	150
Jacksonia sternbergiana	Shrub	50	50	250	300	200	100	150
Kennedia prostrata	Shrub (twining)	200	200	1000	600	400	500	500
Kunzea glabrescens	Shrub	80	120	200	300	200	450	550
Kunzea micrantha	Shrub	100	100	250	300	200	100	100
Macrozamia riedlei	Shrub	50	50	100	75	25	50	50

Species Name	Lifeform	Tubestock Numbers						
		Year 1		Year 2	Year 3		Year 4	
		Area 1a	Area 2a	Area 3a	Area 4a	Area 5a	Area 6a	Area 7a
Melaleuca preissiana	Tree	-	-	1	-	-	-	-
Mesomelaena pseudostygia	Sedge	50	200	250	100	50	250	250
Mesomelaena tetragona	Sedge	50	200	250	75	25	250	250
Patersonia occidentalis	Herb	150	350	650	650	350	200	300
Tricoryne elatior	Perennial Herb	100	100	200	200	50	100	100
Xanthorrhoea brunonis	Shrub	50	50	100	50	50	50	50
Xanthorrhoea preissii	Shrub	50	50	100	100	50	50	50
Total numbers		**3,000**	**4,700**	**16,720**	**15,400**	**9,000**	**9,500**	**9,800**

5.3 Community and Education

Community involvement in revegetation projects bring numerous benefits to both the community and natural environment, including:

- developing a shared 'sense of place'
- increased environmental value
- increased education regarding natural environment
- reduced labour costs
- restoration of ecological system.

Previous management of the Confluence saw the AGLG involve various members of the community in their restoration activities. Continuation of community involvement is vital to success and continued improvement of the Confluence. Community activities can involve a range of educational and hands-on events, such as:

- weed control (hand-weeding)
- revegetation (planting)
- educational signage
- installation of bird and bat boxes
- flora and fauna 'BioBlitz' events using educational applications.

5.4 Monitoring

Monitoring of vegetation activities within all revegetation areas should occur once annually during autumn post summer for three years after the initial planting. Monitoring should involve:

- setting up eight photo monitoring points before initial planting for baseline monitoring (two in each zone), with photos taken of each vegetation area to enable comparison of tubestock growth over time
- establishing eight 10 x 10 m quadrats, one within each vegetation type for each revegetation stage monitoring plant/species survival and percentage coverage, vegetation health and community structure recorded
- assessing the extent of weed diversity and coverage across the site in year 2 and year 4
- assessment for threatening processes withing the revegetation area i.e. damage to plants or herbivory; assess if temporary fencing or tree guards are required
- assessing the site for physical disturbance that requires maintenance, such as rubbish, vandalism, erosion or damage to fencing or pathways
- outcomes of fauna management, feral catches, community engagement and results of annual Autumn monitoring events will be reported to the City, including any recommendations for infill planting and maintenance actions.

Monitoring needs to be carried out by personnel with botanical knowledge and experience, either by the City of Gosnells or through the use of a consultant and/or contractor.

5.5 Completion Criteria

Monitoring activities will also assess the success of the revegetation works by comparing their outcomes to the completion criteria. For the revegetation works to be considered successful the criteria for completion is as follows:

- site contains 80% endemic vegetation of varying strata layers by year 4
- a maximum of 20% weed coverage across the site by year 4
- visual improvement of the quality of water entering the Canning River, with no algal blooms or oil slicks noted
- provision of habitat and micro-climates for a range of native fauna
- system tolerant to high and low water flows
- minimal presence of domestic rubbish
- promotes natural regeneration and is resilient to weed invasion

Completion criteria (Table 19) was created with consideration of the City of Gosnells *Retention, Rehabilitation and Revegetation Guidelines in Council Policy 6.2.2* and the six ecosystem attributes listed by the National Restoration Standards (City of Gosnells, 2021b & Standards Reference Group SERA, 2017), these being:

- Absence of Threats (e.g. invasive species, contamination)
- External exchanges (habitat links, gene flow)
- Ecosystem Function (resilience, natural recruitment, nutrient cycling, habitat availability)
- Structural Diversity (vegetation strata, trophic levels and spatial mosaics)
- Species Composition (desirable plants and animals and absence of undesirable species)
- Physical conditions (chemical and physical characteristics or substrate and water).

Table 19: Completion criteria for management works at the Confluence

Characteristic	Completion Criteria
Revegetation – initial and infill **Based on tubestock*	***Eucalyptus rudis* and *Melaleuca rhaphiophylla* Woodland** - 5 plants per square meter (m^2) with an additional 0.1 tree per m^2 - 80% species diversity representing the vegetation complex and strata - Proof of local provenance - Sources from a local Nursery Industry Accreditation Scheme accredited nursery
	***Corymbia calophylla* Woodland** - 4 plants per m^2 with an additional 0.1 tree per m^2 - 80% species diversity representing the vegetation complex and strata - Proof of local provenance - Sources from a local Nursery Industry Accreditation Scheme accredited nursery
	Infill Planting - Established and in the ground for a minimum of one summer before handover
Rehabilitation	**Flora** - Natural recruitment occurring by year 4 in restoration areas - Education with community
	Fauna - Reduction in feral animal population - Increase native fauna habitat (breeding, foraging etc)

Characteristic	Completion Criteria
	- Increased species diversity
	Weeds - No woody declared plants of weeds of National significance - Reduction in Arum Lily coverage across site by 60% - Weed cover no greater than 20% within revegetation areas and across the entire site - Woody weeds have been removed or treated - Liaise with managers of adjacent land regarding weed management
	Sediment and erosion control measures - Plant buffer zones around stormwater drains - Installed correctly to specifications and plans - Functioning as intended - Water quality not negatively impacted
	Maintenance - No rubbish within site - Inform community on minimising herbicide and fertiliser use

6.0 Recommendations Post Completion

6.1 Weed Control

Natural Area recommends continued weed control after completion of this four-year Foreshore Management Plan. Due to the nature of the site, weed presence is likely to persist after four-years and into the future as it is likely weed species are present in the seed bank and immigration from sources outside of the site boundary will continue. Restoration of degraded areas with endemic flora within the Confluence will provide competition for weed species to establish. However, this will only provide some level of protection against weed establishment and weed control techniques will need to be applied. Continued weed monitoring of the Confluence will allow adaptively management targeting high impact and priority weeds present within the site.

6.2 Continued Rehabilitation

Continued weed management within the site will provide opportunity for further restoration. Removing biomass in various areas within the Confluence, will create areas cleared areas prone to disturbance, such as erosion or re-establishment of weeds. Identifying these areas and restoring them using flora species relevant to their vegetation type identified in Section 5.2 and Appendix 3 will contribute to further restoring a higher quality natural environment.

Two potential revegetation areas that were identified for future restoration are completely degraded, currently grassed and maintained through mowing (refer to Figure 7). These areas require application of herbicide treatment suitable for weed species present, installation of temporary fencing to prevent mowing and a selection of flora species from the planting list within the vegetation type *Corymbia calophylla* Woodland. These areas are ideal for community involvement.

Additional planting of native sedges in the man-made bund that has created a stagnant pool of water (refer to Figure 5) should be considered to out-compete grasses present and strip nutrient from the water. Considered applying Water Sensitive Urban Design principles to locations where drainage outlets enter the Confluence (Department of Water and Environmental Regulation, 2021). Natural Area recommends ongoing maintenance regarding removal of rubbish within the Confluence to prevent pollution of the waterway.

7.0 Implementation Plan and Costing Schedule

7.1 Indicative Implementation Timetable and Costings

Indicative implementation and costings are listed for each year in Tables 20 – 23, with a summary of indicative costings provided in Table 24.

Table 20: Year 1 (2021/2022) indicative implementation and costing schedule

Recommendation No.	Proposed Management Action	Potential Cost (Ex GST)	Resource requirements	Financial Year	Specific Timing (Month(s) and year)
Zone 1					
1	Seed and cutting collection and propagation for Revegetation Areas 1a, 1b, 2a and 2b	$34,030.00	Seed/cutting collection and nursery contractor	2021/2022	Between July and November 2021
2	Weed control (herbicide) within Zone 1 prior to planting activities	$24,000.00	Weed Control contractor	2021/2022	June-September 2021
3	Weed control (manual) within Zone 1 prior to planting activities	$9,500.00	Weed Control contractor	2021/2022	July-September 2021
4	Revegetate infill Areas 1a, 1b, 2a and 2b	$19,920.00	Revegetation contractor	2021/2022	June - September 2022
Zone 2					
N/A					
Zone 3					
N/A					
Zone 4					
N/A					
All Zones					
5	Weed control for woody weeds and declared pests all zones	$12,000.00	Weed Control contractor	2021/2022	October 2021 – March 2022 when the site its drier
6	General maintenance works (rubbish etc.)	$4,000.00	Contractor	2021/2022	Biannually in September and February
7	Supply and install of interpretive signage (3)	$3,000.00	Contractor	2021/2022	March 2022

Table 21: Year 2 (2022/2023) indicative implementation and costing schedule

Recommendation No.	Proposed Management Action	Potential Cost (Ex GST)	Resource requirements	Financial Year	Specific Timing (Month(s) and year)
Zone 1					
1	Seed and cutting collection and propagation for Revegetation Areas 3a and 3b and for any infill for 1a, 1b, 2a and 2b	Revegetate $71,586.00 Infill $6,806.00	Seed/cutting collection and nursery contractor	2022/2023	Between July and November 2022
2	Installation of erosion matting in Areas 3a, 3b, 5a and 5b prior to revegetation works	$3,000.00	Revegetation contractor	2022/2023	April – May 2023
3	Infill revegetation in Areas 1a, 1b, 2a and 2b	$3,984.00	Revegetation contractor	2022/2023	June - September 2023
4	Revegetate Areas 3a and 3b	$41,904.00	Revegetation contractor	2022/2023	June- September 2023
5	Maintenance weed control within Zone 1 (every six weeks)	$19,200.00	Weed Control contractor	2022/2023	July-September 2022
6	Monitoring of revegetation areas	$800.00	Revegetation contractor	2022/2023	March – May 2023
Zone 2					
7	Weed control (herbicide) within Zone 2 prior to planting activities	$20,000.00	Weed Control contractor	2022/2023	July-September 2022
8	Weed control (manual) within Zone 2 prior to planting activities	$9,500.00	Weed Control contractor	2022/2023	July-September 2022
Zone 3					
N/A					
Zone 4					
N/A					
All Zones					
9	Weed control for woody weeds and declared pests all zones	$12,000.00	Weed Control contractor	2022/2023	October 2022 – March 2023 when the site its drier
10	General maintenance works (rubbish etc.)	$4,000.00	Contractor	2022/2023	Biannually in September and February

Table 22: Year 3 (2023/2024) indicative implementation and costing schedule

Recommendation No.	Proposed Management Action	Potential Cost (Ex GST)	Resource requirements	Financial Year	Specific Timing (Month(s) and year)
Zone 1					
1	Seed and cutting collection and propagation for Revegetation infill Areas 3a and 3b	$14,317.20	Seed/cutting collection and nursery contractor	2023/2024	Between July and November 2023
2	Infill revegetation in Areas 3a and 3b	$8,380.80	Revegetation contractor	2023/2024	June- September 2024
Zone 2					
3	Seed and cutting collection and propagation for Revegetation Areas 4a, 5a and 5b	$93,685.00	Seed/cutting collection and nursery contractor	2023/2024	Between July and November 2023
4	Revegetate Areas 4a, 5a and 5b	$54,840.00	Revegetation contractor	2023/2024	June- September 2024
5	Maintenance weed control within Zone 2 (every six weeks)	$14,400.00	Weed Control contractor	2023/2024	July-September 2023
Zone 3					
6	Weed control (herbicide) within Zone 3 prior to planting activities	$18,000.00	Weed Control contractor	2023/2024	July-September 2023
7	Weed control (manual) within Zone 3 prior to planting activities	$9,500.00	Weed Control contractor	2023/2024	July-September 2023
8	Installation of erosion matting in Areas 7a post weed control works	$1,500.00	Erosion control contractor	2023/2024	October - December 2023
Zone 4					
N/A					
All Zones					
9	Monitoring of revegetation areas	$800.00	Revegetation contractor	2023/2024	March – May 2024
10	Weed control for woody weeds and declared pests all zones	$12,000.00	Weed Control contractor	2023/2024	October 2023 – March 2024 when the site its drier
11	General maintenance works (rubbish etc.)	$4,000.00	Contractor	2023/2024	Biannually in September and February

Table 23: Year 4 (2024/2025) indicative implementation and costing schedule

Recommendation No.	Proposed Management Action	Potential Cost (Ex GST)	Resource requirements	Financial Year	Specific Timing (Month(s) and year)
Zone 1					
N/A					
Zone 2					
1	Seed and cutting collection and propagation for infill revegetation in Areas 4a, 5a and 5b	$18,737.00	Seed/cutting collection and nursery contractor	2024/2025	Between July and November 2024
2	Infill revegetation in Areas 4a, 5a and 5b	$10,968.00	Revegetation contractor	2024/2025	June- September 2025
Zone 3					
3	Seed and cutting collection and propagation for Revegetation Areas 6a and 7a	$39,565.00	Seed/cutting collection and nursery contractor	2024/2025	Between July and November 2024
4	Maintenance weed control within Zone 3 (every six weeks)	$14,400.00	Weed Control contractor	2024/2025	July-September 2024
5	Revegetate Areas 6a and 7a	$23,160.00	Revegetation contractor	2024/2025	June- September 2025
Zone 4					
6	Weed control (herbicide) within Zone 4	$20,000.00	Weed Control contractor	2024/2025	July-September 2024
7	Weed control (manual) within Zone 4	$9,500.00	Weed Control contractor	2024/2025	July-September 2024
All Zones					
8	Monitoring of revegetation areas	$800.00	Revegetation contractor	2024/2025	March – May 2025
9	Weed control for woody weeds and declared pests all zones	$12,000.00	Weed Control contractor	2024/2025	October 2024 – March 2025 when the site its drier
10	General maintenance works (rubbish etc.)	$4,000.00	Contractor	2024/2025	Biannually in September and February

7.2 Indicative Costing Summary

Indicative cost estimates for revegetation, weed control and other management activities are provided in Table 21. Costings are based on works being undertaken by commercial contractors so if any activities are undertaken by the City, community members or volunteers, costs may alter/reduce. Please note plant costings may vary depending on where plants are sourced and the final species mix. If sedges or other species are ordered in sedge bags or larger pots as opposed to tubestock or cell stock, this may also alter the pricing of plants. *Note:* costings do not account for CPI increases and weed treatment costs can vary depending on weed control method/herbicide type.

Table 24: Summary of indicative cost schedule

	Year 1 (Jul 2021 - Jun 2022)				Year 2 (Jul 2022 - Jun 2023)				Year 3 (Jul 2023 - Jun 2024)				Year 4 (Jul 2024 - Jun 2025)			
Activity	**Unit**	**Qty**	**Unit rate ($)**	**Cost ($ ex GST)**	**Unit**	**Qty**	**Unit rate ($)**	**Cost ($ ex GST)**	**Unit**	**Qty**	**Unit rate ($)**	**Cost ($ ex GST)**	**Unit**	**Qty**	**Unit rate ($)**	**Cost ($ ex GST)**
Weed control - Zone 1	event	4	6,000.00	24,000.00												
Weed control - Zone 2					event	4	5,000.00	20,000.00								
Weed control - Zone 3									event	4	4,500.00	18,000.00				
Weed control - Zone 4													event	4	5,000.00	20,000.00
Maintenance weed control - Zone 1					event	4	4,800.00	19,200.00								
Maintenance weed control - Zone 2									event	4	3,600.00	14,400.00				
Maintenance weed control - Zone 3													event	3	4,800.00	14,400.00
Maintenance weed control - Zone 4																
Manual Weed Control Zone 1	day	10	950.00	9,500.00												
Manual Weed Control Zone 2					day	10	950.00	9,500.00								
Manual Weed Control Zone 3									day	10	950.00	9,500.00				
Manual Weed Control Zone 4													day	10	950.00	9,500.00
Woody Weed Treatment – site wide	day	10	1,200.00	12,000.00	day	10	1,200.00	12,000.00	day	10	1,200.00	12,000.00	day	10	1,200.00	12,000.00
Plant supply initial - Year 1 (including Terracottem®)	each	16,600	2.05	34,030.00												
Plant supply initial - Year 2 (including Terracottem®)					each	34,920	2.05	71,586.00								
Plant supply initial -Year 3 (including Terracottem®)									each	45,700	2.05	93,685.00				
Plant Supply initial - Year 4 (including Terracottem®)													each	19,300	2.05	39,565.00
Initial plant install - contractor Year 1	each	16,600	1.20	19,920.00												
Initial plant install - contractor Year 2					each	34,920	1.20	41,904.00								
Initial plant install - contractor Year 3									each	45,700	1.20	54,840.00				
Initial plant install - contractor Year 4													each	19,300	1.20	23,160.00
Infill plant supply - Year 2 (including Terracottem®)					each	3,320	2.05	6,806.00								
Infill plant supply - Year 3 (including Terracottem®)									each	6,984	2.05	14,317.20				
Infill plant supply - Year 4 (including Terracottem®)													each	9,140	2.05	18,737.00
Infill plant install - contractor					each	3,320	1.20	3,984.00	each	6,984	1.20	8,380.80	each	9,140	1.20	10,968.00
General maintenance works (rubbish etc)	event	2	2,000.00	4,000.00	event	2	2,000.00	4,000.00	event	2	2,000.00	4,000.00	event	2	2,000.00	4,000.00
Supply and install coir matting Zone 2 slope area					square meter	400	7.50	3,000.00								
Supply and install coir matting Zone 3 slope area									square meter	200	7.50	1,500.00				
Revegetation Monitoring - Contractor					item	1	800.00	800.00	each	1	800.00	800.00	each	1	800.00	800.00
Interpretive signage	each	3	1,000.00	3,000.00												
Yearly Total (ex GST)				**106,450.00**				**192,780.00**				**231,423.00**				**153,130.00**
GST				**10,645.00**				**19,278.00**				**23,142.30**				**15,313.00**
Yearly Total (inc GST)				**117,095.00**				**212,058.00**				**254,565.30**				**168,443.00**
Project Total (ex GST)				**683,783.00**												
GST				**68,378.30**												
Project Total (inc GST)				**752,161.30**												

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Appendix 1: Conservation Codes

Conservation codes are used to describe the status of species and ecological communities that are no longer common and under threat of extinction. Species and communities can be listed under state legislation and/or commonwealth legislation.

Western Australia

Conservation Code	Name	Description
T	Threatened	Flora or fauna that is rare or likely to become extinct, ranked according to their level of threat using IUCN Red List criteria (Schedules 1-3 of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice)
CR	Critically endangered	Species considered to be facing an extremely high risk of extinction within the wild in the immediate future
EN	Endangered	Species considered to be facing a very high risk of extinction in the wild in the near future
VU	Vulnerable	Species considered to be facing a high risk of extinction in the wild in the medium-term future
EX	Extinct Species	Species where 'there is no reasonable doubt that the last member of the species has died (Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice)
EW	Extinct in the Wild	Species that are known to only survive in cultivation, in captivity, or as a naturalised population well outside its past range; and it has not been recorded in its known or expected habitat at appropriate seasons anywhere in its past range, despite surveys over a timeframe appropriate to its life cycle and form
MI	Migratory Species	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth (Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice)
CD	Conservation Dependent	Species of special conservation interest (conservation dependent fauna), being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened (Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice)
OS	Specially Protected	Fauna otherwise in need of special protection to ensure their conservation (Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice)
P	Priority Species	Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories

Conservation Code	Name	Description
		are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.
P1	Priority One	Poorly known species – Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either very small or on lands not managed for conservation, such as road verges, urban areas, farmland, active mineral lease and under threat of habitat destruction or degradation.
2	Priority Two	Poorly known species – Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, such as national parks, conservation parks, nature reserves, State Forest, vacant Crown land, water reserves and similar.
3	Priority Three	Poorly known species – Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat
4	Priority Four	Rare or near threatened and other species in need of monitoring.

(Source: Department of Biodiversity, Conservation and Attractions, 2019)

Commonwealth

Category	Description
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium term

(Source: Department of the Agriculture, Water and the Environment. (2021a)

Appendix 2: Quadrat Data

Quadrat No.:	Q1
Survey Date:	17/5/2021
Personnel:	SH KS
Easting:	403142.22
Northing:	6451959.85
Location:	Southern River Confluence
Topography:	Upper Slope
Aspect:	North-west
Slope:	1-3%
Soil:	Brown sand
Gravel	0%
Rock:	0%
Leaf Litter:	95%
Bare Ground:	3%
Drainage:	Well
Condition:	Completely Degraded

Notes: Marri Woodland

Native Species	Height (m)	Cover (%)	Weed Species	Height (m)	Cover (%)
Corymbia calophylla	10	40	**Ehrharta calycina*	0.5	90
Eucalyptus marginata	3	2	**Oxalis pes-caprae*	0.3	95
Hardenbergia comptoniana	1	1.5			
Tricoryne elatior	0.3	0.1			

Note: *denotes introduced species.

Quadrat No.:	Q2
Survey Date:	17/5/2021
Personnel:	SH KS
Easting:	403349.2
Northing:	6452132.44
Location:	Southern River Confluence
Topography:	Flood Plain
Aspect:	Flat
Slope:	0%
Soil:	Brown loam
Gravel	0%
Rock:	0%
Leaf Litter:	70%
Bare Ground:	0%
Drainage:	Moderate
Condition:	Degraded

Notes: *M. rhaphiophylla* and *E. rudis* Woodland

Native Species	**Height (m)**	**Cover (%)**	**Weed Species**	**Height (m)**	**Cover (%)**
Astartea scoparia	3	3.5	**Cenchrus clandestinus*	1	2
Baumea juncea	1	1	**Cyperus rotundus*	0.2	0.1
Centella asiatica	0.1	70	**Ficus carica*	0.1	0.1
Eucalyptus rudis	20	40	**Hydrocotyle bonariensis*	0.1	3
Lepidosperma longitudinale	0.5	0.2	**Parthenocissus quinquefolia*	6	0.5
Melaleuca rhaphiophylla	15	20	**Paspalum dilatatum*	0.5	50
Typha domingensis	0.1	0.1	**Schinus terebinthifolia*	5	4
			**Washingtonia filifera*	2	4
			**Zantedeschia aethiopica*	0.3	2

Note: *denotes introduced species.

Quadrat No.:	Q3
Survey Date:	19/5/2021
Personnel:	SH KS
Easting:	403480.27
Northing:	6452242.42
Location:	Southern River Confluence
Topography:	Flood Plain
Aspect:	South
Slope:	1-3%
Soil:	Brown loam
Gravel	0%
Rock:	0%
Leaf Litter:	5%
Bare Ground:	2%
Drainage:	Moderate
Condition:	Good

Notes: *M. rhaphiophylla* and *E. rudis* Woodland

Native Species	**Height (m)**	**Cover (%)**	**Weed Species**	**Height (m)**	**Cover (%)**
Alternanthera nodiflora	0	2	**Atriplex prostrata*	0.1	0.1
Baumea articulata	2	8	**Chenopodium album*	0.1	0.1
Baumea juncea	0.3	0.1	**Cyperus tenuiflorus*	0.5	1
Bolboschoenus caldwellii	0.2	0.1	**Eragrostis curvula*	0.5	0.1
Carex appressa	1	3	**Gomphocarpus fruticosus*	1.5	0.1
Carex tereticaulis	0.5	20	**Paspalum dilatatum*	0.5	15
Centella asiatica	0.1	0.1	**Rumex crispus*	1	1
Eucalyptus rudis	30	50	**Symphyotrichum squamatum*	1.5	0.1
Juncus subsecundus	0.3	0.5	**Zantedeschia aethiopica*	0.1	0.1
Melaleuca rhaphiophylla	25	35			

Note: *denotes introduced species.

Quadrat No.:	Q4
Survey Date:	19/5/2021
Personnel:	SH KS
Easting:	403286.54
Northing:	6452107.31
Location:	Southern River Confluence
Topography:	Mid Slope
Aspect:	North
Slope:	3-5%
Soil:	Grey Sand
Gravel	0%
Rock:	0%
Leaf Litter:	90%
Bare Ground:	0%
Drainage:	Well
Condition:	Degraded

Notes: Marri Woodland

Native Species	Height (m)	Cover (%)	Weed Species	Height (m)	Cover (%)
Corymbia calophylla	25	80	**Briza maxima*	0.1	0.1
Hardenbergia comptoniana	1.5	5	**Ehrharta calycina*	0.4	5
Loxocarya cinerea	0.2	0.5	**Ehrharta longifolia*	0.2	3
Macrozamia riedlei	1	0.5	**Erigeron bonariensis*	0.3	0.1
			**Oxalis pes-caprae*	0.2	2
			**Schinus terebinthifolia*	0.2	0.1

Note: *denotes introduced species.

Quadrat No.:	Q5
Survey Date:	19/5/2021
Personnel:	SH KS
Easting:	403016.08
Northing:	6451714.56
Location:	Southern River Confluence
Topography:	Flood Plain
Aspect:	Flat
Slope:	0%
Soil:	Brown Loam
Gravel	0%
Rock:	0%
Leaf Litter:	98%
Bare Ground:	1%
Drainage:	Moderate
Condition:	Degraded

Notes: *M. rhaphiophylla* and *E. rudis* Woodland

Native Species	**Height (m)**	**Cover (%)**	**Weed Species**	**Height (m)**	**Cover (%)**
Allocasuarina fraseriana	0.5	0.1	*Atriplex prostrata	0.1	0.1
Alternanthera nodiflora	0.2	1	**Bromus catharticus*	0.5	2
Banksia littoralis	0.5	0.1	*Ehrharta longifolia	0.3	4
Callistachys lanceolata	2	2	*Fumaria capreolata	0.1	0.1
Eucalyptus rudis	30	50	*Gomphocarpus fruticosus	1	0.1
Juncus subsecundus	0.5	0.3	*Oxalis pes-caprae	0.1	0.1
Lepidosperma gladiatum	0.5	0.5	*Poa annua	0.1	0.1
Melaleuca preissiana	0.3	0.2	*Rumex crispus	1.5	0.1
Melaleuca rhaphiophylla	8	50	*Zantedeschia aethiopica	0.1	0.1

Note: *denotes introduced species.

Quadrat No.:	Q6
Survey Date:	19/5/2021
Personnel:	SH KS
Easting:	402981.97
Northing:	6451903.36
Location:	Southern River Confluence
Topography:	Upper Slope
Aspect:	South-west
Slope:	0%
Soil:	Brown Sand
Gravel	0%
Rock:	0%
Leaf Litter:	95%
Bare Ground:	0%
Drainage:	Well
Condition:	Degraded

Notes: Marri Woodland

Native Species	Height (m)	Cover (%)	Weed Species	Height (m)	Cover (%)
Corymbia calophylla	30	75	**Cenchrus clandestinus*	0.3	70
Hardenbergia comptoniana	4	4	**Cynodon dactylon*	0.1	1
Juncus pallidus	0.5	0.1	**Oxalis pes-caprae*	0.2	40
Lepidosperma longitudinale	1	3	**Watsonia meriana bulbillifera*	0.3	0.5

Note: *denotes introduced species.

Appendix 3: Flora Species List

The complete flora list for the site is provided in the table below with flora listed by species with introduced species listed first. *Denotes introduced species and # denotes species that are native to Western Australia but not to this local region. Species highlighted in green were not identified during survey activities, but have been previously sighted by the AGLG.

Family	Species Name	Common Name
Fabaceae	**Acacia longifolia*	
Fabaceae	**Acacia podalyriifolia*	Queensland Silver Wattle
Apocynaceae	**Araujia sericifera*	Moth Vine
Chenopodiaceae	**Atriplex prostrata*	Hastate Orache
Poaceae	**Avena barbata*	Bearded Oat
Plantaginaceae	**Bacopa monnieri*	
Poaceae	**Briza maxima*	Blowfly Grass
Poaceae	**Bromus catharticus*	Prairie Grass
Poaceae	**Bromus diandrus*	Great Brome
Poaceae	**Cenchrus clandestinus*	Kikuyu
Poaceae	**Cenchrus macrourus*	African Feather Grass
Chenopodiaceae	**Chenopodium album*	Fat Hen
Poaceae	**Cortaderia selloana*	Pampas Grass
Poaceae	**Cynodon dactylon*	Couch
Cyperaceae	**Cyperus rotundus*	Nut Grass
Cyperaceae	**Cyperus tenuiflorus*	Scaly Sedge
Poaceae	**Ehrharta calycina*	Perennial Veldt Grass
Poaceae	**Ehrharta longifolia*	Annual Veldt Grass
Poaceae	**Eragrostis curvula*	Lovegrass
Asteraceae	**Erigeron bonariensis*	Fleabane
Asteraceae	**Erigeron sumatrensis*	Fleabane
Euphorbiaceae	**Euphorbia maculata*	
Euphorbiaceae	**Euphorbia peplus*	Petty Spurge
Euphorbiaceae	**Euphorbia terracina*	Geraldton Carnation Weed
Moraceae	**Ficus carica*	Common Fig
Papaveraceae	**Fumaria capreolata*	White-flowered Fumaria
Apocynaceae	**Gomphocarpus fruticosus*	Narrowleaf Cottonbush

Family	Species Name	Common Name
Euphorbiaceae	**Homanthulus populifolius*	Bleeding Heart Tree
Araliaceae	**Hydrocotyle bonariensis*	Coast Pennywort
Asteraceae	**Hypochaeris glabra*	Smooth Catsear
Asteraceae	**Hypochaeris radicata*	Flatweed
Bignoniaceae	**Jacaranda mimosifolia*	Jacaranda
Asteraceae	**Lactuca serriola*	Prickly Lettuce
Verbenaceae	**Lantana camara*	Common Lantana
Fabaceae	**Lupinus cosentinii*	Sandplain Lupin
Poaceae	**Melinis repens*	Natal Grass
Onagraceae	**Oenothera drummondii*	Beach Evening Primrose
Oleaceae	**Olea europaea*	Olive
Asteraceae	**Osteospermum ecklonis*	African Veldt Daisy
Oxalidaceae	**Oxalis pes-caprae*	Soursob
Vitaceae	**Parthenocissus quinquefolia*	Virginia Creeper
Poaceae	**Paspalum dilatatum*	
Geraniaceae	**Pelargonium capitatum*	Rose Pelargonium
Arecaceae	**Phoenix dactylifera*	Date Palm
Solanaceae	**Physalis peruviana*	Cape Gooseberry
Phytolaccaceae	**Phytolacca octandra*	Inkweed
Plantaginaceae	**Plantago lanceolata*	Ribwort Plantain
Poaceae	**Poa annua*	Winter Grass
Asteraceae	**Pseudognaphalium luteoalbum*	Jersey Cudweed
Euphorbiaceae	**Ricinus communis*	Castor Oil
Rosaceae	**Rubus laudatus*	Blackberry
Polygonaceae	**Rumex crispus*	Curled Dock
Salicaceae	**Salix babylonica*	Weeping Willow
Anacardiaceae	**Schinus terebinthifolia*	Brazilian Pepper
Asteraceae	**Senecio vulgaris*	Common Groundsel
Solanaceae	**Solanum nigrum*	Black Berry Nightshade
Asteraceae	**Sonchus oleraceus*	Common Sowthistle
Poaceae	**Stenotaphrum secundatum*	Buffalo Grass
Asteraceae	**Symphyotrichum squamatum*	Bushy Starwort

Family	Species Name	Common Name
Fabaceae	**Trifolium angustifolium*	Narrowleaf Clover
Arecaceae	**Washingtonia robusta*	Fan Palm
Iridaceae	**Watsonia meriana* var. *bulbillifera*	Watsonia
Araceae	**Zantedeschia aethiopica*	Arum Lily
Fabaceae	*#Acacia cyclops*	Coastal Wattle
Fabaceae	*#Acacia trigonophylla*	
Fabaceae	*#Acacia urophylla*	
Proteaceae	*#Banksia nivea*	Honeypot Dryandra
Fabaceae	*#Callistachys lanceolata*	Wonnich
Myrtaceae	*#Callistemon phoeniceus*	Lesser Bottlebrush
Haemodoraceae	*#Conostylis candicans*	Grey Cottonhead
Myrtaceae	*#Eucalyptus patens*	Swan River Blackbutt
Myrtaceae	*#Grevillea vestita*	
Myrtaceae	*#Melaleuca cardiophylla*	Tangling Melaleuca
Santalaceae	*#Santalum acuminatum*	Quandong
Fabaceae	*Acacia alata*	Winged Wattle
Fabaceae	*Acacia dentifera*	
Fabaceae	*Acacia lasiocarpa* var. *lasiocarpa*	Panjang
Fabaceae	*Acacia pulchella*	Prickly Moses
Fabaceae	*Acacia saligna*	Orange Wattle
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*	Common Woollybush
Casuarinaceae	*Allocasuarina fraseriana*	Sheoak
Amaranthaceae	*Alternanthera nodiflora*	Common Joyweed
Haemodoraceae	*Anigozanthos manglesii*	Mangles Kangaroo Paw
Myrtaceae	*Astartea scoparia*	Common Astartea
Chenopodiaceae	*Atriplex cinerea*	Grey Saltbush
Poaceae	*Austrostipa elegantissima*	
Poaceae	*Austrostipa flavescens*	
Proteaceae	*Banksia attenuata*	Slender Banksia
Proteaceae	*Banksia dallanneyi*	Couch Honeypot
Proteaceae	*Banksia littoralis*	Swamp Banksia
Proteaceae	*Banksia menziesii*	Firewood Banksia

Family	Species Name	Common Name
Cyperaceae	*Baumea articulata*	Jointed Rush
Cyperaceae	*Baumea juncea*	Bare Twigrush
Cyperaceae	*Baumea preissii*	
Pittosporaceae	*Billardiera fraseri*	Elegant Pronaya
Cyperaceae	*Bolboschoenus caldwellii*	Marsh Club-rush
Myrtaceae	*Calothamnus lateralis*	
Myrtaceae	*Calothamnus quadrifidus*	One-sided Bottlebrush
Myrtaceae	*Calothamnus sanguineus*	Silky-leaved Blood Flower
Cyperaceae	*Carex appressa*	Tall Sedge
Cyperaceae	*Carex tereticaulis* (P3)	
Apiaceae	*Centella asiatica*	Centella
Fabaceae	*Chorizema cordatum*	
Fabaceae	*Chorizema* sp.	
Haemodoraceae	*Conostylis aculeata*	Prickly Conostylis
Myrtaceae	*Corymbia calophylla*	Marri
Myrtaceae	*Darwinia citriodora*	Lemon-scented Darwinia
Restionaceae	*Desmocladus asper*	
Myrtaceae	*Eucalyptus marginata*	Jarrah
Myrtaceae	*Eucalyptus rudis*	Flooded Gum
Cyperaceae	*Gahnia trifida*	Coast Sea-sedge
Fabaceae	*Gompholobium tomentosum*	Hairy Yellow Pea
Proteaceae	*Grevillea thelemanniana* (CR)	Spider Net Grevillea
Proteaceae	*Hakea lissocarpha*	Honey Bush
Proteaceae	*Hakea prostrata*	Harsh Hakea
Myrtaceae	*Hakea undulata*	Wavy-leaved Hakea
Proteaceae	*Hakea varia*	Variable-leaved Hakea
Fabaceae	*Hardenbergia comptoniana*	Native Wisteria
Lamiaceae	*Hemiandra pungens*	Snakebush
Dilleniaceae	*Hibbertia hypericoides*	Yellow Buttercups
Fabaceae	*Jacksonia furcellata*	Grey Stinkwood
Fabaceae	*Jacksonia sternbergiana*	Stinkwood
Juncaceae	*Juncus pallidus*	Pale Rush

Family	Species Name	Common Name
Juncaceae	*Juncus subsecundus*	Finger Rush
Fabaceae	*Kennedia prostrata*	Scarlet Runner
Cyperaceae	*Lepidosperma gladiatum*	Coast Sword Sedge
Cyperaceae	*Lepidosperma longitudinale*	Pithy Sword-sedge
Campanulaceae	*Lobelia anceps*	Angled Lobelia
Restionaceae	*Loxocarya cinerea*	
Zamiaceae	*Macrozamia riedlei*	Zamia
Myrtaceae	*Melaleuca preissiana*	Moonah
Myrtaceae	*Melaleuca rhaphiophylla*	Swamp Paperbark
Myrtaceae	*Melaleuca seriata*	
Myrtaceae	*Melaleuca viminea*	Mohan
Fabaceae	*Paraserianthes lophantha*	Albizia
Thymelaeaceae	*Pimelea* sp.	
Myrtaceae	*Regelia ciliata*	
Myrtaceae	*Regelia inops*	
Fabaceae	*Templetonia retusa*	Cockies Tongue
Malvaceae	*Thomasia macrocarpa*	Large Fruited Thomasia
Hemerocallidaceae	*Tricoryne elatior*	Yellow Autumn Lily
Typhaceae	*Typha domingensis*	Bulrush
Myrtaceae	*Verticordia densiflora* var. *densiflora*	Compacted Featherflower
Fabaceae	*Viminaria juncea*	Swishbush
Xanthorrhoeaceae	*Xanthorrhoea brunonis*	

Carnaby Cockatoo Flora Species Endemic to Southern and Canning River Confluence

Species	Source	Growth form	Vegetation Type	
High Priority			ErMrW	CcW
Banksia attenuata	Foraging	Tree		X
Banksia littoralis	Foraging	Tree	X	X
Banksia menziesii	Foraging	Tree		X
Corymbia calophylla	Foraging, Roosting, Nesting	Tall shrub	X	X
Hakea prostrata	Foraging	Tall / medium shrub	X	X
Hakea trifurcata	Foraging	Tall shrub		X
Hakea undulata	Foraging	Tall shrub	X	X
Medium Priority				
Eucalyptus marginata	Foraging, Roosting	Tree		X
Grevillea bipinnatifida	Foraging	Medium / small shrub	X	X
Hakea candolleana	Foraging	Medium / small shrub		X
Hakea cyclocarpa	Foraging	Medium / small shrub		X
Hakea lissocarpha	Foraging	Medium / small shrub		X
Hakea ruscifolia	Foraging	Tall shrub		X
Hakea neospathulata	Foraging	Medium / small shrub		X
Hakea stenocarpa	Foraging	Medium / small shrub		X
Hakea sulcata	Foraging	Medium / small shrub		X
Hakea varia	Foraging	Tall shrub	X	X

Species	Source	Growth form	Vegetation Type	
Jacksonia furcellata	Foraging	Tall shrub	X	X
Lambertia multiflora	Foraging	Medium / small shrub		X
Xanthorrhoea preissii	Foraging	Grassy / strappy		X
Low Priority				
Darwinia citriodora	Foraging	Medium / small shrub		X
Eucalyptus rudis	Foraging, Roosting	Tree	X	
Low Priority				
Mesomelaena graciliceps	Foraging	Grassy / strappy	X	
Mesomelaena pseudostygia	Foraging	Grassy / strappy	X	X
Mesomelaena tetragona	Foraging	Grassy / strappy		X

Source: DBCA (2021b) and DEC (2011)

Appendix 4: Fauna Species List

The complete fauna list for the site is provided in the table below with fauna listed by type with introduced species listed first. * Denoted introduced species. Species highlighted in green were not identified during survey activities, but have been previously sighted by the AGLG.

Family	Species Name	Common Name
Birds		
Anatidae	*Anas superciliosa*	Pacific Black Duck
Cacatuidae	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo (flying overhead)
Rallidae	*Porphyrio porphyrio*	Purple Swamphen
Invertebrates		
Apidae	**Apis mellifera*	European Honeybee
Nymphalidae	*Danaus plexippus*	Monarch Butterfly
Araneidae	*Eriophora transmarina*	Garden Orb Weaver
Mammals		
Canidae	**Canine familiaris familiaris*	Domestic Dog
Leporidae	**Oryctolagus cuniculus*	Rabbit (diggings)
Mustelidae	**Vulpes vulpes*	Red Fox (scat and diggings)
Peramelidae	*Isoodon fusciventer*	Quenda / Southern Brown Bandicoot
Phalangeridae	*Trichosurus vulpecula hypoleucus*	Common Brushtail Possum (scat)
Reptiles		
Chelidae	*Chelodina colliei*	Southwestern Snake Necked Turtle

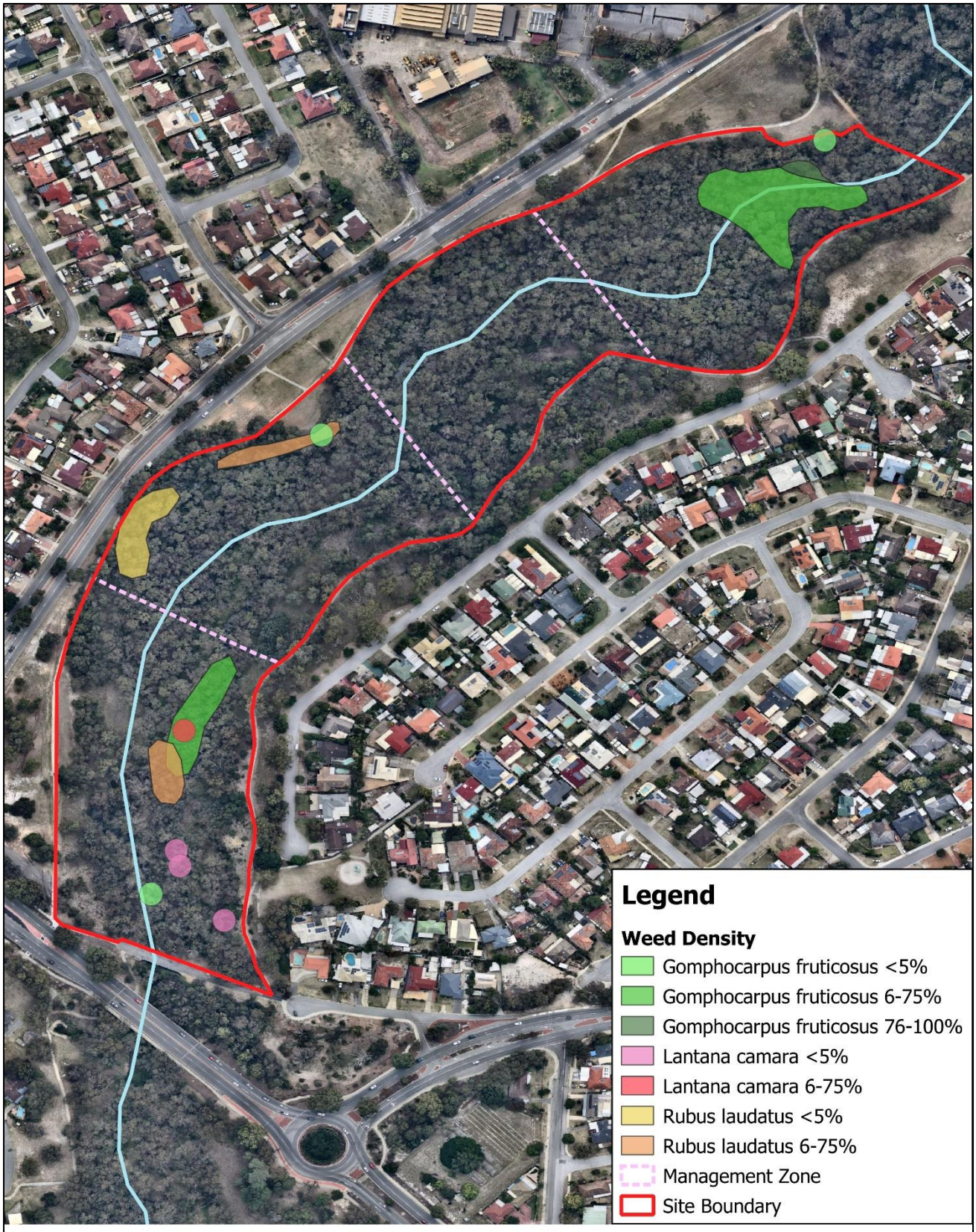
Appendix 5: Weed Maps

Declared Pests (Arum Lily) Distribution
Southern and Canning River
Confluence, Thornlie

0 50 100 m

N

Client: City of Gosnells
Date: 28/06/21
Created by: M. Gray
Image Source: Nearmap 2021
Datum: GDA 94

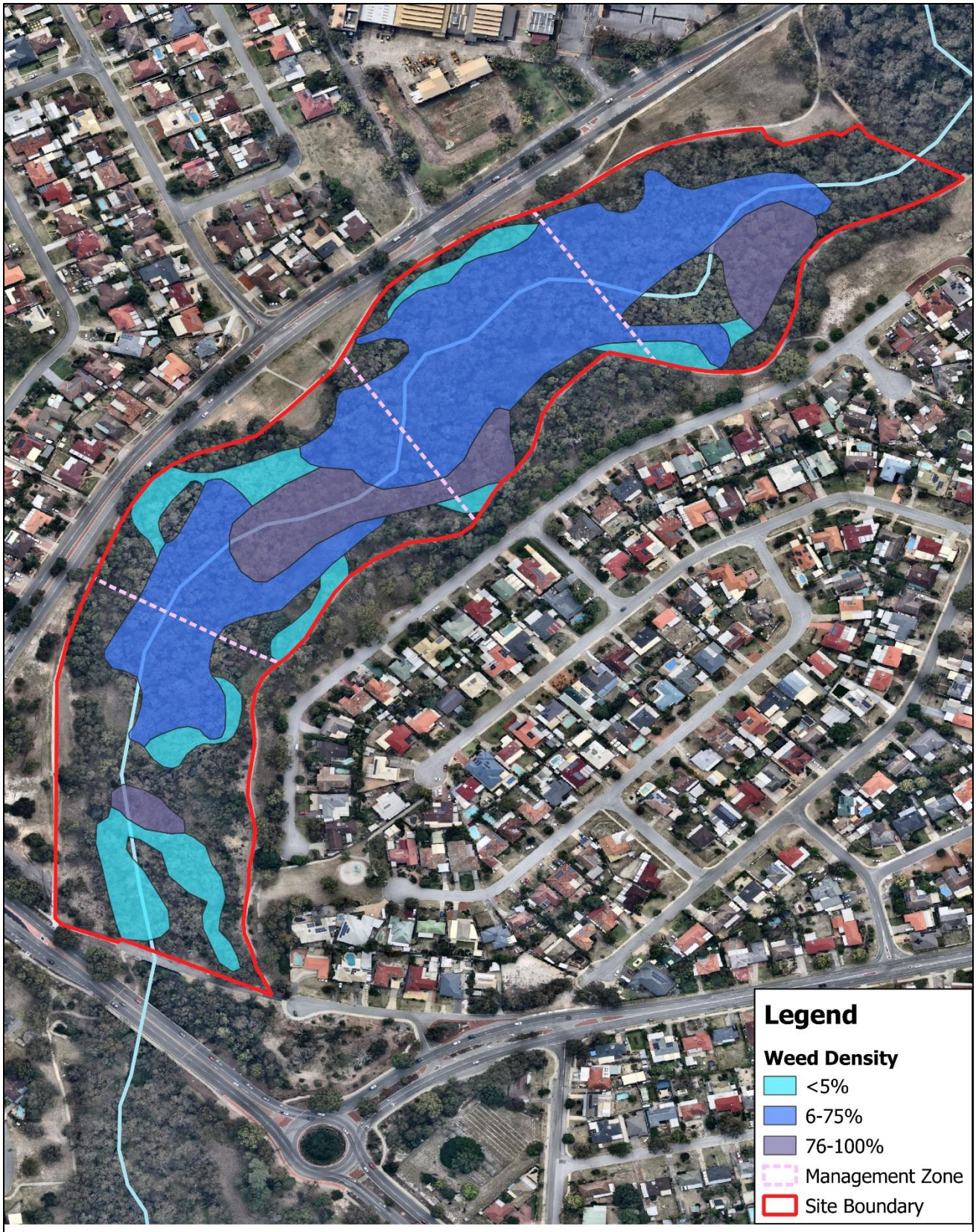


Declared Pests (Woody Weeds) Distribution
Southern and Canning River
Confluence, Thornlie

0 50 100 m

N

Client: City of Gosnells
Date: 28/06/21
Created by: M. Gray
Image Source: Nearmap 2021
Datum: GDA 94

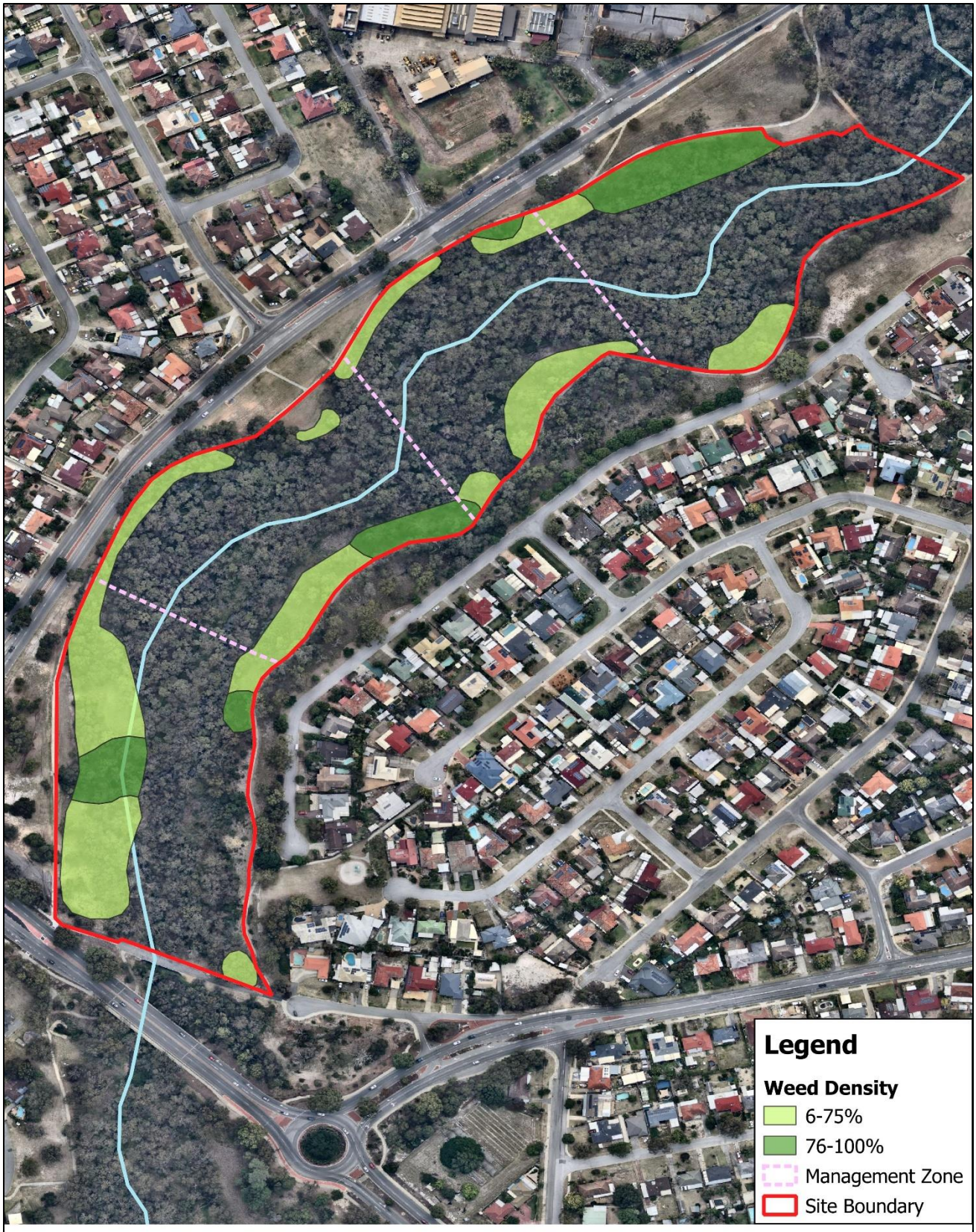


Woody Weeds
Southern and Canning River
Confluence, Thornlie

0 50 100 m

N

Client: City of Gosnells
Date: 28/06/21
Created by: M. Gray
Image Source: Nearmap 2021
Datum: GDA 94

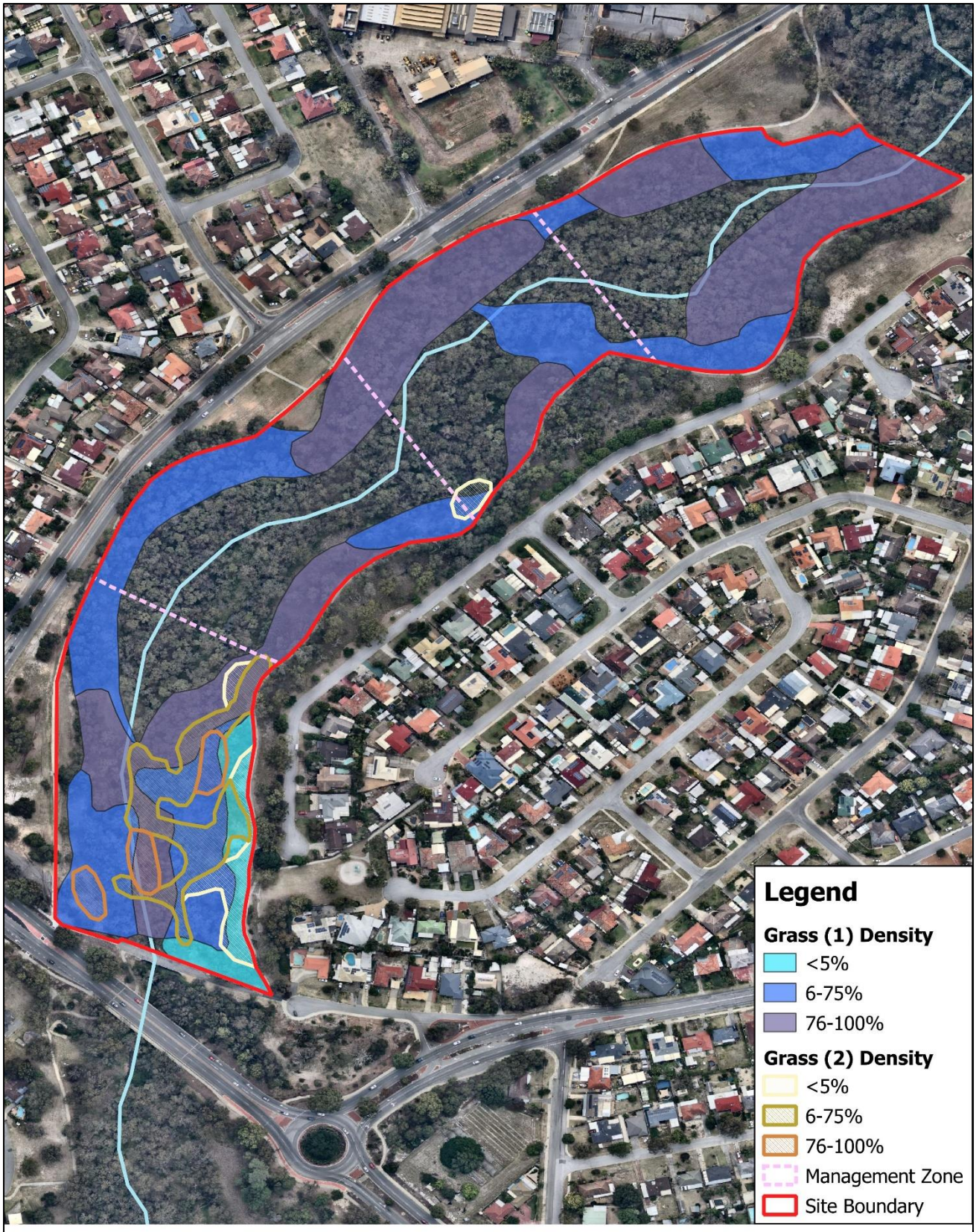


Geophytes and Bulbous Weeds
Southern and Canning River
Confluence, Thornlie

0 50 100 m

N

Client: City of Gosnells
Date: 28/06/21
Created by: M. Gray
Image Source: Nearmap 2021
Datum: GDA 94

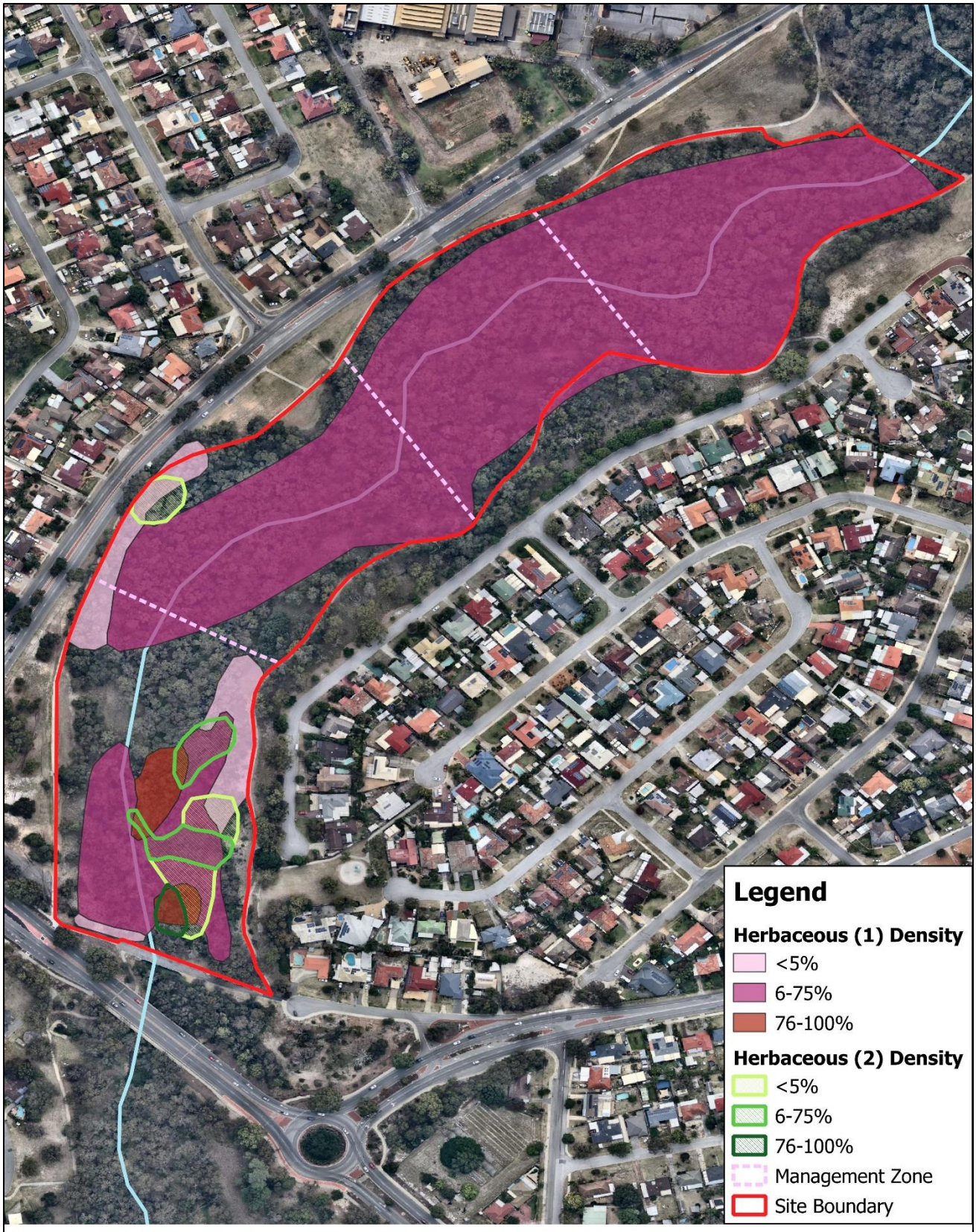


Invasive Grasses
Southern and Canning River
Confluence, Thornlie

0 50 100 m

N

Client: City of Gosnells
Date: 28/06/21
Created by: M. Gray
Image Source: Nearmap 2021
Datum: GDA 94



Herbaceous Weeds
Southern and Canning River
Confluence, Thornlie

0 50 100 m

N

Client: City of Gosnells
Date: 28/06/21
Created by: M. Gray
Image Source: Nearmap 2021
Datum: GDA 94