Lake Claremont
Invertebrate Fauna Survey

Report to Town of Claremont

6 July 2026

Document Status				
Revision No.	Author	Review / Approved for issue	Approved for Issue to:	Date
1	Ashley Jenkin, Kim Nguyen, Shae Surman, Juliana Pille Arnold	Nihara Gunawardene	Natalie Mitchell	31/03/2026
2	Ashley Jenkin, Kim Nguyen, Juliana Pille Arnold	Nihara Gunawardene	Natalie Mitchell	06/07/2026
3				

Executive Summary

The Town of Claremont commissioned Biologic Environmental to undertake a single-season terrestrial and aquatic invertebrate fauna survey within the Lake Claremont precinct. The 70-hectare survey area is located in Claremont, ~10 kilometres (km) north-west of the Perth CBD, Western Australia and includes a conservation significant natural wetland and native bushland.

The purpose of the survey was for the Town to improve their knowledge of invertebrate fauna biodiversity and habitat values in the survey area, particularly regarding terrestrial and aquatic invertebrates that serve as indicators of biologic health and change (bioindicators). This report presents the findings for the assessment (presence or potential presence of taxa and suitable habitat) of three key bioindicator groups: ants, native bees and aquatic macroinvertebrates, with the inclusion of conservation significant and short-range endemic invertebrates to provide further context to the assessment of the Lake Claremont precinct as an area of conservation importance. This report presents the finding of a detailed desktop assessment and single-season invertebrate (terrestrial and aquatic) survey.

Desktop assessment

The desktop assessment identified the following:

- Few targeted surveys have been undertaken within the Survey Area, with one previous native bee survey and two aquatic macroinvertebrate surveys identified. No records of previous ant or SRE invertebrate surveys for Lake Claremont.
- 246 ant species within 40 km, including four invasive species of conservation concern. The invasive African big-headed ant (*Pheidole megacephala*) is considered Likely to occur in the Survey Area.
- 149 native bee species have been recorded within 40 km, including all six-conservation priority-listed species. No priority species are expected to occur in the Survey Area
- A total of 409 aquatic macroinvertebrates were recorded within 40 km of the Survey Area, of which six were conservation significant taxa, and ten were exotic taxa.
- Twenty-seven Confirmed SRE invertebrate taxa (primarily arachnids) have been recorded within 40 km of the Survey Area.
- Three conservation-significant invertebrate species were recorded within 40 km. Notably, the Swan Coastal Plain shield-backed trapdoor spider (*Idiosoma sigillatum*) is considered Highly Likely to occur.

Terrestrial and aquatic invertebrate survey

Ant fauna survey

- Nine species of ants were collected, representing key functional groups (scavengers, foragers, and predators). Two species (*Stigmacros pusilla* and *Tetramorium caldarium*) were not previously recorded within the Survey Area
- The collection of the post-disturbance ant species, Iridomyrmex rufoniger, suggests potential habitat improvement in some areas. The presence of a low-quality habitat specialist ant *Technomyrmex jocosus* only in an area assessed as low quality woodland highlights the species occurrence as a useful tool in further monitoring.
- Two invasive *Tetramorium* ant species were collected but are not currently of conservation concern for the area. No invasive ant species of conservation concern collected in the Survey Area.

Bee fauna survey

- A total of 778 bees were recorded, including 149 native bee specimens representing 27 species across four families.
- The survey substantially expanded existing knowledge, with 19 species recorded for the first time in the Study Area and eight undescribed taxa identified, including a likely new morphotype (*Euhesma* sp. 1).
- Bee assemblages were characterised by a small number of abundant species and a relatively high proportion of singletons, consistent with typical native bee community structure.
- No conservation-listed native bee species were recorded.
- Plant–pollinator network analysis showed strong dominance of the non-native European honeybee (*Apis mellifera*), which accounted for 81% of all interactions and utilised all flowering plant species, overlapping in resource use with native bees.
- Key floral resources identified included *Scaevola crassula*, *Melaleuca huegelii* subsp. *huegelii*, *Melaleuca systena*, and *Jacksonia sternbergiana*, which supported the highest number of interactions and bee species richness.
- The co-occurrence of the kleptoparasitic bee *Thyreus waroonensis* and its host *Amegilla chlorocyanea* indicates suitable nesting habitat and a functionally intact component of the bee community.
- Overall, the Study Area supports a diverse native bee assemblage, including both generalist and specialist species, as well as higher-order ecological interactions.
- Further surveys across multiple seasons, increased sampling effort, and long-term monitoring are recommended to better characterise bee diversity, understand plant–pollinator dynamics, and inform conservation and restoration planning.

Aquatic survey

- The Survey Area was dominated by Hemiptera, Crustacea and Diptera. Salinity sensitive taxa such as mayflies and caddisflies were either absent or in low richness.
- A total of 58 taxa (species-level where possible) from 32 families were recorded from the Survey Area.
- Historic data indicate that Lake Claremont has previously supported mayfly taxa, which were absent from the current survey, as well as a higher diversity of native freshwater snails and limpets (up to eight taxa compared to one taxon in the current survey). The lower native snail richness may be due to the invasiveness of the introduced bladder snail.

SRE invertebrate fauna survey

- Two taxa, the jumping spider *Maratus pavonis*, and pseudoscorpion *Pseudotyrannochthonius* sp. indet were new records for the Survey Area and surrounding 40 km. This pseudoscorpion represents the first record of the Pseudotyrannochthoniidae family within 40 km.

Overall Conclusions

The terrestrial and aquatic invertebrate survey indicates that the Study Area supports a functionally representative invertebrate assemblage, including ant fauna, native bees, and aquatic invertebrates. Woodland and riparian habitats were generally of moderate suitability, supporting a range of taxa, including potential SRE invertebrates and previously unrecorded species, highlighting the ecological value of the area.

While no confirmed SRE taxa or conservation-listed bee species were recorded, the detection of new and undescribed taxa demonstrates that the invertebrate fauna remains incompletely documented. This survey provides valuable baseline data for the Swan Coastal Plain, including two new ant species records, new records of both Potential and Widespread SRE taxa, and the collection of eight undescribed native bee species.

Native bee communities were diverse, with evidence of both generalist and specialist species, key floral resource use, and higher-order ecological interactions, including kleptoparasitism. However, strong dominance of the non-native honeybee (*Apis mellifera*) and incomplete sampling coverage indicate that further investigation is required to better understand community dynamics and potential ecological pressures.

Ongoing habitat restoration is likely to improve habitat quality and support greater species diversity over time. Ensuring rehabilitated areas are protected and appropriately managed should remain a key focus and presents an opportunity to engage the local community in conservation efforts. Incorporating ants and native bee fauna into future monitoring, alongside existing aquatic macroinvertebrate assessments, would provide a more comprehensive indicator of habitat quality and ecological change within the Lake Claremont area.

Overall, the Study Area demonstrates ecological complexity and functional integrity; however, additional multi-season surveys and long-term monitoring are recommended to more fully characterise invertebrate diversity, detect potentially restricted taxa, and inform conservation, restoration, and land management strategies.

Table of Contents

Tables

Figures

Plates

Appendices

1 Introduction

1.1 Background

The Town of Claremont (ToC) commissioned Biologic Environmental (Biologic) to undertake invertebrate surveys in the Lake Claremont area. This was in response to the current Lake Claremont Management Plan (2024), whereby the Town recognised the need to improve the understanding, management, and protection of native fauna within and surrounding Lake Claremont (collectively referred to as the Survey Area), approximately 10 km north-west of Perth, Western Australia. The Survey Area contains a Bush Forever site (#220), a conservation category wetland, and is an area of Aboriginal heritage that covers ~70 hectares (Figure 1.1). Management of the Lake Claremont precinct is the responsibility of the Town of Claremont and supported by the Friends of Lake Claremont.

Biologic was commissioned by ToC to perform baseline invertebrate surveys (aquatic and terrestrial) and habitat assessment of the Survey Area to improve knowledge needed to support environmental management of the area. This included providing an invertebrate species diversity dataset, assessment of current habitat quality, recommendations for future survey methods and ways to enhance habitat, the identification of safety considerations for visitors, and ways to promote conservation. Three key invertebrate groups, ants, native bees, and aquatic macroinvertebrates, were included in the survey based on existing knowledge of each group and effectiveness as indicators of environmental health (bioindicators). Conservation significant and short-range endemic (SRE) invertebrates were also included in order to provide accurate and meaningful habitat assessment for invertebrates of conservation importance within the Survey Area.

1.2 Scope and objectives

The main objective of the desktop assessment and survey was to gather data on invertebrate species and habitats present (or potentially present) in the Survey Area to improve local and regional knowledge of the Lake Claremont precinct. Specifically, the key objectives of the survey and this report were to:

- provide a dataset of invertebrate species from the three target bioindicator groups (ants, native bees and aquatic macroinvertebrates) as well as conservation significant and SRE invertebrate fauna to document species diversity in the Survey Area.
- provide an assessment of habitat quality
- recommend future ways for ToC to improve invertebrate habitat
- suggest monitoring methods for ToC and Friends of Lake Claremont, identify safety considerations for visitors, and ways to promote conservation.

1.3 Ants

Ants are a diverse group of insects that perform important ecosystem roles in seed dispersal, predation, food webs, soil processes, and nutrient cycling (Hoffmann & Andersen, 2003). There are an estimated 500 described species of ant in southwest Western Australia (SWWA), with this number likely to be considerably higher with many undescribed species, limited targeted surveys for ant taxa, and a paucity in molecular analyses for ants (Heterick, 2009). Ants are important for supporting healthy populations of native flora with well-studied interactions with native plants, including often highly specialised roles in pollination (Delnevo *et al.*, 2020), seed collection and dispersal, tending extra-floral nectaries, alongside herbivore control and the 'farming' of potentially destructive insects that suck sap from plants (Huxley & Cutler, 1991). Ants are also 'ecosystem engineer' taxa with important roles in bioturbation (movement of organic matter through soil horizons) to improve soil quality. These ecological roles are of particular importance for improved rehabilitation efforts across altered/degraded landscapes such as agriculture, mining, and urban environments.

Given the important roles ants perform and their recognised sensitivity to environmental stress, there is strong precedence for using ants as bioindicators, i.e. taxa that may be used as surrogates for monitoring terrestrial ecosystems, particularly as low-cost indicators of environmental change or the progression of rehabilitation. This is supported extensively in peer-reviewed literature from around the world. Ants are an ideal bioindicator group because they are very common in most terrestrial ecosystems (Andersen, 1997), have relatively stable home ranges with colonies that can be long-lived and stationary (Alonso & Agosti, 2000), and display well-studied responses to many different types of environmental change (Borges *et al.*, 2021; Majer, 1983; Majer & De Kock, 1992; Majer & Nichols, 1998). Furthermore, there exists a well-developed morphological taxonomic framework for studying and identifying ants, with species-level identification relatively simple to achieve (Heterick, 2009). The relative ease of species level identification combined with well-established and effective methods for sampling, assessing population dynamics and analysing community composition (Longino, 2000; Oliver & Beattie, 1996) supports the use of ant taxa as bioindicators for monitoring change and function of terrestrial ecosystems.

1.4 Native bees

Bees are among the most effective pollinators (Ballantyne *et al.*, 2017; Willmer *et al.*, 2017), owing to their specialised body morphology, foraging behaviour, and active collection of pollen (Michener, 2000). Many bee species exhibit varying degrees of resource specialisation, ranging from associations with particular plant families or genera to strict dependence on single plant species (Houston, 2000; Michener, 1965). This ecological specialisation makes them particularly vulnerable to environmental change, as the loss of key floral resources is a major driver of bee declines (Biesmeijer *et al.*, 2006; Roulston & Goodell, 2011; Scheper *et al.*, 2014). Consequently, native bee communities are widely regarded as bioindicators of ecosystem health and function, as their composition and activity reflect floral resource availability, habitat structure, and broader landscape disturbance gradients (Kevan, 1999; Schindler *et al.*, 2013).

Australia supports a highly diverse native bee fauna, with over 2,000 species estimated to occur, although only approximately 1,700 have been formally described, and many taxa require taxonomic revision (Batley & Hogendoorn, 2009; Houston, 2018). Knowledge of their biology and ecology remains limited, particularly with respect to flower visitation patterns (Brown *et al.*, 1997; Houston, 2000). Approximately 800 species are estimated to occur in Western Australia, many of which are endemic, poorly known, and potentially undescribed (Houston, 2011).

Native bees are important providers of pollination services in south-western Australia, a globally recognised biodiversity hotspot characterised by high levels of plant endemism (Phillips et al., 2010). Many plant species in this region rely on specialised pollination mechanisms to achieve successful reproduction. Unlike the introduced European honeybee (*Apis mellifera*), most Australian native bees are solitary and do not form hives. They nest either above ground (e.g. in hollow stems, twigs, or borings in wood) or below ground in soil burrows. After mating, females construct nests comprising individual brood cells provisioned with pollen and nectar. Solitary bees generally have short lifespans and may produce only a few offspring (Michener, 2000), and their persistence is influenced by multiple factors, including floral resource availability, nesting substrate availability, soil disturbance, predation, climate change, and other anthropogenic impacts (Brunet & Fragoso, 2024; Potts *et al.*, 2016).

While most native bees directly interact with flowering plants through foraging and pollination, some species are kleptoparasites ("cuckoo bees"). These species do not collect pollen or construct nests; instead, females lay their eggs in the nests of host bees, where their larvae develop using provisions collected by the host. Kleptoparasitic bees are typically host-specific and occupy a higher trophic level within bee communities. As such, they are often sensitive to environmental disturbance and dependent on stable host populations. Their presence and diversity can therefore provide insight into ecosystem stability, indicating that habitats maintain the integrity of ecological interactions (Dodge & Davis, 2025; Sheffield *et al.*, 2013).

Systematic surveys of bee fauna for assessment and monitoring in Western Australia are relatively uncommon, and species distribution data remain limited. Information on potential short-range endemic (SRE) bee species is currently lacking due to insufficient taxonomic resolution and gaps in ecological knowledge. However, recent studies in Banksia woodlands

(Gunawardene *et al.*, 2021; Pille Arnold, 2021; Pille Arnold *et al.*, 2019; Pille Arnold *et al.*, 2024) and urban environments in Perth (Prendergast, 2020b; Prendergast & Ollerton, 2021) have demonstrated that bee assemblages in the region can be highly diverse, even under anthropogenic pressure, with new species continuing to be documented. Given the degree of resource specialisation and specific nesting requirements exhibited by many bee species, it is likely that some taxa may have restricted distributions. However, further data on species biology, ecology, and distributions are required to confirm this. The present survey contributes to addressing these knowledge gaps. Specifically, assessing native bee diversity and plant–pollinator interactions within the Study Area is important for understanding ecosystem health and function, and for informing conservation and management actions aimed at supporting local biodiversity.

1.5 Aquatic macroinvertebrates

Aquatic macroinvertebrates are a diverse, fundamental lower trophic group comprised of detritivores, herbivores, and predators that are important for maintaining water quality and providing food resources for vertebrate fauna (Gooderham & Tsyrlin, 2002). The use of aquatic macroinvertebrates as bioindicators is a well-established, globally recognised method for assessing aquatic ecosystem health and overall trophic function in a cost-efficient, effective, and replicable manner (Smith *et al.*, 1999). Aquatic macroinvertebrate fauna displays differing sensitivities/tolerances to common water quality parameters, including electrical conductivity, dissolved oxygen, pH, and water temperature, at varying taxonomic resolutions (Gooderham & Tsyrlin, 2002). As such, the assessment of aquatic invertebrate assemblages (including abundance) based on recognised sensitivity/tolerance indices is a suitable indicator of the overall health of the examined aquatic environment. The use of aquatic macroinvertebrate fauna in water quality assessments for wetlands on the Swan Coastal Plain is commonplace, with long-term monitoring studies often supported by university and community groups (McLure & Horwitz, 2009; Smith *et al.*, 1999; Sommer & Horwitz, 2009). This highlights the accessibility of this method across different skill levels, especially for community groups such as the Friends of Lake Claremont. Water quality monitoring efforts for Lake Claremont currently includes assessment of aquatic macroinvertebrates alongside traditional water quality parameters, with the Town seeking expertise to further evaluate invertebrate assemblages.

1.6 Short-range endemic (SRE) invertebrate fauna

Endemism refers to the restriction of a species to a particular area, whether it is at the continental, national, or local scale (Allen *et al.*, 2002). Endemism at a local scale is referred to as short-range endemism (Harvey, 2002). Short-range endemism of a species is influenced by several factors including life history, physiology, habitat requirements, dispersal capabilities, biotic and abiotic interactions and historical conditions which not only influence the distribution of a species, but also the tendency for differentiation and speciation (Ponder & Colgan, 2002).

Harvey (2002) proposed a range criterion for terrestrial SRE invertebrate species at less than 10,000 km^2 (or 100 km x 100 km), which has been adopted by regulatory authorities in Western Australia (EPA, 2016b). SRE invertebrate species often share similar biological, behavioural, and life history characteristics that influence their restricted distributions and limit their wider dispersal (Harvey, 2002). For example, burrowing taxa such as mygalomorph spiders and *Urodacus* scorpions may only leave their burrows (or a narrow home territory near the burrow) as juveniles dispersing from the maternal burrow, or when males search for a mate (Rix *et al.*, 2017a). Taxa such as terrestrial isopods, millipedes and snails are dispersal-limited because of their slow movement and cryptic habitat (Car *et al.*, 2019), while some taxa can be limited by very specific habitat requirements, such as selenopid spiders within fractured rocky outcrops (Crews, 2013).

Several taxonomic groups of invertebrates are currently understood to have a high proportion of species with restricted ranges and are given additional consideration in terrestrial fauna assessments. These include mygalomorph spiders (Castalanelli *et al.*, 2014), selenopid spiders (Crews, 2013), scorpions (Volschenk *et al.*, 2010), pseudoscorpions (Harvey *et al.*, 2016), millipedes (Car *et al.*, 2019), land snails (Johnson *et al.*, 2004), and terrestrial isopods (Judd & Perina, 2013). The Environmental Protection Authority (EPA) considers the existence of SRE invertebrate fauna to be a significant biodiversity issue and that SRE fauna "may be at a greater risk of changes in conservation status as a result of habitat loss or other threatening processes" (EPA, 2016b).

1.7 Conservation legislation

Protection for significant invertebrate species and ecological communities (i.e. Threatened and Priority Ecological Communities - TECs and PECs) is provided under State and Federal legislation, comprising:

- *Environmental Protection Act 1986* (*EP Act 1986,* WA)
- *Biodiversity Conservation Act 2016* (*BC Act 2016,* WA)
- *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999, Commonwealth*).

However, most invertebrates (including native bees) and ecological communities are not currently listed under these Acts, largely due to inadequate taxonomic and ecological knowledge. As a result, assessments of conservation significance for these species rely heavily on advice provided by the Western Australian Museum (WAM) and other taxonomic experts, as well as technical guidance from the Environmental Protection Authority (EPA), including:

- EPA (2016a) *Environmental Factor Guideline: Terrestrial Fauna.*
- EPA (2016b) *Technical Guidance: Sampling of Short-range Endemic (SRE) Invertebrate Fauna.*
- EPA (2016c) *Technical Guidance: Terrestrial Fauna Surveys.*

However, the current EPA Technical Guidance for SRE invertebrates has no specific guidelines on survey methods for flying insects like bees. While legal protections exist for conservation-significant bees, impact assessments usually overlook bees unless a listed species is already known from the area. Therefore, most surveys target only protected species in known locations, leaving other species overlooked and unassessed despite some likely being at risk and deserving protection. This is particularly problematic in areas that are vastly under sampled and where the bee fauna is largely unknown, like the Wheatbelt, Jarrah Forest, and the Pilbara.

LEGEND

Survey Area

Local Road

State Road

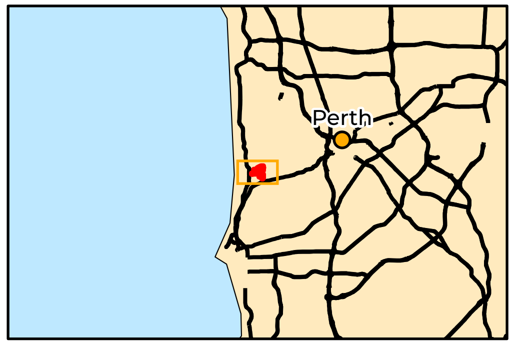
Rail

Biologic Environmental

Scale 1:10,000

0 0.1 0.2 0.3 0.4 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/03/2026



TOWN OF CLAREMONT

Lake Claremont Invertebrate Fauna Survey

Figure 1.1: Survey Area and regional context

2 Existing environment

2.1 Biogeography

The Interim Biogeographic Regionalisation for Australia (IBRA) is a bioregional framework that divides Australia into 85 bioregions and 419 subregions based on climate, geology, landforms, vegetation and fauna (Thackway & Cresswell, 1995). The Survey Area is located within the Swan Coastal Plain (SCP) bioregion and is part of the South-west Botanical Province (Figure 1.1). The SCP is characterised by a low lying coastal plain, mainly covered with woodlands (Thackway & Cresswell, 1995). The Survey Area lies entirely within the Perth (SWA2) subregion of the bioregion, which is composed of colluvial and aeolian sands, alluvial river flats and coastal limestones. Heath and/or Tuart woodlands occur on limestone, while Banksia and Jarrah Banksia woodlands are found on Quaternary marine dunes of various ages and Marri on colluvial and alluvial soils (Figure 1.1). The subregion also includes a complex series of seasonal wetlands that are often within interdunal swales and offshore islands including Rottnest, Carnac and Garden Island (Mitchell *et al.*, 2003)

2.2 Climate

The SWA2 subregion experiences a Warm Mediterranean climate, with a winter precipitation of 600- 1,000 mm with 5-6 dry months per year (Beard, 2015). The Swanbourne meteorological station (#009215; BoM, 2026) presents long-term averages (LTA) based on collated data between 1993 and 2026.. This data shows the long-term average climate of the Lake Claremont area as follows:

- Annual average rainfall of 484.44 mm occurring predominantly between May and September
- Long-term average maximum temperature range of 18.4 ˚C (July) and 30.4 ˚C (February).
- Long-term average minimum temperature range of 9.9 ˚C (July) and 19.1 ˚C (February).
- Wind direction is predominantly morning easterlies and afternoon south-westerly sea breeze (notably in summer). Average 9am wind speed of 19 km/h, and 3pm average of 23 km/h.

2.3 Land systems

The Survey Area is located in a depression on the boundary of the Quindalup and Spearwood Dune Systems, with the Quindalup system to the west of Lake Claremont and the Spearwood system to the east and south (Figure 2.1). Calcareous sands common to beach ridges and parabolic dunes are associated with the Quindalup Dunes (Churchward & McArthur, 1980) with the Spearwood Dune System consisting of a predominant limestone core with surface yellow sand. The topography of Lake Claremont varies, with the lake mainly flat (elevation of 4-6 m Australian Height Datum (AHD)) in the south and east area of the Spearwood system, with the northwest elevation rising to 14 m AHD in the area of the Quindalup system. Acid sulphate soils have been identified at Lake Claremont but remain stable as determined by ongoing water and soil quality assessments, with pH fluctuations (neutral to strong acidity) considered normal and representative of Perth sandy soils. High nutrient loading and heavy metal contamination across the entirety of Lake Claremont soil types has been identified with the potential to impact aquatic health.

LEGEND

Survey Area

Land System

Quindalup South System

Spearwood System

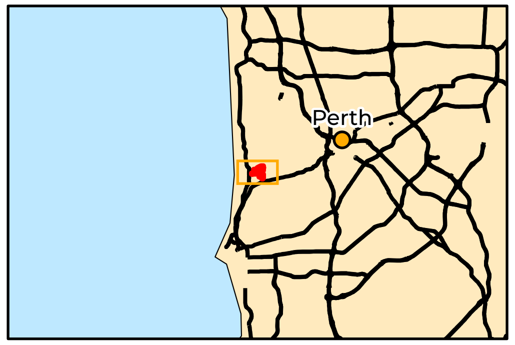
Biologic Environmental

Scale 1:10,000

0 0.1 0.2 0.3 0.4 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator

Created: 23/03/2026



TOWN OF CLAREMONT

Lake Claremont Invertebrate Fauna Survey

Figure 2.1: Land systems of the Survey Area

3 Methods

3.1 Desktop assessment

A desktop assessment comprising of database searches and a literature review was done prior to the field surveys. The purpose of the desktop assessment was to identify fauna from the target bioindicator groups (ants, native bees and aquatic macroinvertebrates), as well as conservation significant and SRE invertebrate taxa potentially occurring in the Survey Area.

3.1.1 Database searches

Six databases were searched for target bioindicator, conservation significant and SRE invertebrate fauna records and any relevant ecological communities, within and surrounding the Survey Area (Table 3.1). A 40 km search radius was applied in the desktop search, with this distance considered an appropriate Biologic standard for assessing invertebrate records relevant to the urban Survey Area. Records of invertebrates from target bioindicator, conservation significant, and SRE groups including aquatic macroinvertebrates, ants, spiders, scorpions, pseudoscorpions, millipedes, centipedes, symphylans, land snails, diplurans, terrestrial isopods, and native bees were extracted and collated. Indeterminate records were excluded, except where generic level characters and distribution information indicated a high likelihood of short-range endemism. Repeat records were consolidated and the most current data was used with consideration for recent updates to specimen identification and SRE status. Where taxonomic identification varied between databases for records with identical WAM registration codes, the WAM identification was used as it was considered the most up-to date. Morphospecies records, other than established WAM morphotypes, were simplified to indeterminate records because non-WAM morphospecies are not comparable to other records and may present a false sense of diversity.

Table 3.1: Details of database searches conducted

Database	Retrieval date	Search area
Atlas of Living Australia (ALA) (2026)	02/02/2026	40 km buffer surrounding the Survey Area
Department of Biodiversity, Conservation and Attractions (DBCA) (2026) Dandjoo Biodiversity Data Repository	02/02/2026	
WAM (2026a) Arachnida and Myriapoda Database	06/02/2026	
WAM (2026b) Crustacea Database	02/02/2026	
WAM (2026c) Insecta Database	30/01/2026	
WAM (2026d) Mollusca Database	06/02/2026	

3.1.2 Literature review

Relevant available literature was reviewed to record previous survey effort and surveyed habitat types present within the Survey Area, and to locate additional records of conservation significant and SRE invertebrate fauna not captured in the database search (Table 3.2). Literature searches included reports within ten years and ~40km from the Survey Area to ensure relevancy.

Table 3.2: Literature sources used for the review

Report Title	Survey Type	Distance from Study Area (km)
Conservation Significant and SRE Invertebrate Fauna		
Bennelongia (2024) Wattle Grove South SRE Invertebrate Fauna Desktop Assessment	Desktop	~24 km
Biologic (2018a) City of Perth Spring Invertebrate Survey	Single season	~5 km
Biologic (2018b) City of Rockingham Spring Invertebrate Survey	Single season	~41 km
Invertebrate Solutions (2018) Desktop Review and Risk Assessment of SRE Invertebrates for the Yanchep Rail Extension, Western Australia	Desktop Risk Assessment	~43 km
Invertebrate Solutions (2019) Conservation Significant and SRE Invertebrate Desktop Habitat Assessment for Thornlie-Cockburn Link Proposal, Perth, Western Australia	Desktop Habitat Assessment	~30 km
Invertebrate Solutions (2019) SRE Invertebrate Desktop Assessment of Lot 102 Farral Rd, Midvale, Western Australia	Desktop	~25 km
Invertebrate Solutions (2020) Baseline SRE and Conservation Significant Invertebrate Survey for the Malaga to Ellenbrook Rail Works, Western Australia	Desktop & Baseline	~35 km
Invertebrate Solutions (2021a) Desktop Review and Impact Assessment of SRE and Conservation Significant Invertebrates for the Byford Rail Extension Project, Western Australia	Desktop & Impact Assessment	~40 km
Invertebrate Solutions (2021b) SRE Invertebrate Assessment of Lots 11 and 74 (Part), Beenyup Rd, Banjup, Perth, Western Australia	Single season	~ 30 km
Invertebrate Solutions (2022) SRE Invertebrate Assessment of Maddington Kenwick Strategic Employment Area (MKSEA), Kenwick, Perth, Western Australia	Desktop & Baseline	~30 km
Pheonix Environmental (2023) SRE and Significant Invertebrate Desktop Assessment for the Garden Street Extension Project	Desktop	~20 km
Targeted Invertebrate Fauna within Survey Area		
Town of Claremont (2016b) Lake Claremont Management Plan 2016-21. Sampling years specified as 2012 and 2014.	Desktop	Within
Lake Claremont Native Bee Survey Nov-Dec 2019 to Jan-Feb 2020 (Prendergast, 2020a)	Targeted	Within

3.1.3 SRE invertebrate fauna status categorisation

The SRE categorisation used in this report follows the Western Australian Museum (WAM) revised classification system for SRE invertebrates, based upon the 10,000 km^2 range criterion proposed by Harvey (2002), and uses three categories (Confirmed SRE, Potential SRE, and Widespread) to describe the degree of certainty with which a species can be considered to be SRE or not (Table 3.3).

Table 3.3: SRE categorisation used by WAM, adapted from Harvey (2002)

Distribution	Taxonomic Certainty	Taxonomic Uncertainty
Species range < 10,000 km^2	**Confirmed SRE** A known distribution of < 10,000 km^2. The taxonomy is well known. The group is well represented in collections and/or has been comprehensively sampled.	**Potential SRE** Patchy sampling has resulted in incomplete knowledge of geographic distribution. Incomplete taxonomic knowledge. The group is not well represented in collections. Any other significant knowledge gaps occur. **SRE Sub-categories may apply:** A: Data Deficient B: Habitat Indicators C: Morphology Indicators D: Molecular Evidence E: Research & Expertise
Species range > 10,000 km^2	**Widespread** A known distribution of > 10,000 km^2. The taxonomy is well known. The group is well represented in collections and/or has been comprehensively sampled.	

Confirmed SRE species are those for which sufficient evidence exists, from both taxonomic certainty and extent of sampling, to confirm that the species is restricted to a range of less than 10,000 km^2, whereas Widespread species are confirmed to have a range greater than 10,000 km^2. For taxa belonging to groups known to include SRE species, unless sufficient evidence exists to denote Confirmed SRE or Widespread status, the default categorisation is Potential SRE. This is usually due to lack of taxonomic knowledge and extensity of sampling.

Potential SRE status is sub-categorised by what information does currently exist about the taxon. Generally, all Potential SRE taxa are considered to be data deficient (sub-category A); however, where there are habitat indicators (B), morphological indicators (C), molecular evidence (D), or general expert knowledge and experience with the taxonomic group (E), there is usually a greater likelihood that the taxon is an SRE, and the more sub-categories that apply, the greater the likelihood.

3.1.3.1 Biologic SRE categorisation: A reviewed approach for Western Australia

Harvey (2002) provided a definition for what qualified an organism for short-range endemic status 24 years ago, with this definition becoming the backbone for assessing whether a taxon should be categorized as SRE or Widespread. This categorization method has been widely used where there was a lack of geographic or collection information. The categorisation framework has provided support for placing a taxon into the Potential SRE category at the order or family level.

The adoption of these categories as part of the EPA fauna guidance for impact assessment, specifically for terrestrial invertebrates, resulted in an increase in invertebrate specimens being collected from many areas throughout Western Australia. As a result, a dedicated collection of terrestrial invertebrates from orders prone to short-range endemism has formed over the last 20 years and greatly enhanced our understanding of which taxa are more likely to be short-range endemics in each group.

In addition, the taxonomy and molecular systematics of many SRE invertebrate groups have been given increasing attention, with many large monographs being produced over the last 20 years (e.g. Car *et al.*, 2019; Castalanelli *et al.*, 2014; Edward & Harvey, 2010; Harvey *et al.*, 2016; Huey *et al.*, 2019; Rix *et al.*, 2018; Rix *et al.*, 2017b; Sato *et al.*, 2018; Whisson *et al.*, 2024). Many consultancies and researchers have collected and sequenced several groups, which has contributed to a greater understanding of whether a group of invertebrates are more or less likely to contain short-range endemics.

Based on the data generated on many of these groups, we have attempted to refine the level of taxonomic certainty for various SRE terrestrial invertebrate groups further. In our assessments, we consider the probability that a specimen collected is going represent an SRE taxon within its taxonomic group. Data and experience have shown that if there is a greater than 50% chance that a specimen collected will represent a short ranging taxon within the taxonomic group, then that taxon will be considered 'Likely SRE'. If the chance of representing a short-range taxon is less than 50% then the taxon will be considered 'Unlikely SRE'. For groups where there is a general lack of knowledge in degree of species diversity, distribution in the landscape or limited records from which to compare, the taxon will be considered Potential SRE (Table 3.4). Further considerations, including the habitat in which a particular specimen was recorded and the known range of a particular taxon (if it appears to be approaching 10,000 km^2) are used on a case-by-case basis to further refine this metric.

Table 3.4: Categorisation of taxa when it is neither a Widespread species nor a Confirmed SRE taxon

Category	Description
Likely SRE	• Taxonomic knowledge of genus level is developed. Taxon is undescribed but has been sequenced multiple times. • Geographic distribution of named species in the genus is demonstrating that most species (more than 50%) or operational taxonomic units (OTUs) defined by molecular sequencing are short ranging.

Category	Description
	• Habitat tends to be highly significant for SRE invertebrate fauna (discrete landscape units).
Unlikely SRE	• Taxonomic knowledge of genus level is developed. Taxon is undescribed but has been sequenced multiple times. • Geographic distribution of named species in the genus is demonstrating that most species/OTUs (more than 50%) are widespread. • Habitat collected in tends to be widespread in the landscape and/or is not significant habitat for SRE invertebrate fauna.
Potential SRE	• Taxon is indeterminate, no morphological or molecular identification has been made past genus or family. • Incomplete taxonomic knowledge at genus level or only family level identification possible. • Incomplete knowledge of geographic distribution, e.g. based on singleton record. • The group is not well represented in collections.

3.1.4 Assessment of Likelihood of Occurrence

The likelihood of occurrence within the Survey Area for bioindicator, conservation significant and SRE invertebrate taxa identified in the desktop assessment was assessed using a decision matrix (Table 3.5). The occurrence assessment was based on known information relating to species distribution, known habitat requirements, and locality records from database searches and previous studies within the desktop search area. The assessment assigned each taxon one of five ratings, ranging from Present to Highly Unlikely to occur (Table 3.5). Taxonomic groups whose primary habitat is restricted will have a lower likelihood to occur than groups who may occupy more widespread habitat, as demonstrated in the differing likelihoods between Habitat available (widespread) and Habitat available (restricted). Whilst this matrix is specific to SRE invertebrate fauna, there is relevancy for other groups including bioindicator and native bee fauna with known information on species biology and ecological requirements considered during assessment.

Table 3.5: Significant and SRE invertebrate species likelihood of occurrence in the Survey Area

		Habitat		
		Previously recorded in widespread habitat	**Previously recorded in restricted habitat**	**Habitat not present**
Range	**Recorded within Survey Area**	Recorded	Recorded	Recorded
	Recorded within < 2 km	Highly Likely	Likely	Possible
	Recorded within 2-5 km	Likely	Possible	Possible
	Recorded within 5-20 km	Possible	Possible	Unlikely
	Recorded > 20 km	Possible	Unlikely	Highly Unlikely

3.2 Field survey methods

The Survey Area is approximately 70 hectares in size and covers terrestrial and aquatic habitats (Figure 1.1). A total of seventeen terrestrial sites were visited and assessed for focal invertebrate group habitat suitability, with 16 of these sites selected for sampling ant and SRE invertebrate fauna based on the landform and vegetation types represented within the Survey Area (Figure 3.1). Sampling for SRE taxa aligned with recommendations by the EPA (2016b) technical guidance to include the targeting of sheltered habitats and microhabitats, and also isolated habitat. Where suitable, ant and SRE sampling sites were combined for efficiency. Native bee sampling was carried out at 16 sites selected based on the availability of flowering plants and to ensure geographical spread and cover of different vegetation types. Fifteen of the sites were sampled by sweep netting, and two sites were sampled by vane trapping (Figure 3.1), with one the sites sampled by both methods (Figure 3.1). Aquatic macroinvertebrates were sampled at four sites with consideration to safety, access, and representation of key aquatic microhabitats of the Survey Area (Figure 3.1).

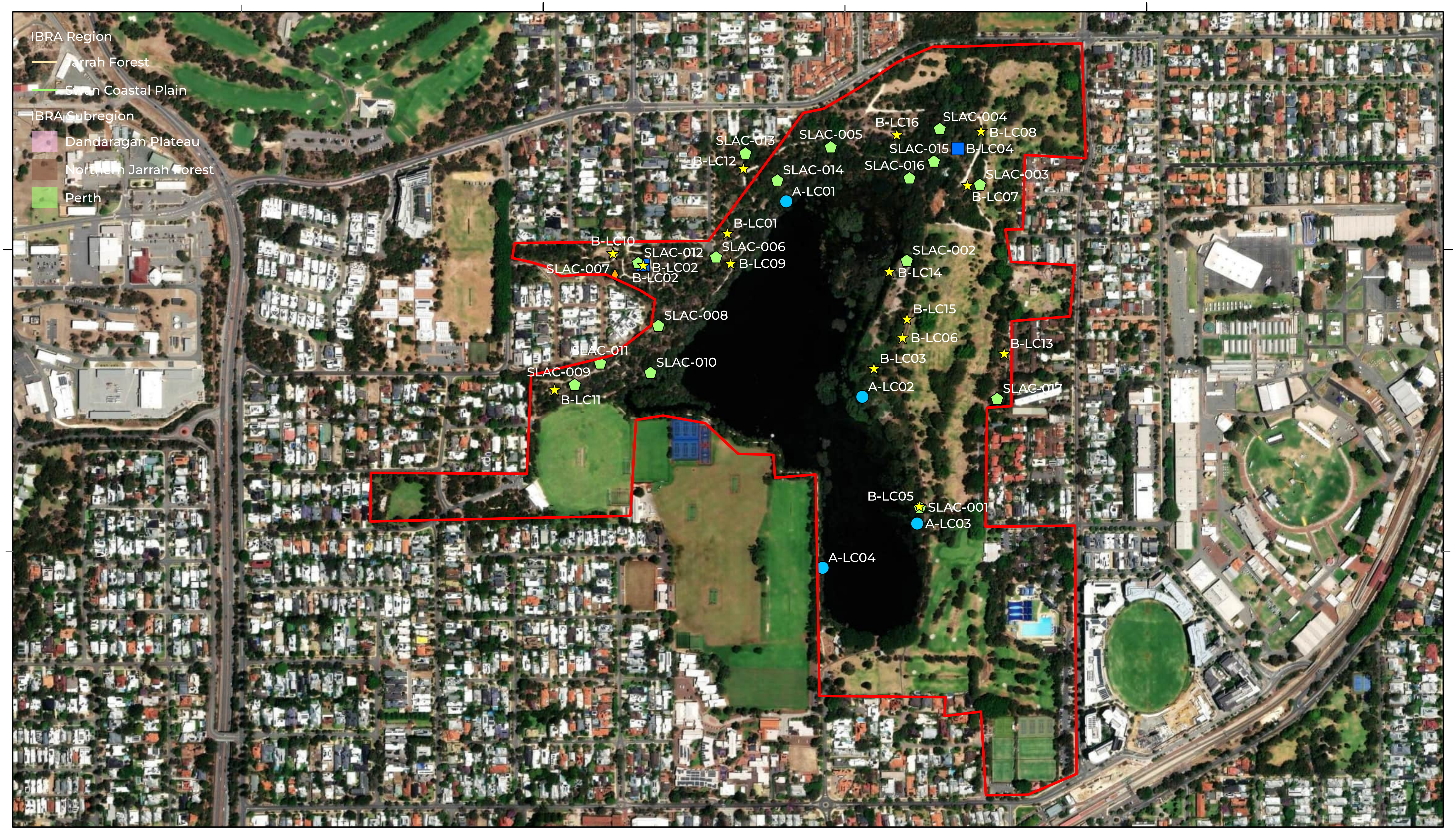
3.2.1 Survey timing and weather

The Lake Claremont invertebrate survey consisted of a single season survey undertaken between 27 November and 16 December 2025. Vane trapping for native bees was the only sampling technique that required traps be deployed and left on-site in the Survey Area for the duration of the survey (~ 2 weeks).

The minimum and maximum temperatures 12-months prior (recorded at Swanbourne station #009215) were some-what comparable to long-term averages, although March to June temperatures leading up to the survey were higher (Figure 3.2).

Leading up to the survey, the spring was very wet, with total rainfall much higher than the long-term averages. No rainfall was recorded during active sampling for the survey, but rain did occur during the survey period.

The timing of the survey was chosen, where possible, to maximise sampling in optimal conditions, particularly for native bee fauna as activity can be adversely affected by lower temperatures, rain, and windy conditions. Weather conditions during the survey were representative of the November monthly average for Lake Claremont, with a temperature minimum of 12.7 °C and a maximum of 22.5 °C recorded across the survey. Wind speeds during sweep netting were generally low ranging from S 15 km/h (9 am) and SSW 22 km/h (3 pm).



LEGEND

Survey Area

Vane Trap Site

Sample Sites

Habitat Assessment Only Site

Litter Sample Site

Aquatic Sampling Site

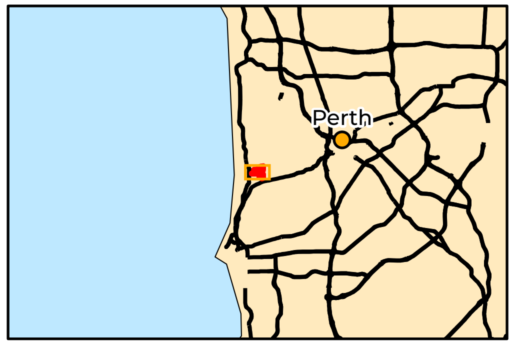
Sweep Netting Site

Biologic Environmental

Scale 1:6,000

0 0.1 0.2 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 17/07/2026



TOWN OF CLAREMONT

Lake Claremont Invertebrate Fauna Survey

Figure 3.1: Survey sampling sites

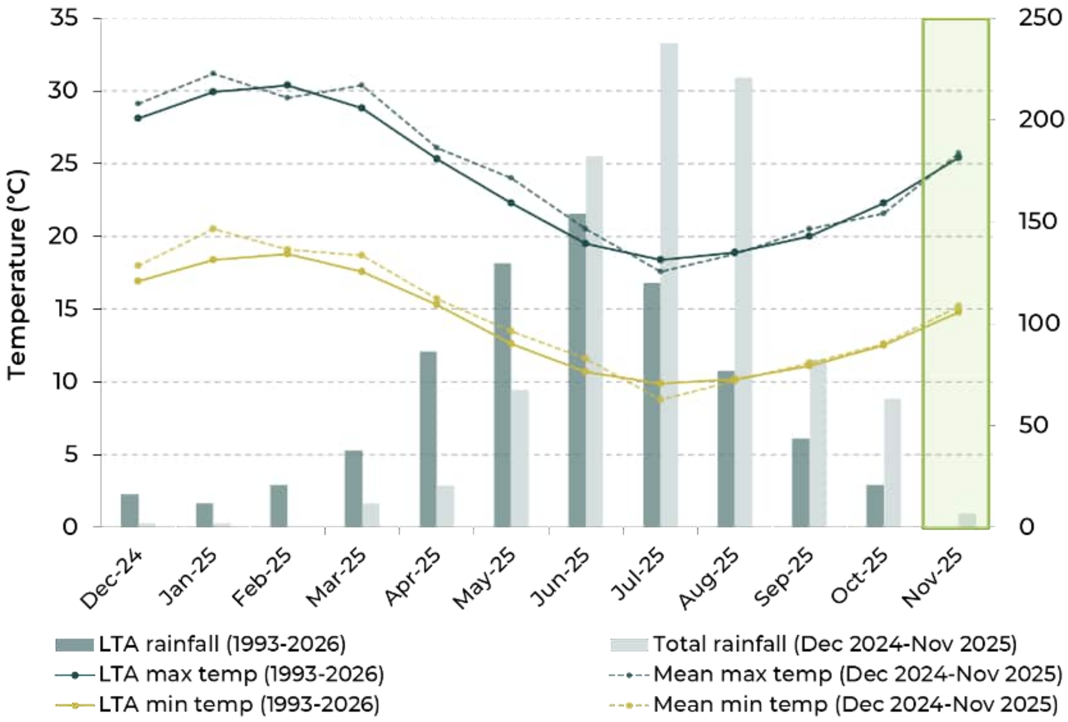


Figure 3.2: Long-term average and total monthly rainfall and long-term and monthly average maximum and minimum temperatures recorded at Swanbourne station (#009215; BoM, 2026). Green shading indicates the survey timing.

3.2.2 Survey team and licensing

Invertebrate fauna sampling for the Lake Claremont project was conducted under a DBCA Regulation 27 "Fauna Taking (Biological Assessment) License" (BA27001389) and a DBCA "Authorisation to take or disturb threatened species" (TFA 2526-0092), issued to Jessica Delaney (Appendix A). The assessment was conducted by Principal Ecologists Dr Nihara Gunawardene, Dr Juliana Pille Arnold (bees), Kim Nguyen, Senior Zoologist Morgan Lythe, Senior Taxonomist Dr Christopher Taylor, Zoologist Aimee Carpenter, and Aquatic Ecologists Lily Carson and Shae Surman (Table 3.6). All field members have extensive experience with invertebrate fauna survey in the region.

Table 3.6: Field survey and lab personnel experience

Personnel	Project involvement	Experience
Terrestrial Invertebrate Fauna		
Dr Nihara Gunawardene *Principal Ecologist*	• Project Manager • Survey and reporting design • Field survey • Reporting QA	23 years
Dr Juliana Pille Arnold *Principal Ecologist*	• Survey and reporting design • Reporting • Data management and analyses • Field survey	18 years

Personnel	Project involvement	Experience
	• Invertebrate specimen identification	
Dr Christopher Taylor *Senior Taxonomist*	• Invertebrate specimen identification • Data management and collation	20 years
Morgan Lythe *Senior Zoologist*	• Survey and reporting design • Reporting • Field survey	10 years
Aimee Carpenter *Zoologist*	• Field survey	5 years
Kim Nguyen *Principal Aquatic Ecologist*	• Reporting	14 years
Lily Carson *Aquatic Ecologist*	• Field survey • Aquatic macroinvertebrate identification	3 years
Shae Surman *Aquatic Ecologist*	• Reporting • Aquatic macroinvertebrate identification	2 years

3.2.3 Habitat assessment – Terrestrial invertebrates

Habitat assessments for terrestrial invertebrates were undertaken at seventeen sites by observation of the physical characteristics of the site. The broad habitat type in which each site occurred was observed and any site-specific landform characteristics were recorded. Physical characteristics of relevance to bioindicator, conservation significant and SRE invertebrate fauna were recorded, including major vegetation type and structure, vegetation condition, leaf litter cover, shade cover, and evidence of disturbance.

The suitability of each site, specifically for conservation significant and SRE invertebrate fauna, was assessed and considered site isolation, protection, and complexity as indicators of suitability. Each site was designated as being either High, Moderate or Low suitability for conservation significant and SRE invertebrate fauna (Table 3.7).

Table 3.7: Conservation significant and SRE invertebrate fauna habitat suitability assessment factors

Suitability	Requirement
High	A habitat with high isolation (e.g., mountaintops, islands, remnant bushland) will likely be significant for SRE invertebrates as such fauna are usually characterised by limited dispersal ability. Protection from exposure and disturbance can support a variety of invertebrate species. Habitat complexity, such as leaf litter volume, rocky substrates, loose rocks and crevices, vegetation variation and soil depth and structural variation drive species richness and often abundance.
Moderate	Long mountain ranges and large plateaus with undulating hills may be isolated in a larger landscape scale and can support unique species.

Suitability	Requirement
	Moderate protection in shallow gullies and hillcrests/ hillslopes where rocky crevices may offer some protection from the elements. Moderate complexity is often found in areas of vegetation and leaf litter.
Low	No isolation occurs in habitats such as sandy/stony plains. These areas are often vast and continuous through a landscape with no barriers to dispersal for species adapted to occurring. Very little protection from exposure and disturbance from the elements occurs in these plains and drainage areas. Low complexity characterizes many plains and drainage areas, areas dominated by invasive plant species or prone to disturbance.

Similar metrics were used to assess habitat suitability for the two terrestrial bioindicator fauna groups (ants and native bees), with additional considerations applied for taxon-specific habitat requirements. Ant and native bee habitat was assessed based on major vegetation type and structure, vegetation condition, leaf litter cover, shade cover, and evidence of disturbance, with additional considerations for presence of flowering plants, substrate type, and impervious surface cover, such as roads and concrete foot paths.

Sites assessed for ant and SRE habitat suitability were not evaluated for native bee fauna, as habitat suitability parameters differ for bees. Habitat suitability for native bees is largely influenced by the availability of flowering plants, vegetation structure, and nesting substrates (e.g. bare soil and dead wood). Consistent with standard practice, sampling sites for bees in this survey were selected based on the presence of flowering resources. A more comprehensive assessment would be required to evaluate habitat suitability for native bees across the broader Survey Area.

3.2.4 Habitat assessment – Aquatic macroinvertebrates

Four replicate sites (LC01 to LC04) were sampled in the Survey Area targeting aquatic habitat (Figure 3.1). Habitat characteristics were recorded at each site to provide information on the variability of aquatic habitat present, and to assist in explaining patterns in aquatic faunal assemblages. Habitat characteristics recorded included percent cover by inorganic sediment, submerged macrophyte, floating macrophyte, emergent macrophyte, algae, large woody debris (LWD), detritus, roots, and trailing vegetation. Substrate composition included percent cover by bedrock, boulders, cobbles, pebbles, gravel, sand, silt, and clay. Maximum water depth was measured with a graduated pole.

Lake Claremont was classified using the Interim Australian National Aquatic Ecosystem (ANAE) Classification Framework, as described in Module 2 of the nationally-recognised Aquatic Ecosystems Toolkit (Aquatic Ecosystems Task Group, 2012). The ANAE Framework is designed to classify aquatic ecosystem and habitat types within a regional and/or landscape setting, using an attribute-based approach. For lacustrine (lake) systems, these attributes include:

- Landform (e.g. upland or lowland)
- Soil/substrate (i.e. soil and substrate composition)
- Vegetation/fringing vegetation
- Water source (e.g. surface water or groundwater)
- Water type (e.g. freshwater, brackish or saline)
- Water regime (e.g. permanent, seasonal, a-seasonal)

Within each attribute, the ANAE Framework provides a standard suite of metrics which can be used to classify aquatic ecosystems. In some cases, additional metrics based on Biologic's field observations were utilised in the classification.

3.2.5 Water quality

In situ water quality was measured at each site using a portable Hanna multiparameter. Parameters recorded were pH, electrical conductivity (EC), dissolved oxygen (DO), total dissolved solids (TDS), salinity (parts per thousand; ppt), oxidation reduction potential (ORP) and water temperature (°C).

Water quality data were compared against the national default guideline values (DGVs) for the protection of aquatic ecosystems in the South West of Western Australia (ANZG, 2018). Electrical conductivity (EC), pH and DO were compared against stressor DGVs for slightly-to -moderately disturbed ecosystems in south-west Australia.

3.2.6 Sampling techniques

3.2.6.1 Ant Fauna

Ants were sampled at 16 sites across the Survey Area and included all SRE invertebrate sampling sites (Figure 3.1). Sampling was undertaken between 27th November 2025 and 16th December 2025. Leaf litter sampling was selected as the most appropriate method as it could be used in conjunction with SRE sampling, and minimised potential limitations caused by animal ethics review and community safety issues associated with other trapping techniques. As per SRE leaf litter sampling, ~15 cm of surface leaf litter and soil were taken per site and coarse sieved to remove large twigs and leaves, with the resulting substrate collected in a cloth bag. Samples were transported to the Biologic laboratory and placed in Winkler sacks (Agosti & Alonso, 2000; Bestelmeyer *et al.*, 2000) a standard method for capturing litter dwelling ants. The Winkler sacks were suspended for 7 days to allow for maximum capture of ant specimens. All specimens were preserved in 100% ethanol.

3.2.6.2 Native bee fauna

The native bee assessment was undertaken at 16 sites within the Survey Area (Figure 3.1) using a combination of complementary survey methods consistent with current best-practice approaches for bee sampling (Levenson *et al.*, 2024; Packer & Darla-West, 2021;

Tronstad *et al.*, 2022). Bees were surveyed using two standardised methods: passive collection via pollinator vane traps and active collection using sweep netting (Plate 3.1). The use of both passive and active methods is recommended to maximise detection of different bee taxa, as reliance on individual techniques may produce incomplete and biased results (Packer & Darla-West, 2021; Tronstad *et al.*, 2022)

A pair of blue and yellow UV-reflective pollinator vane traps (SpringStar Inc., Woodville, USA) was deployed at two of the 16 survey sites (Figure 3.1). Each trap consisted of ultraviolet-reflective coloured plastic cross-vanes fitted above a funnel attached to a collection jar containing 100 mL of 80% propylene glycol as a preservative. Traps were deployed on 28 November 2025 and retrieved on 10 December 2025 (approximately two weeks). Each trap was suspended from a wooden pole at a height of approximately 1.5 m and spaced approximately 3 m apart (Plate 3.1).

Plate 3.1: Bee collection methods: blue and yellow vane traps deployed in the Survey Area (left); sweep netting (right).

Sweep net sampling of native bees was undertaken at 15 sites (Figure 3.1) across four days (28 November, 02 December, 10 December and 16 December) during peak bee activity (10:00–15:00) to maximise capture success. This active method is particularly effective for recording plant–bee interactions and targeting species that may be underrepresented in passive traps (Tronstad *et al.*, 2022). Survey dates were chosen based on favourable weather conditions for bee sampling (warm temperatures and light winds). At each site, flowering plants within an area of approximately 50 × 50 m were observed for one hour, with 10 minutes of sampling time spent per flowering plant species. Native bees visiting flowers were collected using a sweep net, and the link between the bee specimen and the plant visited was recorded. Where non-native European honeybees (*Apis mellifera*, Apidae) were present, the number of interactions with flowering plants was recorded (estimated sightings per plant species), but specimens were not collected to maximise native bee collections. Specimens were stored individually in screw top vials, submersing them in ethanol (90% concentration) to euthanise and preserve them for later identification.

Plant–bee associations were recorded in the field to characterise flower visitation patterns. Voucher specimens of plant species visited by bees were collected, pressed, and dried using standard herbarium techniques, and subsequently identified by Biologic botanists.

Flower visitation patterns were determined by recording plant-bee associations in the field. Voucher specimens of plant species visited by bees were collected to assist plant identification. These specimens were pressed and dried following standard techniques for plant preservation and subsequently identified in the lab by Biologic's botanists.

All analyses were conducted in R (R Core Team, 2025). Flower visitation patterns for native and feral bees were pooled and analysed by constructing plant-pollinator networks. Individual plant-bee observations were summed to create an interaction matrix with bee species in columns and plant species in rows, comprising a quantitative bipartite interaction network (site-level metanetwork). Interaction data from co-occurring species were used to infer resource specialisation (Poisot *et al.*, 2012) and potential floral resource overlap between native and non-native bees. Networks were constructed using the *bipartite* (Dormann *et al.*, 2019), *igraph* (Csardi & Nepusz, 2006), *tidygraph* (Pedersen, 2024), and *ggraph* (Pedersen, 2025) packages. Interaction data were converted from a plant × bee matrix to a weighted bipartite graph. Plant and bee nodes were manually arranged to maximise readability, with plant species displayed above bee species. Edge widths were proportional to the number of recorded interactions, and edge colours corresponded to the associated plant species. Species accumulation curves were generated using the *vegan* package (Oksanen *et al.*, 2024), with visualisation performed in *ggplot2* (Kahle & Wickham, 2013).

3.2.6.3 Aquatic macroinvertebrate fauna

Macroinvertebrates were sampled at four sites (Figure 3.1) within the Lake Claremont waterbody, using a recognised 'kick-sweep' net method to ensure a representative sample of invertebrates were collected (Gooderham & Tsyrlin, 2002; Horwitz *et al.*, 2009; Smith *et al.*, 1999). Sampling for aquatic macroinvertebrates occurred between 27th November 2025 and 16th December 2025. All aquatic microhabitats within each site were sampled, including open water, riffle zones, macrophyte beds, LWD, detritus and shoreline. The 'kick-sweep' method involved submerging a 250 µm mesh D-frame dip net into the water at each site and vigorously disturbing sediments and benthic habitat to cause a plume that could then be swept for specimens (Plate 3.2). The contents of the sweep net were then elutriated and washed through a 250 µm sieve to remove fine sediment, with coarse leaf litter and other debris removed by hand. Each sample was reserved in 95% ethanol in the field and taken back to the Biologic laboratory for processing. Traditional water quality parameters including pH, electrical conductivity (EC; µS/cm), dissolved oxygen (DO; % and mg/L) and water temperature (◦C) was measured using a portable multi-meter.

Plate 3.2: D frame dip net used for aquatic macroinvertebrate sampling in the Survey Area.

3.2.6.4 SRE invertebrate fauna

SRE invertebrates were sampled at 16 sites across the Survey Area (Figure 3.1). Sampling techniques included active foraging of rocks, trees and debris, leaf litter and soil sifting, and ground searches for spider and scorpion burrows. The target SRE taxonomic groups were arachnids (spiders, scorpions, and pseudoscorpions), myriapods (millipedes, centipedes, and symphylans), land snails, and terrestrial isopods. The sampling methods used were in accordance with EPA guidelines (EPA, 2016b), and are detailed below:

Active foraging

Active foraging was undertaken at each sampling site for up to two person hours and involved various techniques, depending on the characters of the site:

- Presence of rocky outcropping and loose rocks: suitably sized rocks were overturned, and rocky microhabitats (cracks, crevices, and boulders) were actively searched for rock-dwelling species (selenopid spiders, pseudoscorpions, scorpions, centipedes, millipedes, isopods, and snails).
- Presence of woody debris: larger logs and woody debris were overturned and actively searched for detritivore species (millipedes and isopods).
- Presence of trees and larger vegetation: trees such as *Eucalyptus, Corymbia* and *Allocasuarina* were actively searched, including underneath bark and in tree hollows, for bark dwelling species (scorpions and pseudoscorpions).
- Presence of flat ground: active searching of open ground and beneath leaf litter was conducted for burrow-dwelling species (mygalomorph spiders and scorpions).

Leaf litter and soil sifting

Leaf litter, humus, and soil (to approximately 15 cm below surface where possible) was placed in a sieve at the site and agitated to sift invertebrates into a white tray. The sifted litter was then thoroughly searched for target species such as pseudoscorpions, springtails, millipedes, snails, and isopods. Up to eight sifts (~ 3L of material) were conducted at each site, providing enough leaf litter and humus was available.

3.2.7 Specimen preservation and identification

All invertebrate specimens collected across the three targeted faunal groups (ants, native bees and aquatic invertebrates) were identified to the lowest taxonomic resolution possible (genus or species level in most cases) using a dissecting microscope and existing published keys and literature. Ants were recorded as presence/absence due to their tendency to be clumped over space and time due the fact that they exist in the environment as a colony; this can skew their abundances in any one sample if the sample was collected near a colony. All sorting and identification of specimens was conducted in-house at Biologic by invertebrate taxonomists Dr Christopher Taylor and Morgan Lythe using available keys and expertise.

Native bee specimens collected via sweep net were stored individually in screw-top vials containing 90% ethanol. Bee specimens collected via vane trapping were drained from each trap, washed to remove the propylene glycol, preserved in ethanol 100%, and sorted in the laboratory for identification. Bee specimens were identified to the lowest possible taxonomic level by Dr Christopher Taylor and Dr Juliana Pille Arnold using available published keys, digital data repositories (Atlas of Living Australia - ALA, Australian Pollinators – PaDIL, Australian Faunal Directory), and comparisons to reference collections held by the WAM and J. Pille Arnold.

A $\log_{10}$ class abundance measure was applied aquatic macroinvertebrate fauna during sorting and identification due to the abundance and/or smaller size of specimens within these groups. All specimens were identified to the lowest taxonomic level where possible by aquatic ecologists Lily Carson and Shae Surman using available keys.

4 Results

4.1 Desktop assessment

4.1.1 Ant fauna

The database search returned 246 ant taxa from 54 genera within 40 km of the Survey Area. These taxa were predominantly represented by the widespread genera *Camponotus*, *Iridomyrmex*, *Lioponera*, and *Myrmecia* (Appendix B). While there are no Australian ant species of conservation significance in the conventional sense, there exists invasive species that are known to have a negative environmental impact, especially on native ant species. Six ant speices are recognised as serious invasive species in Australia (Lach, 2008):

- Yellow crazy ant (*Anoplolepis gracilipes*)
- Tropical fire ant (*Solenopsis geminata*)
- African big-headed ant (*Pheidole megacephala*)
- Singapore ant (*Monomorium destructor*)
- Red imported fire ant (*Solenopsis invicta*)
- Argentine ant (*Linepithema humile*)

Four of these six invasive species were recorded within 40 km of the Survey Area, with *Linepithema humile, Monomorium destructor* and *Solenopsis geminata* considered Possible to occur, and *Pheidole megacephala* considered Likely to occur (Figure 4.2).

Of the remaining 242 ant taxa, 17 were considered Highly Likely to occur in the Survey Area, 69 considered Likely, and the remaining 156 taxa considered Possible to occur. Only two records were returned from within the Survey Area and were not exclusive to Lake Claremont. These few records are likely a reflection of the lack of targeted ant surveys on the Swan Coastal Plain in general rather than an absence of ant taxa from the Survey Area.

4.1.2 Native bee fauna

The database search returned 149 native bee taxa from all five families in Australia (including the rare Stenotritidae) recorded within 40 km of the Survey Area (Appendix C). A previous targeted native bee survey within the Survey Area over a longer survey period (Nov-Dec 2019 and Jan-Feb 2020) identified 44 taxa across four families and twelve genera, with some of these species being' considered possible specialists of native flora groups (unpublished report by Prendergast, 2020a). These records were included in the desktop search (Appendix E). There are currently six priority bee species listed in Western Australia:

- *Neopasiphae simplicior* (DBCA & EPBC Critically Endangered)
- *Leioproctus* (Andrenopsis) *douglasiellus* (DBCA & EPBC Critically Endangered)
- *Hesperocolletes douglasi* (DBCA & EPBC Critically Endangered)

- *Glossurocolletes bilobatus* (DBCA Priority 2)
- *Leioproctus* (Colletopsis*) contrarius* (DBCA Priority 3)
- *Hylaeus* (Sphaerhylaeus) *globuliferus* (DBCA Priority 3).

All six priority species were recorded within 40 km of the Survey Area (Figure 4.3). There is very limited information on the distribution and biology of these species, however, based on the information available, *N. simplicior* and *L. douglasiellus* seem to be associated with food-plants restricted to clay pans, a habitat type that is not present in the Survey Area. Therefore, their likelihood of occurrence is low (Unlikely). The closest record of *N. simplicior* to the Survey Area is ~15 km and *L. douglasiellus* ~16 km (Appendix C).

Hesperocolletes douglasi is a very rare species with only two specimens ever collected over an 80-year period despite extensive searching by J. Pille Arnold during her PhD and ongoing searches being carried out by Terry Houston at the WAM. The type specimen, a male, was collected in Rottnest Island in 1938, and a female specimen was collected by J. Pille Arnold in Muchea in 2015 (Pille Arnold *et al.*, 2019), with this record ~15 km from the Survey Area (Appendix C). The species is likely a generalist flower visitor, however given its rarity, the likelihood of occurrence in the Survey Area is Unlikely.

The closest record of *Glossurocolletes bilobatus* to the Survey Area is ~19.5 km and as such, it is Unlikely to occur. *Leioproctus contrarius* has previously been collected in Murdock, Bullsbrook, Moore River National Park, and Wanneroo with the closest record ~11 km from the Survey Area (Appendix C). Past assessments and surveys within 40 km of the Survey Area (Table 3.2) support that the occurrence of *L. contrarius* is considered Possible. *Hylaeus globuliferus* is considered a Proteaceae specialist and has been recorded in several locations across the Swan Coastal Plain, however, as the closest record to the Survey Area is ~31 km it is Unlikely to occur at Lake Claremont.

4.1.3 Aquatic invertebrate fauna

4.1.3.1 Aquatic macroinvertebrates

The database search gathered aquatic invertebrate taxa from within 40km of the Survey Area. A total of 409 invertebrate taxa were extracted, of which six were conservation significant taxa, and ten were exotic taxa. Conservation significant and exotic taxa are summarised in Table 4.1, and taxa richness of all aquatic invertebrates recorded form the database search are summarised in Table 4.2.

Table 4.1: Conservation significant aquatic invertebrates within 40km of the Survey Area

Higher taxon	Taxon	Conservation status	Exotic
BIVALVIA			
Hyriidae	*Westralunio carteri*	VU (DBCA, EPBC, IUCN)	N/A
BRANCHIOPODA			
Artemiidae	*Artemia sp.*	N/A	Yes
GASTROPODA			
Glacidorbidae	*Glacidorbis occidentalis*[1]	P3 (DBCA) VU (IUCN)	N/A
Lymnaeidae	*Lymnaea stagnalis*	N/A	Yes
	Pseudosuccinea columella	N/A	Yes
	Stagnicola palustris	N/A	Yes
	Racesina cf. luteola	N/A	Yes
Planorbidae	*Helisoma cf. anceps*	N/A	Yes
	Planorbis cf. corneus	N/A	Yes
	Planorbella cf. duryi	N/A	Yes
MALACOSTRACA			
Atyidae	*Caridina indistincta*	N/A	Yes
Parastacidae	*Cherax destructor*	VU (IUCN)[2]	Yes
ODONATA			
Argiolestidae	*Archiargiolestes parvulus*	NT (IUCN)	N/A
Corduliidae	*Lathrocordulia metallica*	VU (IUCN)	N/A
Gomphidae	*Armagomphus armiger*	VU (IUCN)	N/A
Synthemistidae	*Archaeosynthemis spiniger*	VU (IUCN)	N/A

Table 4.2: Taxa richness of aquatic invertebrates within 40km of the Survey Area

Taxonomic Group	Common Name	Taxa richness
Crustacea	Crustaceans	71
Arachnida	Arachnids/Mites	23
Collembola	Springtails	1
Insecta	Insects	263
Annelida	Segmented worms	5
Cnidaria	Hydra	1
Mollusca	Molluscs	32

[1] Highly restricted to intermittent freshwater streams within Jarrah forest, highly unlikely to occur in lowland water features such as Lake Claremont (Bunn *et al.*, 1989)
[2] Not locally conservation significant owing to exotic status

Taxonomic Group	Common Name	Taxa richness
Nematomorpha	Horsehair worms	2
Porifera	Sponges	1
Rotifera	Rotifers	10
Total richness of aquatic invertebrates		**409**

4.1.4 SRE invertebrate fauna

The database search gathered SRE and conservation significant invertebrate records from within 40 km of the Survey Area. A total of 223 invertebrate taxa were extracted, including 76 indeterminate records (Appendix D). These were narrowed down to taxa that are Confirmed SRE and conservation significant only (Table 4.3, Figure 4.1). Most records were of arachnids; namely mygalomorph spiders, jumping spiders, and scorpions. Twenty-seven taxa are Confirmed SRE, including ten mygalomorph spiders, two jumping spiders, one scorpion, three isopods, seven millipedes, three land snails, and one velvet worm. One of these species is also considered conservation significant, the mygalomorph spider *Euoplos inornatus* (DBCA P3). Two Widespread taxa were also of conservation significance, the Priority 2 mygalomorph spider, *Idiosoma* sigillatum, and the Priority 4 moth species, *Synemon gratiosa*. The remaining taxa are considered Likely (76 taxa), Potential (34), Unlikely (34) or Widespread (52) based on the records available and knowledge of higher taxonomy where species designation is indeterminate.

Table 4.3: Highly Likely to occur Confirmed SRE taxa within 40 km of the Survey Area recorded from the desktop assessment

Higher taxon	Taxon	SRE status	Within 2km	Likelihood of occurrence
Anamidae	*Teyl* \`sp. WAM-MYG241\`	Confirmed	X	Highly Likely
Idiopidae	*Idiosoma* \`sp. WAM-MYG187\`	Confirmed	X	Highly Likely
Salticidae	*Maratus clupeatus*	Confirmed	X	Highly Likely
Paradoxosomatidae	*Antichiropus whistleri*	Confirmed	X	Highly Likely
Bothriembryontidae	*Bothriembryon indutus*	Confirmed	X	Highly Likely
	Bothriembryon serpentinus	Confirmed	X	Highly Likely
Peripatopsidae	*Occiperipatoides gilesii*	Confirmed	X	Highly Likely

The likelihood of occurrence for Confirmed SRE or conservation significant species identified in the desktop assessment was measured using the decision matrix found in Section 3.1.4, which takes into consideration proximity to the Survey Area and the extent of habitat in which these taxa occur. The likelihood of occurrence analysis found that seven Confirmed SRE taxa are considered Highly Likely to occur, including two mygalomorph spiders, one jumping spider, one millipede, two land snails, and one velvet worm (Table 4.3) The conservation significant *Idiosoma sigillatum* (DBCA P2) was recorded within 2 km of the

Survey Area and is also considered Highly Likely to occur as a Widespread taxon. Three Confirmed SRE taxa were considered Likely to occur in the Survey Area, including two mygalomorph spiders and one millipede which were found within 5 km of the Survey Area (Table 4.3) All remaining conservation significant and Confirmed SRE taxa recorded in the desktop assessment are considered Possible to occur and were recorded > 5 km from the Survey Area (Table 4.3).No recorded taxa were found exclusively within the Survey Area.

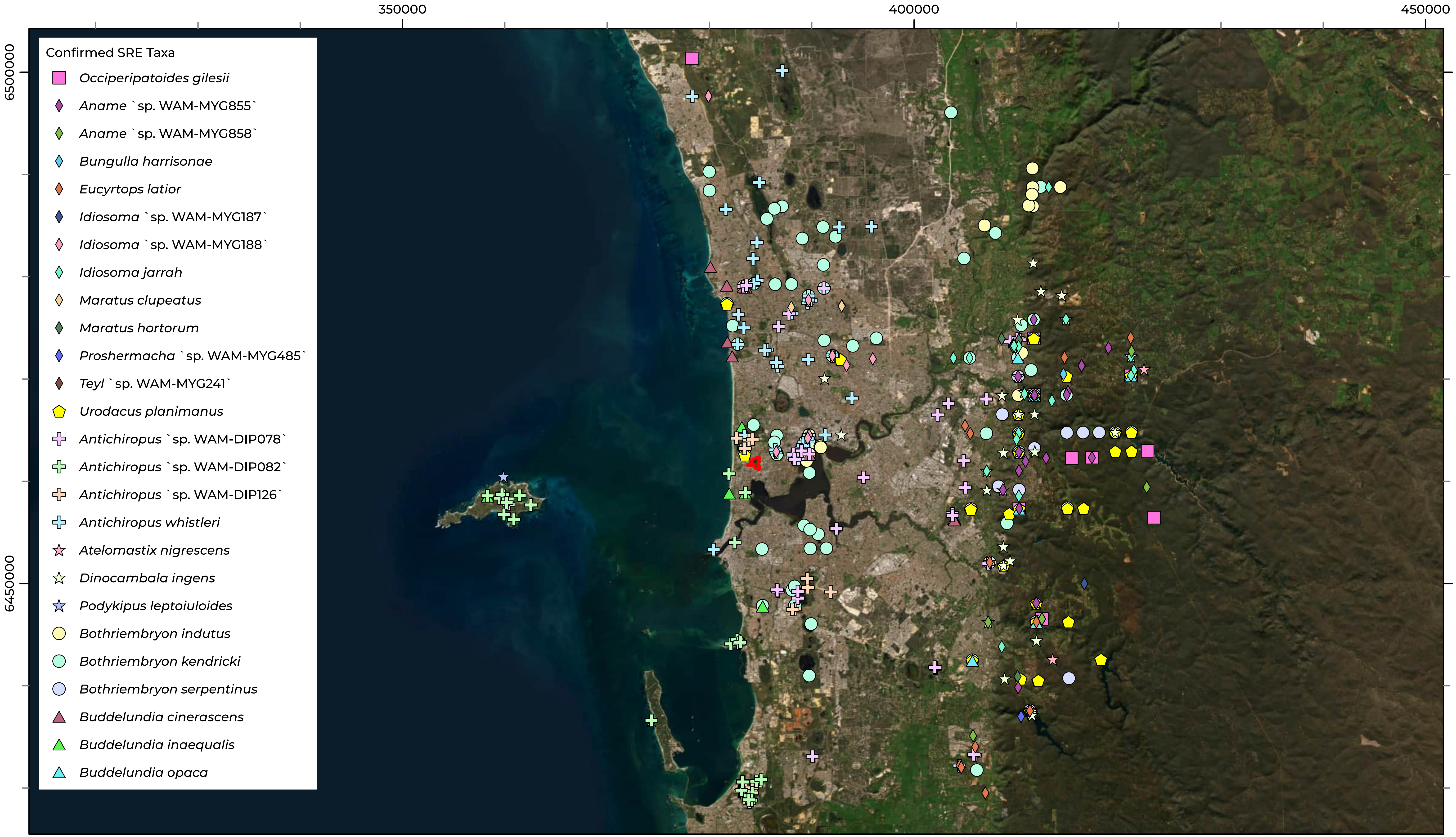
4.1.5 Previous surveys within the Survey Area

Few standardised invertebrate surveys publicly exist for the Lake Claremont Survey Area, with most records a result of 'citizen scientists' uploading invertebrate sightings to public, open-source platforms such as iNaturalist Available studies within the Survey Area include a terrestrial desktop study and aquatic invertebrate surveys (2012 and 2014) by the Town of Claremont (2016b), and a native bee survey across the summer 2019-2020 season (2020a) (Table 3.2).

The desktop study and aquatic invertebrate surveys were incorporated in the Lake Claremont Management Plan 2016-2021 (Town of Claremont, 2024). Of the ~42 terrestrial invertebrate taxa identified by the Town, there were no records of ant or native bee taxa. The Potential occurrence of the Priority 4 Graceful Sun Moth (*Synemon gratiosa*) was noted within the Survey Area, with the lifecycle of this species dependent on native *Lomandra* species.

Aquatic invertebrate specimens were identified from across 43 families and 66 genera with species level identification predominantly limited to Insecta taxa only.

The native bee survey carried out between November 2019 and February 2020 identified 44 native bee taxa from across four families and twelve genera, revealing a diverse bee assemblage. The occurrence of the kleptoparasite native bee *Coelioxys froggatti* was recognised as an important finding as the presence of this species may indicate a healthy population of host Megachilid bees, many of which are generalist pollinators of native plants.



LEGEND

Survey Area

Biologic Environmental

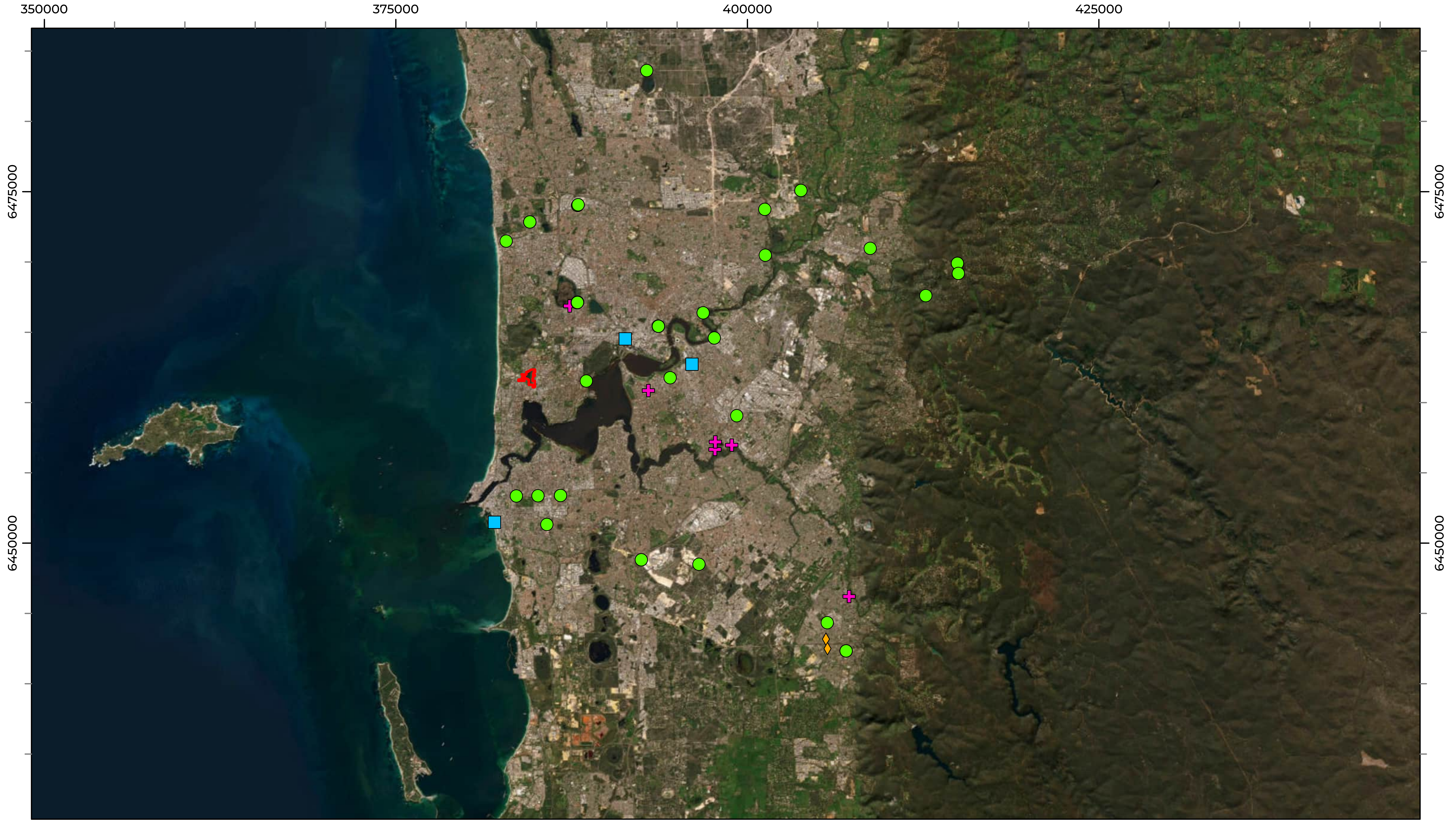
Scale 1:350,000

0 2 4 6 8 10 12 14 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/03/2026

TOWN OF CLAREMONT
Lake Claremont Invertebrate Fauna Survey

Figure 4.1: Confirmed SRE taxa within 40 km of the Survey Area



LEGEND

Survey Area

Invasive Ant Species

Linepithema humile

Monomorium destructor

Pheidole megacephala

Solenopsis geminata

Biologic Environmental

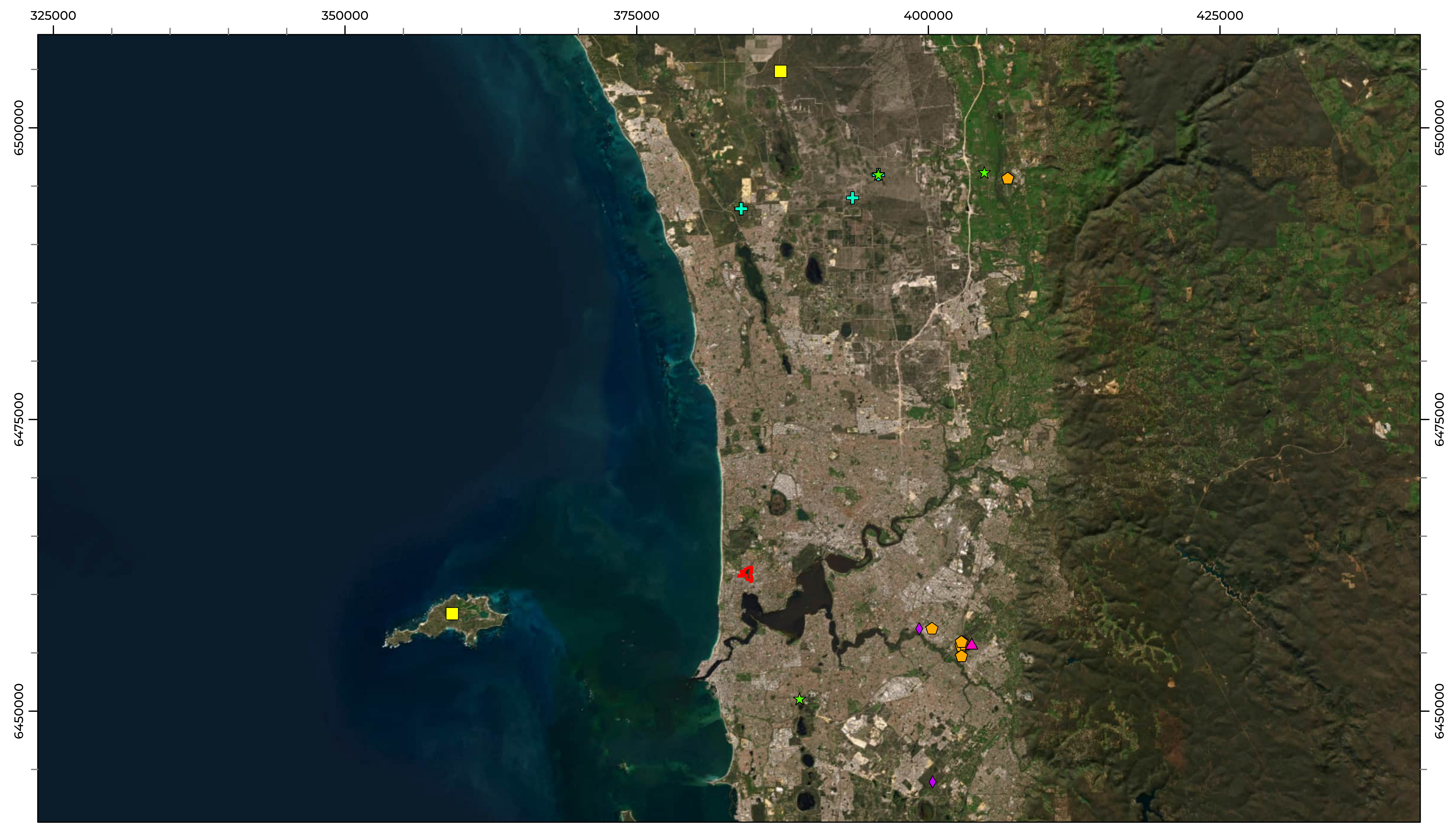
Scale 1:250,000

0 2 4 6 8 10 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/03/2026

TOWN OF CLAREMONT
Lake Claremont Invertebrate Fauna Survey

Figure 4.2: Invasive ant taxa within 40 km of the Survey Area



LEGEND

Survey Area

Native Bee Records

- *Glossurocolletes bilobatus*
- *Hesperocolletes douglasi*
- *Hylaeus globuliferus*
- *Leioproctus contrarius*
- *Leioproctus douglasiellus*
- *Neopasiphae simplicior*

Biologic Environmental

Scale 1:300,000

0 2 4 6 8 10 12 Km

Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 23/03/2026

TOWN OF CLAREMONT

Lake Claremont Invertebrate Fauna Survey

Figure 4.3: Conservation significant native bee taxa within 40 km of the Survey Area

4.2 Field Survey

4.2.1 Terrestrial habitat assessment

A total of seventeen sites were assessed for habitat suitability for terrestrial bioindicator (ant) and SRE invertebrates across the Survey Area (Table 4.4). This included all sample sites plus one additional habitat assessment only site. Sites were predominantly woodland and riparian habitats in dry condition but typically provided medium structural complexity in the vegetation, medium shade cover, and some detritus availability. Leaf litter and soil cover was generally of an even spread across each site, although some variation was present. All assessed sites and habitats were considered of Moderate suitability for both ant and SRE fauna, except for one site (SLAC 017: Forest woodland (Wandoo)) considered of Low suitability. Sampling occurred at 16 of the 17 assessed sites for both ant and SRE fauna within the Survey Area (Table 4.4, Figure 3.1).

Table 4.4: Assessed sites within the Survey Area with description and explanation of significance for ants and SRE invertebrate fauna.

Site	Habitat Description	Habitat assessment for target fauna	Representative photo
SLAC 001	- **Riparian vegetation** - Standing water body - *Eucalyptus*, *Corymbia* & *Melaleuca* species - Weed invasion	- Med-high shade cover (60-80%) - Flat slope & aspect - Med-high structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 002	- **Riparian vegetation** - Standing water body - *Acacia* & other shrub species - Weed invasion	- Low-med shade cover (20-40%) - Flat slope & aspect - Medium-high structural complexity in vegetation & some detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	

Site	Habitat Description	Habitat assessment for target fauna	Representative photo
SLAC 003	- **Forest woodland (Jarrah/Marri)** - Dry condition - Acacia, *Melaleuca* & other shrub species - Weed invasion	- Medium shade cover (40-60%) - Flat slope & aspect - Medium-high structural complexity in vegetation & some detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 004	- **Forest woodland (Jarrah/Marri)** - Dry condition - *Eucalyptus*, *Corymbia* & other shrub species - Weed invasion	- Med-High shade cover (60-80%) - Flat slope & aspect - Medium structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 005	- **Fig trees** - Damp topsoil - Likely *Ficus rubiginosa* - Weed invasion	- Med-high shade cover (60-80%) - Low slope & flat aspect - Low-medium structural complexity in vegetation & some detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	

Site	Habitat Description	Habitat assessment for target fauna	Representative photo
SLAC 006	- **Forest woodland (Jarrah/Marri)** - Dry condition - *Eucalyptus*, *Corymbia* & other shrub species - Weed invasion	- Medium shade cover (40-60%) - Moderate slope & south facing aspect - Medium structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 007	- ***Agonis flexuosa* woodland** - Dry condition - *Agonis flexuosa* & other shrubs - Weed invasion	- Medium shade cover (60-80%) - Low slope & flat aspect - Medium structural complexity in vegetation & some detritus availability - Only a few small patches of leaf litter, soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 008	- **Forest woodland (Jarrah/Marri)** - Dry condition - *Eucalyptus*, *Corymbia* & other shrub species - Weed invasion	- Medium shade cover (40-60%) - Moderate slope & south facing aspect - Low-medium structural complexity in vegetation & detritus availability - Some large patches of leaf litter, soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	

Site	Habitat Description	Habitat assessment for target fauna	Representative photo
SLAC 009	- **Riparian vegetation** - Dry condition - *Acacia, Eucalyptus, Corymbia, Grevillea* & *Melaleuca* - No major weed invasion	- Medium shade cover (40-60%) - Flat slope & aspect - Medium structural complexity in vegetation & detritus availability - Many large patches of leaf litter, soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 010	- **Riparian vegetation** - Standing water body - *Acacia* & *Melaleuca* - Road/access track as disturbance	- Med-high shade cover (60-80%) - Flat slope & aspect - Low-medium structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 011	- **Riparian vegetation** - Dry condition - *Eucalyptus* & *Corymbia* - Road/access track as disturbance	- Medium shade cover (40-60%) - Low slope & south facing aspect - Medium structural complexity in vegetation & some detritus availability - Many large patches of leaf litter, soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	

Site	Habitat Description	Habitat assessment for target fauna	Representative photo
SLAC 012	- **Forest woodland (Banksia)** - Dry condition - *Banksia* species - Road/access track as disturbance	- Medium shade cover (40-60%) - Flat slope & aspect - Med-high structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 013	- **Forest woodland (Jarrah/Marri)** - Dry condition - *Banksia, Eucalyptus, Corymbia* & *Ficus* - Road/access track as disturbance	- High shade cover (80-100%) - Flat slope & aspect - Med-high structural complexity in vegetation & some detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 014	- **Forest woodland (Jarrah/Marri)** - Dry condition - *Acacia*, *Banksia, Eucalyptus, Corymbia* & *Ficus* - Road/access track as disturbance	- Medium shade cover (40-60%) - Flat slope & aspect - Medium structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	

Site	Habitat Description	Habitat assessment for target fauna	Representative photo
SLAC 015	- **Forest woodland (Jarrah/Marri)** - Dry condition - *Eucalyptus*, *Corymbia*, *Melaleuca* & other shrubs - Road/access track as disturbance	- Med-high shade cover (60-80%) - Flat slope & aspect - Some structural complexity in vegetation & detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 016	- **Riparian vegetation** - Damp topsoil - *Eucalyptus*, *Corymbia* & *Melaleuca* - Road/access track as disturbance	- Med-high shade cover (60-80%) - Flat slope & aspect - Med-high structural complexity in vegetation & some detritus availability - Many large patches of leaf litter, soil evenly spread **SRE suitability**: Moderate **Ant suitability**: Moderate	
SLAC 017	- **Forest woodland (Wandoo)** - Dry condition - *Eucalyptus*, *Corymbia*, *Melaleuca* & other shrubs - Parkland as a disturbance	- Medium shade cover (40-60%) - Flat slope & aspect - Low structural complexity in vegetation & medium detritus availability - Leaf litter & soil evenly spread **SRE suitability**: Low **Ant suitability**: Low	

4.2.1 Aquatic habitat assessment

4.2.1.1 Habitat

Lake Claremont was classified as a permanently inundated wetland (Table 4.7). Riparian vegetation included isolated *Eucalyptus* sp. and *Melaleuca* sp. trees and rushes. Shrubs were dense at sites LC02 and LC04, with weeds present on the edges of the bank. Lake Claremont was well-flushed at the time of sampling, with low algae cover and relatively high water levels. Maximum depth ranged from 1 m to 2 m between sites. A range of in-stream habitat types were present across the Survey Area (Table 4.6). Submerged macrophyte cover was particularly high at LC02 (50%), while most sites had a high cover of detritus (10-30%). Substrate within the Survey Area consisted mainly of sand and silt (Table 4.7). Gravel was present at LC01, LC03 and LC04, while LC02 also consisted of clay substrates.

Table 4.5: Percentage cover by each of the in-stream habitat types

Site	Inorg. sed.	Sub. mac.	Emerg. mac.	Floating mac.	Algae	LWD	Detritus	Roots	Trailing veg.
LC01	30	15	5	0	0	10	30	5	5
LC02	23	50	0	0	5	5	10	2	5
LC03	30	20	10	0	3	5	24	3	5
LC04	25	10	0	0	0	10	30	5	20

Inorgic sed. = inorganic sediment, Sub. mac = submerged macrophyte, Emerg. mac. = emergent macrophyte, Floating mac. = floating macrophyte, LWD = large woody debris and Trailing veg. = trailing vegetation

Table 4.6: Percentage cover by each of the in-stream substrate types

Site	Bedrock	Boulders	Cobbles	Pebbles	Gravel	Sand	Silt	Clay
LC01	0	0	0	0	15	75	10	0
LC02	0	0	0	0	0	50	30	20
LC03	0	0	0	0	3	87	10	0
LC04	0	0	0	0	5	80	15	0

Table 4.7: Australian National Aquatic Ecosystem (ANAE) classifications of each replicate site around Lake Claremont

Site Code	Class	Landform	Soil/ Substrate	Vegetation	Water Source	Water Type	Water Regime	Site Photographs
LC1	Lacustrine/ Wetland	Lowland	Porous substrate (sand, gravel, silt)	Fringing *Eucalyptus* sp., *Melaleuca* sp. and rushes	Surface water + groundwater	Saline, alkaline	Permanent	
LC2	Lacustrine/ Wetland	Lowland	Porous substrate (sand, silt, clay)	Fringing *Melaleuca* sp., shrubs and rushes	Surface water + groundwater	Saline, alkaline	Permanent	

Site Code	Class	Landform	Soil/ Substrate	Vegetation	Water Source	Water Type	Water Regime	Site Photographs
LC3	Lacustrine/ Wetland	Lowland	Porous substrate (sand, silt, gravel)	Fringing *Eucalyptus* sp., *Melaleuca* sp. and rushes	Surface water + groundwater	Saline, alkaline	Permanent	
LC4	Lacustrine/ Wetland	Lowland	Porous substrate (sand, silt, gravel)	Fringing *Eucalyptus* sp., *Melaleuca* sp. and shrubs	Surface water + groundwater	Saline, alkaline	Permanent	

4.2.1.2 Water quality

Surface waters in the Survey Area were saline[3] and well oxygenated, with alkaline pH (Table 4.8). Electrical conductivity (EC) was in excess of the ANZG (2018) DGV for wetlands in the South West, ranging from 3,835 to 4,309 µS/cm. Dissolved oxygen (DO) was variable across the Survey Area, ranging from 77.0% (LC2) to 124.1% (LC4; Table 4.8Table 4.8). Diel cycles of DO can fluctuate considerably, with photosynthesis by aquatic plants producing oxygen and depleting carbon dioxide during the day, and respiration and lack of photosynthesis reducing DO at night and early in the morning (Andersen *et al.*, 2017).

Table 4.8: In situ water quality results in comparison to ANZG (2018) DGVs

Site	Sample Time	Temp. °C	EC µS/cm	Salinity ppt	pH	Redox mV	DO %
LC01	09:40	22.53	4,309	2.29	8.51	20.1	91.7
LC02	11:50	23.32	4,215	2.24	8.28	-14.7	77.0
LC03	12:45	26.40	3,835	2.01	8.49	-17.8	110.7
LC04	13:40	25.02	3,971	2.09	8.54	-25.7	124.1
DGV (ANZG, 2018)		n/a	300-1500	n/a	7.0-8.5	n/a	90-120

■ = outside of ANZG (2018) DGVs

[3] Salinity categories are based on the DWER classification system for freshwater rivers, where fresh/marginal < 1,000 mg/L (~ 1,500 µS/cm), brackish = 1,000 mg/L – 2,000 mg/L (~ 1,500 µS/cm to 3,000 µS/cm), saline = 2,000 mg/L – 10,000 mg/L (~ 3,000 µS/cm – 15,000 µS/cm), and hypersaline > 10,000 mg/L (> 15,000 µS/cm) (Mayer *et al.*, 2005).

4.2.2 Ant fauna

Ant specimens were collected at all 16 sampled sites and were represented by nine species across seven genera (Figure 4.4; Table 4.9). The genus *Tetramorium* accounted for most specimens based on a $\log^{10}$ range of abundance, followed by *Iridomyrmex,* and *Stigmacros*. The cosmopolitan genus *Camponotus* was represented by the least number specimens across the Survey Area (Table 4.9).Most genera were represented by just one taxon, except for *Stigmacros* and *Tetramorium* with ~2 taxa each.

Two taxa were new records for the Survey Area and within 40 km: *Stigmacros pusilla* and *Tetramorium caldarium*. None of the six recognised invasive ant species of conservation concern were collected from the Survey Area, but two species of cosmopolitan *Tetramorium* species were collected. The ants species collected in the Survey Area are further elaborated upon below.

Table 4.9: Ant fauna collected within the Survey Area. Red text indicates taxa previously not recorded in the Survey Area.

Taxon	Number of sites	Habitat type
Camponotus claripes?	1	FWB
Crematogaster laeviceps	3	Rip
Iridomyrmex rufoniger	5	FWJM, FWB, Rip
Solenopsis clarki	4	FWJM, FWB, FWW, Rip
Stigmacros aemula	4	FWJM, FWW
Stigmacros pusilla	2	FWJM, Rip
Technomyrmex jocosus	1	FWW
Tetramorium caldarium (invasive)	6	FWJM, Rip, FWW
Tetramorium simillimum (highly invasive)	3	FWJM, Fig

Habitat types: Fig (Fig tree), Rip (Riparian), FWJM (Forest Woodland: Jarrah and Marri), FWB (Forest Woodland: Banksia), FWW (Forest Woodland: Wandoo). Log^{10} range: 1 = 1 ant, 2 = 2 – 10 ants, 3 = 11 – 100 ants

4.2.2.1 Camponotus

The sugar ant genus *Camponotus* is common across most Australian environments and is represented by ~74 morphospecies in SWWA (Heterick, 2009). Members of the genus are predominantly scavengers and foragers, with some also collecting nectar and plant secretions or tending Hemipterans (true bugs) and Lycaeniae butterflies. Specimens collected from the Survey Area were identified as *Camponotus claripes*, however the *C. claripes* complex in SWWA contains many species that can be difficult to distinguish if minor and major caste specimens are not collected. Only one specimen was collected via litter sampling from woodland (Banksia) habitat (Figure 4.4), which is surprising given the recognised common distribution of this taxon. This survey does, however, represent a limited snapshot of ant diversity and abundance, with *C. claripes* representing an important functional group (scavengers and foragers) of invertebrates within the Survey Area. More specimens will likely be collected with an extended sampling effort over time.

4.2.2.2 Crematogaster

Overseas, ants within the genus *Crematogaster* are often referred to as 'acrobat ants' due to the noticeable tilt in their gaster that resembles a somersaulting acrobat. There currently exists nine species of *Crematogaster* in SWWA but many more species are expected with revision of the genus (Heterick, 2009). Species are typically foragers and generalist predators but have also been noted as tending to Hemipterans and Lepidopteran larvae (caterpillars). One species, *Crematogaster laeviceps* was collected from the Survey Area from Riparian habitat in relatively high abundance (Figure 4.4). The species is the most common ant in SWWA and can be found in almost all environments. It is very common predacious ant across Perth, with the high abundance of collected specimens reflecting this within the Survey Area.

4.2.2.3 Iridomyrmex

The genus *Iridomyrmex* is predominantly confined to Australia, although some species do occur as far as India and China (Heterick, 2009). Australian species are commonplace and obvious across many ecosystems but tend to avoid overly moist environments such as rain forests and wet sclerophyll forests. This genus also contains species that are known as meat ants. In SWWA, *Iridomyrmex* is considered one of the best-known ant genera, with many species that form large nests and are considered very aggressive (Heterick, 2009). The genus is considered very ecologically important, and function as generalist carnivores and scavengers in the environment. Specimens collected from Banksia, and Jarrah/Marri woodland as well as Riparian habitat within the Survey Area were represented by one species, *Iridomyrmex rufoniger* (Figure 4.4; Plate 4.1). This species forms part of the dominant *I. rufoniger* species-group and is likely one of the first ant species in Perth to recolonise disturbed environments after treatment. As such, *I. rufoniger* represents an important functional group present in the Survey Area, especially in areas of habitat rehabilitation where their presence can indicate environmental improvement.

4.2.2.4 Solenopsis

All Australian species within the genus *Solenopsis* are commonly called 'thief ants' as they often steal prey items or nests of other ant species (Heterick, 2009). Only two species of native *Solenopsis* are present in SWWA, with one of these species; the very widespread *Solenopsis clarki*, collected within the Survey Area from Banksia, Jarrah/Marri, and Wandoo woodland as well as Riparian habitat (Figure 4.4). A relatively high abundance of specimens was collected within the Survey Area, with *S. clarki* likely a 'thief' of other ant species prey and nests within the Lake Claremont area. Despite the negative connotations associated with the term 'thief', kleptoparasitic or lestobiotic ('thieving') behaviour is an important functional role for natural population control, especially for mass-abundant groups such as ants.

4.2.2.5 Stigmacros

The genus *Stigmacros* is predominantly comprised of very small, inconspicuous ants that are easily overlooked during sampling. Despite this, there exists ~30 species in SWWA, with the genus still requiring significant revision. The genus is comprised of generalist predators that typically forage on the ground or in leaf litter, with some arboreal behaviour noted, but not in Western Australian species (Heterick, 2009). A high abundance of *Stigmacros* specimens were collected from Jarrah/Marri and Wandoo woodland as well as Riparian habitat within the Survey Area. These specimens represented two recognised species, *S. aemula* and *S. pusilla* both very common on the SCP and Darling Range, with *S. aemula* frequently found in Perth residential gardens and *S. pusilla* found as far as the eastern wheatbelt. Of note was the collection of a queen specimen of *S. aemula* from the Survey Area (Figure 4.4), which indicates an established species presence in the area. Both collected ant species represent important generalist predators within the Survey Area.

4.2.2.6 Technomyrmex

The genus *Technomyrmex* has a global distribution, but is represented by just one species in SWWA, *Technomyrmex jocosus* (Heterick, 2009). The species contains medium sized worker ants, and despite being a native species, is often considered a 'pest' across metropolitan Perth. This is due to the species uncanny behaviour of nesting in suburban houses, rubbish bins, and even in car engines. The species is a generalist forager and can be found in high abundance in disturbed areas of vegetation but is less likely to establish in large areas of native vegetation. There was not a high abundance of *T. jocosus* contained in the Survey Area samples, with most specimens collected from leaf litter samples in woodland (Wandoo) habitat that was considered low suitability (Figure 4.4; Plate 4.1). Disturbance specialists like *T. jocosus* are important in the context of bioindicator taxa, as they highlight areas of habitat that are potentially degraded and of lower suitability for other fauna. Likewise, the species absence may also indicate areas of better-quality habitat alongside other indicators.

4.2.2.7 Tetramorium

The genus *Tetramorium* is widespread around the world with ~600 recognised species, most of which are predators. In SWWA, there are ~10 tentative species described, although distinction between species is very difficult and requires further study (Heterick, 2009). Two exotic species were collected from the Survey Area, the invasive *Tetramorium caldarium* and the highly invasive *T. simillimum* (Figure 4.4; Plate 4.1). Both species were collected from woodland (Jarrah/Marri) habitat, with *T. caldarium* also collected from woodland (Wandoo) and Riparian habitats, and *T. simillimum* from Fig tree habitat. Whilst neither species are recognised as a major conservation threat, they were of high abundance in leaf litter samples across the Survey Area and may represent increased competition with native ant fauna, especially predacious *Crematogaster*. *Iridomyrmex*, and *Stigmacros* species present in the area.

Plate 4.1: Notable ant species collected from the Survey Area. Top (Left to Right): *Iridomyrmex rufoniger* and *Technomyrmex jocosus* are key bioindicator taxa. Bottom (left to right): *Tetramorium caldarium* and *T. simillimum* were two invasive species present in the Survey Area.

LEGEND

Survey Area

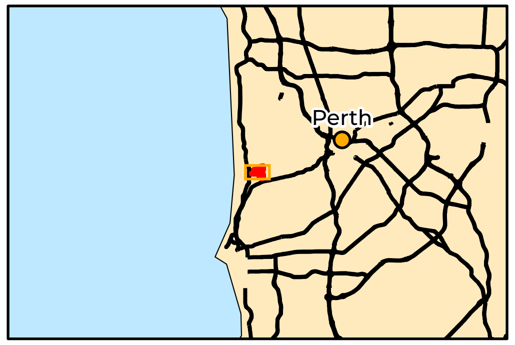
Ant Taxa

- *Camponotus claripes?*
- *Crematogaster clarior*
- *Crematogaster laeviceps*
- *Iridomyrmex rufoniger*
- *Solenopsis clarki*
- *Stigmacros aemula*
- *Stigmacros cf. aemula*
- *Stigmacros pusilla*
- *Technomyrmex jocosus*
- *Tetramorium caldarium*
- *Tetramorium simillium*

Biologic Environmental

Scale 1:6,000

0 0.1 0.2 Km



Coordinate System: GDA 1994 MGA Zone 50 Transverse Mercator Created: 17/07/2026

TOWN OF CLAREMONT

Lake Claremont Invertebrate Fauna Survey

Figure 4.4: Distribution of ant taxa collected during the survey

4.2.3 Native bee fauna

A total of 778 bees were recorded. Of these, 149 native bee specimens were recorded using both sampling methods (Table 4.10) with remaining represented by the European honeybee. Of the five bee families occurring in Australia, all except Stenotritidae were recorded. No listed conservation-significant bee species were recorded during the survey.

Vane traps captured a relatively low number of native bee specimens (blue traps: n = 15; yellow traps: n = 0) and species (n = 3; Table 4.10) despite generally favourable weather conditions during the sampling period. This low capture rate is likely attributable to the limited sampling effort (two trap sets deployed for approximately three weeks) and reduced floral resource availability at trap locations.

Sweep netting yielded 134 native bee specimens, representing 27 species across 10 genera (Table 4.10). The European honeybee (*Apis mellifera*) was widely distributed throughout the Survey Area. A total of 46 honeybee specimens were collected in vane traps, and an additional 583 floral visitation records were made during sweep netting.

Megachilidae was the most abundant family (n = 82), followed by Colletidae (n = 34), Apidae (n = 25), and Halictidae (n = 8). Colletidae exhibited the highest species richness (n = 11), closely followed by Megachilidae (n = 10).

The most abundant native bee species was *Megachile fultoni* (n = 39), followed by *Hylaeus amiculus* (n = 16), *Amegilla chlorocyanea* (n = 13), and *Megachile latericauda* (n = 13). Eight species were recorded as singletons, distributed across four genera within the families Colletidae and Megachilidae (Table 4.10).

Eight undescribed species were also recorded, including three Megachilidae (*Megachile (Hackeriapis)* sp. 3, *Megachile (Hackeriapis)* sp. 4, and *Megachile* cf. "sp. E" [Padil]) and five Colletidae (*Hylaeus (Prosopisteron)* sp. 1, *H. (Prosopisteron)* sp. 2, *H. (Rhodohylaeus)* sp. 3, *Euryglossula* cf. *fultoni*, and *Euhesma* sp. 1). The latter likely represents a new morphotype (i.e. first recorded occurrence) (Table 4.10, Plate 4.2).

Comparison with a previous survey conducted in the Study Area in 2019 (Prendergast, 2020a) over the same sampling period (November–December) indicated that, of the 27 species recorded in the present survey, 19 are new records for the Survey Area and nine were re-collected (Appendix E). However, this comparison should be interpreted with caution, as morphospecies may have been assigned different names between surveys due to the unavailability of 2019 specimens for direct comparison. Furthermore, the present survey employed both passive and active collection methods, increasing overall sampling effort and providing a more comprehensive assessment of bee assemblages compared to surveys relying solely on active sweep netting.

A species accumulation curve shows a steady, near-linear increase in cumulative species richness across sampled sites and does not approach an asymptote (Appendix E), indicating that additional sampling would likely yield further species.

Table 4.10: Native bee taxa collected within the Survey Area using sweep netting and vane trap methods.

Species	Species code	Vane trap	Sweep net	Total
APIDAE				
Amegilla (Notomegilla) *chlorocyanea*	Amegilla.chlo	12	1	13
Apis (Apis) *mellifera*	Apis.mell	46	583	629
Exoneura (Exoneura) *laeta*	Exoneura.laet	0	8	8
Thyreus waroonensis	Thyreus.waro	3	1	4
COLLETIDAE				
Euhesma sp. 1	Euhesma.sp.1	0	2	2
Euryglossina (Euryglossina) *bowenensis*	Euryglossina.bowe	0	1	1
Euryglossina (Euryglossina) *narifera*	Euryglossina.nari	0	1	1
Euryglossula cf. *fultoni*	Euryglossula.fult	0	2	2
Hylaeus (Euprosopis) *violaceus*	Hylaeus.viol	0	2	2
Hylaeus (Euprosopoides) *obtusatus*	Hylaeus.obtu	0	3	3
Hylaeus (Gnathoprosopis) *amiculus*	Hylaeus.amic	0	16	16
Hylaeus (Gnathoprosopis) *euxanthus*	Hylaeus.euxa	0	3	3
Hylaeus (Prosopisteron) sp. 1	Hylaeus.sp.1	0	2	2
Hylaeus (Prosopisteron) sp. 2	Hylaeus.sp.2	0	1	1
Hylaeus (Rhodohylaeus) sp. 3	Hylaeus.sp.3	0	1	1
HALICTIDAE				
Lasioglossum (Chilalictus) *castor*	Lasioglossum.cast	0	1	1
Lasioglossum (Chilalictus) *oblitum*	Lasioglossum.obli	0	4	4
Lipotriches (Austronomia) *flavoviridis grp*	Lipotriches.flav	0	3	3
MEGACHILIDAE				
Megachile (Hackeriapis) sp. 3	Megachile.sp.3	0	1	1
Megachile (Hackeriapis) sp. 4	Megachile.sp.4	0	1	1
Megachile cf. "sp. E" [Padil]	Megachile."sp.	0	5	5
Megachile (Eutricharaea) *chrysopyga*	Megachile.chry	0	6	6
Megachile fultoni	Megachile.fult	0	39	39
Megachile latericauda	Megachile.late	0	13	13
Megachile (Hackeriapis) *monkmani*	Megachile.monk	0	11	11
Megachile rufolobata	Megachile.rufo	0	3	3
Megachile tarltoni	Megachile.tarl	0	2	2
Megachile (Hackeriapis) *tosticauda*	Megachile.tost	0	1	1
	Total	**61**	**717**	**778**

Plate 4.2: Undescribed native bee species collected from the Survey Area. Top (left to right): *Megachile* cf. "sp. E" [Padil} and *Euryglossina* cf. *fultoni*. Middle (left to right): *Hylaeus* (Prosopisteron) sp. and *Hylaeus* (Rhodohylaeus) sp. 3. Bottom: *Euhesma* sp. 1

4.2.3.1 Plant-bee Network

Bee visitation was recorded on eight flowering plant species (Table 4.11) with a total of 714 bee–plant interactions documented. However, the majority of these interactions (n = 583) involved the non-native European honeybee (*Apis mellifera*), which was abundant at most sites. As a super-generalist species, honeybees visited all eight plant species in the network and accounted for 81% of all interaction events, therefore using floral resources of the 27 native bee species recorded (Table 4.11). Honeybees were also the only visitor recorded for *Corymbia citriodora*, which is a non-native plant species (Figure 4.5).

Among native bees, *Megachile fultoni* had the highest number of recorded interactions (n = 39 across five plant species), representing 5.5% of all native bee interactions (n = 131) (Figure 4.5; Plate 4.3).

Nineteen native bee species were recorded visiting only a single plant species. Some of these taxa, such as members of the subfamily Euryglossinae, are known to be oligolectic (i.e. specialised), and are associated with Myrtaceae. However, other single-record species are typically generalist and commonly observed across multiple plant species. For example, *Lasioglossum castor* was recorded only once, visiting *Scaevola*. This species is often abundant in vane trap samples but was not captured during this survey, suggesting it may occur at low abundance within the Survey Area. Similarly, *Lipotriches flavoviridis* grp was recorded three times, exclusively visiting *Melaleuca systena*, which may reflect limited availability of other preferred floral resources during the sampling period (Figure 4.5; Plate 4.3).

Some bee species exhibited apparent associations with particular plant taxa. For instance, *Hylaeus euxanthus* and *Hylaeus obtusatus* were recorded exclusively on *Melaleuca huegelii* (Plate 4.3). Several *Megachile* species (including *M. rufolobata*, *M. tarltoni,* and *M. chrysopyga*) were recorded only on *Jacksonia sternbergiana*, as was the newly identified morphotype *Euhesma* sp. 1. However, given the limited temporal scope of the survey, further sampling is required to confirm patterns of host-plant preference or specialisation (Figure 4.5; Plate 4.3).

The blue-banded bee, *Amegilla (Notomegilla) chlorocyanea*, was recorded visiting *Hemiandra pungens*. Notably, *Thyreus waroonensis* was recorded visiting *Scaevola* at the same site (LC-11) (Figure 4.5; Plate 4.4). This species, commonly known as the Waroona cuckoo bee, is a kleptoparasite of *Amegilla* species. Female *T. waroonensis* do not construct nests or collect pollen but instead lay their eggs in the nests of blue-banded bees. The co-occurrence of these species suggests that suitable nesting habitat may be present within the Survey Area. Both species were also recorded in vane traps at sites LC-2 and LC-4.

Plate 4.3: Native bee species recorded visiting native flora in the Survey Area. Top (left to right): *Megachile fultoni* and *Lipotriches flavoviridis*. Middle (left to right): *Hylaeus euxanthus* and *Hylaeus obtusatus*. Bottom: *Lasioglossum castor*. These species were included in the plant-bee network model (Figure 4.5)

Plate 4.4: Native bee species *Amegilla chlorocyanea* (left) and the associated kleptoparasite *Thyreus waroonensis* (right) collected from the Survey Area likely indicates that suitable nesting habitat is present in the Lake Claremont area to support both species

The plant species with the highest number of interactions were *Scaevola crassifolia* (n = 265), *Melaleuca huegelii* subsp. *huegelii* (n = 226), and *Melaleuca systena* (n = 73), collectively accounting for 78% of all interactions. These species were visited by 8, 11, and 6 bee species, respectively (Figure 4.5). *Jacksonia sternbergiana* also represented an important floral resource (n = 50 interactions; 7% of total interactions), supporting the highest bee species richness (n = 12). Visitors included multiple *Megachile* species, which are known to utilise this genus. These findings indicate that these plant species were key floral resources during the survey period (Figure 4.5).

Table 4.11: Plant species observed being visited by bee taxa during the survey. These plant species were incorporated in the metanetwork analysis in Figure 4.6 using the plant code column of this table.

Family	Species	Plant Code
Fabaceae	*Jacksonia sternbergiana*	Jacksonia.ste
Goodeniaceae	*Scaevola crassifolia*	Scaevola.cras
Lamiaceae	*Hemiandra glabra*	Hemiandra.gla
Myrtaceae	*Corymbia citriodora*	Corymbia.cit
Myrtaceae	*Corymbia ficifolia*	Corymbia.fic
Myrtaceae	*Melaleuca huegelii* subsp. *huegelii*	Melaleuca.hug
Myrtaceae	*Melaleuca systena*	Melaleuca.sys
Myrtaceae	*Melaleuca teretifolia*	Melaleuca.ter

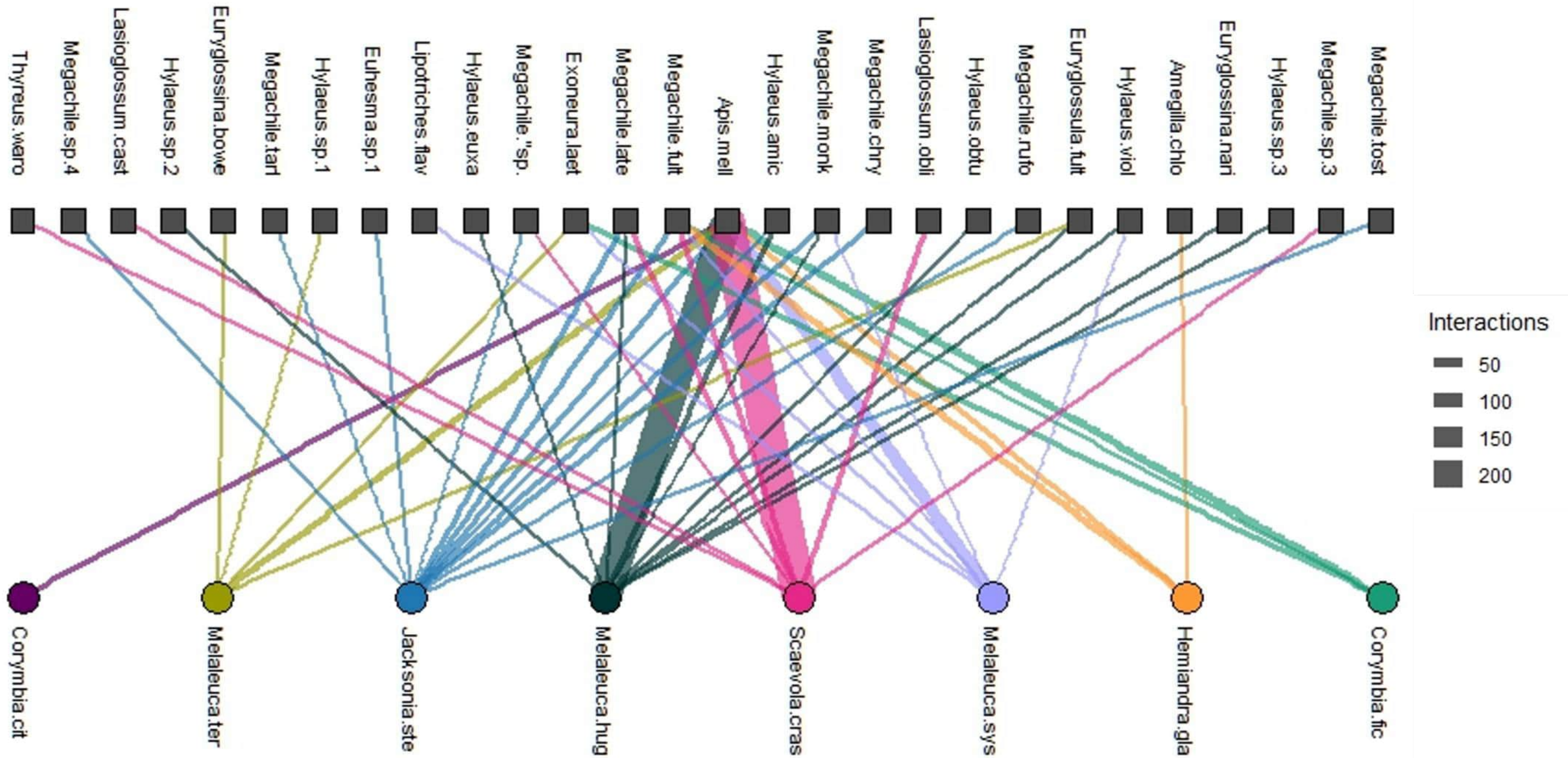


Figure 4.5: Metanetwork comprising all plant-bee interactions across the sampled area (with data pooled across all sites). It depicts 717 interaction events (pairwise interactions) among 27 native bee species (top squares) and 8 plant species (bottom circles). It also includes interactions of the non-native honeybee (*Apis mellifera*) with local plants. Link width is proportional to the frequency of interactions. For full species names see Table 4.10

4.2.4 Aquatic invertebrate fauna

4.2.4.1 Aquatic macroinvertebrates

A total of 58 aquatic macroinvertebrate taxa were recorded from the Survey Area (Table 4.12). Within-site macroinvertebrate taxa richness ranged from 29 taxa (LC04) to 41 taxa (LC02). Macroinvertebrate composition within the Survey Area was dominated by Hemiptera, Diptera and Crustacea (Figure 4.6). Salinity sensitive mayflies were absent from the Survey Area, and caddisflies were present at all sites in low richness (Figure 4.6).

Table 4.12: Aquatic macroinvertebrate taxa collected from the Survey Area, including log abundance

Higher taxon	Family	Lowest taxon	LC01	LC02	LC03	LC04
ANNELIDA						
Oligochaeta						
Tubificida	Naididae	*Pristina osborni*	3	4	4	0
NEMATODA						
		Nematoda sp.	0	0	1	0
MOLLUSCA						
Gastropoda						
Hygrophila	Physidae	*Physa acuta*	2	2	2	0
	Planorbidae	*Glyptophysa* sp.	3	3	3	3
ARTHROPODA						
CRUSTACEA						
Branchiopoda						
Anomopoda	Chydoridae	Chydoridae sp.	3	0	0	0
		Leydigia sp.	3	0	0	0
		Pseudochydorus globosus	3	0	0	0
	Daphniidae	*Simocephalus exspinosus*	3	4	3	2
Malacostraca						
Amphipoda	Chiltoniidae	*Austrochiltonia subtenuis*	4	5	5	5
Isopoda	Amphisopodidae	*Paramphisopus palustris*	5	4	4	4
Copepoda						
Calanoida	Centropagidae	*Boeckella triarticulata*	2	5	5	4
Cyclopoida	Cyclopidae	*Mesocyclops brooksi*	2	5	4	4
		Mesocyclops notius	3	4	4	3
Ostracoda						
Podocopida	Candonidae	*Candonopsis* sp.	0	4	0	0
	Cyprididae	*Candonocypris* sp.	3	0	0	0
		Cypretta sp.	0	0	4	0
		Heterocypris sp.	5	5	5	4

Higher taxon	Family	Lowest taxon	LC01	LC02	LC03	LC04
		Sarscypridopsis sp.	0	4	4	0
ARACHNIDA						
Trombidiformes	Arrenuridae	*Arrenurus* sp.	2	2	2	3
		Arrenurus (*Truncaturus*) sp.	2	0	0	2
	Hydrachnidae	*Hydrachna* sp.	2	0	0	0
	Limnesiidae	*Limnesia* sp. `solida group`	3	2	0	3
	Pionidae	*Acercella falcipes*	3	3	2	3
INSECTA						
Coleoptera	Dytiscidae	*Limbodessus shuckardii*	0	1	0	1
	Hydraenidae	Hydraenidae sp. (L)	0	0	0	1
	Hydrophilidae	*Berosus* sp. (L)	0	2	1	0
		Berosus australiae	1	1	0	0
	Scirtidae	Scirtidae sp. (L)	0	0	0	1
Diptera	Chironomidae	Chironomidae sp. (P)	0	0	0	2
	Chironominae	Chironominae sp.	0	0	0	2
	Chironomini	*Chironomus alternans*	2	2	4	0
		Dicrotendipes sp.	2	1	3	0
		Parachironomus sp.	2	2	3	2
	Orhtocladiinae	*Cricotopus parbicinctus*	0	1	0	0
	Tanypodinae	*Ablabesmyia notabilis*	0	1	0	0
		Paramerina sp.	2	2	0	2
		Procladius sp.	2	1	2	0
	Culicidae	Culicidae sp.	0	1	1	0
	Dolichopodidae	Dolichopodidae sp.	0	1	0	0
	Ephydridae	Ephydridae sp.	0	2	2	1
	Stratiomyidae	Stratiomyidae sp.	2	3	2	0
Hemiptera		Corixoidea sp.	3	2	2	2
	Corixidae	Agraptocorixa sp.	0	1	0	0
		Sigara mullaka	0	1	0	0
	Micronectidae	*Micronecta robusta*	2	0	0	0
	Notonectidae	*Anisops* sp.	2	3	2	3
		Anisops thienemanni	2	2	3	2
		Notonectidae sp.	3	3	3	3
	Veliidae	Veliidae sp.	0	0	0	1
		Nesidovelia australiensis	0	0	0	1
Odonata		Zygoptera sp.	0	2	2	1
	Coenagrionidae	*Ischnura heterosticta*	0	1	0	0
	Lestidae	*Austrolestes annulosus*	0	1	1	0

Higher taxon	Family	Lowest taxon	LC01	LC02	LC03	LC04
		Anisoptera sp.	2	2	2	0
	Aeshnidae	Hemianax papuensis	1	1	0	1
Trichoptera	Leptoceridae	Leptoceridae sp.	0	1	2	2
		Oecetis sp.	1	0	0	0
		Triplectides sp.	4	0	0	0
		Taxa richness	**35**	**41**	**31**	**29**

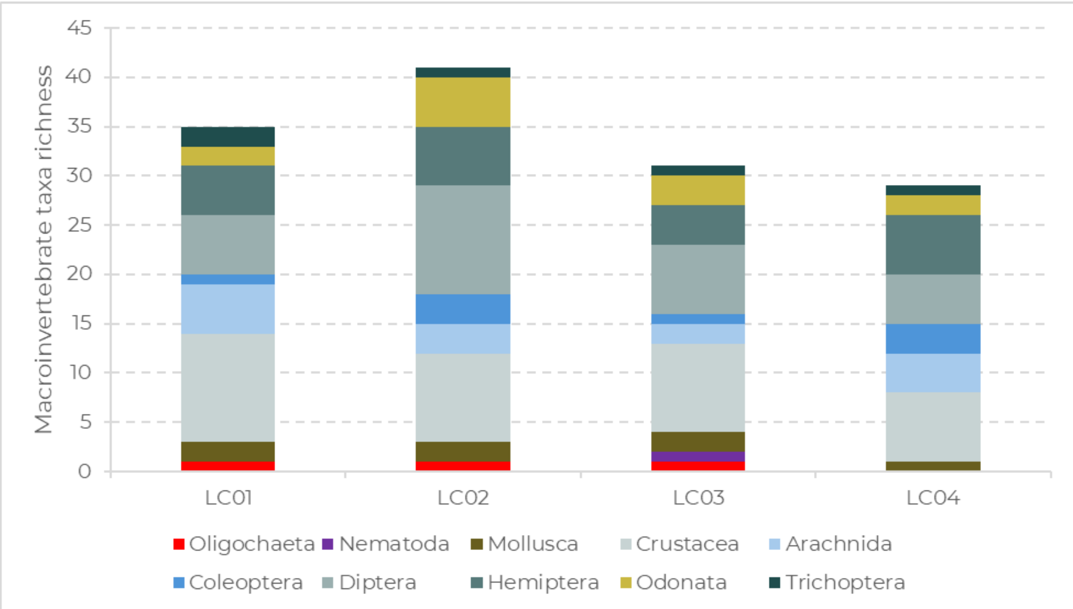


Figure 4.6: Macroinvertebrate taxa composition recorded from each site

Most aquatic macroinvertebrates recorded were common, ubiquitous species. Excluding taxa which could not be assigned a distribution status due to insufficient information or taxonomy (juvenile or damaged specimens), most taxa from the Survey Area had distributions extending across Australia (55%), followed by taxa with Australasian (18%) and cosmopolitan distributions (14%). A total of 9% of taxa from the Survey Area were endemic to the South West of Western Australia.

None of the taxa recorded are listed or priority species, though two South West endemic taxa were recorded from the Survey Area. These were the freshwater isopod *Paramphisopus palustris* (all sites) and the true bug *Sigara mullaka* (LC02). One introduced taxon was recorded: the bladder snail (*Physa acuta*), which is an invasive species from Europe. The bladder snail was recorded at all sites except LC04.

4.2.5 SRE invertebrate fauna

A total of eleven specimens representing five SRE taxa were collected within the Survey Area from six of the 16 sampled sites (Table 4.13,). Taxa were primarily represented by arachnids, namely pseudoscorpions (three taxa across three families), with one jumping spider. Two millipede specimens were also collected within the Survey Area.

Two taxa were new records for the Survey Area and within 40 km, with *Maratus pavonis* a new jumping spider record and *Pseudotyrannochthonius* sp. indet a new pseudoscorpion record. The record of *Pseudotyrannochthonius* sp. indet is notable because the pseudoscorpion family Pseudotyrannochthoniidae had not been recorded in the Survey Area or within 40 km on the Swan Coastal Plain prior to this survey.

Table 4.13: SRE invertebrate fauna collected within the Survey Area from target groups during the survey. Red text indicates taxa not recorded in the desktop assessment. Red text indicates taxa previously not recorded in the Survey Area.

Higher taxon	Taxon	SRE status	No. of specimens	Habitat type
ARACHNIDA: Araneae				
Salticidae	*Maratus pavonis*	Widespread	1	Fig
ARACHNIDA: Pseudoscorpiones				
Chernetidae	Chernetidae sp. indet	Potential	1	Rip
Geogarypidae	*Geogarypus* sp. indet	Potential	3	Rip, FWJM
Pseudotyrannochthoniidae	*Pseudotyrannochthonius* sp. indet	Potential	4	Rip
DIPLODA: Polydesmida				
Paradoxosomatidae	*Antichiropus variabilis*	Widespread	2	Rip, FWJM
TOTAL			**11**	

Habitat types: Fig (Fig tree), Rip (Riparian), FWJM (Forest Woodland: Jarrah and Marri).

4.2.5.1 Arachnida: Araneae

Salticidae

A single male specimen of the jumping spider, *Maratus pavonis* was collected via leaf litter sampling from Fig tree habitat in the Survey Area (Figure 4.7). The species has a widespread distribution across SWWA and southeastern Australia, although the two Western Australian subspecies (*M. pavonis* var. *brunneis*, and *M. pavonis* var. *nornalup*), which are often referred to as *M. pavonis*, likely represent an undescribed species complex or at least one new species altogether (Otto & Hill, 2021). Subspecies identification often requires molecular analysis and is limited without further study of *M. pavonis* in Western Australia. The Lake Claremont specimen is therefore considered *M. pavonis* with a Widespread distribution and, perhaps surprisingly, represents an exclusive record of this species for the Survey Area and within 40 km.

4.2.5.2 Arachnida: Pseudoscorpiones

Chernetidae

A single specimen of the globally distributed pseudoscorpion family, Chernetidae was collected via leaf litter sampling from Riparian vegetation in the Survey Area (Figure 4.7). Whilst chernetid fauna are represented by 664 species from 117 of the 467 accepted pseudoscorpion genera, Australian chernetids remain relatively unknown with only 37 recognised species from 17 genera (Harvey, 2018). Australian chernetids are expected to be very diverse, likely with many new genera and undescribed species. Without molecular analysis (which is also constrained by the availability of published sequences to compare), genera and species level identification can often be limited. As such, the Lake Claremont chernetid was identified as Chernetidae sp. indet, and is considered Potential SRE (WAM Categories 'A' Data Deficient and 'E' Research and Expertise).

Geogarypidae

Three specimens of the global pseudoscorpion family, Geogarypidae were collected via leaf litter sampling from Jarrah and Marri woodland, and Riparian habitat in the Survey (Figure 4.7). All specimens were identified to the genus *Geogarypus* which has a recognised global distribution across all major biogeographic zones, excluding the Nearctic (Cullen & Harvey, 2021). There are only eight described species of *Geogarypus* in Australia, two of which have recently been described by Cullen and Harvey (2021). Without molecular analysis, species level identification is often restricted. As such, the Lake Claremont *Geogarypus* specimens were identified as *Geogarypus* sp. indet and considered Potential SRE (WAM Categories 'A' Data Deficient and 'E' Research and Expertise).

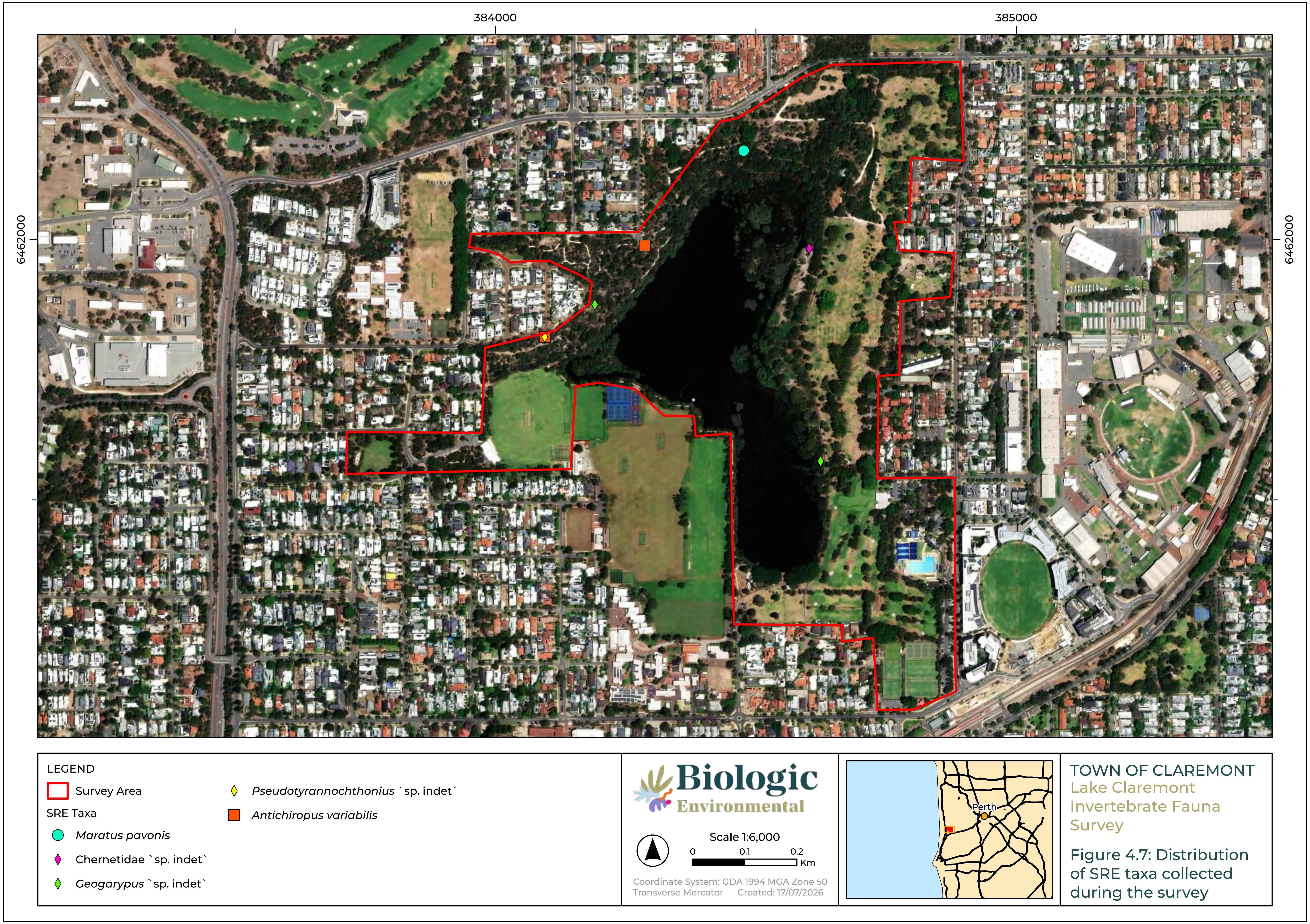
Pseudotyrannochthoniidae

Four specimens of the global yet small pseudoscorpion family, Pseudotyrannochthoniidae were collected via leaf litter sampling from Riparian habitat in the Survey Area (Figure 4.7). All four specimens were identified to the genus *Pseudotyrannochthonius*, which represents the most diverse of the five recognised genera within the family. There are currently 20 described species of *Pseudotyrannochthonius* around the world, with Australian species containing epigean (surface dwelling), troglophilic (epigean and cave dwelling), and troglomorphic (cave dwelling only) members (Harms *et al.*, 2025). All Australian species are found exclusively in mesic forests along eastern and southern coastlines or in cave systems. The Australian epigean *Pseudotyrannochthonius* fauna is likely to be very species rich but still remains relatively unknown with just four described species. As such, the Lake Claremont specimens were identified as *Pseudotyrannochthonius* sp. indet and considered Potential SRE (WAM Categories 'A' Data Deficient and 'E' Research and Expertise).

4.2.5.3 Diplopoda: Polydesmida

Paradoxosomatiae

Two millipede specimens were collected via leaf litter sampling from Forest woodland (Jarrah and Marri) and riparian vegetation in the Survey Area (Figure 4.7). Both specimens were identified as the 'Marri' millipede, *Antichiropus variabilis* which is Widespread taxon found on the SCP. *Antichiropus variabilis* is the most geographically widespread species of *Antichiropus* and can be found in Marri (*Corymbia calophylla)* and Jarrah (*Eucalyptus marginata*) woodlands along most of the Darling Escarpment, east of Perth (Wojcieszek *et al.*, 2011). The presence of this common millipede in the Survey Area, particularly from Marri and Jarrah woodland vegetation is therefore unsurprising and supports the widespread distribution of this species on the SCP.



TOWN OF CLAREMONT
Lake Claremont Invertebrate Fauna Survey

Figure 4.7: Distribution of SRE taxa collected during the survey

4.1 Constraints and Limitations

The EPA (2016c) outlines several potential limitations to fauna surveys. These aspects are assessed and discussed in Table 4.14. The identification of invertebrate fauna species, the interpretation of species' distributions and the resulting categorisation of their respective conservation status is dependent on the current state of taxonomic and ecological knowledge of the target groups at the time of survey. Owing to ongoing developments in regional sampling coverage and taxonomic information, the conservation status, distributions and habitat preferences of the taxa described herein may be subject to change over time. It is not considered that the survey suffered from any specific constraints in relation to the number of samples, the coverage of habitat types or the sampling and preservation methods used to detect the target fauna.

Table 4.14: Survey limitations and constraints

Potential limitation or constraint	Limitation to current survey	Applicability to this survey
Experience of personnel.	No	All personnel were experienced and qualified to carry out the survey and assessment.
Scope (faunal groups sampled and whether any constraints affect this)	No	Key bioindicator and conservation significant invertebrate groups were sampled and results aligned with scope and objective of the project.
Proportion of fauna identified	No	Appropriate resolution was achieved for the scope and objectives of the project. Identification of invertebrate specimens was completed by relevant taxonomic experts.
Sources of information (recent or historic) and availability of contextual information	No	All sources of information were appropriate for the purpose of the project. We recommend the Town ask all future parties involved in surveys to provide them with a species dataset in the future to facilitate data comparisons. Standardized methods for surveys should be applied.
Proportion of the task achieved	No	All tasks were achieved as proposed.
Timing / weather / season / cycle	Potential	Spring was wetter and warmer than usual, and survey was carried out at the end of the spring. Reduced availability of flowering plants may have influenced bee catches. It is unlikely that the weather impacted ant, aquatic, or SRE activity.
Disturbances (e.g., fire or flood)	No	No immediate disturbances occurred during the survey.
Intensity of survey	No	Survey intensity was as proposed. We do recommend an increased survey effort and yearly monitoring to capture seasonal variation and species turnover.
Completeness of survey	No	The proposed single-season survey was completed in full within the Survey Area. The survey achieved sufficient geographic spread

Potential limitation or constraint	Limitation to current survey	Applicability to this survey
		and coverage of all relevant habitats within the Survey Area.
Resources (e.g., degree of expertise available)	No	All relevant resources and expertise required to complete the survey were available and utilized. All species recorded during the survey were identified by experienced taxonomists.
Remoteness or access issues	No	No access issues were identified.

5 Discussion

5.1 Terrestrial invertebrates

A wetter and warmer lead up to Spring was expected to be beneficial to terrestrial invertebrates with conditions expected to provide optimal habitat and food availability. Native bees are also expected to benefit from warmer temperatures and improved flowering associated with pre-spring rainfall. Although continued rain throughout spring is likely to inhibit bee activity. Habitat quality for ant, bee and SRE invertebrates was generally considered moderate across the Survey Area, reflecting the long-standing history of Lake Claremont as a site of recreational use and land-use change.

Ants

A lower-than-average diversity of ant fauna was present in the Survey Area, represented by nine species across key functional groups. Previous surveys in metropolitan Perth have typically yielded over 15 species (Biologic, 2018b; Gunawardene *et al.*, 2021; Heterick *et al.*, 2013). The presence of the post-disturbance specialist, *Iridomyrmex rufoniger*, indicates that most habitats at Lake Claremont are disturbed. Likewise, the presence of the low-quality habitat specialist, *Technomyrmex jocosus*, in some areas of the Survey Area is a useful indicator of where rehabilitation efforts are needed. No invasive ant species of conservation concern were found in the Survey Area; however, two collected *Tetramorium* species are considered somewhat invasive, but unlikely to present any immediate threat to native ant species.

A factor that would have reduced the number of ant species encountered by the surveys was the fact that only one method of sampling was utilised for sampling (litter sampling). Typically ant species diversity would be assessed using multiple methods including pitfall traps which were not deployed due to ethical issues with by-catch of vertebrate fauna. Additionally, only a single season was undertaken late in spring which also may have impacted assessment of species diversity. Overall, ant species diversity is likely to be higher at Lake Claremont and a single season survey would be inadequate to assess diversity of this group.

Native Bees

The present survey provides a targeted assessment of native bee fauna and plant–pollinator interactions within the Study Area, substantially expanding existing knowledge. A total of 27 native bee species across four families were recorded, with all Australian bee families except Stenotritidae represented.

The bee assemblage was dominated by a small number of relatively abundant species, particularly within Megachilidae and Colletidae, while a substantial proportion of species were represented by singletons. This pattern is typical of bee communities in Western Australia but may also reflect temporal constraints and patchy floral resource availability. The presence of eight undescribed species, including a likely new morphotype (*Euhesma* sp. 1), further highlights the ecological significance of the Study Area and its contribution to regional biodiversity knowledge.

As the survey was conducted at the end of the spring season, relatively few plant species were in flower at the time. Despite favourable weather conditions, vane trapping yielded comparatively low specimen numbers and species richness relative to previous surveys conducted in the Swan Coastal Plain (Biologic, 2024; Gunawardene *et al.*, 2021; Pille Arnold, 2021). This is likely attributable to limited sampling effort (two trap sets over approximately two weeks) and reduced floral resource availability during the sampling period. In contrast, sweep netting proved effective at capturing higher bee diversity. Increasing sampling effort through extended survey duration and additional trap deployments would likely improve survey representativeness. The use of both active (sweep netting) and passive (vane trapping) sampling methods was appropriate, as reliance on a single method can result in incomplete and biased sampling (Packer & Darla-West, 2021; Saunders *et al.*, 2021). The limited overlap between species recorded by vane traps and sweep netting is consistent with previous studies (Biologic, 2024; Gunawardene *et al.*, 2021; Pille Arnold, 2021), highlighting the complementary nature of these methods.

The likelihood of occurrence analysis (Appendix C) also suggests that additional species are likely to occur in the Study Area. However, the present survey represents only a temporal snapshot at the end of the spring season and does not capture peak flowering periods (September–October). Surveys spanning the full spring and early summer period would provide a more comprehensive assessment of bee assemblages and better capture seasonal turnover in response to plant phenology.

Plant–pollinator network analysis revealed a strong dominance of the non-native honeybee (*Apis mellifera*), which accounted for 81% of all recorded interactions and utilised all flowering plant species. This resulted in substantial overlap in floral resource use with native bee species. Such dominance is consistent with findings from other studies on modified (Valido *et al.*, 2019) and urban-adjacent landscapes (Gross, 2001; Paini, 2004; Paini & Roberts, 2005; Prendergast *et al.*, 2022), and may have implications for resource competition with native bees. While direct competitive effects were not assessed, honeybees may influence native bee assemblages through depletion of nectar and pollen resources (Torné-Noguera *et al.* 2016; Magrach *et al.* 2017), particularly during periods of limited floral availability.

Native bee interactions were more restricted, with many species recorded visiting a single plant species. While some taxa are known specialists (e.g. Euryglossinae associated with Myrtaceae), other apparent single-plant associations likely reflect limited sampling duration rather than true ecological specialisation. Nonetheless, several plant taxa, particularly *Scaevola crassula*, *Melaleuca huegelii* subsp. *huegelii*, *Melaleuca systena*, and *Jacksonia sternbergiana,* were identified as key floral resources, supporting the majority of interactions and the highest bee species richness. Myrtaceae and Fabaceae are known to attract a wide range of bee taxa (Houston, 2000; Pille Arnold, 2021), and their inclusion in restoration programs would likely benefit native bee communities. Additional plant–pollinator network studies across different seasons, particularly during peak flowering periods, would further improve understanding of species interactions and resource use.

Evidence of ecological interactions beyond flower visitation/pollination was also observed. The co-occurrence of the kleptoparasitic *Thyreus waroonensis* and its host *Amegilla chlorocyanea* suggests the presence of suitable nesting habitat and indicates a functionally intact component of the bee community. Such interactions are important biondicators of ecosystem health, as kleptoparasitic bees are sensitive to landscape change (e.g. urbanisation). They contribute to the regulation and structuring of pollinator communities and are often associated with intact ecosystems, where their diversity and abundance reflect the availability of host species and the overall stability of trophic interactions (Dodge & Davis, 2025; Sheffield *et al.*, 2013). Another kleptoparasitic species, *Coelioxys froggatti*, previously recorded in the Study Area (Prendergast, 2020a) was not detected during the present survey.

Overall, the Study Area supports a diverse native bee assemblage, with evidence of both generalist and specialist foraging strategies, as well as higher-order ecological interactions (e.g. parasitism). However, further investigation and long-term monitoring are required to fully characterise the bee community and its ecological dynamics.

5.2 Aquatic macroinvertebrates

Above average winter rainfall meant that Lake Claremont was flushed at the time of sampling, with low algae cover. A high diversity of in-stream habitat existed in the Survey Area with which to support aquatic fauna. This included submerged and emergent macrophytes, algae, LWD, trailing vegetation, roots and benthic sediment. Water quality was comparable to results from annual monitoring undertaken by the Town of Claremont, with high EC, slightly alkaline pH and variable DO (Town of Claremont, 2016a).

The Survey Area was dominated by Hemiptera, Crustacea and Diptera. This is common among wetlands of the Darling Scarp and Swan Coastal Plain (Horwitz *et al.*, 2009; Sommer, 2008). These groups are broadly tolerant of salinity and other anthropogenic disturbances (Hart *et al.*, 1991), and generally dominate rivers and wetlands of the South West (Kay *et al.*, 2001; Pinder *et al.*, 2004). Salinity sensitive taxa such as mayflies and caddisflies were either absent or in low richness. This is unsurprising given the saline conditions within the Survey Area. A considerable shift in aquatic fauna assemblages is known to occur above 1,500 µS/cm (Hart *et al.*, 1991), favouring salinity-tolerant taxa.

A total of 58 taxa (species-level where possible) from 32 families were recorded from the Survey Area, while previous macroinvertebrate surveys have recorded 66 genera from 43 families. However, this represents a combined dataset from surveys undertaken between 2012 to 2014, rather than a single sampling event (Town of Claremont, 2016b). Historic data indicate that Lake Claremont has previously supported mayfly taxa, which were absent from the current survey, as well as a higher diversity of native freshwater snails and limpets (up to eight taxa compared to one taxon in the current survey). These groups can be sensitive to salinity (Greenop *et al.*, 2024; Kefford *et al.*, 2003), though it is currently unclear from the available data whether the current survey represents a loss of these taxa from the Survey Area over time. The lower native snail richness may be due to the invasiveness of the introduced bladder snail. Presence of this freshwater snail has been known to cause a decline in native *Glyptophysa* species due to increased competition (Zukowski & Walker, 2009).

SRE invertebrates

Despite the optimal weather conditions for SRE invertebrates, only five taxa were collected from leaf litter samples, primarily represented by pseudoscorpions. It is likely this is a reflection of the single-season sampling period and not a true representation of SRE diversity in the Survey Area. An increased sampling effort will likely reveal a greater diversity over time. Consideration must also be given to the site's history of recreation and land-use change, which may also impact SRE invertebrate diversity. Ensuring rehabilitation efforts continue will help support SRE presence for Lake Claremont. The collection of a new record of pseudoscorpion family Pseudotyrannochthoniidae within 40 km of the Survey Area presents a unique opportunity to increase awareness of these often-overlooked invertebrates with the wider community and encourage habitat restoration/rehabilitation.

6 Recommendations

Future monitoring strategies

The result of this survey highlights the importance of including key bioindicator groups in any future monitoring efforts by the Town as an accessible and effective way to assess the current suitability of habitat and the progression of rehabilitation efforts.

Ant species are commonly used in ongoing monitoring, however without a robust baseline survey (multiple seasons and multiple years), it is difficult to ascertain whether a paucity in diversity is representative of a larger issue or simply a sampling artefact. We would recommended that further ant surveys be conducted to assess whether the low diversity was simply survey timing and sampling or if the diversity is impacted by other factors such as invasive species or lack of appropriate habitat.

Native bees represent an important group of bioindicator taxa. The current survey indicates a good diversity of native bee species utilising the parklands of the area. Ongoing monitoring of bee diversity would provide valuable data to inform the Town's conservation and restoration initiatives. It is important that surveys employ standardised and replicable methods, while accounting for spatial and temporal variation in bee communities. This approach will ensure robust datasets that can inform land-use planning and management decisions and enable meaningful comparisons across surveys and through time. The combined use of active (sweep netting) and passive (vane trapping) sampling methods is recommended to maximise detection of bee diversity and capture a representative sample of the assemblage. The use of complementary methods also helps reduce bias associated with weather conditions, site characteristics, and collector variability. Plant–pollinator interaction network surveys are also recommended, as they provide insights into flower visitation patterns, resource use, and dietary preferences of different bee species, and assist in identifying key floral resources for native bees.

Survey design can be tailored to address specific management questions. For example, surveys across different seasons can be used to characterise native bee fauna within the Lake Claremont, while repeated surveys during the spring period can assess how bee assemblages respond to flowering plant phenology.

Long-term, standardised monitoring across multiple years is recommended to detect changes in species richness, diversity, composition, and abundance over time. Such data can be used to assess the effects of environmental change on bee communities, identify potentially restricted or endemic taxa, and evaluate the outcomes of rehabilitation and restoration efforts. Monitoring ant and bee communities alongside revegetation programs would provide a useful indicator of ecosystem recovery and function.

Conservation and Education Opportunities

The rehabilitation of habitat at Lake Claremont presents a key opportunity to champion conservation and education efforts, particularly for the local community. Lake Claremont is a site of conservation, cultural, and recreational importance and balancing these values can be difficult without community engagement and support. Including community groups in all facets of the rehabilitation process – consultation, site selection, method development, implementation, and monitoring – can instil a sense of ownership and responsibility that will likely improve conservation outcomes.

Encouraging the community to safely record their own invertebrate findings and highlighting bioindicator taxa of importance will also improve monitoring efforts. Where feasible and strictly under the supervision of qualified personnel, community groups should be included in the Town's ongoing monitoring of terrestrial and aquatic invertebrates as a way to introduce the general public to the scientific process.

7 References

Agosti, D., & Alonso, L. (2000). The ALL protocol: A standard protocol for the collection of ground-dwelling ants. In D. Agosti, J. D. Majer, L. E. Alonso, & T. R. Schultz (Eds.), *Ants: Standard Methods for Measuring and Monitoring Biodiversity* (pp. 204-206). Washington, D.C.: Smithsonian Institution Press.

ALA, Atlas of Living Australia. (2026). Occurrence search (custom search). Retrieved 2026 https://www.ala.org.au/

Allen, G. R., Midgley, S. H., & Allen, M. (2002). *Field Guide to the Freshwater Fishes of Australia*. Melbourne, VIC: CSIRO Publishing.

Alonso, L., & Agosti, D. (2000). Biodiversity studies, monitoring, and ants: An overview. In D. Agosti, J. D. Majer, L. E. Alonso, & T. R. Schultz (Eds.), *Ants: Standard Methods for Measuring and Monitoring Biodiversity* (pp. 1-8). Washington, D.C.: Smithsonian Institution Press.

Andersen, A. N. (1997). Using ants as bioindicators: Multiscale issues in ant community ecology. *Conservation Ecology, 1*, 1-17.

Andersen, M. R., Kragh, T., & Sand-Jensen, K. (2017). Extreme diel dissolved oxygen and carbon cycles in shallow vegetated lakes. *Proceedings of the Royal Society B, 284*(1862).

ANZG. (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Retrieved from www.waterquality.gov.au/anz-guidelines

Aquatic Ecosystems Task Group. (2012). *Aquatic ecosystems toolkit. Module 2: Interim Australian national aquatic ecosystem classification framework*. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT.

Ballantyne, G., Baldock, K. C. R., Rendell, L., & Willmer, P. G. (2017). Pollinator importance networks illustrate the crucial value of bees in a highly speciose plant community. *Scientific Reports, 7*, 8389.

Batley, M., & Hogendoorn, K. (2009). Diversity and conservation status of native Australian bees. *Apidologie, 40*(3), 347-354. doi:https://doi.org/10.1051/apido/2009018

Beard, J. S. (2015). *Plant life of Western Australia* (2nd ed.). Dural, NSW: Rosenberg Publishing Pty Ltd.

Bennelongia. (2024). *Wattle Grove South SRE invertebrate fauna desktop assessment*. Unpublished report prepared for JBS&G. Bennelongia Environmental Consultants, Jolimont, WA.

Bestelmeyer, B. T., Agosti, D., Alonso, L. E., Brandão, C. R. F., Brown Jr., W. L., Delabie, J. H. C., & Silvestre, R. (2000). Field techniques for the study of ground-dwelling ants: An overview, description and evaluation. In D. Agosti, J. D. Majer, L. E. Alonso, & T. R. Schultz (Eds.), *Ants: Standard methods for measuring and monitoring biodiversity* (pp. 122-144). Washington, DC: Smithsonian Institution Press.

Biesmeijer, J. C., Roberts, S. P. M., Reemer, M., Ohlemüller, R., Edwards, M., Peeters, T., . . . Kunin, W. E. (2006). Parallel declines in pollinators and insect-pollinated plants in Britain and the Netherlands. *Science, 313*(5785), 351-354. doi:10.1126/science.1127863

Biologic. (2018a). *Spring invertebrates survey*. Unpublished report prepared for City of Perth. Biologic Environmental Survey, Subiaco, WA.

Biologic. (2018b). *Tamworth Hill Swamp spring invertebrate survey*. Unpublished report prepared for City of Rockingham. Biologic Environmental Survey, Subiaco, WA.

Biologic. (2024). *Chalice Gonneville Project Short-range Endemic Invertebrate Fauna and Bee Survey Consolidated Report*. Unpublished report prepared for Chalice Mining Ltd. Biologic Environmental Survey, East Perth, WA.

BoM, Bureau of Meteorology. (2026). Climate data online. Retrieved 2026 http://www.bom.gov.au./climate/data/index.shtml

Borges, F. L. G., Oliveira, M. d. R., Almeida, T. C. d., Majer, J. D., & Garcia, L. C. (2021). Terrestrial invertebrates as bioindicators in restoration ecology: A global bibliometric survey. *Ecological Indicators, 125*, 107458.

Brown, E. M., Burbidge, A. H., Dell, J., Edinger, D., Hopper, S. D., & Wills, R. T. (1997). *Pollination in Western Australia: a database of animals visiting flowers*. Perth, Western Australia: Western Australian Naturalists' Club.

Brunet, J., & Fragoso, F. P. (2024). What are the main reasons for the worldwide decline in pollinator populations? *CABI Reviews, 19*. doi:doi.org/10.1079/cabireviews.2024.0016

Bunn, S. E., Davies, P. M., & Edward, D. H. (1989). The association of *Glacidorbis occidentalis* Bunn and Stoddart 1983 (Gastropoda: Glacidorbidae) with intermittently-flowing, forest streams in south-western Australia. *Journal of the Malacological Society of Australia, 10*(1), 25-34. doi:10.1080/00852988.1989.10674002

Car, C. A., Harvey, M. S., Hillyer, M. J., & Huey, J. A. (2019). The millipede genus Antichiropus (Diplopoda: Polydesmida: Paradoxosomatidae), part 3: species of the Pilbara bioregion of Western Australia. *Zootaxa, 4617*(1), 1-71. doi:10.11646/zootaxa.4617.1.1

Castalanelli, M. A., Teale, R., Rix, M. G., Kennington, W. J., & Harvey, M. S. (2014). Barcoding of mygalomorph spiders (Araneae: Mygalomorphae) in the Pilbara bioregion of Western Australia reveals a highly diverse biota. *Invertebrate Systematics, 28*, 375-385.

Churchward, H. M., & McArthur, W. M. (1980). Landforms and soils of the Darling System. In *Atlas of Natural Resources, Darling System, Western Australia.* (pp. 25-36). Western Australia: Department of Conservation and Environment.

Crews, S. C. (2013). Thirteen new species of the spider genus *Karaops* (Aranae: Selenopidae) from Western Australia. *Zootaxa, 3647*(3), 443-469.

Cullen, K. L., & Harvey, M. S. (2021). New species of the pseudoscorpion genus Synsphyronus (Pseudoscorpiones: Garypidae) from Australia. *Records of the Western Australian Museum, 36*.

DBCA, Department of Biodiversity Conservation and Attractions. (2026). Dandjoo biodiversity data repository (custom search). Retrieved 2026 https://dandjoo.bio.wa.gov.au/

Delnevo, N., van Etten, E. J., Clemente, N., Fogu, L., Pavarani, E., Byrne, M., & Stock, W. D. (2020). Pollen adaptation to ant pollination: a case study from the Proteaceae. *Annals of Botany, XX*, 1-10.

Dodge, J. M., & Davis, T. S. (2025). Bee-Kleptoparasite interactions, but not nest provisioning, vary across a wildland-urban gradient in the Colorado Front Range. *Journal of Forestry, 124*, 251-266. doi:doi.org/10.1007/s44392-025-00031-2

Dormann, C. F., Fruend, J., & Gruber, B. (2019). Package ' bipartite ' - Visualising Bipartite Networks and Calculating Some (Ecological) Indices.

Edward, K. L., & Harvey, M. S. (2010). A review of the Australian millipede genus *Atelomastix* (Diplopoda: Spirostreptida: Iulomorphidae). *Zootaxa, 2371*, Page 1-Page 63.

EPA, Environmental Protection Authority. (2016a). *Environmental Factor Guideline: Terrestrial Fauna*. Perth, Western Australia: Environmental Protection Authority.

EPA, Environmental Protection Authority. (2016b). *Technical Guidance: Sampling of Short-range Endemic Invertebrate Fauna*. (Guidance Statement No. 20). Perth, Western Australia: Environmental Protection Authority.

EPA, Environmental Protection Authority. (2016c). *Technical Guidance: Terrestrial Fauna Surveys*. Perth, Western Australia: Environmental Protection Authority.

Gooderham, J., & Tsyrlin, E. (2002). *The Waterbug Book*. Melbourne, VIC: CSIRO Publishing.

Greenop, K. R., Stewart, B. A., & Close, P. G. (2024). Can a naturally depauperate Ephemeroptera, Plectoptera and Trichoptera (EPT) fauna track river degradation in south-western Australia? *Environmental Monitoring and Assessment, 196*(7), 592. doi:10.1007/s10661-024-12734-8

Gross, C. L. (2001). The effect of introduced honeybees on native bee visitation and fruit-set in *Dillwynia juniperina* (Fabaceae) in a fragmented ecosystem. *Biological Conservation, 102*(1), 89-95. doi:10.1016/S0006-3207(01)00088-X

Gunawardene, N. R., Durrant, B., Szydlowski, S., & Pille Arnold, J. (2021). *The value of small urban bushlands and the importance of documenting and preserving biodiversity in the suburbs.* Paper presented at the The Biodiversity Conference - Resilient Landscapes,15-17 September 2021, Perth, WA.

Harms, D., McRae, J., Curran, M., & Harvey, M. S. (2025). Identifying refugia for invertebrate conservation in biodiversity hotspots: examples from a new genus of dragon pseudoscorpions (Pseudotyrannochthoniidae: Karrichthonius). *Invertebrate Systematics, 39*, IS25028. doi:doi:10.1071/IS25028

Hart, B. T., Bailey, P., Edwards, R., Hortle, K., James, K., McMahon, A., . . . Swadling, K. (1991). A review of the salt sensitivity of the Australian freshwater biota. *Hydrobiologia, 210*, 105-144.

Harvey, M. S. (2002). Short range endemism in the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics, 16*, 555-570.

Harvey, M. S. (2018). *Balgachernes occultus*, a new genus and species of pseudoscorpion (Pseudoscorpiones: Chernetidae) associated with balga (*Xanthorrhoea preissii*) in south-western Australia, with remarks on *Austrochernes* and *Troglochernes*. *Records of the Western Australian Museum, 35*(1), 115-130.

Harvey, M. S., Abrams, K. M., Beavis, A. S., Hillyer, M. J., & Huey, J. A. (2016). Pseudoscorpions of the family Feaellidae (Pseudoscorpiones: Feaelloidea) from the Pilbara region of Western Australia show extreme short-range endemism. *Invertebrate Systematics, 30*(5), 491-508.

Heterick, B. E. (2009). *A Guide to the Ants of South-Western Australia* (Vol. Supplement 76).

Heterick, B. E., Lythe, M., & Smithyman, C. (2013). Urbanisation factors impacting on ant (Hymenoptera: Formicidae) biodiversity in the Perth metropolitan area, Western Australia: Two case studies. *Urban Ecosystems, 16*, 145.

Hoffmann, B., & Andersen, A. N. (2003). Responses of ants to disturbance in Australia, with particular reference to functional groups. *Austral Ecology, 28*, 444-464.

Horwitz, P., Rogan, R., Halse, S. A., Davis, J., & Sommer, B. (2009). Wetland invertebrate richness and endemism on the Swan Coastal Plain, Western Australia. *Marine and Freshwater Research, 60*, 1006-1020.

Houston, T. (2011). Native Bees. Retrieved from https://museum.wa.gov.au/research/collections/terrestrial-zoology/entomology-insect-collection/entomology-factsheets/native-bees

Houston, T. (2018). *A Guide to Native Bees of Australia*. Clayton South, VIC: CSIRO Publishing.

Houston, T. F. (2000). *Native bees on wildflowers in Western Australia - A synopsis of bee visitation of wildflowers based on the bee collection of the Western Australian Museum*. Perth, Western Australia: Western Australian Insect Study Society Inc.

Huey, J. A., Hillyer, M. J., & Harvey, M. S. (2019). Phylogenetic relationships and biogeographic history of the Australian trapdoor spider genus Conothele (Araneae: Mygalomorphae: Halonoproctidae): diversification into arid habitats in an otherwise tropical radiation. *Invertebrate Systematics, 33*(4), 628-643.

Huxley, C., & Cutler, D. (1991). *Ant-plant interactions*. Oxford, UK: Oxford University Press,.

Invertebrate Solutions. (2018). *Desktop Review and Risk Assessment of Short Range Endemic Invertebrates for the Yanchep Rail Extension, Western Australia*. Unpublished report prepared for Public Transport Authority. Invertebrate Solutions, Victoria Park, WA.

Invertebrate Solutions. (2019). *Conservation Significant and Short Range Endemic Invertebrate Desktop Habitat Assessment for Thornlie-Cockburn Link Proposal, Perth, Western Australia*. Unpublished report prepared for Public Transport Authority. Invertebrate Solutions, Victoria Park, WA.

Invertebrate Solutions. (2020). *Baseline Short Range Endemic and Conservation Significant Invertebrate Survey for the Malaga to Ellenbrook Rail Works, Western Australia*. Unpublished report prepared for Public Transport Authority. Invertebrate Solutions, Victoria Park, WA.

Invertebrate Solutions. (2021a). *Desktop review and impact assessment of short range endemic and conservation significant invertebrates for the Byford Rail Extension Project, Western Australia*. Unpublished report prepared for Public Transport Authority. Invertebrate Solutions, Victoria Park.

Invertebrate Solutions. (2021b). *Short range endemic invertebrate assessment of Lots 11 and 74 (Part), Beenyup Rd, Banjup, Perth, Western Australia*. Unpublished report prepared for 360 Environmental. Invertebrate Solutions, Victoria Park, WA.

Invertebrate Solutions. (2022). *Short range endemic invertebrate assessment of Maddington Kenwick Strategic Employment Area (MKSEA), Kenwick, Perth, Western Australia*. Unpublished report prepared for City of Gosnells. Inevrtebrate Solutions, Victoria Park, WA.

Johnson, M. S., Hamilton, Z. R., Murphy, C. E., MacLeay, C. A., Roberts, B., & Kendrick, P. G. (2004). Evolutionary genetics of island and mainland species of *Rhagada* (Gastropoda: Pulmonata) in the Pilbara Region, Western Australia. *Australian Journal of Zoology, 52*(4), 341-355.

Judd, S., & Perina, G. (2013). An illustrated key to the morphospecies of terrestrial isopods (Crustacea: Oniscidea) of Barrow Island, Western Australia. *Records of the Western Australian Museum, Supplement*(83), 185-207.

Kahle, D., & Wickham, H. (2013). ggmap: spatial Visualization with ggplot2. *The R Journal, 5*(1), 144-161.

Kay, W. R., Halse, S. A., Scanlon, M. D., & Smith, M. J. (2001). Distributional and environmental tolerances of aquatic macroinvertebrate familes in the agricultural zone of southwestern Australia. *Journal of the North American Benthological Society, 20*(2), 182-199.

Kefford, B. J., Papas, P. J., & Nugegoda, D. (2003). Relative salinity tolerance of macroinvertebrates from the Barwon River, Victoria, Australia. *Marine and Freshwater Research, 54*(6), 755. doi:10.1071/MF02081

Kevan, P. G. (1999). Pollinators as bioindicators of the state of the environment: species, activity and diversity. *Agriculture, Ecosystems and Environment, 74*, 373-393.

Lach, L. T., M.L. (2008). Invasive ants in Australia: Documented and potential ecological consequences. *Australian Journal of Entomology, 47*, 275-288. doi:https://doi.org/10.1111/j.1440-6055.2008.00659.x

Levenson, H. K., Metz, B. N., & Tarpy, D. R. (2024). Effects of study design parameters on estimates of bee abundance and richness in agroecosystems: a meta-analysis. *Annals of the Entomological Society of America, 117*(2), 92-106. doi:10.1093/aesa/saae001

Longino, J. T. (2000). What to do with the data. In D. Agosti, J. D. Majer, L. E. Alonso, & T. R. Schultz (Eds.), *Ants: Standard Methods for Measuring and Monitoring Biodiversity* (pp. 186-203). Washington, D.C.: Smithsonian Institution Press.

Majer, J. D. (1983). Ants: bio-indicators of minesite rehabilitation, land-use, and land conservation. *Environmental Management, 7*(4), 375-383.

Majer, J. D., & De Kock, A. (1992). Ant recolonization of sand mines near Richards Bay, South Africa: an evaluation of progress with rehabilitation. *South African Journal of Science, 88*(1), 31-36.

Majer, J. D., & Nichols, O. G. (1998). Long-term recolonization patterns of ants in Western Australian bauxite mines with reference to their use as indicators of restoration success. *Journal of Applied Ecology, 35*, 161-182.

Mayer, X. M., Ruprecht, J. K., & Bari, M. A. (2005). *Stream salinity status and trends in south-west Western Australia. Report No. SLUI38*. Department of Environment and Salinity and Land Use Series.

McLure, N., & Horwitz, P. (2009). *An Investigation of Aquatic Macroinvertebrate Occurence & Water Quality at Lake Chandala, Western Australia*. Unpublished report prepared for Prepared for the Western Australian Department of Environment and Conservation.

Michener, C. D. (1965). A classification of the bees of the Australian and South Pacific regions. *Bulletin of the American Museum of Natural History, 130*, 1-362. doi:10.1086/405376

Michener, C. D. (2000). *The bees of the world*. Maryland, USA: Johns Hopkins University Press.

Mitchell, D., Williams, K., & Desmond, A. (2003). Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion). In *A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002* (pp. 606-623). Kensington, WA: Department of Conservation and Land Management.

Oksanen, J., Simpson, G. L., Blanchet, F. G., Kindt, R., Legendre, P., Minchin, P. R., . . . Wagner, H. (2024). vegan: community ecology package (Version R package version 2.7-1). Retrieved from https://CRAN.R-project.org/package=vegan

Oliver, I., & Beattie, A. (1996). Designing a cost-effective invertebrate survey: a test of methods for rapid assessment of biodiversity. *Ecological Applications, 6*, 594-607.

Otto, J. C., & Hill, D. E. (2021). Catalogue of the Australian peacock spiders (Araneae: Salticidae: Euophyrini: Maratus), version 4. *Peckhamia, 148*(4), 1-35.

Packer, L., & Darla-West, G. (2021). Bees: How and why to sample them. In J. C. Santos & G. Wilson-Fernandes (Eds.), *Measuring Arthropod Biodiversity: A Handbook of Sampling Methods*. Cham, Switzerland: Springer Nature.

Paini, D. R. (2004). Impact of the introduced honey bee (*Apis mellifera*) (Hymenoptera: Apidae) on native bees: A review. *Austral Ecology, 29*(4), 399-407. doi:10.1111/j.1442-9993.2004.01376.x

Paini, D. R., & Roberts, J. D. (2005). Commercial honey bees (*Apis mellifera*) reduce the fecundity of an Australian native bee (*Hylaeus alcyoneus*). *Biological Conservation, 123*(1), 103-112. doi:10.1016/j.biocon.2004.11.001

Phoenix. (2023). *Short-range endemic and significant invertebrate desktop assessment for the Garden Street Extension Project*. Unpublished report prepared for City of Gosnells. Phoenix Environmental Sciences, Osborne Park, WA.

Pille Arnold, J. (2021). *Modulating effects of the surrounding landscape matrix on plant-pollinator networks within remnant habitat.* (PhD), University of Western Australia, Crawley, WA. Zotero database.

Pille Arnold, J., Murphy, M. V., Didham, R. K., & Houston, T. (2019). Rediscovery of the 'extinct' bee *Hesperocolletes douglasi* Michener, 1965 (Colletidae: Colletinae: Paracolletini) in Western Australia and first description of the female. *Journal of Threatened Taxa, 11*(3), 13310-13319. doi:https://doi.org/10.11609/jott.4610.11.3.13310-13319

Pille Arnold, J., Tylianakis, J. M., Murphy, M. V., Cawthray, G. R., Webber, B. L., & Didham, R. K. (2024). Body-size-dependent effects of landscape-level resource energetics on pollinator abundance in woodland remnants. *Proceedings of the Royal Society B: Biological Sciences, 291*, 20232771. doi:10.1098/rspb.2023.2771

Pinder, A. M., Halse, S. A., McRae, J. M., & Shiel, R. J. (2004). Aquatic invertebrate assemblages of wetlands and rivers in the wheatbelt region of Western Australia. *Records of the Western Australian Museum, 67*, 7-37.

Poisot, T., Canard, E., Mouquet, N., & Hochberg, M. E. (2012). A comparative study of ecological specialization estimators. *Methods in Ecology and Evolution, 3*, 537-544.

Ponder, W. F., & Colgan, D. J. (2002). What makes a narrow range taxon? Insights from Australian fresh-water snails. *Invertebrate Systematics, 16*(5), 571-582.

Potts, S. P., Imperatriz-Fonseca, V., Ngo, H. T., Aizen, M. A., Biesmeijer, J. C., Breeze, T. D., . . . Vanbergen, A. J. (2016). Safeguarding pollinators and their values to human well-being. *Nature, 540*. doi:doi:10.1038/nature20588

Prendergast, K. (2020a). Native bee survey of Lake Claremont Nov 2019-Feb 2020. Retrieved from https://friendsoflakeclaremont.org/?p=4771

Prendergast, K. (2020b). *Species of native bees in the urbanised region of the southwest Western Australian biodiversity hotspot.* Curtin University., Perth, Western Australia.

Prendergast, K. S., Dixon, K. W., & Bateman, P. W. (2022). The evidence for and against competition between the European honeybee and Australian native bees. *Pacific Conservation Biology, 29*(2), 89-109. doi:10.1071/PC21064

Prendergast, K. S., & Ollerton, J. (2021). Plant-pollinator networks in Australian urban bushland remnants are not structurally equivalent to those in residential gardens. *Urban Ecosystems, 24*(5), 973-987. doi:10.1007/s11252-020-01089-w

R Core Team. (2025). R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing.

Rix, M. G., Huey, J. A., Main, B. Y., Waldock, J. M., Harrison, S. E., Comer, S., . . . Harvey, M. S. (2017a). Where have all the spiders gone? The decline of a poorly known invertebrate fauna in the agricultural and arid zones of southern Australia. *Austral Entomology, 56*(1), 14-22.

Rix, M. G., Raven, R. J., & Harvey, M. S. (2018). Systematics of the giant spiny trapdoor spiders of the genus *Gaius* Rainbow (Mygalomorphae: Idiopidae: Aganippini): documenting an iconic lineage of the Western Australian inland arid zone. *Journal of Arachnology, 46*, 438-472.

Rix, M. G., Raven, R. J., Main, B. Y., Harrison, S. E., Austin, A. D., Cooper, S. J. B., & Harvey, M. S. (2017b). The Australasian spiny trapdoor spiders of the family Idiopidae (Mygalomorphae : Arbanitinae): a relimitation and revision at the generic level. *Invertebrate Systematics, 31*(5), 566-634. doi:https://doi.org/10.1071/IS16065

Roulston, T. a. H., & Goodell, K. (2011). The role of resources and risks in regulating wild bee populations. *Annual Review of Entomology, 56*(1), 293-312. doi:10.1146/annurev-ento-120709-144802

Sato, S., Buckman-Young, R. S., Harvey, M. S., & Giribet, G. (2018). Cryptic speciation in a biodiversity hotspot: multilocus molecular data reveal new velvet worm species from Western Australia (Onychophora : Peripatopsidae : <i>Kumbadjena</i>). *Invertebrate Systematics, 32*(6), 1249-1264. doi:https://doi.org/10.1071/IS18024

Saunders, M. E., Hall, M. A., Lentini, P. E., Brown, J., & Cunningham, S. A. (2021). Scholarly shortcomings and a lack of evidence beleaguer bee sampling critique: A response to Prendergast and Hogendoorn (2021). *Austral Ecology, 46*(5), 885-887. doi:10.1111/aec.13042

Scheper, J., Reemer, M., Van Kats, R., Ozinga, W. A., Van Der Linden, G. T. J., Schaminée, J. H. J., . . . Kleijn, D. (2014). Museum specimens reveal loss of pollen host plants as key factor driving wild bee decline in The Netherlands. *Proceedings of the National Academy of Sciences, 111*(49), 17552-17557. doi:10.1073/pnas.1412973111

Schindler, M., Diestelhorst, O., Härtel, S., Saure, C., Schanowski, A., & Schwenninger, H. R. (2013). Monitoring agricultural ecosystems by using wild bees as environmental indicators. *BioRisk, 8*, 53-71. doi:10.3897/biorisk.8.3600

Sheffield, C. S., Pindar, A., Packer, L., & Kevan, P. G. (2013). The potential of cleptoparasitic bees as indicator taxa for assessing bee communities. *Apidologie, 44*, 501-510. doi:10.1007/s13592-013-0200-2

Smith, M. J., Kay, W. R., Edward, D. H., Papas, P. J., Richardson, K., Simpson, J. C., . . . Halse, S. A. (1999). AusRivAS: using macroinvertebrates to assess ecological condition of rivers in Western Australia. *Freshwater Biology, 41*, 269-282. doi:10.1046/j.1365-2427.1999.00430.x

Sommer, B., & Horwitz, P. (2009). Macroinvertebrate cycles of decline and recovery in Swan Coastal Plain (Western Australia) wetlands affected by drought-induced acidification. *Hydrobiologia, 624*, 191-203. doi:10.1007/s10750-008-9692-6

Sommer, B. H., P.

Hewitt, P. (2008). *Assessment of wetland invertebrate and fish biodiversity for the Gnangara Sustainability Strategy (GSS). Final Report to the Western Australian Department of Environment and Conservation.* Edith Cowan University, Centre for Ecosystem Management.

Thackway, R., & Cresswell, I. (1995). *An interim biogeographical regionalisation for Australia: A framework for setting priorities in the National Reserves System Cooperation Plan*. Canberra, ACT: Australian Nature Conservation Agency.

Town of Claremont. (2016a). *Lake Claremont management plan 2016-2021: Appendix 2 Biophysical Wetland Values*. Town of Claremont, Claremont, WA.

Town of Claremont. (2016b). *Lake Claremont management plan 2016-2021: Appendix 3 fauna values*. Town of Claremont, Claremont, WA.

Town of Claremont. (2024). *Lake Claremont management plan 2024 - 2029*. Town of Claremont, Claremont, WA.

Tronstad, L., Bell, C., & Crawford, M. (2022). Choosing collection methods and sample sizes for monitoring bees. *Agricultural and Forest Entomology, 24*(4), 531-539. doi:10.1111/afe.12518

Valido, A., Rodríguez-Rodríguez, M. C., & Jordano, P. (2019). Honeybees disrupt the structure and functionality of plant-pollinator networks. *Scientific Reports, 9*(1), 4711. doi:10.1038/s41598-019-41271-5

Volschenk, E. S., Burbidge, A. H., Durrant, B. J., & Harvey, M. S. (2010). Spatial distribution patterns of scorpions (Scorpiones) in the arid Pilbara region of Western Australia. *Records of the Western Australian Museum*, 271-284.

WAM, Western Australian Museum. (2026a). Arachnida and Myriapoda Collection Database (custom search). Retrieved 2026 http://www.museum.wa.gov.au

WAM, Western Australian Museum. (2026b). Crustacea Collection Database (custom search). Retrieved 2025 http://www.museum.wa.gov.au

WAM, Western Australian Museum. (2026c). Insecta Collection Database (custom search). Retrieved 2026 http://www.museum.wa.gov.au

WAM, Western Australian Museum. (2026d). Mollusca Collection Database (custom search). Retrieved 2026 http://www.museum.wa.gov.au

Whisson, C. S., Breure, A. S. H., & Kirkendale, L. A. (2024). *Bothriembryon rocketi* sp. nov. (Mollusca, Gastropoda, Bothriembryontidae) from the semi-arid Pilbara region of Western Australia. *Australian Journal of Taxonomy*, 1-10. doi:10.54102/ajt.1y4jy

Willmer, P. G., Cunnold, H., & Ballantyne, G. (2017). Insights from measuring pollen deposition: quantifying the pre-eminence of bees as flower visitors and effective pollinators. *Arthropod-Plant Interactions, 11*, 411–425.

Wojcieszek, J. M., Harvey, M., & Rix, M. (2011). Optimised captive husbandry conditions for the Western Australian 'Marri Millipede' Antichiropus variabilis (Diplopoda: Polydesmida: Paradoxosomatidae), with notes on natural history. *Records of the Western Australian Museum, 26*, 87–93.

Zukowski, S., & Walker, K. F. (2009). Freshwater snails in competition: alien *Physa acuta* (Physidae) and native *Glyptophysa gibbosa* (Planorbidae) in the River Murray, South Australia. *Marine and Freshwater Research, 60*, 999-1005.

Appendix A : DBCA licenses

Department of
Primary Industries and
Regional Development

GOVERNMENT OF
WESTERN AUSTRALIA

Protect
Grow
Innovate

FIELD SITE NOTIFICATION FORM

Individuals and institutions that hold a licence to use animals for scientific purposes issued under the *Animal Welfare Act 2002* (licence holders) are required to advise the Department of Primary Industries and Regional Development (DPIRD) in writing of the locations where animals are used or kept for scientific purposes.

This form has been provided to enable licence holders to notify DPIRD of activities using animals for scientific purposes at field sites (locations that are not owned or managed by the licence holder).

Please submit a notification form if the:

- location(s) are in Western Australia; and
- location(s) have been approved by an animal ethics committee for the dates provided.

Should the location of animal use, or the start or end dates of animal use change, please notify DPIRD by submitting a new notification form with the appropriate changes.

This form must be submitted to DPIRD prior to animals being used for scientific purposes. Failure to provide the information required in accordance with the licensing conditions may result in the licence being suspended or revoked.

More information on locations where animals are used or kept for scientific purposes can be found on DPIRD's website. If you are unsure if you need to submit a notification form, please contact scientific.licensing@dpird.wa.gov.au.

To submit a notification form, please send the completed document to scientific.licensing@dpird.wa.gov.au.

Section 1 – Licensing and Project Details

Part A – Licensing Details

Name of scientific establishment (as printed on issued licence)

Biologic Environmental Survey

Licence number (as printed on issued licence) U244/2022-2024

Part B – Project Details

Project ID RW3354-21

Project Title (optional) Basic, Detailed and Targeted Survey Methods

Part C – Animal Ethics Committee Approval

Name of Animal Ethics Committee that approved the project

Murdoch University Animal Ethics Committee

Approval ID (if different to Project ID)

Part D – Contact Person(s) (*At least one (1) contact person must be provided*)

Name	Email	Phone
Siobhan Paget	siobhan.paget@biologicgroup.com.au	0431 695 627
Kim Nguyen	kim.nguyen@biologicgroup.com.au	0404 003 565
Nihara Gunawardene	nihara.gunawardene@biologicgroup.com.au	0420 889 177

SIGNATURE OF AUTHORISED PERSON

Signature

Date 24-Nov-2025

Name Siobhan Paget

Job Title

Senior Aquatic Ecologist

Email address

siobhan.paget@biologicgroup.com.au

Phone number

0431 695 627

Section 2 – Location and dates of animal use

Location Name	Location Address	Start date	End date
Lake Claremont	-31.975080, 115.776373	28-Nov-2025	28-Nov-2025

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

OFFICIAL

FAUNA TAKING (BIOLOGICAL ASSESSMENT) LICENCE

Regulation 27, Biodiversity Conservation Regulations 2018

Licence Number: BA27001452

Licence Holder: Ms Jessica Delaney
Biologic Environmental Survey
24-26 Wickham Street
EAST PERTH WA 6004

Date of Issue: 19/11/2025

Date Valid From: 19/11/2025
Date of Expiry: 18/11/2026

LICENSED ACTIVITIES

Subject to the terms and conditions on this licence, the licence holder may –

1. Undertake Lake Claremont invertebrate fauna survey for the Town of Claremont for the primary objective of the project is to gather quantitative data on invertebrate fauna species assemblages and habitats in the Survey Area to enhance and contextualise the level of knowledge at the local and regional scale.

   Take fauna aquatic macroinvertebrate sampling will be conducted using a 250 µm mesh D-net to selectively collect the macroinvertebrate fauna., specimens will be ethically euthanised and preserved in 70% ethanol. Invertebrates may also be captured hand captured using butterfly nets and collect litter samples (Winkler sack sifting).

   All proposed activities will be conducted in accordance with Animal Ethics Committee approval and Department of Biodiversity, Conservation and Attractions (DBCA) Standard Operating Procedures for fauna survey and monitoring techniques.

LOCATIONS

1. Lake Claremont, Stirling Road Claremont.

AUTHORISED PERSONS

The following persons or persons of the specified class may assist in carrying out the licensed activities:

1. Lily Carson
2. Shae Surman
3. Nihara Gunawardene
4. Juliana Pille Arnold
5. Aimee Carpenter

CONDITIONS

1. Fauna must not be taken on CALM land, (as defined in the Conservation and Land Management Regulations 2002*)*, unless authorised by a written notice of a lawful authority issued under regulations 4 and 8 of the Conservation and Land Management Regulations 2002.

2. If persons, other than the licence holder, are authorised to carry out/assist in carrying out the activities under the licence, the licence holder must ensure those persons have read and understand the licence terms and conditions.
3. The written authorisation of the person in possession or occupation of the land accessed and upon which fauna is taken, as required under regulation 101(2) and referred to in "Additional information" below, <u>must</u>:
   a) state location details (including lot or location number, street/road, suburb and local government authority);
   b) state land owner or occupier name, and contact phone number;
   c) specify the time period that the authorisation is valid for;
   d) be signed and dated; and
   e) be attached to this licence at all times.
4. This licence, and any written authorisation or lawful authority which authorises the take of fauna on specified locations must be carried at all times while conducting licensed activities and be produced on demand by a wildlife officer.
5. If a species of fauna listed as a threatened species under Section 19 of the *Biodiversity Conservation Act 2016* is inadvertently captured, that species is to be released immediately at the point of capture. If the fauna is injured or deceased, the licence holder shall contact the DBCA Wildlife Licensing Section (wildlifelicensing@dbca.wa.gov.au) for advice on treatment or disposal. Details of any capture of threatened fauna must be included in the "Return of Fauna Taken."
6. The licence holder must not:
   a) release any fauna in any area where it does not naturally occur;
   b) transfer fauna to any other person or authority (other than the Western Australian Museum) unless approved in writing by the CEO; or
   c) dispose of the remains of fauna in any manner likely to interfere the natural or present day distribution of the species.
7. The licence holder must not take and remove more than ten specimens of any one protected species of fauna from any location less than 20km apart. Where exceptional circumstances make it necessary to take a larger number of specimens from a particular location in order to obtain adequate statistical data, the collector must proceed with circumspection and justify their actions to the Director General in advance.
8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence must be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected, which represents a significant extension of geographic range must be offered to the Western Australian Museum.
9. All specimens and material retained under the authority of this licence must be offered to the Western Australian Museum for loan, for inclusion in its collection, or on request be made available to other persons involved in relevant scientific studies.
10. The licence holder must create, compile and maintain records and information as required in a DBCA approved "Return of Fauna Taken" of all fauna taking activities as they occur.
11. A DBCA approved "Return of Fauna Taken" must be completed in full (including nil taking details) and submitted to DBCA Wildlife Licensing Section (wildlifelicensing@dbca.wa.gov.au) prior to the end of each annual period of the licence (from the valid from date) (refer to "Additional Information" section below).

D Stefoni
LICENSING OFFICER
WILDLIFE PROTECTION BRANCH

Delegate of CEO

ADDITIONAL INFORMATION

1. It is an offence to take any species of fauna listed as a threatened species under Section 19 of the *Biodiversity Conservation Act 2016* unless the person is authorised under Section 40. The penalty ranges between $300 000 and $500 000; Section 150 Biodiversity Conservation Act 2016.
2. Regulation 82 empowers the CEO to add, substitute or delete a term or condition of a licence or to correct errors. Such power may be exercised on application of a licence holder or by the CEO's own initiative. If an amendment to a licence term or condition is required, please contact the CEO or the Licensing Section on wildlifelicensing@dbca.wa.gov.au in the first instance. The licence holder, if adversely affected by a condition imposed in this licence, may apply to the State Administrative Tribunal for review of the decision of the CEO to impose that condition on a licence: regulation 89(2) Biodiversity Conservation Regulations 2018.
3. A person must not contravene a condition of a licence. The penalty for an offence involving the contravention of a condition of a licence is a fine of $10 000: regulation 84 of the Biodiversity Conservation Regulations 2018.
4. It is an offence for persons authorised by this licence to enter land that is not in their possession or under their control without first having the *prior* written authorisation of the current owner or occupier of the land to:
   a) enter the land; and
   b) carry out the activity authorised by this licence.

   The penalty for this offence is a fine of $5 000: regulation 101(2) of the Biodiversity Conservation Regulations 2018.
5. The licence holder must be able to produce for inspection upon request any information or records required by regulation 85(2) of the Biodiversity Conservation Regulations 2018 Penalty $10 000. It is an offence to knowingly include false or misleading information or make statements in records: regulation 85(3) of the Biodiversity Conservation Regulations 2018 Penalty $10 000. It is an offence to include any information or make any statement in a return that the licence holder knows to be false or misleading in a material particular: regulation 86 (2) of the Biodiversity Conservation Regulations 2018 Penalty $10 000.
6. The approved DBCA "Return of Fauna Taken" data file can be downloaded from the DBCA webpage (https://www.dpaw.wa.gov.au/plants-and-animals/licences-and-authorities).
7. The issuing of a licence under the Biodiversity Conservation Regulations 2018 does not constitute an animal ethics approval or a licence to use animals for scientific purposes as required under the *Animal Welfare Act 2002,* Animal Welfare (Scientific Purposes) Regulations 2003. It is the responsibility of a licence applicant / licence holder to ensure that they comply with the requirements of all applicable legislation. Enquiries relating to the Animal Welfare Act licences and animal ethics approvals are to be

directed to the Department of Primary Industries and Regional Development (https://www.agric.wa.gov.au/animalwelfare).

8. Threatened fauna can only be taken under a *Biodiversity Conservation Act 2016* Section 40 authorisation, Occurrences of threatened species must be reported to the CEO. For more information please see https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals.

9. Any interaction involving Nationally Listed Threatened Fauna that may be invasive and/or harmful to the fauna may require approval from the Commonwealth Department of the Environment and Energy http://www.environment.gov.au/about-us/business-us/permits-assessments-licences. Interaction with such species is controlled by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and Environment Protection and Biodiversity Conservation Regulations 2000 as well as the *Biodiversity Conservation Act 2016* and Biodiversity Conservation Regulations 2018.

Appendix B: Likelihood of occurrence within the Survey Area for ant fauna identified in the desktop assessment

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Acropyga		
Acropyga myops	36.5	Possible
Adlerzia		
Adlerzia froggatti	2.1	Likely
Amblyopone		
Amblyopone aberrans	36.8	Possible
Amblyopone australis	36.0	Possible
Amblyopone clarki	9.7	Possible
Anonychomyrma		
Anonychomyrma fornicata	3.1	Likely
Anonychomyrma itinerans	2.4	Likely
Anonychomyrma itinerans perthensis	3.2	Likely
Anonychomyrma nitidiceps	6.8	Possible
Aphaenogaster		
Aphaenogaster poultoni	2.4	Likely
Arnoldius		
Arnoldius flavus	37.7	Possible
Austromorium		
Austromorium flavigaster	6.8	Possible
Austromorium hetericki	26.1	Possible
Austroponera		
Austroponera rufonigra	4.0	Likely
Brachyponera		
Brachyponera lutea	2.0	Likely
Calomyrmex		
Calomyrmex similis	ALL INSIDE	Highly Likely
Camponotus		
Camponotus capito	27.4	Possible
Camponotus ceriseipes	29.3	Possible
Camponotus chalceus	2.4	Likely
Camponotus cinereus	12.9	Possible
Camponotus cinereus amperei	38.0	Possible
Camponotus cinereus notterae	12.1	Possible
Camponotus claripes	2.4	Likely
Camponotus consectator	36.2	Possible
Camponotus consobrinus	6.8	Possible
Camponotus darlingtoni	6.8	Possible
Camponotus discors	1.8	Highly Likely
Camponotus dryandrae	6.9	Possible
Camponotus ephippium	38.0	Possible

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Camponotus ephippium narses	27.4	Possible
Camponotus evae	38.0	Possible
Camponotus insipidus	2.4	Likely
Camponotus johnclarki	26.8	Possible
Camponotus lividipes	38.0	Possible
Camponotus lownei	12.1	Possible
Camponotus marcens	21.1	Possible
Camponotus michaelseni	6.8	Possible
Camponotus minimus	36.8	Possible
Camponotus molossus	6.8	Possible
Camponotus nigriceps	6.8	Possible
Camponotus novaehollandiae	37.3	Possible
Camponotus pallidiceps	6.8	Possible
Camponotus prosseri	3.9	Likely
Camponotus prostans	4.7	Likely
Camponotus rufus	6.8	Possible
Camponotus scotti	32.7	Possible
Camponotus scratius	0.8	Highly Likely
Camponotus simpsoni	20.7	Possible
Camponotus terebrans	3.3	Likely
Camponotus tumidus	27.9	Possible
Camponotus walkeri	6.8	Possible
Camponotus walkeri bardus	27.4	Possible
Camponotus whitei	26.0	Possible
Cardiocondyla		
Cardiocondyla atalanta	6.8	Possible
Cardiocondyla nuda	1.7	Highly Likely
Chelaner		
Chelaner crinitum	38.0	Possible
Chelaner decuria	28.1	Possible
Chelaner leae	2.4	Likely
Chelaner legulus	38.0	Possible
Chelaner pubescens	4.2	Likely
Chelaner punctulatum	10.5	Possible
Chelaner rubriceps	38.0	Possible
Colobopsis		
Colobopsis gasseri	4.3	Likely
Colobostruma		
Colobostruma elliotti	4.1	Likely
Crematogaster		

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Crematogaster frivola	7.5	Possible
Crematogaster laeviceps	2.4	Likely
Crematogaster laeviceps chasei	6.8	Possible
Crematogaster perthensis	6.8	Possible
Crematogaster queenslandica	4.0	Likely
Crematogaster rufotestacea	6.8	Possible
Doleromyrma		
Doleromyrma darwiniana	19.0	Possible
Doleromyrma darwiniana fida	19.1	Possible
Doleromyrma rottnestense	25.4	Possible
Dolichoderus		
Dolichoderus clusor	2.4	Likely
Dolichoderus formosus	27.9	Possible
Dolichoderus niger	6.8	Possible
Dolichoderus nigricornis	2.4	Likely
Dolichoderus parvus	25.3	Possible
Dolichoderus rufotibialis	21.3	Possible
Dolichoderus scabridus	27.9	Possible
Dolichoderus ypsilon	1.8	Highly Likely
Epopostruma		
Epopostruma inornata	34.3	Possible
Epopostruma kangarooensis	13.0	Possible
Heteroponera		
Heteroponera imbellis	31.0	Possible
Hypoponera		
Hypoponera congrua	25.8	Possible
Iridomyrmex		
Iridomyrmex anceps	2.4	Likely
Iridomyrmex bicknelli	0.8	Highly Likely
Iridomyrmex calvus	6.8	Possible
Iridomyrmex chasei	2.4	Likely
Iridomyrmex conifer	4.9	Likely
Iridomyrmex continentis	1.8	Highly Likely
Iridomyrmex discors	4.8	Likely
Iridomyrmex dromus	38.0	Possible
Iridomyrmex exsanguis	4.7	Likely
Iridomyrmex hartmeyeri	4.2	Likely
Iridomyrmex innocens	21.2	Possible
Iridomyrmex lividus	36.5	Possible
Iridomyrmex longisoma	6.8	Possible

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Iridomyrmex minor	30.0	Possible
Iridomyrmex mjobergi	4.9	Likely
Iridomyrmex purpureus	6.8	Possible
Iridomyrmex rufoniger	17.6	Possible
Iridomyrmex splendens	9.2	Possible
Iridomyrmex sucheroides	1.8	Highly Likely
Iridomyrmex suchieri	4.9	Likely
Leptanilla		
Leptanilla swani	6.0	Possible
Leptogenys		
Leptogenys neutralis	25.4	Possible
Linepithema		
Linepithema humile	25.3	Possible
Lioponera		
Lioponera angustata	5.2	Possible
Lioponera bicolor	1.7	Highly Likely
Lioponera brevicollis	29.9	Possible
Lioponera brevis	27.9	Possible
Lioponera clarki	26.5	Possible
Lioponera clarus	9.0	Possible
Lioponera constricta	28.7	Possible
Lioponera fervida	16.5	Possible
Lioponera flammea	27.9	Possible
Lioponera gilesi	37.2	Possible
Lioponera inconspicua	37.2	Possible
Lioponera nigriventris	36.8	Possible
Lioponera punctatissima	30.0	Possible
Lioponera reticulata	29.9	Possible
Lioponera ruficornis	36.8	Possible
Lioponera simmonsae	29.9	Possible
Melophorus		
Melophorus aeneovirens	36.8	Possible
Melophorus andersenioides	0.8	Highly Likely
Melophorus bruneus	2.4	Likely
Melophorus chauliodon	25.4	Possible
Melophorus cuneatus	4.9	Likely
Melophorus inconspicuus	5.2	Possible
Melophorus perthensis	4.1	Likely
Melophorus translucens	6.8	Possible
Melophorus wheeleri	2.4	Likely

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Meranoplus		
Meranoplus aureolus	4.9	Likely
Meranoplus ferrugineus	3.1	Likely
Meranoplus oceanicus	29.9	Possible
Meranoplus pubescens	0.8	Highly Likely
Meranoplus rugosus	12.1	Possible
Meranoplus similis	21.8	Possible
Monomorium		
Monomorium destructor	15.9	Possible
Monomorium fieldi	0.8	Highly Likely
Monomorium laeve	6.8	Possible
Monomorium pharaonis	2.4	Likely
Monomorium rothsteini	2.4	Likely
Monomorium sordidum	6.8	Possible
Monomorium sydneyense	12.1	Possible
Myrmecia		
Myrmecia chasei	2.4	Likely
Myrmecia clarki	3.3	Likely
Myrmecia desertorum	6.8	Possible
Myrmecia elegans	3.2	Likely
Myrmecia fuscipes	3.2	Likely
Myrmecia gratiosa	30.9	Possible
Myrmecia gulosa	33.8	Possible
Myrmecia infima	6.8	Possible
Myrmecia ludlowi	4.1	Likely
Myrmecia mandibularis	3.2	Likely
Myrmecia michaelseni	6.8	Possible
Myrmecia nigra	4.8	Likely
Myrmecia nigriceps	6.8	Possible
Myrmecia nigriscapa	6.8	Possible
Myrmecia occidentalis	4.9	Likely
Myrmecia picta	3.0	Likely
Myrmecia rufinodis	21.1	Possible
Myrmecia rugosa	12.1	Possible
Myrmecia swalei	3.2	Likely
Myrmecia tepperi	0.8	Highly Likely
Myrmecia testaceipes	6.8	Possible
Myrmecia urens	27.7	Possible
Myrmecia varians	27.9	Possible
Myrmecia vindex	2.8	Likely

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Nebothriomyrmex		
Nebothriomyrmex majeri	0.4	Highly Likely
Nothomyrmecia		
Nothomyrmecia macrops	2.4	Likely
Notoncus		
Notoncus ectatommoides	7.7	Possible
Notoncus gilberti	2.1	Likely
Notoncus hickmani	6.8	Possible
Nylanderia		
Nylanderia braueri	6.8	Possible
Nylanderia glabrior	4.2	Likely
Nylanderia obscura	10.5	Possible
Ochetellus		
Ochetellus glaber	37.2	Possible
Ochetellus punctatissimus	6.8	Possible
Odontomachus		
Odontomachus ruficeps	19.5	Possible
Onychomyrmex		
Onychomyrmex glauerti	25.8	Possible
Papyrius		
Papyrius nitidus	30.7	Possible
Papyrius nitidus queenslandensis	27.9	Possible
Paraparatrechina		
Paraparatrechina minutula	2.5	Likely
Paratrechina		
Paratrechina longicornis	4.9	Likely
Pheidole		
Pheidole ampla	5.4	Possible
Pheidole antipodum	6.8	Possible
Pheidole bos	2.6	Likely
Pheidole impressiceps	4.3	Likely
Pheidole megacephala	2.4	Likely
Pheidole variabilis	12.1	Possible
Plagiolepis		
Plagiolepis clarki	15.9	Possible
Plagiolepis clarki clarki	4.0	Likely
Plagiolepis lucidula	37.4	Possible
Plagiolepis squamulosa	37.2	Possible
Platythyrea		
Platythyrea dentinodis	11.5	Possible

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Platythyrea micans	31.6	Possible
Platythyrea parallela	0.9	Highly Likely
Podomyrma		
Podomyrma adelaidae	34.1	Possible
Podomyrma chasei	6.8	Possible
Podomyrma christae	12.1	Possible
Podomyrma clarki	7.5	Possible
Podomyrma elongata	4.8	Likely
Podomyrma ferruginea	4.1	Likely
Podomyrma macrophthalma	27.9	Possible
Polyrhachis		
Polyrhachis (Campomyrma) *femorata*	4.1	Likely
Polyrhachis (Campomyrma) *leae*	26.5	Possible
Polyrhachis (Campomyrma) *ops*	0.7	Highly Likely
Polyrhachis (Campomyrma) *phryne*	37.2	Possible
Polyrhachis (Hagiomyrma) *ammonoeides*	37.2	Possible
Prolasius		
Prolasius antennatus	33.3	Possible
Prolasius wheeleri	2.1	Likely
Rhytidoponera		
Rhytidoponera foveolata	2.4	Likely
Rhytidoponera inornata	6.0	Possible
Rhytidoponera levior	6.8	Possible
Rhytidoponera metallica	2.4	Likely
Rhytidoponera punctata	13.3	Possible
Rhytidoponera punctigera	0.1	Highly Likely
Rhytidoponera rufonigra	12.1	Possible
Rhytidoponera scaberrima	6.8	Possible
Rhytidoponera violacea	6.8	Possible
Solenopsis		
Solenopsis clarki	1.8	Highly Likely
Solenopsis geminata	6.8	Possible
Stigmacros		
Stigmacros aemula	27.4	Possible
Stigmacros anthracina	2.1	Likely
Stigmacros brachytera	7.4	Possible
Stigmacros castanea	32.7	Possible
Stigmacros clivispina	30.0	Possible
Stigmacros epinotalis	37.2	Possible
Stigmacros flava	2.4	Likely

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Stigmacros glauerti	2.4	Likely
Stigmacros occidentalis	37.2	Possible
Stigmacros rectangularis	28.7	Possible
Stigmacros reticulata	4.0	Possible
Stigmacros stanleyi	37.7	Possible
Strumigenys		
Strumigenys quinquedentata	23.6	Possible
Tapinoma		
Tapinoma melanocephalum	4.0	Likely
Technomyrmex		
Technomyrmex jocosus	4.9	Likely
Tetramorium		
Tetramorium bicarinatum	3.0	Likely
Tetramorium impressum	6.8	Possible
Tetramorium simillimum	5.6	Possible
Tetramorium striolatum	2.4	Likely
Tetramorium viehmeyeri	5.9	Possible
Tetraponera		
Tetraponera punctulata	22.3	Possible
Zasphinctus		
Zasphinctus imbecilis	24.5	Possible
Zasphinctus occidentalis	12.0	Possible

Appendix C: Likelihood of occurrence within the Survey Area for native bee fauna identified in the desktop assessment

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Apidae		
Amegilla `sp. indet.`	5.4	Possible
Amegilla chlorocyanea	0.6	Highly Likely
Amegilla dawsoni	29.2	Possible
Amegilla preissi	1.6	Highly Likely
Exoneura `sp. indet.`	5.0	Possible
Exoneura bicolor	26.0	Possible
Exoneura nigrescens	24.7	Possible
Exoneura pictifrons	12.7	Possible
Exoneura robusta	7.6	Possible
Exoneurella setosa	30.2	Possible
Thyreus `sp. indet.`	5.4	Possible
Thyreus waroonensis	1.6	Highly Likely
Colletidae		
Anthoglossa nigrocinctus	21.5	Possible
Callohesma `sp. indet.`	30.0	Possible
Callohesma aureopicta	29.1	Possible
Callomelitta antipodes	15.7	Possible
Dasyhesma `sp. indet.`	35.4	Possible
Dasyhesma robusta	39.9	Possible
Dasyhesma scholtziae	24.4	Possible
Euhesma `sp. indet.`	4.8	Likely
Euhesma morrisoni	35.4	Possible
Euhesma platyrhina	21.5	Possible
Euhesma tubulifera	19.6	Possible
Euryglossa `sp. indet.`	29.1	Possible
Euryglossina `sp. indet.`	9.8	Possible
Euryglossina argocephala	1.6	Highly Likely
Euryglossina hypochroma	2.3	Likely
Euryglossina melanocephala	27.3	Possible
Euryglossina perpusilla	8.0	Possible
Euryglossula fultoni	15.1	Possible
Glossurocolletes bilobatus	19.6	Possible
Hesperocolletes douglasi	15.1	Possible
Hylaeus `sp. indet.`	2.3	Likely
Hylaeus alcyoneus	10.9	Possible
Hylaeus amiculus	10.2	Possible
Hylaeus aralis	7.3	Possible
Hylaeus chrysaspis	10.9	Possible
Hylaeus dromedarius	25.7	Possible

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Hylaeus elegans	3.5	Likely
Hylaeus euxanthus	2.3	Likely
Hylaeus globuliferus	30.7	Possible
Hylaeus musgravei	33.4	Possible
Hylaeus obtusatus	All within Study Area	Highly Likely
Hylaeus proximus	24.4	Possible
Hylaeus quadratus	2.3	Likely
Hylaeus ruficeps	5.0	Possible
Hylaeus rufipes	10.9	Possible
Hylaeus sanguinipictus	12.7	Possible
Hylaeus violaceus	0.6	Highly Likely
Hylaeus vittatifrons	15.1	Possible
Hyleoides waterhousei	3.5	Likely
Hyleoides zonalis	2.3	Likely
Hyphesma `sp. indet.`	29.1	Possible
Hyphesma atromicans	21.5	Possible
Leioproctus `sp. indet.`	0.6	Highly Likely
Leioproctus antennatus	5.2	Possible
Leioproctus contrarius	10.9	Possible
Leioproctus cupreus	2.3	Likely
Leioproctus douglasiellus	15.9	Possible
Leioproctus floccosus	37.5	Possible
Leioproctus macmillani	22.8	Possible
Leioproctus microdontus	4.5	Likely
Leioproctus minutus	15.1	Possible
Leioproctus muelleri	22.6	Possible
Leioproctus plautus	32.8	Possible
Leioproctus rhodurus	21.5	Possible
Neopasiphae mirabilis	21.5	Possible
Neopasiphae simplicior	14.9	Possible
Pachyprosopis `sp. indet.`	29.1	Possible
Pachyprosopis eucyrta	27.3	Possible
Pachyprosopis haematostoma	22.5	Possible
Paracolletes `sp. indet.`	38.3	Possible
Paracolletes crassipes	15.1	Possible
Trichocolletes `sp. indet.`	0.6	Highly Likely
Trichocolletes dives	14.9	Possible
Trichocolletes gelasinus	38.3	Possible
Xanthesma `sp. indet.`	7.1	Possible
Xanthesma perpulchra	2.7	Likely

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Xanthesma scutellaris	15.1	Possible
Halictidae		
Lasioglossum `sp. indet.`	0.6	Highly Likely
Lasioglossum appositum	29.1	Possible
Lasioglossum bicolor	30.9	Possible
Lasioglossum bremerense	12.7	Possible
Lasioglossum bullatum	16.0	Possible
Lasioglossum castor	7.7	Possible
Lasioglossum chapmani	21.5	Possible
Lasioglossum cognatum	16.0	Possible
Lasioglossum dotatum	2.3	Likely
Lasioglossum ebeneum	25.1	Possible
Lasioglossum eremaean	14.9	Possible
Lasioglossum hapsidum	0.6	Highly Likely
Lasioglossum hemichalceum	2.3	Likely
Lasioglossum hilactum	29.1	Possible
Lasioglossum hiltacum	0.6	Highly Likely
Lasioglossum lanarium	21.5	Possible
Lasioglossum lichatum	30.2	Possible
Lasioglossum megacephalum	25.1	Possible
Lasioglossum melanopterum	16.0	Possible
Lasioglossum mesembryanthemi	15.1	Possible
Lasioglossum mirandum	19.1	Possible
Lasioglossum occidens	30.2	Possible
Lasioglossum sculpturatum	12.7	Possible
Lasioglossum sphecodoides	15.1	Possible
Lasioglossum supralucens	38.8	Possible
Lasioglossum teltiri	30.7	Possible
Lasioglossum veronicae	2.3	Likely
Lasioglossum vitripenne	25.2	Possible
Lipotriches `sp. indet.`	10.9	Possible
Lipotriches australica	21.5	Possible
Lipotriches flavoviridis	4.8	Likely
Megachilidae		
Coelioxys `sp. indet.`	0.6	Highly Likely
Coelioxys froggatti	5.0	Possible
Megachile `sp. indet.`	0.6	Highly Likely
Megachile aethiops	8.3	Possible
Megachile apicata	1.6	Highly Likely
Megachile atrella	24.7	Possible

Taxon	Distance from Survey Area (km)	Likelihood of occurrence
Megachile aurifrons	2.3	Likely
Megachile axillaris	2.3	Likely
Megachile canifrons	4.0	Likely
Megachile captionis	19.6	Possible
Megachile chrysopyga	0.0	Highly Likely
Megachile chrysopygopsis	4.5	Likely
Megachile clypeata	15.1	Possible
Megachile dinognatha	7.3	Possible
Megachile duboulaii	4.5	Likely
Megachile erythropyga	2.3	Likely
Megachile fabricator	16.7	Possible
Megachile ferox	35.4	Possible
Megachile fultoni	2.3	Likely
Megachile horatii	2.3	Likely
Megachile ignita	1.6	Highly Likely
Megachile latericauda	2.3	Likely
Megachile leeuwinensis	1.6	Highly Likely
Megachile macularis	5.0	Possible
Megachile monstrosa	5.0	Possible
Megachile oblonga	2.3	Likely
Megachile obtusa	2.3	Likely
Megachile preissi	7.6	Possible
Megachile remotula	2.3	Likely
Megachile resinifera	35.4	Possible
Megachile rottnestensis	2.3	Likely
Megachile rugosa	24.6	Possible
Megachile semiluctuosa	0.6	Highly Likely
Megachile serricauda	2.3	Likely
Megachile simplex	12.7	Possible
Megachile speluncarum	0.6	Highly Likely
Megachile subferox	19.6	Possible
Megachile tosticauda	0.6	Highly Likely
Stenotritidae		
Stenotritus greavesi	33.5	Possible

Appendix D: Likelihood of occurrence within the Survey Area for SRE invertebrate fauna identified in the desktop assessment

Family	Lowest ID	SRE Status (incl. conservation listing)	Minimum Distance from Survey Area (km)	Linear Distance (km)	Likelihood of occurrence
ARACHNIDA: Araneae					
Actinopodidae	*Missulena* `sp. indet.`	Unlikely	25.4	(blank)	Possible
	Missulena granulosa	Widespread	27.3	526.7	Possible
	Missulena hoggi	Widespread	16.8	482.2	Possible
	Missulena insignis	Widespread	8.2	1111.6	Possible
	Missulena occatoria	Widespread	0.6	2158.3	Highly Likely
Anamidae	*Aname* `mainae complex`	Likely	1.3	1598.2	Highly Likely
	Aname `sp. indet.`	Likely	29.1	(blank)	Possible
	Aname `sp. WAM-MYG405`	Likely	9.6	0.0	Possible
	Aname `sp. WAM-MYG496`	Likely	15.9	138.2	Possible
	Aname `sp. WAM-MYG633`	Likely	23.9	0.0	Possible
	Aname `sp. WAM-MYG855`	Confirmed	25.4	167.0	Possible
	Aname `sp. WAM-MYG858`	Confirmed	17.0	178.0	Possible
	Kwonkan `sp. indet.`	Likely	28.8	(blank)	Possible
	Proshermacha `sp. indet.`	Likely	1.7	(blank)	Highly Likely
	Proshermacha `sp. WAM-MYG449`	Likely	31.6	140.7	Possible
	Proshermacha `sp. WAM-MYG485`	Confirmed	3.3	96.5	Likely
	Proshermacha `sp. WAM-MYG490`	Likely	2.0	13.8	Highly Likely
	Teyl `sp. indet.`	Likely	34.9	(blank)	Possible
	Teyl `sp. WAM-MYG241`	Confirmed	1.3	80.0	Highly Likely
	Teyl `sp. WAM-MYG249`	Likely	23.9	53.6	Possible
	Teyl `sp. WAM-MYG860`	Likely	31.6	36.7	Possible
	Anamidae `sp. indet.`	Likely	24.9	(blank)	Possible
Barychelidae	*Aurecocrypta lugubris*	Widespread	16.2	647.7	Possible
	Idiommata `sp. indet.`	Unlikely	28.1	(blank)	Possible
	Idiommata blackwalli	Widespread	3.4	2130.1	Likely
	Synothele `sp. indet.`	Unlikely	1.7	(blank)	Highly Likely
	Synothele durokoppin	Widespread	24.0	204.2	Possible
	Synothele michaelseni	Widespread	13.9	224.9	Possible
	Synothele mullaloo	Unlikely	13.5	122.9	Possible
	Synothele rastelloides	Unlikely	34.2	14.8	Possible
	Barychelidae `sp. indet.`	Unlikely	9.5	(blank)	Possible
Euagridae	*Cethegus* `sp. indet.`	Unlikely	0.9	(blank)	Highly Likely
	Cethegus fugax	Widespread	0.9	427.9	Highly Likely
Idiopidae	*Bungulla harrisonae*	Confirmed	33.2	85.3	Possible
	Eucyrtops `sp. indet.`	Likely	27.0	(blank)	Possible
	Eucyrtops `sp. WAM-MYG142`	Likely	18.9	102.2	Possible
	Eucyrtops latior	Confirmed	35.4	187.8	Possible
	Euoplos `sp. indet.`	Likely	29.2	(blank)	Possible
	Euoplos inornatus (**DBCA P3**)	Confirmed	22.9	123.6	Possible
	Gaius `sp. indet.`	Unlikely	1.3	(blank)	Highly Likely

Family	Lowest ID	SRE Status (incl. conservation listing)	Minimum Distance from Survey Area (km)	Linear Distance (km)	Likelihood of occurrence
	Gaius villosus	Widespread	18.8	738.9	Possible
	Idiosoma `rhaphiduca complex`	Likely	3.9	362.6	Likely
	Idiosoma `sp. indet.`	Likely	0.8	(blank)	Highly Likely
	Idiosoma `sp. WAM-MYG187`	Confirmed	0.8	105.5	Highly Likely
	Idiosoma `sp. WAM-MYG188`	Confirmed	4.6	47.2	Possible
	Idiosoma `sp. WAM-MYG189`	Likely	1.3	0.0	Highly Likely
	Idiosoma `sp. WAM-MYG221`	Likely	21.0	148.1	Possible
	Idiosoma `sp. WAM-MYG808`	Likely	13.8	0.2	Possible
	Idiosoma jarrah	Confirmed	4.9	200.5	Likely
	Idiosoma rhaphiduca	Widespread	16.4	288.4	Possible
	Idiosoma sigillatum (**DBCA P2**)	Widespread	1.3	268.8	Highly Likely
	Idiopidae `sp. indet.`	Likely	4.9	(blank)	Likely
Salticidae	*Maratus* `sp. indet.`	Likely	2.5	(blank)	Likely
	Maratus banyowla	Likely	0.4	0.2	Highly Likely
	Maratus clupeatus	Confirmed	1.8	4.9	Highly Likely
	Maratus hortorum	Confirmed	25.7	33.1	Possible
	Maratus mungaich	Widespread	30.8	394.9	Possible
Selenopidae	*Karaops* `sp. indet.`	Unlikely	1.3	(blank)	Highly Likely
	Karaops ellenae	Widespread	0.8	294.4	Highly Likely
	Karaops jarrit	Widespread	12.3	451.9	Possible
ARACHNIDA: Opiliones					
Neopilionidae	*Ballarra* `sp. indet.`	Potential	29.2	(blank)	Possible
	Ballarra longipalpus	Potential	30.8	335.4	Possible
	Megalopsalis `sp. indet.`	Potential	1.7	(blank)	Highly Likely
	Neopilionidae `sp. indet.`	Potential	34.6	(blank)	Possible
Sclerosomatidae	Sclerosomatidae `sp. indet.`	Potential	0.4	(blank)	Highly Likely
Triaenonychidae	*Calliuncus* `sp. indet.`	Potential	14.4	(blank)	Possible
	Nunciella `sp. indet.`	Potential	27.6	(blank)	Possible
	Nunciella aspera	Widespread	18.9	379.6	Possible
	Triaenonychidae `sp. indet.`	Potential	16.8	(blank)	Possible
	Triaenonychinae `sp. indet.`	Potential	20.0	(blank)	Possible
ARACHNIDA: Pseudoscorpiones					
Cheiridiidae	*Apocheiridium* `sp. indet.`	Widespread	3.6	(blank)	Likely
Chernetidae	*Balgachernes occultus*	Unlikely	6.4	141.5	Possible
Chthoniidae	*Austrochthonius* `sp. indet.`	Unlikely	2.2	(blank)	Likely
	Austrochthonius `sp. WAM-PSE188`	Widespread	8.3	411.5	Possible
	Austrochthonius `sp. WAM-PSE192`	Unlikely	14.9	115.0	Possible
	Austrochthonius australis	Widespread	2.5	394.1	Likely
	Austrochthonius muchmorei	Widespread	5.3	117.8	Possible
	Lagynochthonius `sp. indet.`	Potential	38.2	(blank)	Possible
	Tyrannochthonius `sp. indet.`	Unlikely	20.3	(blank)	Possible

Family	Lowest ID	SRE Status (incl. conservation listing)	Minimum Distance from Survey Area (km)	Linear Distance (km)	Likelihood of occurrence
	Chthoniidae `sp. indet.`	Unlikely	8.1	(blank)	Possible
Garypidae	*Synsphyronus* `sp. indet.`	Unlikely	31.8	(blank)	Possible
	Synsphyronus callus	Widespread	9.4	1514.5	Possible
	Synsphyronus magnus	Widespread	2.5	225.1	Likely
	Garypinae `sp. indet.`	Unlikely	1.8	(blank)	Highly Likely
Garypinidae	*Aldabrinus rixi*	Unlikely	8.0	0.0	Possible
	Protogarypinus giganteus	Widespread	1.3	357.2	Highly Likely
	Solinus `sp. WAM-PSE235`	Unlikely	24.0	242.7	Possible
Geogarypidae	*Geogarypus taylori*	Widespread	2.0	1302.9	Highly Likely
Olpiidae	*Beierolpium* `sp. indet.`	Likely	25.4	(blank)	Possible
	Indolpium `sp. indet.`	Likely	30.0	(blank)	Possible
	Xenolpium `sp. indet.`	Likely	14.9	(blank)	Possible
	Olpiidae `sp. indet.`	Likely	25.6	(blank)	Possible
ARACHNIDA: Scorpiones					
Bothriuridae	*Cercophonius* `sp. indet.`	Unlikely	2.2	(blank)	Likely
	Cercophonius granulosus	Widespread	16.9	1558.0	Possible
	Cercophonius sulcatus	Widespread	13.0	569.5	Possible
Buthidae	*Isometroides* `sp. indet.`	Unlikely	3.1	(blank)	Likely
	Isometroides `vescus complex`	Unlikely	3.9	1975.2	Likely
	Lychas `austroccidentalis complex`	Unlikely	10.2	1274.0	Possible
	Lychas `sp. indet.`	Unlikely	11.9	(blank)	Possible
	Lychas `splendens complex`	Unlikely	7.7	1265.5	Possible
	Buthidae `sp. indet.`	Unlikely	33.7	(blank)	Possible
Urodacidae	*Urodacus* `armatus complex`	Unlikely	1.7	2249.4	Highly Likely
	Urodacus `sp. indet.`	Unlikely	15.2	(blank)	Possible
	Urodacus hartmeyeri	Widespread	1.9	244.7	Highly Likely
	Urodacus novaehollandiae	Widespread	10.0	1464.7	Possible
	Urodacus planimanus	Confirmed	21.3	151.5	Possible
CHILOPODA: Geophilomorpha					
Geophilidae	*Ribautia imparata*	Potential	4.9	0.0	Likely
	Ribautia repanda	Potential	0.4	82.1	Highly Likely
	Steneurytion incisunguis	Potential	20.8	0.0	Possible
	Tuoba pallida	Potential	35.6	282.6	Possible
	Chilenophilinae `sp. indet.`	Potential	26.4	(blank)	Possible
	Geophilidae `sp. indet.`	Potential	22.2	(blank)	Possible
Mecistocephalidae	*Mecistocephalus* `sp. indet.`	Potential	8.3	(blank)	Possible
	Mecistocephalus tahitiensis	Widespread	11.9	25.3	Possible
Oryidae	*Orphnaeus brevilabiatus*	Widespread	28.0	1151.9	Possible
	Oryidae `sp. indet.`	Potential	22.8	(blank)	Possible
CHILOPODA: Lithobiomorpha					
Henicopidae	*Henicops* `sp. indet.`	Potential	1.7	(blank)	Highly Likely

Family	Lowest ID	SRE Status (incl. conservation listing)	Minimum Distance from Survey Area (km)	Linear Distance (km)	Likelihood of occurrence
	Henicops dentatus	Widespread	32.7	461.1	Possible
	Paralamyctes cammooensis	Potential	1.3	0.0	Highly Likely
	Henicopidae `sp. indet.`	Potential	1.7	(blank)	Highly Likely
Lithobiidae	*Lithobius* `sp. indet.`	Potential	12.0	(blank)	Possible
	Lithobiidae `sp. indet.`	Potential	1.8	(blank)	Highly Likely
CHILOPODA: Scolopendromorpha					
Cryptopidae	Cryptopidae `sp. indet.`	Potential	35.4	(blank)	Possible
CLITELLATA: Crassiclitellata					
Acanthodrilidae	*Diplotrema cornigravei*	Potential	20.7	0.0	Possible
Megascolecidae	*Graliophilus candidus*	Potential	13.5	1.8	Possible
	Graliophilus levis	Potential	14.3	0.0	Possible
	Woodwardiella magna	Potential	3.2	5.1	Likely
Ocnerodrilidae	*Eukerria saltensis*	Potential	2.2	0.0	Likely
CLITELLATA: Lumbriculida					
Megascolecidae	*Megascolex imparicystis*	Potential	0.8	20.9	Highly Likely
	Megascolex longicystis	Potential	1.3	0.0	Highly Likely
DIPLOPODA: Polydesmida					
Dalodesmidae	*Sphaerotrichopus* `sp. indet.`	Likely	2.0	(blank)	Highly Likely
	Sphaerotrichopus ramosus	Likely	29.0	40.7	Possible
Paradoxosomatidae	*Antichiropus* `sp. WAM-DIP062`	Likely	25.2	15.3	Possible
	Antichiropus `sp. WAM-DIP078`	Confirmed	15.0	119.2	Possible
	Antichiropus `sp. WAM-DIP082`	Confirmed	26.4	39.4	Possible
	Antichiropus `sp. WAM-DIP112`	Likely	17.5	4.0	Possible
	Antichiropus `sp. WAM-DIP126`	Confirmed	20.3	47.2	Possible
	Antichiropus `sp. WAM-DIP166`	Likely	0.4	2.0	Highly Likely
	Antichiropus `sp. WAM-DIP168`	Likely	4.9	14.3	Likely
	Antichiropus `sp. WAM-DIP171`	Likely	18.1	0.4	Possible
	Antichiropus `sp. WAM-DIP226`	Likely	2.1	0.0	Likely
	Antichiropus minimus	Likely	29.2	0.0	Possible
	Antichiropus variabilis	Widespread	1.7	422.4	Highly Likely
	Antichiropus whistleri	Confirmed	0.4	162.6	Highly Likely
	Antichiropodini `sp. indet.`	Likely	3.3	(blank)	Likely
	Paradoxosomatidae `sp. indet.`	Likely	32.5	(blank)	Possible
DIPLOPODA: Polyzoniida					
Siphonotidae	Siphonotidae `sp. indet.`	Likely	1.9	(blank)	Highly Likely
	Siphonotidae `sp. WAM-DIP193`	Likely	1.7	350.3	Highly Likely
DIPLOPODA: Spirostreptida					
Iulomorphidae	*Atelomastix nigrescens*	Confirmed	4.9	244.0	Likely
	Dinocambala ingens	Confirmed	25.7	89.4	Possible
	Podykipus `sp. indet.`	Likely	7.6	(blank)	Possible
	Podykipus `sp. WAM-DIP241`	Likely	2.0	75.4	Highly Likely

Family	Lowest ID	SRE Status (incl. conservation listing)	Minimum Distance from Survey Area (km)	Linear Distance (km)	Likelihood of occurrence
	Podykipus collinus	Widespread	20.6	275.5	Possible
	Podykipus leptoiuloides	Confirmed	22.5	178.7	Possible
	Iulomorphidae `sp. indet.`	Likely	1.7	(blank)	Highly Likely
GASTROPODA: Stylommatophora					
Bothriembryontidae	*Bothriembryon* `sp. indet.`	Likely	3.0	(blank)	Likely
	Bothriembryon bulla	Widespread	3.0	178.3	Likely
	Bothriembryon indutus	Confirmed	1.3	153.9	Highly Likely
	Bothriembryon kendricki	Confirmed	12.2	117.9	Possible
	Bothriembryon serpentinus	Confirmed	0.4	128.0	Highly Likely
Charopidae	*Annoselix dolosa*	Widespread	16.8	323.8	Possible
	Epinicium restifer	Likely	9.0	83.2	Possible
	Luinodiscus `sp. indet.`	Likely	20.0	(blank)	Possible
	Luinodiscus sublestus	Likely	3.9	8.9	Likely
	Charopidae `sp. indet.`	Likely	23.9	(blank)	Possible
Punctidae	*Insullaoma predicta*	Widespread	11.2	2339.3	Possible
	Magilaoma `sp. indet.`	Likely	14.4	(blank)	Possible
	Paralaoma `sp. indet.`	Unlikely	5.3	(blank)	Possible
	Paralaoma caputspinulae	Widespread	16.4	389.7	Possible
	Paralaoma servilis	Widespread	35.2	253.5	Possible
	Westralaoma `sp. indet.`	Likely	33.3	(blank)	Possible
	Punctidae `sp. indet.`	Likely	10.0	(blank)	Possible
Succineidae	*Succinea* `sp. indet.`	Likely	1.3	(blank)	Highly Likely
	Succinea contenta	Likely	1.3	56.7	Highly Likely
	Succinea scalarina	Likely	1.0	313.4	Highly Likely
	Succinea strigillata	Likely	1.7	0.0	Highly Likely
	Succineidae `sp. indet.`	Likely	14.9	(blank)	Possible
INSECTA: Dermaptera					
Anisolabididae	*Gonolabis woodwardi*	Unlikely	2.5	0.0	Likely
INSECTA: Lepidoptera					
Castniidae	*Synemon gratiosa* (**DBCA P4**)	Widespread	12.0	0.0	Possible
INSECTA: Orthoptera					
Tettigoniidae	*Caedicia longipennoides*	Potential	6.8	0.0	Possible
MALACOSTRACA: Isopoda					
Alloniscidae	*Alloniscus pallidulus*	Widespread	24.0	24.3	Possible
Armadillidae	*Acanthodillo* `sp. 2 (Judd 2004)`	Likely	29.2	(blank)	Possible
	Acanthodillo `sp. indet.`	Likely	24.3	(blank)	Possible
	Buddelundia `sp. indet.`	Likely	3.1	(blank)	Likely
	Buddelundia `sp. SJ-3`	Likely	37.9	(blank)	Possible
	Buddelundia `sp. SJ-4`	Likely	27.9	(blank)	Possible
	Buddelundia `sp. SJ-7`	Likely	1.8	(blank)	Highly Likely
	Buddelundia cinerascens	Confirmed	16.4	125.5	Possible

Family	Lowest ID	SRE Status (incl. conservation listing)	Minimum Distance from Survey Area (km)	Linear Distance (km)	Likelihood of occurrence
	Buddelundia inaequalis	Confirmed	9.5	241.8	Possible
	Buddelundia nigripes	Widespread	27.3	368.4	
	Buddelundia nitidissima	Widespread	6.4	420.6	Possible
	Buddelundia opaca	Confirmed	35.4	260.9	Possible
	Cubaris `sp. 2 (Judd 2004)`	Likely	1.3	(blank)	Highly Likely
	Cubaris `sp. SJ-1`	Likely	4.1	(blank)	Likely
	Pseudodiploexochus `sp. 1 (Judd 2004)`	Likely	32.4	181.7	Possible
	Pseudodiploexochus `sp. 2 (Judd 2004)`	Likely	25.6	204.5	Possible
	Spherillo `sp. 2 (Judd 2004)`	Likely	1.9	3.3	Highly Likely
	Spherillo `sp. 4 (Judd 2004)`	Likely	31.2	0.0	Possible
	Spherillo `sp. 5 (Judd 2004)`	Widespread	1.4	249.0	Highly Likely
	Armadillidae `sp. indet.`	Likely	6.1	(blank)	Possible
Detonidae	*Deto marina*	Widespread	1.9	1284.1	Highly Likely
	Armadilloniscus `sp. indet.`	Likely	20.3	(blank)	Highly Likely
Oniscidae	Hanoniscus tuberculatus	Unlikely	12.2	285.0	Possible
Philosciidae	Haloniscus searlei	Unlikely	1.7	90.1	Highly Likely
	Laevophiloscia `sp. 1 (Judd 2004)`	Widespread	6.7	224.6	Possible
	Laevophiloscia `sp. 2 (Judd 2004)`	Widespread	19.2	213.2	Possible
	Laevophiloscia `sp. indet.`	Unlikely	4.9	(blank)	Likely
	Laevophiloscia perlata	Widespread	5.3	355.1	Possible
	Laevophiloscia yalgoonensis	Widespread	35.4	1369.7	Possible
	Philosciidae `sp. indet.`	Unlikely	10.6	(blank)	Possible
	Philosciidae `sp. SJ-1`	Potential	35.4	(blank)	Possible
Platyarthridae	Platyarthridae `sp. 1 (Judd 2004)`	Likely	24.2	184.9	Possible
	Platyarthridae `sp. 3 (Judd 2004)`	Likely	35.4	98.3	Possible
Styloniscidae	Styloniscus `sp. 1 (Judd 2004)`	Widespread	5.2	210.7	Possible
	Styloniscus `sp. 7 (Judd 2004)`	Widespread	36.6	207.2	Possible
	Styloniscidae `sp. indet.`	Likely	35.5	(blank)	Possible
Trichoniscidae	Trichoniscus `sp. indet.`	Likely	2.8	(blank)	Likely
PAUROPODA: Tetramerocerata					
Pauropodidae	Stylopauropoides wungongensis	Potential	8.1	0.0	Possible
TURBELLARIA: Tricladida					
Geoplanidae	*Caenoplana coerulea*	Widespread	0.8	0.0	Highly Likely
UDEONYCHOPHORA: Euonychophora					
Peripatopsidae	*Occiperipatoides gilesii*	Confirmed	0.8	180.9	Highly Likely

Appendix E: Comparison of taxa collected in a previous native bee survey (2019) and the current survey at the ke Claremont Survey Area

Species	Survey 2019	Survey 2025	Recollected
Amegilla (Notomegilla) *chlorocyanea*	x	x	x
Coelioxys (Coelioxys) *froggatti*	x		
Euhesma sp. 1		x	
Euryglossina (Euryglossina) *bowenensis*		x	
Euryglossina (Euryglossina) *cockerelli*	x		
Euryglossina (Euryglossina) *hypochroma*	x		
Euryglossina (Euryglossina) *narifera*	x	x	x
Euryglossina (Euryglossina) *perpusilla*	x		
Euryglossina (Microdontura) *mellea*	x		
Euryglossina (Turnerella) *argocephala*	x		
Euryglossina (Turnerella) *atomaria*	x		
Euryglossinae 65[13?] *Euryglossina* "Spp. C"	x		
Euryglossinae LkCl1 *Euhesma*	x		
Euryglossula cf. *fultoni*		x	
Euryglossula fultoni	x		
Exoneura (Exoneura) *laeta*		x	
Exoneura (Exoneura) *pictifrons*	x		
Homalictus (Homalictus) *dotatus*	x		
Homalictus sp.6	x		
Hylaeus (Euprosopis) *violaceus*	x	x	x
Hylaeus (Euprosopoides) *obtusatus*	x	x	x
Hylaeus (Euprosopoides) *ruficeps kalamundae*	x		
Hylaeus (Gnathoprosopis) *amiculus*	x	x	x
Hylaeus (Gnathoprosopis) *euxanthus*	x	x	x
Hylaeus (Hylaeorhiza) *nubilosus*	x		
Hylaeus (Prosopisteron) aralis	x		
Hylaeus (Prosopisteron) sp. 1		x	
Hylaeus (Prosopisteron) sp. 2		x	
Hylaeus (Prosopisteron) *"bicurvatus"*	x		
Hylaeus (Prosopisteron) *"breviscapatus"*	x		
Hylaeus (Rhodohylaeus) *proximus*	x		
Hylaeus (Rhodohylaeus) sp. 3		x	
Hylaeus 66 F Hylaeus (Prosopisteron) sp	x		
Hylaues (Prosopisteron) *latifacies*	x		
Hyleoides zonalis	x		
Lasioglossum (Chilalictus) *castor*	x	x	x
Lasioglossum (Chilalictus) *oblitum*		x	
Lipotriches (Austronomia) *flavoviridis*	x	x	x
Megachile (Austrochile) *resinifera*	x		
Megachile (Eutricharaea) *chrysopyga*	x	x	x
Megachile (Eutricharaea) obtusa	x		
Megachile (Eutricharaea) *simplex*	x		
Megachile (Hackeriapis) *apicata*	x		
Megachile (Hackeriapis) *monkmani*		x	
Megachile (Hackeriapis) *oblonga*	x		
Megachile (Hackeriapis) sp. 3		x	
Megachile (Hackeriapis) sp. 4		x	
Megachile (Hackeriapis) *tosticauda*		x	
Megachile cf. "sp. E" [Padil]		x	
Megachile fultoni		x	

Species	Survey 2019	Survey 2025	Recollected
Megachile latericauda		x	
Megachile rufolobata		x	
Megachile tarltoni		x	
Megachile "houstoni"	x		
Pachyprosopis (Pachyprosopula) *purnongensis*	x		
Thyreus waroonensis		x	