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HOLCIM (AUSTRALIA) PTY LTD
GOSNELLS QUARY TARGETED FLORA AND FAUNA SURVEY

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EXECUTIVE SUMMARY

Holcim (Australia) Pty Ltd (Holcim) operates the Gosnells hardrock quarry, located approximately 20 kilometres (km) southeast of Perth in Western Australia within the City of Gosnells. Holcim plans to clear approximately 2.45 hectares (ha) on the east of the existing quarry in an area that is largely comprised of old revegetation, unused benches and a small section of remnant native vegetation. Ecologia Environment (*ecologia*) was engaged by Holcim to undertake a targeted flora search and fauna habitat assessment over the proposed development area to support a Native Vegetation Clearing Permit (NVCP) application. The survey was undertaken over one day in November 2023.

Targeted searches were conducted along traverses at approximately 10 m spacings in accessible vegetated areas. No flora of conservation significance were observed.

The survey area was broadly defined into three types, of which two – Wandoo-Marri-Jarah Open Forest (0.39 ha) and revegetation (0.76 ha) – were considered to some level of potential as habitat for native terrestrial fauna. The Wandoo-Marri-Jarrah Open Forest was relatively complex structurally and floristically, with multiple strata present and fallen trunks and branches with hollows large enough to provide refuge for fauna. No evidence of native vertebrate fauna activity was noted in this area, potentially due to the lack of connectivity to adjacent, larger areas of native vegetation.

The revegetated areas were noted as lacking structural and floristic complexity. Older sections in the east of the survey area contained a canopy of *Eucalyptus* spp., *Corymbia calophylla* and *Allocasuarina fraseriana* on steep gravel slopes while newer sections in the west were a thicket of *Acacia* spp. and *Calothamnus* spp. on sections of benches separated by banks approaching verticality. The lack of structural and floristic complexity resulted in limited amounts of litter and large amounts of erosion, and in combination with the comparatively young age of any of the revegetation, potential habitat value, while present, was considered low. As with the Open Forest, there was no evidence of fauna activity.

The balance of the survey area was cleared (1.3 ha) and was not considered to have any fauna habitat potential.

The proximity to the existing quarry operations, degree of fragmentation and lack of vegetation or poor structural and floristic complexity greatly reduced the fauna habitat value of the vegetated areas. While seasonal conditions may have been sub-optimal in 2023, it is considered that increased rainfall would not make a significant difference to the value of the vegetation nor alter the likelihood of finding flora of conservation significance.

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Appendix A: Conservation Significant Flora Likelihood Assessment

ABBREVIATIONS

BC Act	*Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
DBCA	Department of Biodiversity, Conservation and Attractions (previously DPaW)
DEC	Department of Environment and Conservation (now DBCA)
DER	Department of Environment Regulation
DWER	Department of Water and Environmental Regulation
DoEE	Department of Environment and Energy (previously DSEWPaC, now DAWE)
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industry and Regional Development
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
IBRA	Interim Biogeographic Regionalisation for Australia
TPFL	Threatened and Priority Flora List database
WA	Western Australia
WC Act	*Wildlife Conservation Act 1950*

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Holcim (Australia) Pty Ltd (Holcim) operates the Gosnells hardrock quarry (the quarry), located approximately 20 km southeast of Perth in Western Australia within the Local Government Area (LGA) of the City of Gosnells. To ensure safety at the quarry and correct a geotechnical fault, Holcim need to cut back the bench on the pit, which requires clearing of approximately 2.45 ha on the east of the existing quarry (the survey area) in an area that is largely comprised of old revegetation, unused benches and a small section of remnant native vegetation. Ecologia Environment (*ecologia*) was engaged by Holcim to undertake a targeted flora search and fauna habitat assessment over the proposed development area to support a Native Vegetation Clearing Permit (NVCP) application. The survey was undertaken on November 10, 2023.

1.2 SCOPE OF WORK

Holcim required a biological survey of the area to determine whether flora of conservation significance were present and to quantify the potential fauna habitat value within the survey area (Map 1). The following were therefore provided as part the biological assessment of the survey area:

- A desktop assessment to evaluate biological values of the survey area and surrounds, including a review of existing physical and biological values, conservation significant species, and other relevant available data.
- Targeted searches for flora of conservation significance.
- A basic fauna and fauna habitat assessment in accordance with the *Technical Guidance* (EPA 2020).

1.3 LEGISLATIVE AND REGULATORY FRAMEWORK

The Environmental Protection Authority's (EPA) environmental objectives for the factors *Flora and Vegetation* (EPA 2016a) and *Terrestrial Fauna* (EPA 2020) are to protect fauna, flora and vegetation so that biological diversity and ecological integrity are maintained. In this context, ecological integrity is the composition, structure, function and processes of ecosystems, and the natural range of variation of these elements. The primary objective of this flora, vegetation and fauna assessment was to provide sufficient information to assess the impact of any proposed development on the fauna, flora, and vegetation of the survey area, thereby ensuring that the EPA's objectives can be met.

The survey was designed and undertaken to comply with the following guidance documents:

- Environmental Factor Guideline: Flora and Vegetation (EPA 2016a).
- Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020).
- Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b).

1.4 DEFINITIONS

1.4.1 Significant Flora

According to the *EPA Factor Guideline: Flora and Vegetation* (EPA 2016a), plant taxa (or records) may be considered significant for reasons including, but not restricted to, the following:

- A taxon listed as Threatened under Western Australia's *Biodiversity Conservation Act 2016* (BC Act) or the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- A taxon on the Department of Biodiversity, Conservation and Attractions (DBCA) Priority Flora List.
- Locally endemic species or those associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems).
- New species or those having anomalous features that indicate a potential new species.

- Being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range).
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids.
- Being representative of taxonomic groups that no longer occur widely in the broader landscape (relictual species/populations).

For the purposes of the targeted searches, the definition of significant flora was a species that are listed under the provisions of either the BC Act, the EPBC Act or that were on the DBCA Priority Flora List.

1.4.2 Significant Fauna

According to the *EPA Factor Guideline: Terrestrial Fauna* (EPA 2020), animal taxa (or records) may be considered significant for a number of reasons including, but not restricted to, the following:

- A taxon listed as Threatened under Western Australia's Biodiversity *Conservation Act 2016* (BC Act) or the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- A taxon on the Department of Biodiversity, Conservation and Attractions (DBCA) Priority Fauna List (DBCA 2020).
- Species with restricted distributions.
- Degree of historical impact from threatening processes.
- Providing an important function required to maintain the ecological integrity of a significant ecosystem.



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Author: BN
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MGA Map Zone 50
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Absolute Scale 1:3000 @A4

Map 1: Location of Survey Area

Map credits: Google, the GIS community

0 75 150 m

2 DESKTOP ASSESSMENT

2.1 DESKTOP METHODOLOGY

The methodology adopted for the desktop assessment was in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) and *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2020). A review of background environmental information for the survey area was undertaken, including, but not limited to, climate (Bureau of Meteorology, BOM), biogeography (IBRA 7) (DSEWPaC 2012), soil-landscape systems (land systems) (DPIRD 2016), the Surface Geology of Australia 1:1M spatial dataset (Geoscience Australia 2012), the Atlas of Australian Soils (Northcote *et al.* 1960-1968), and pre-European native vegetation of Western Australia (Shepherd *et al.* 2002).

Searches of the databases listed in Table 1 were undertaken to determine the significant species previously recorded (DBCA database) or with the potential to occur (Protected Matters database) within 10 km of the survey area. The criteria listed in Table 2 were then applied to determine the likelihood of occurrence of these species within the survey area. Habitat preferences were sourced, where available, from relevant taxonomic literature, FloraBase records (Western Australian Herbarium 1998–), Threatened Species Profiles (SPRATs), or specimen data from the Australasian Virtual Herbarium (AVH) database (CHAH 2017). The presence of potentially suitable habitat within the survey area was determined using broad landforms, soils, and vegetation associations in comparison to cited preferred habitat (if available) for each species.

Table 1: Databases queried for the desktop assessment.

Database	Search details
EPBC Act Protected Matters database	Records of matters of national significance under the EPBC Act within 10 km of the survey area, with specific reference to conservation significant flora and fauna.
DBCA Threatened and Priority Flora (TPFL) and WAHERB databases	BC Act Threatened or DBCA Priority flora records within 10 km of the survey area.

Table 2: Criteria used to assess the likelihood of occurrence of significant species.

Rating	Criterion
Present	There are existing records of the species within the survey area.
High potential	There are existing records of this species within 1 km of the survey area and suitable habitat is known to be present.
Moderate potential	There are existing records of this species greater than 1 km from the survey area and suitable habitat (where known for the species) is or is likely to be present.
Low potential	There are existing records of the species greater than 2.5 km from the survey area and suitable habitat (where known for the species) is not or is unlikely to be present.
Presumed extinct	The species is considered to be extinct

2.2 CLIMATE

The survey area is in the Jarrah Forest region of Western Australia, which experiences Mediterranean climate with two distinct seasons: a warm to hot dry summer December to February and a mild to cool wet winter from June to September.

In Mediterranean type climates some flora species have adapted to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period by spending part of their lifecycle as either underground storage organs or as seed. These species are known as 'geophytes' or 'annuals' and typically re-emerge during the winter seasons when conditions are favourable for their return. Spring is the flowering period for majority of plant species and is when they are most visible. Due to this, the optimal time for conducting flora and vegetation surveys in the south-west of WA is during spring.

Rainfall and temperature data from the nearest long-term Bureau of Meteorology (BOM) weather station (since 1961) were obtained from Gosnells City (Station No. 9106), located 5.2 km to the north-west of the survey area. Rainfall at Gosnells City over the 12 months prior to the survey was approximately 27% of mean annual rainfall (211.2 mm) (Figure 1). Maximum daytime temperature at Gosnells City is frequently above 30°C between December and February and minimum temperatures can drop below 10°C between June and August.

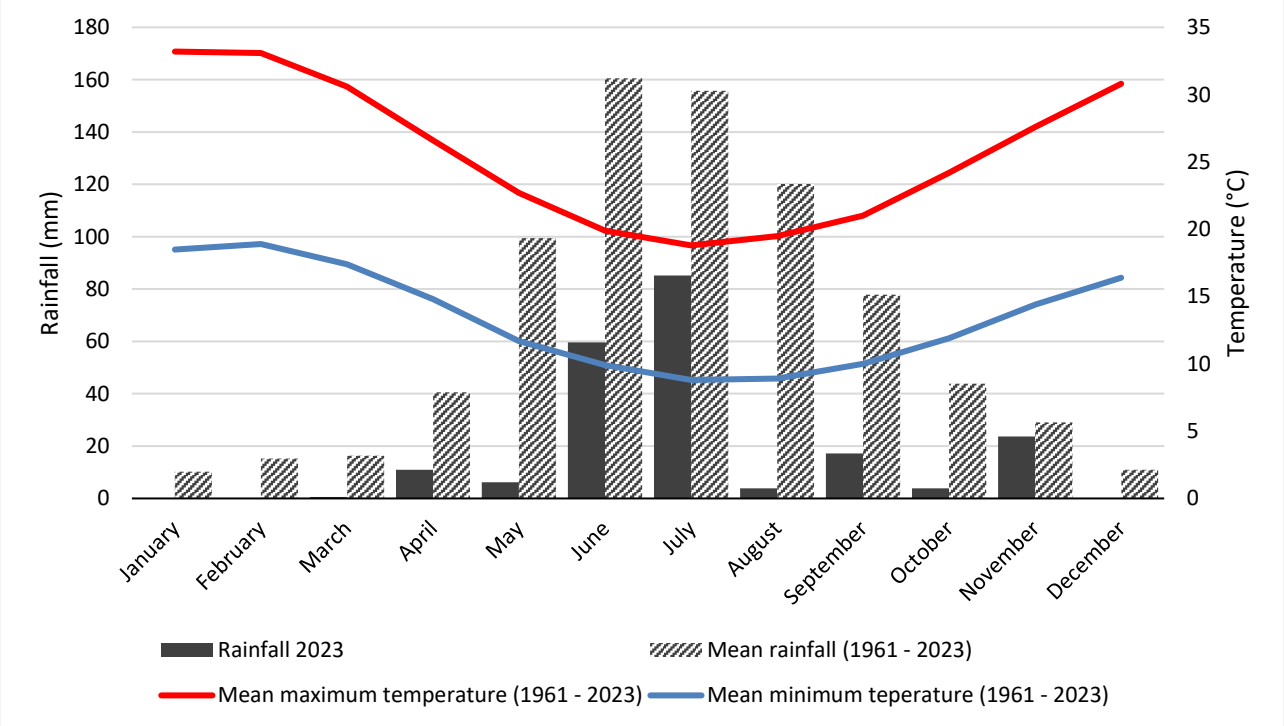


Figure 1: Monthly mean rainfall and temperature for Gosnells City (rainfall and temperature).

2.3 INTERIM BIOGEOGRAPHIC REGIONALISATION FOR AUSTRALIA

The survey area is in the Northern Jarrah Forest subregion of the Jarah Forest Interim Biogeographic Regionalisation for Australia (IBRA, Version 7; DSEWPaC 2012). The Northern Jarrah Forest subregion is the duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by woodlands of Wandoo – Marri on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands (Williams and Mitchell 2001). In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands. The climate is Warm Mediterranean (Williams and Mitchell 2001). The Northern Jarrah Forest incorporates the area east of the Darling Scarp, overlying Archaean granite and metamorphic rocks of an average elevation of 300 m, capped by an extensive lateritic duricrust, dissected by later drainage and broken by occasional granite hills (Williams and Mitchell 2001). In the east the laterite becomes deeply dissected until it compresses isolated remnants (Williams and Mitchell 2001). Rainfall is from 1300 mm on the scarp to approximately 700 mm in the east and north (Williams and Mitchell 2001). Vegetation comprises Jarrah – Marri forest in the west with Bullich and Blackbutt in the valleys grading to Wandoo and Marri woodlands in the east with Powder bark on breakaways (Williams and Mitchell 2001). There are extensive but localised sand sheets with *Banksia* low woodlands (Williams and Mitchell 2001). Heath is found on granite rocks and as a common understorey of forests and woodlands in the north and east (Williams and Mitchell 2001). Most of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions (Willams and Mitchell 2001). Subregional area is 2,255,904 ha (Williams and Mitchell 2001).

2.4 LAND SYSTEMS [SOIL-LANDSCAPE SYSTEMS]

Two soil-landscape systems (DPIRD 2016) are associated with the survey area (Map 2):

- Murray Valley Systems – Western Darling Range from Avon Valley to Harvey. Deeply incised valleys with Red loamy earths, shallow duplexes and rock outcrop and Jarrah-marri-wandoo forest and woodland with mixed shrubland (1.78 ha).
- Darling Plateau System – Lateritic plateau. Duplex sandy gravels, loamy gravels and wet soils. Jarrah-marri-wandoo forest and woodland (0.682 ha).

2.5 SURFACE GEOLOGY

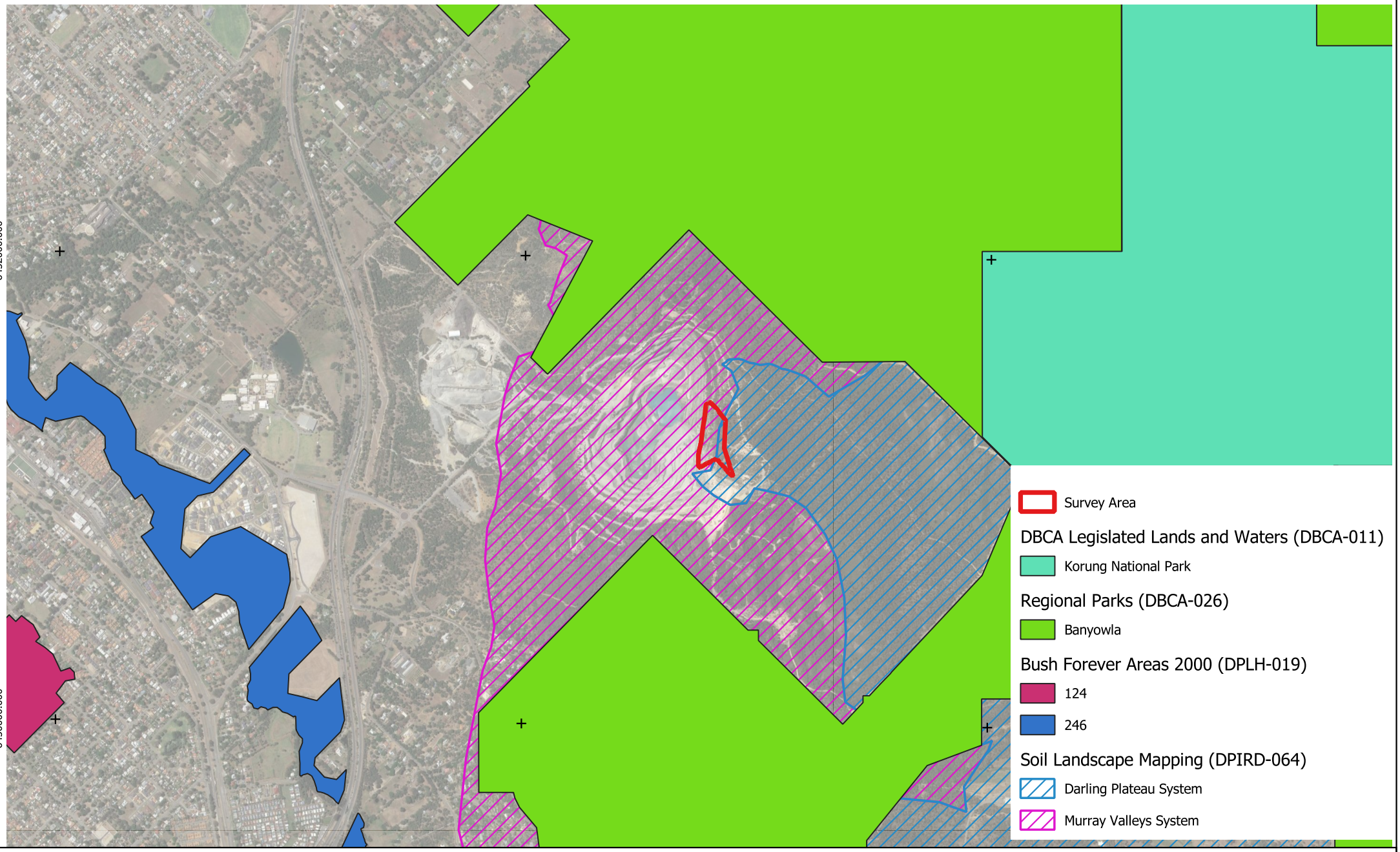
One surface geological unit is associated with the survey area – Felsic intrusives 74292 (map unit AG), which is described as “undifferentiated felsic intrusive rocks, including monzogranite, granodiorite, granite, tonalite, quartz monzonite, syenogranite, diorite, monzodiorite, pegmatite. Locally metamorphosed, foliated, gneissic. Local abundant mafic and ultramafic inclusions” (Geoscience Australia 2012).

2.6 SOILS

One soil type of the Atlas of Australian Soils is associated with the survey area - Mw31, which is described as deeply incised, steep scarp and valley side slopes of the Darling scarp and its more deeply incised tributary valleys: chief soils of the steep scarp and valley side slopes, on which massive rock outcrops are a feature, seem to be acid red earths (Gn2.14) on the colluvial slope deposits. Associated are (Dr2.21) and (Dy3.21) soils on moderate to steep upper slopes with some (Uc4.11) soils containing ironstone gravel on spurs and ridge tops (Northcote *et al.* 1960-1968).

2.7 DBCA MANAGED LANDS AND OTHER CONSERVATION AREAS

The survey area is located in close proximity to Banyowla Nature Reserve, the boundary of which follows the edge of the Holcim Gosnells quarry tenement. Korung National Park is located to the east of the survey area, while two Bush Forever sites, 124 and 246, are located on the plains to the east (Map 2). None of these areas is continuous with the survey area.



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Date: 30 November 2023
Author: BN
Coordinate System: GDA 2020
MGA Map Zone 50
Projection: Transverse Mercator
Absolute Scale: !:20000 @A4

Map 2: Soil Landscape Mapping and Conservation Areas

0 500 1,000 m

Map credits: Google, DPIRD (2018), DBCA (2017, 2023), DPLH (2019), the GIS community

2.8 REVIEW OF PREVIOUS SURVEYS

2.8.1 Gosnells Quarry – Flora, Vegetation and Targeted Survey (AECOM 2017)

AECOM conducted flora, vegetation and targeted surveys over the entire Holcim tenement within which the quarry is located in 2015 and 2016. The current survey area was mapped as being cleared or planted, with one section in the southeast mapped as EwHhSa (AECOM 2017). EwHhSa was described as *Eucalyptus wandoo* subsp. *wandoo, Corymbia calophylla* and *E. marginata* subsp. *marginata* medium open forest over *Xanthorrhoea preissii* and occasional *X. drummondii* tall open shrubland over *Macrozamia riedlei, Hibbertia hypericoides, Acacia pulchella* var. *pulchella, Boronia ovata, Hakea lissocarpha* and *H. stenocarpa* low shrubland *Stylidium affine, Acanthocarpus canaliculatus, Conostylis setosa, Lagenophora huegelii* and *Trichocline spathulata* low sparse forbland. The vegetation in the current survey area, remnant and planted, was assessed as being in very good condition, according to the scale of Keighery (1994) (AECOM 2017.

The current survey area was subject to targeted searches by AECOM botanists, with no records of flora of conservation significance recorded (AECOM 2017). Five flora taxon of conservation significance were recorded within the entire AECOM (2017) survey area, being - *Acacia horridula* (P3), *A. oncinophylla* subsp. *patulifolia* (P4), *Asteridia gracilis* (P3), *Beaufortia purpurea* (P3) and *Lasiopetalum glutinosum* subsp. *glutinosum* (P3). Targeted searches in habitat considered suitable for *Thelymitra magnifica* (P1) and *T. stellata* (Endangered under BC Act and EPBC Act) were conducted, with no plants observed (AECOM 2017).

2.8.2 Holcim Gosnells Quarry – Fauna Assessment of the Quarry Area (Bamford, Moore and Chuk 2017)

A fauna assessment was conducted in 2016 over the entire Holcim Gosnells tenement within which the quarry and current survey area is located by zoologists from Bamford Consulting Ecologists. A total of 194 vertebrate fauna species were identified as potentially occurring within the 198.8 ha tenement as surveyed, although only 47 of these were identified as being resident in the area and further three were migrant or regular visitors (Bamford, Moore and Chuk 2017). There were eight introduced birds and 10 introduced mammals recorded in the Holcim tenement (Bamford, Moore and Chuk 2017). It was noted that the overall fauna assemblage was not as rich as in surrounding areas, a product of the physical extent and temporal duration of extractive industries operations at the site (Bamford, Moore and Chuk 2017).

2.9 FLORA

2.9.1 Significant Species

There were 102 flora taxa within 10 km of the survey area listed in DBCA databases, of which 25 were Threatened (T). Of the remaining taxa, there were eight Priority 1 (P1), 14 Priority 2 (P2), 33 Priority 3 (P3), 20 Priority 4 (P4) and two extinct taxa. The distribution of these in relation to the survey area is presented in Maps 3-6. A likelihood assessment for each taxon to occur within the survey area was completed, with 11 taxa considered to have a high likelihood of occurring (Table 3). Of these, five have been recorded in the area surrounding the survey area in recent surveys conducted by AECOM in 2016. In conducting the likelihood assessments, it was noted that a substantial proportion of the taxa were Swan Coastal Plain species, and of these, a significant number were associated with Brixton St Wetlands and other seasonally wet areas. Given the location of the survey area on the Darling Scarp, these taxa were deemed unlikely to be present. Pre- and post-survey likelihood assessments for all species listed in the database searches are presented in Appendix A.

Table 3: Conservation significant flora assessed as highly likely to be in the survey area.

Taxon	Conservation status		Habitat	Known flowering period	Records
	BC Act/DBCA	EPBC Act			
Acacia horridula	P3	-	Gravelly soils over granite, sand. Rocky hillsides.	May – Aug	AECOM (2017); DBCA
Acacia oncinophylla subsp. *patulifolia*	P4	-	Granitic soils, occasionally on laterite.	Aug – Nov or Nov – Dec	AECOM (2017); DBCA
Asteridea gracilis	P3	-	Sand, clay, gravelly soils.	Sep – Dec	AECOM (2017); DBCA
Beaufortia purpurea	P3	-	Lateritic or granitic soils. Rocky slopes	Oct – Dec or Jan – Feb	AECOM (2017); DBCA
Lasiopetalum glutinosum subsp. *glutinosum*	P3	-			AECOM (2017); DBCA
Calothamnus graniticus subsp. *leptophyllus*	P4	-	Clay over granite, lateritic soils. Hillsides.	Jun – Aug	DBCA
Goodenia arthrotricha	T	En*	Gravel. Granite rocks, slopes.	Oct – Nov	DBCA; PMST
Andersonia sp. Blepharifolia (F. & J. Hort 1919)	P2	-	Unknown	Unknown	DBCA
Darwinia apiculata	T	En*	Lateritic soils	Oct	DBCA; PMST
Stackhousia sp. Red-blotched corolla 9A. Markey 911)	P3	-	Unknown	Unknown	DBCA
Thelymitra magnifica	T	-	Stony ridges	Sep – Oct	DBCA

*En – endangered

400000 405000 410000 415000 420000

6465000 6460000 6455000 6450000 6445000 6440000

1987 Survey area
10km Buffer
T, *Acacia anomala*
T, *Acacia aphylla*
T, *Andersonia gracilis*
T, *Anthocercis gracilis*
T, *Austrostipa bronweniae*
T, *Austrostipa jacobsiana*
T, *Banksia mimica*
T, *Caladenia huegelii*
T, *Calytrix breviseta* subsp. *breviseta*
T, *Conospermum undulatum*
T, *Darwinia apiculata*
T, *Diuris drummondii*
T, *Diuris purdiei*
T, *Drakaea elastica*
T, *Drosera oreopodion*
T, *Eleocharis keigheryi*
T, *Eremophila glabra* subsp. *chlorella*
T, *Goodenia arthrotricha*
T, *Grevillea thelemanniana*
T, *Lepidosperma rostratum*
T, *Morelotia australiensis*
T, *Ptilotus pyramidatus*
T, *Synaphea* sp. Fairbridge Farm (D. Papenfus 696)
T, *Thelymitra magnifica*
T, *Thelymitra stellata*

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Date: 16 November 2023
Author: SN
Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
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Map 3.1: Significant plant species recorded within 10km of the survey area (Threatened and Priority 1).

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 0.5 1 2 3
Kilometers

400000 405000 410000 415000 420000

6465000 6460000 6455000 6450000 6445000 6440000

1987 Survey area
10km Buffer
2, *Acacia benthamii*
2, *Andersonia* sp. Blepharifolia
2, *Bossiaea modesta*
2, *Calectasia grandiflora*
2, *Comesperma griffinii*
2, *Commersonia* sp. Lesmurdie (A.A. Mitchell 11429)
2, *Diuris brevis*
2, *Haloragis aculeolata*
2, *Johnsonia pubescens* subsp. *cygnorum*
2, *Lepyrodia curvescens*
2, *Paracaleana ferricola*
2, *Rytidosperma racemosum* var. *racemosum*
2, *Schoenus loliaceus*
2, *Stenanthemum sublineare*

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Map 3.2: Significant plant species recorded within 10km of the survey area (Priority 2).

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 0.5 1 2 3
Kilometers

400000 405000 410000 415000 420000

6460000 6455000 6450000 6445000 6440000

1987 Survey area
10km Buffer
3, *Allocasuarina grevilleoides*
3, *Acacia horridula*
3, *Amanita fibrillopes*
3, *Amanita wadjukiorum*
3, *Asteridea gracilis*
3, *Babingtonia urbana*
3, *Banksia kippistiana* var. *paenepeccata*
3, *Banksia pteridifolia* subsp. *vernalis*
3, *Beaufortia purpurea*
3, *Byblis gigantea*
3, *Carex tereticaulis*
3, *Chamaescilla gibsonii*
3, *Comesperma rhadinocarpum*
3, *Eryngium pinnatifidum* subsp. Palustre (G.J. Keighery 13459)
3, *Eryngium* sp. Subdecumbens (G.J. Keighery 5390)
3, *Haemodorum loratum*
3, *Halgania corymbosa*
3, *Isopogon autumnalis*
3, *Isotropis cuneifolia* subsp. *glabra*
3, *Jacksonia gracillima*
3, *Lasiopetalum glutinosum* subsp. *glutinosum*
3, *Meionectes tenuifolia*
3, *Myriophyllum echinatum*
3, *Pithocarpa corymbulosa*
3, *Schoenus benthamii*
3, *Schoenus capillifolius*
3, *Schoenus pennisetis*
3, *Schoenus* sp. Waroona (G.J. Keighery 12235)
3, *Stackhousia* sp. Red-blotched corolla (A. Markey 911)
3, *Stylidium aceratum*
3, *Styphelia filifolia*
3, *Thysanotus anceps*
3, *Thysanotus cymosus*

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Project No.: 1987
Date: 16 November 2023
Author: SN
Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:80,000 @A3

Map 3.3: Significant plant species recorded within 10km of the survey area (Priority 3).

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

0 0.5 1 2 3
Kilometers

400000 405000 410000 415000 420000

6460000 6455000 6450000 6445000 6440000

1987 Survey area
10km Buffer
4, *Acacia oncinophylla* subsp. *patulifolia*
4, *Aponogeton hexatepalus*
4, *Calothamnus accedens*
4, *Calothamnus graniticus* subsp. *leptophyllus*
4, *Cyanicula ixioides* subsp. *ixioides*
4, *Cyanothamnus tenuis*
4, *Drosera occidentalis*
4, *Grevillea pimeleoides*
4, *Hydrocotyle lemnoides*
4, *Lasiopetalum bracteatum*
4, *Microtis quadrata*
4, *Ornduffia submersa*
4, *Pimelea rara*
4, *Schoenus natans*
4, *Senecio leucoglossus*
4, *Stylidium longitubum*
4, *Stylidium striatum*
4, *Thysanotus glaucus*
4, *Tripterococcus* sp. Brachylobus (A.S. George 14234)
4, *Verticordia lindleyi* subsp. *lindleyi*

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Project No.: 1987
Date: 16 November 2023
Author: SN
Coordinate System: GDA2020 MGA Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:80,000 @A3

Map 3.4: Significant plant species recorded within 10km of the survey area (Priority 4).

0 0.5 1 2 3
Kilometers

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

2.10 VEGETATION

2.10.1 Pre-European Vegetation

The survey area was located over one vegetation association – 3 – which is defined as Medium Forest; jarrah-marri (Shepherd et al. 2002). Within Western Australia, 67 % of the inferred pre-European extent remains, of which approximately 27 % is in conservation estates (Government of Western Australia 2018). There is just under 80 % of this association remaining within the Northen Jarrah Forest IBRA subregion, with approximately 12 % within conservation estates, while 57 % remains in the City of Gosnells, with 17 % in conservation reserves (Government of Western Australia 2018).

The National Objectives and Targets for Biodiversity Conservation 2001-2005 (DEH 2001) recognise that the retention of 30% or more of the pre-clearing extent of an ecological community is necessary if Australia's biological diversity is to be protected, as this is the threshold below which species loss appears to accelerate exponentially (EPA 2000). The survey area falls within Bush Forever study area, and as such, a target of greater than 10 % remaining is acknowledged as an appropriate target retention amount (DER 2014). Greater than 10 % of this association remains at levels assessed (State, IBRA subregion and LGA).

3 METHODOLOGY

3.1 TARGETED FLORA SEARCH

3.1.1 Field Survey

The targeted flora search and fauna habitat assessment of the survey area was conducted by an *ecologia* ecologist on the 11th of November 2023. The survey was completed in accordance with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b). Targeted searches for significant plant species identified from the desktop assessment were made along traverses at approximately 10 m spacings within accessible vegetated sections of the survey area (Map 7). Where significant species were observed the following parameters were recorded: location (for individual or localised plants) or population boundary (for more extensive populations, time permitting); number of plants (count, for individual or localised plants) or estimated number of plants for more extensive populations; reproductive state; plant community; and landform. The initial likelihood of occurrence assessment for each species was reviewed following the field survey based on the level of survey effort, seasonal conditions, vegetation condition, and the presence of suitable habitat. This reassessment is presented in the desktop results.

3.1.2 Specimen Identification

Specimen identification was undertaken with reference to current taxonomic literature. Scientific names used in this report follow the species concepts currently adopted by the Western Australian Herbarium.

3.2 FAUNA

A basic vertebrate fauna habitat assessment was undertaken by an *ecologia* ecologist concurrently with the targeted flora search. The survey methods adopted accorded with the *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2020). Low-intensity fauna sampling (tracks, scats, diggings, visual observations) was also undertaken to identify any significant terrestrial vertebrate fauna within the survey area.

3.2.1 Habitat Descriptions and Mapping

A fauna habitat type broadly describes an area of habitat that is distinguished by its vegetation, soil characteristics and land features, and is likely to support a different fauna assemblage to that found in other fauna habitats. Habitat delineation and mapping was based upon interpretation of aerial photography and

landforms, habitat site assessments, soil descriptions, and the complementary vegetation descriptions and vegetation mapping undertaken for this report.

Habitat assessments were undertaken at 10 difference locations within the survey area (Map 7). For each fauna survey site, the following parameters were recorded:

- Broad habitat type.
- Digital photographs.
- Landform type.
- Soil colour, type and characteristics.
- Type and extent of non-vegetative surface cover.
- Type of vegetation in lower, middle and upper strata.
- Observable fire history and evidence of any disturbance.
- Presence and extent of leaf litter and coarse woody debris.
- Presence of, or distance to, water sources.
- Presence of significant microhabitats such as tree hollows and rocky outcrops.
- Notes on suitability for hosting significant fauna.

A habitat condition rating was assigned to each habitat assessment site, delineated according to the habitat condition criteria described in Table 4.

Table 4: Habitat Condition Assessment

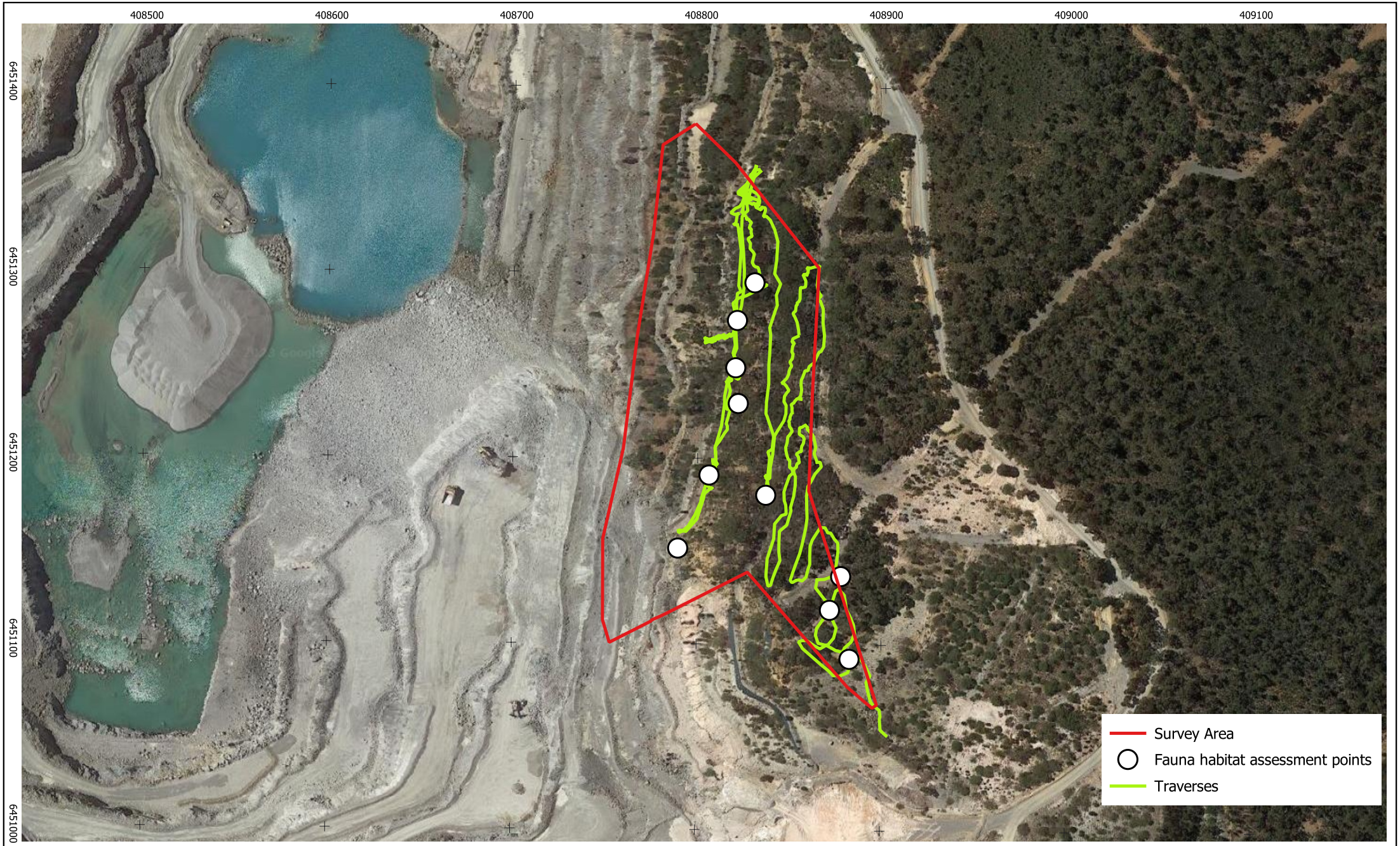
Habitat Condition	Criteria
Excellent	Pristine or nearly so, no obvious sign of damage caused by human activity since European settlement or introduced fauna and/or flora. No signs of recent, extensive fires.
Very Good	Some relatively slight signs of damage caused by human activity since European settlement e.g. damage to tree trunks by repeated fires, no significant signs of introduced fauna and/or flora or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact to vegetation structure such as that caused by low levels of grazing, weed introduction or by selective logging. Some tracks or secondary evidence of introduced fauna. Some signs of recent fires.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activity since European settlement such as partial clearing or very frequent fires. Presence of introduced fauna and/or flora.
Very Poor	Severely impacted by grazing, introduced fauna and/or flora, fire, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management.
Completely Degraded	Areas that are completely or almost completely without vegetation communities and are heavily impacted by extensive fires and/or introduced species e.g. cow paddock.

3.3 STUDY TEAM AND LICENCES

The targeted flora searches and fauna assessment were undertaken by those summarised in Table 5.

Table 5: Project staff and licences.

Project staff				
Name	**Qualification**	**Role**	Project role	Experience
Shaun Grein	B.App. Sc (Biol.); Grad. Dip. Nat. Resources; MBA	Managing Director/Senior Principal Scientist	Project management, QA	25+
Brett Neasham	B.Sc (Hons.)	Senior Ecologist	Field survey, reporting	15+
Tim McCabe	B.Sc. Env. Biol, Dip Proj Mngment, Cert III Vert Pest Mngment	Principal Zoologist	Review of fauna habitat assessment	15+
Dr Andrew Craigie	B.Sc (Hons.) (Botany); PhD (Botany)	Principal Botanist	Taxonomic work	15+
Licences				
Brett Neasham	Flora Taking (Biological Assessment) Licence: FB62000483 (exp. 07/11/2025); Authorisation to Take or Disturb Threatened Species: TFL 2223-0107 (exp. 28/02/2026)			



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Project: 1987 Gosnells Holcim
Date: 21 Novmber 2023
Author: BN
Coordinate System: GDA 2020
MGA Map Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:3000 @A4

Map 2. Survey effot

Map credits: Google

0 75 150 m

3.4 LIMITATIONS AND CONSTRAINTS

An assessment of survey-specific issues and limitations is detailed in Table 6 for the flora and vegetation survey and Table 7 for the fauna survey.

Table 6: Targeted flora search limitations.

Aspect	Assessment	Constraint
Availability of contextual information at a regional and local scale	The survey area has been subject to previous flora and vegetation surveys and targeted flora searches.	Nil
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	The targeted search was conducted by an ecologist with over 15 years of relevant experience. Taxonomic work was completed by an experienced taxonomist with over 15 years of relevant experience.	Nil
Proportion of flora recorded and/or collected, any identification issues	Flora specimens collected were in flower and could be identified. Due to climatic conditions in the months preceding the targeted search, there is the potential that annual or ephemeral taxa that might otherwise be present were absent.	Minor
Was the appropriate area fully surveyed (effort and extent)	All areas of native vegetation that could be readily accessed were surveyed at approximately 10 m intervals.	Minor
Access restrictions within the survey area	The survey area incorporated sections of old benches and sloping areas between them. The eastern section of the survey area was considered to be safe to access and traverses were able to be completed. The western section of the survey area was deemed unsafe to access due to the relative narrowness of the benches and the steepness of the sections between the benches.	Minor
Survey timing, rainfall, season of survey	The targeted search was conducted at the correct time of the year for species identified as having a high potential of being within the survey area. However, the three months preceding the survey was characterised as having an amount of rainfall that was substantially lower than the longer-term average for the nearest BoM weather station (Gosnells City). This could potentially impact the presence of annual and ephemeral taxa.	Minor
Disturbance that may have affected the results of survey such as fire, flood or clearing	The survey area incorporated historic benches associated with the extraction of resources at the site between 40-70 years ago. The majority of these have not been subject to any form of rehabilitation works, and as such remained devoid of native vegetation. The extent of disturbance in the area was such that the structural and floristic complexity of remaining vegetation located between the benches had been significantly impacted, with almost no understory or midstory species present. In addition to this, there was extensive erosion observed, likely due to the absence of vegetation along the old benches and the limited vegetation on the slopes between these.	Major

Table 7: Fauna survey limitations.

Aspect	Comment
Competency/experience of the consultant carrying out the survey.	The ecologist conducting the field survey has extensive experience in defining vegetation values and identifying changes in potential habitat. Field data was reviewed by a zoologist with over 15 years of experience.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	The scope was to determine the potential habitat value of vegetation in the survey area and to conduct *ad hoc* assessments for evidence (scats, tracks, diggings, visual) of native terrestrial vertebrate fauna activity.
Proportion of fauna identified, recorded and/or collected.	No terrestrial vertebrate fauna were observed within the survey area.
Sources of information (previously available information as distinct from new data).	The area has been subject to a detailed fauna assessment in 2016.
The proportion of the task achieved and further work which might be needed.	Planned survey works were conducted and completed. No further work is required to complete the survey scope.
Timing/weather/season/cycle.	The survey was conducted during an appropriate time/season.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	The survey area incorporated historic benches associated with the extraction of resources at the site between 40-70 years ago. The majority of these have not been subject to any form of rehabilitation works, and as such remained devoid of native vegetation. The extent of disturbance in the area was such that the structural and floristic complexity of remaining vegetation located between the benches had been significantly impacted, with almost no understory or midstory species present. In addition to this, there was extensive erosion observed, likely due to the absence of vegetation along the old benches and the limited vegetation on the slopes between these.
Intensity (in retrospect was the intensity adequate).	Given the access to available information from the area, the survey intensity was considered adequate and is appropriate for a basic fauna and fauna habitat assessment.
Completeness (e.g. was relevant area fully surveyed).	The survey area incorporated sections of old benches and sloping areas between them. The eastern section of the survey area was considered to be safe to access and traverses were able to be completed. The western section of the survey area was deemed unsafe to access due to the relative narrowness of the benches and the steepness of the sections between the benches.
Resources (e.g. degree of expertise available in animal identification to taxon level).	Staff involved in the site survey and subsequent reporting had appropriate levels of competence.
Remoteness and/or access problems.	The survey area incorporated sections of old benches and sloping areas between them. The eastern section of the survey area was considered to be safe to access and fauna habitat assessments were able to be completed. The western section of the survey area was deemed unsafe to access due to the relative narrowness of the benches and the steepness of the sections between the benches.
Availability of contextual (e.g. biogeographic) information on the region.	The region surrounding the Holcim quarry was subject to a fauna survey by other zoologists in 2017. This report was reviewed prior to the field assessment. Supplementary site environmental spatial data was reviewed to broaden contextual information.
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	A comprehensive desktop study adequately gathered background information on the study area. A basic survey verified the desktop results and characterised habitats.

4 RESULTS

4.1 FLORA

4.1.1 Significant Species

No flora of conservation significance were observed during the survey.

4.2 FAUNA

4.2.1 Fauna Habitat

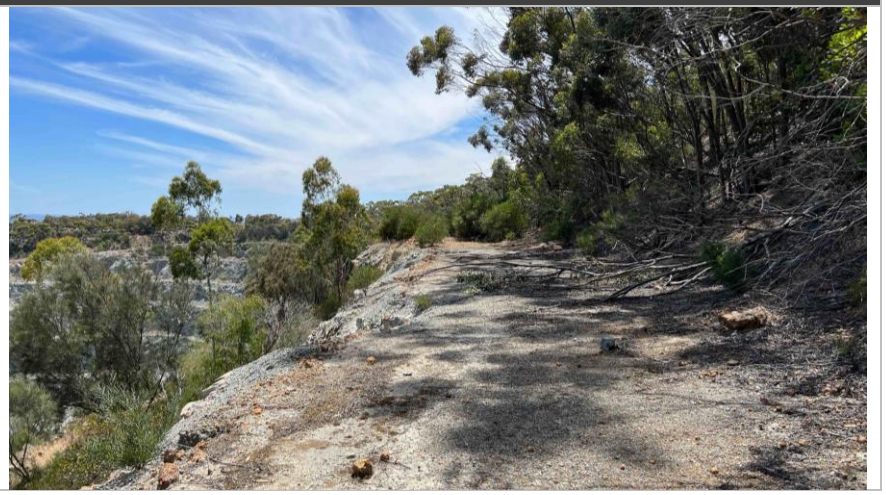
The survey area was categorised into Wandoo-Marri-Jarrah Open Forest (0.39 ha) and revegetated (0.76 ha), both of which have potential vertebrate fauna habitat value, and cleared (1.3 ha), which was not considered to have habitat value (Table 8, Map 8). The condition of the Open Forest area was "Very Good", with a structural and floristic complexity observed in all strata. In addition to this, there were fallen branches and trunks that were observed with large hollows in them that would potentially be used as habitat. This area was on the eastern edge of the survey area, which places it closer to larger areas of native vegetation adjacent to the Holcim quarry.

Condition of the revegetated was variable, with the older areas in the east of the survey area containing *Eucalyptus marginata, E. wandoo, Corymbia calophylla* and *Allocasuarina fraseriana* on steeper slopes (up to 40°). These were assessed as being "Good" condition. Canopy species were comparatively small, with no evidence of the presence of hollows in standing trees or fallen trunks or branches. The eastern sections of revegetation were noted as being almost entirely devoid of any ground and midstory flora. Leaf litter was variable in the eastern section, with the majority of the area having sparse to no litter. Erosion was common, with gullies up to 1.5 m deep observed. The potential habitat value of this area was considered to be limited to bird species for foraging.

The remaining areas that were revegetated were dominated by *Acacia* spp. and *Calothamnus* spp. in thickets, with a sparse emergent canopy of species similar to the other revegetated areas. Banks between benches in these areas were steeper, approaching verticality in some areas. Combined with the limited range of species for foraging, the relative distance from better quality habitat and proximity to ongoing mining activities, the habitat values of these areas were considered to be limited.

Table 8: Fauna habitats in survey area.

Broad habitat type	Extent within survey area (ha)	Habitat description	Representative photos
Wandoo-Marri-Jarrah open forest	0.39 ha	Wandoo-Marri-Jarrah Open Forest over *Macrozamia riedlei, Hibbertia hypericoides* and *Acacia pulchella* on gravel. Presence of large hollows on fallen logs may form habitat for some species. Structural and floristic complexity is considered suitable for a range of reptiles, birds and mammals. No evidence of activity of native terrestrial vertebrate fauna (scats etc.).	
Revegetated	0.76 ha	Revegetated steep slopes (up to 40°) between benches with *Eucalyptus* spp., *Allocasuarina* sp. and *Acacia* spp. over gravel or *Calothamnus* spp. and *Acacia* spp on benches. Understorey almost entirely absent on slopes, extensive erosion. No hollows in branches or fallen trees on slopes, standing trees to narrow and young for hollow formation. No evidence of native terrestrial vertebrate fauna activity (scats etc.).	

Broad habitat type	Extent within survey area (ha)	Habitat description	Representative photos
Cleared	1.3 ha	No fauna habitat value.	

Map 8: Fauna habitat types within the survey area.

5 CONCLUSIONS

The area over which Holcim intends to obtain a NVCP was assessed for the presence of flora of conservation significance and the potential of the vegetation as habitat for native terrestrial vertebrate fauna in November 2023. The survey area was immediately adjacent to the quarry area and contained a series of old benches and either native vegetation or revegetation. The overwhelming majority of the survey area was evidently impacted by historic operational activities, with a reduction or absence on floristic diversity and structural complexity. Reflecting this, there were no flora of conservation significance observed.

The survey area and the entire Holcim Gosnells quarry tenement has been subject to a number of surveys, with the most recent conducted in 2016 by AECOM. The AECOM survey included searches for flora of conservation significance with the potential to occur in the area. Five species were recorded in these searches, of which only one, *Asteridea gracilis,* is an annual. Repeated searches for *Thelymitra magnifica* have been conducted, none of which has resulted in this species being recorded. Based on this, the lack of rainfall in the months preceding the survey is not considered to be a factor that will have greatly impacted on the species present.

Fauna habitat value was variable across the site. Vegetation on the eastern edge, described as Wandoo-Jarrah-Marri Open Forest, was structurally and floristically complex, while revegetated areas were clearly trending to more recent planting moving closer to the quarry edge. Fauna habitat value in adjacent areas of native vegetation would likely be significantly greater, reflected in the absence of evidence of fauna habitat activity within the survey area.

Revegetated areas were considered to have limited fauna habitat value. Trees in these areas were not large enough to have hollows form, which was reflected in the absence of larger fallen trunks or branches. Understory and midstory vegetation was essentially absent, resulting in a landscape best characterised as a canopy of species not yet mature enough to form hollows over eroding slopes. Bird species may utilise the canopy for food and temporary shelter, but the value for ground species is very limited.

While retaining vegetation is always a priority in peri-urban areas and landscapes in the transitional zone from the Swan Coastal Plain to the Jarrah Forests on the Darling Scarp, the value of vegetation in the survey area is considered marginal. The small area of Wandoo-Marri-Jarrah located on the eastern edge of the survey area is not considered to represent significant habitat worth retaining as it is somewhat isolated from larger areas by access tracks associated with the Holcm Gosnells quarry.

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Project: 1987 Gosnells Holcim
Date: 29 November 2023
Author: BN
Coordinate System: GDA 2020
MGA Map Zone 50
Projection: Transverse Mercator
Absolute Scale: 1:2000 @A4

Map 8: Fauna habitat

Map credits: Google, the GIS community

0 50 100 m

Appendix A: Conservation Significant Flora Likelihood Assessment

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Acacia horridula	P3	Gravelly soils over granite, sand. Rocky hillsides.	May to August	AECOM (2017) and DBCA records within 1km	HIGH	UNLIKELY
Acacia oncinophylla subsp. patulifolia	P4	Granitic soils, occasionally on laterite.	August to November or November to December.	AECOM (2017) and DBCA records within 1 km	HIGH	UNLIKELY
Andersonia sp. Blepharifolia (F. & J. Hort 1919)	P2	Laterite with surface stone and black pebbles.	September to November.	DBCA records within 1 km, although not recorded by AECOM (2017)	**HIGH**	UNLIKELY
Asteridea gracilis	P3	Sand, clay, gravelly soils	September to December.	AECOM (2017) and DBCA records within 1 km	**HIGH**	UNLIKELY
Beaufortia purpurea	P3	Lateritic or granitic soils. Rocky slopes.	October to December or January to February	AECOM (2017) and DBCA records within 1 km	**HIGH**	UNLIKELY
Calothamnus graniticus subsp. leptophyllus	P4	Clay over granite, lateritic soils. Hillsides.	June to August	DBCA records within 1 km, although not recorded by AECOM (2017)	**HIGH**	UNLIKELY
Darwinia apiculata	T	Lateritic soils	October.	DBCA records within 1 km, although not recorded by AECOM (2017)	HIGH	UNLIKELY
Goodenia arthrotricha	T	Gravel. Granite rocks, slopes.	October to November	DBCA records within 1 km, although not recorded by AECOM (2017)	HIGH	UNLIKELY
Lasiopetalum glutinosum subsp. glutinosum	P3	Steep slopes of lateritic gravel, clay or sandy loam near granite outcrops and creeklines.	September to December	AECOM (2017) and DBCA records within 1km.	HIGH	UNLIKELY
Thelymitra magnifica	T	Stony ridges.	October to November.	DBCA records within 1 km, although not recorded in any recent targeted flora searches	HIGH	UNLIKELY
Stackhousia sp. Red-blotched corolla (A. Markey 911)	P3	Light grey gritty clay, with surface granitic cobbels, on a gentle southern upper slope.	September to November	AECOM (2017) and DBCA records within 1km	HIGH	UNLIKELY

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Acacia anomala	T	Laterite in shallow sand, loam, clay or gravel. It grows in low open woodland or forest dominated by Eucalyptus marginata, E. wandoo, E. accedens and Corymbia calophylla	August to September	Suitable habitat possibly present.	**POSSIBLE**	UNLIKELY
Acacia aphylla	T	Sand, loam, clay loam. Granite outcrops, hills.	August to October	Suitable habitat possibly present.	**POSSIBLE**	UNLIKELY
Andersonia gracilis	T	Winter-wet areas, near swamps. White/grey sand, sandy clay, gravelly loam.	September to November	Suitable habitat not present.	UNLIKELY	UNLIKELY
Conospermum undulatum	T	Grey or yellow-orange clayey sand.	May to October.	Suitable habitat not present.	UNLIKELY	UNLIKELY
Grevillea thelemanniana	T	Sand, sandy clay. Winter-wet low-lying flats.	May to November	Suitable habitat not present	UNLIKELY	UNLIKELY
Morelotia australiensis	T	Flat. Light brown sand clay loam.	October	Suitable habitat not present	UNLIKELY	UNLIKELY
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	Grey or black sand over clay. Swampy areas, winter wet lowlands.	May or August	Suitable habitat not present	**UNLIKELY**	UNLIKELY
Bolboschoenus fluviatilis	P1	Edge of watercourse. In standing water or wet mud throughout year.	November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Calandrinia uncinella	P1	Wetlands, seasonally wetlands, swamps. Clay, loam, sand, silt.	August to September	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Calytrix simplex subsp. simplex	P1	Shallow soils over granite outcrops on slopes	October to November	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Drosera patens	P1	Sandy soils. Margins of winter-wet depressions, swamps and lakes.	December or February	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Eriochilus glareosus	P1	Periphery of gravel scrape. Sandy lateritic gravel.	June.	Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Schoenus sp. Beaufort (G.J. Keighery 6291)	P1	Mud. Winter-wet claypans.	September to October	Suitable habitat not present	**UNLIKELY**	UNLIKELY
Acacia benthamii	P2	Sand. Typically on limestone breakaways.	August to September	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Bossiaea modesta	P2	Soils derived from granite. Damp areas close to stream.	October to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Calectasia grandiflora	P2	White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges.	June to November.	Suitable habitat not present	**UNLIKELY**	UNLIKELY
Comesperma griffinii	P2	Yellow or grey sand. Plains	October	Suitable habitat not present	**UNLIKELY**	UNLIKELY
Commersonia sp. Lesmurdie (A.A. Mitchell 11429)	P2	Brown cracking clay on basalt sill/dyke.	November to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Diuris brevis	P2	Flat coastal plain; grey sand.	August.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Haloragis aculeolata	P2	Black sand or clay over limestone. Winter-wet areas.	September or December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Johnsonia pubescens subsp. cygnorum	P2	Grey-white-yellow sand. Flats, seasonally-wet sites.	September.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Lepyrodia curvescens	P2	Sand, laterite. Seasonally inundated swampland.	September to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Paracaleana ferricola	P2	Dry laterite with surface boulders and black/brown pebbles.	November to December.	Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Rytidosperma racemosum var. racemosum	P2	Brown loam on gravel/granite.	June to July	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Schoenus loliaceus	P2	Sandy soils. Winter-wet depressions.	August to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Stenanthemum sublineare	P2	Littered white sand. Coastal plain.	October to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Allocasuarina grevilleoides	P3	Sand over laterite, gravel.	October.	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Babingtonia urbana	P3	Associated with wetlands on the Swan Coastal Plain	January to March	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Banksia kippistiana var. paenepeccata	P3	Lateritic gravelly soils.	October to November	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Banksia pteridifolia subsp. vernalis	P3	White/grey sand over laterite	September to October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Byblis gigantea	P3	Sandy-peat swamps. Seasonally wet areas.	September to December or January	Suitable habitat not present.	**UNLIKELY**	UNLIKELY

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Carex tereticaulis	P3	Black peaty sand.	September to October.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Chamaescilla gibsonii	P3	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	September.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Comesperma rhadinocarpum	P3	Sandy soils	October to November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3	Clay, sandy clay, grey or black peaty sand. Winter-wet areaqs, claypans, sandy rises.	August to November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Eryngium sp. Subdecumbens (G.J. Keighery 5390)	P3	Seasonal wetland, open claypan, winter wet, claypan. Grey-white clay.	September to January.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Haemodorum loratum	P3	Grey or yellow sand, gravel	November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Halgania corymbosa	P3	Gravelly soils, soils over granite.	August to November	Records old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Isopogon autumnalis	P3	Sandplain	February	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Isotropis cuneifolia subsp. glabra	P3	Sand, clay loam. Winter-wet flats.	September	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Jacksonia gracillima	P3	Sand and loam soils. Wetlands, winter wet flats, slopes and flats.	October and November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Meionectes tenuifolia	P3	Sand or clay. Wetlands and Swamps.	September to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Myriophyllum echinatum	P3	Clay. Winter-wet flats.	November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Pithocarpa corymbulosa	P3	Gravely or sandy loam. Amongst granite outcrops	January to April	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Schoenus benthamii	P3	White, grey sand, sandy clay. Winter-wet flats, swamps.	October to November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Schoenus capillifolius	P3	Brown mud. Claypans	October to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Schoenus pennisetis	P3	Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	August to September	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	Clay or sandy clay. Winter-wet flats	October to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Stylidium aceratum	P3	Sandy soils. Swamp heathland.	October to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Styphelia filifolia	P3	It grows on sandy soils of the coastal plain (with one known occurrence from the northern Darling Scarp), usually in Banksia or Jarrah woodland and in low-lying situations.	July to October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Thysanotus anceps	P3	White or grey sand, lateritic gravel, laterite.	October to December.	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Thysanotus cymosus	P3	Clay, granitic or lateritic sand.	September to October	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Aponogeton hexatepalus	P4	Mud. Freshwater: ponds, rivers, claypans.	July to October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Calothamnus accedens	P4	Sandy soils over laterite. Road verge.	All year round	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Cyanicula ixioides subsp. ixioides	P4	Laterite, gravel	August to October	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Cyanothamnus tenuis	P4	Base of granite rock. Gritty brown sandy clay over granite.	August to November	Records old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Drosera occidentalis	P4	White-yellow sand, clayey soils. Swamps, seasonally wet depressions and slopes.	October to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Grevillea pimeleoides	P4	Gravelly soils over granite. Rocky hillsides.	May to November	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Hydrocotyle lemnoides	P4	Swamps	August to October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Lasiopetalum bracteatum	P4	Sandy clay, clay, lateritic gravel. Along drainage lines, creeks, gullies, granite outcrops.	August to November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Microtis quadrata	P4	Seasonally wet depressions and in swampy mounds in near-coastal areas between Perth and Augusta.	December to January	Suitable habitat not present.	**UNLIKELY**	UNLIKELY

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Ornduffia submersa	P4	Black-grey sandy clay. Permanent and seasonally inundated wetlands, swamps and claypans	August to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Pimelea rara	P4	Lateritic soils	December to January	Records old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Schoenus natans	P4	Winter-wet depressions	October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Senecio leucoglossus	P4	Gravelly lateritic or granitic soils. Granite outcrops, slopes.	August to December	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Stylidium longitubum	P4	Sandy clay, clay. Seasonal wetlands	October to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Stylidium striatum	P4	Brown clay loam over laterite. Hillslopes. Jarrah/Marri forest, Wandoo woodland.	October to November	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Thysanotus glaucus	P4	White, grey or yellow sand, sandy gravel.	October to December or January to March	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	Grey, black or peaty sand. Winter - wet flats	October to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Verticordia lindleyi subsp. lindleyi	P4	Sand, sandy clay soils. Winter-wet depressions.	November to January, May	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Anthocercis gracilis	T	Sandy or loamy soils. Granite outcrops.	September to October	Records limited and old. Suitable habitat possibly not present.	**UNLIKELY**	UNLIKELY
Austrostipa bronweniae	T	Seasonally wetland, swamp. Brown to grey sandy clay.	September to January	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Austrostipa jacobsiana	T	Winter wet flats. Grey sandy clay, loam.	November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Banksia mimica	T	White or grey sand over laterite, sandy loam.	December or January to February	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Caladenia huegelii	T	Grey, white or brown sand, clay loam soils. Margins of swamps, low depressions and flats. Mixed jarrah and Banksia woodlands.	September to October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY

Taxon	Status (DBCA)	Habitat	Known flowering period	Desktop assessment	Desktop likelihood of occurrence	Post-survey likelihood of occurrence
Calytrix breviseta subsp. breviseta	T	Sandy clay. Swampy flats.	October to November.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Diuris drummondii	T	Low-lying depressions in peaty and sandy clay swamps	November to December or January	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Diuris purdiei	T	Grey-black sand, sandy clay moist soils. Winter wet swamps.	September to October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Drakaea elastica	T	Bare patches of white or grey sandy soils. Low lying situations adjoining winter wet swamps.	October to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Drosera oreopodion	T	Clayey sand sometimes mixed with lateritic pebbles.	September to October.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Eleocharis keigheryi	T	Clay, sandy loam. Emergent in freshwater: creeks, claypans. In seasonally filled clay pans and drainage lines, in water about 15 cm deep, in clayey soils.	August to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Eremophila glabra subsp. chlorella	T	Sandy clay. Winter-wet depressions.	July to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Lepidosperma rostratum	T	Grows in sandy soils in low heath, in winter wet swamps	June to August	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Ptilotus pyramidatus	T	Wetland. Grey-white sandy clay.	October to December	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	T	Grey, clayey sand with lateritic pebbles in low woodland area near winter-wet areas	October	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Thelymitra stellata	T	Sand, gravel, lateritic loam.	October to November	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Ptilotus sericostachyus subsp. roseus	X	Unknown.	September to December.	Suitable habitat not present.	**UNLIKELY**	UNLIKELY
Scholtzia sp. Bickley (W.H. Loaring s.n. PERTH 06165184)	X	Unknown	Unknown	Suitable habitat not present.	**UNLIKELY**	UNLIKELY