

ESPERANCE QUARRY DEVELOPMENT AREA
and
MYRUP ROAD
VEGETATION, FLORA & FAUNA ASSESSMENT

A report prepared for
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Level 3, 200 Adelaide Terrace, EAST PERTH WA 6004

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DISCLAIMER

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Executive Summary

Holcim owns and operates the Esperance Quarry, located 10.5 kilometres north of Esperance. The Esperance Quarry is located in gneissic granite and provides aggregate to the Esperance region. Lot 835 is freehold private land where Holcim has a lease agreement with the owner and has operated for more than 50 years.

Holcim currently holds two Clearing Permits for the quarry site, CPS 5393/3 and CPS 8875/1. The latter permit site requires amendment to include four small additional areas of native vegetation (0.43 ha total) which are around the edge of the current quarry extent.

In addition, Holcim needs to clear vegetation to progress widening (0.5 ha) and line of sight (up to 1.85 ha) of Myrup Road near the quarry site entrance to comply with the DA/EIL conditions issued by the Shire of Esperance. Holcim has conducted consultation with the Department of Water and Environmental Regulation (DWER) who have confirmed that a Clearing Permit is required.

Flora, vegetation and fauna surveys were requested to determine whether any conservation taxa or threatened/ priority ecological communities were present at the survey sites.

Flora

No Threatened or Priority flora were found in the survey areas.

Vegetation and Condition

The three quarry sites and Myrup Road are located within Beard's vegetation association 'bSZc - Shrublands; banksia scrub-heath on sandplain in the Esperance Plains region' (association_6048) which has only 15.3 per cent remaining.

Vegetation communities have been previously described for Lot 835 by MWH (2015). The three quarry survey sites correspond with the MWH 'Granite Ridge' community on outcropping granite with shallow coarse sandy clay soil.

Two vegetation types on pale grey, sandy duplex soil were present in the Myrup Road road reserves and are congruent with the areas previously mapped by MWH (2015) for Lot 835. 'Banksia Heathland' occurs east of Cook Road and varied in condition from excellent to good, while degraded 'Acacia Heathland' occurs west of Cook Rd in the south road reserve. On the north road reserve, at the intersection and west of Cook Rd, the native vegetation has been cleared and weeds have grown on the disturbed soil; non-local native species have been planted on the private property.

Threatened and Priority Ecological Communities

No Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) were present in the survey areas. The survey sites had the potential to be included in the 'Proteaceae dominated kwongan shrublands of the southeast coastal floristic province of Western Australia', however they did not have the >30% cover of proteaceous species which is a diagnostic feature of this EPBC Act listed TEC.

Fauna

No conservation taxa were sighted during the survey. The vegetation communities include plant species that threatened Carnaby's Cockatoo (*Calyptrorhynchus latirostris*) may occasionally forage.

1. Introduction

Holcim owns and operates the Esperance Quarry, located 10.5 kilometres north of Esperance on Lot 835 Plan 230232, Quarry Road, Myrup (Fig 1). The Esperance Quarry is located in gneissic granite and provides aggregate to the Esperance region.

Holcim currently holds a Development Approval, Extractive Industry Licence and Cat 12 Licence to process up to 250,000 tonnes per annum (campaign operation every 18 months to 3 years and stockpile onsite) although volume transported from site is up to 60,000 tonnes per annum. The site is on freehold private land where Holcim has a lease agreement with the owner and has operated for more than 50 years.

1.1 Clearing Permit Applications

Esperance quarry

Holcim currently holds two Clearing Permits for the site, CPS 5393/3 and CPS 8875/1 (Fig 2). The latter site, CPS 8875/1 requires amendment to include four small additional areas of native vegetation.

The quarry areas requiring survey are:

- Site 1 – 2,050 m²
- Site 2 – 250 m²
- Site 3 – 500 m²
- Site 4 – 1,500 m²

Myrup Road

In addition, Holcim needs to clear vegetation to progress widening and line of sight of Myrup Road near the quarry site entrance to comply with the DA/EIL conditions issued by the Shire of Esperance. Holcim has conducted consultation with the Department of Water and Environmental Regulation (DWER) who have confirmed that a Clearing Permit is required.

The survey area (Fig 2) includes:

- Myrup Road Widening - 0.5 ha
- Sightline Buffer with 5 m buffer – up to 1.85 ha

1.2 Physical Environment

The survey areas are within the soil-landscape ‘Esp_4 subsystem’ described by the Department of Agriculture and Food (2006) as gently inclined scarp (40m high) mantled in places by subdued sand sheets, also dissected by drainage lines in places. Soils are grey shallow sandy duplex soils and pale deep sands with associated grey deep sandy duplex (gravelly) soils, minor wet soils. The vegetation is mallee shrub.

The region experiences a Mediterranean climate with warm summers (January - February mean maximum 26.2°C) and cool wet winters (July mean maximum 17.2°C). The long term annual rainfall is 618 millimetres (mm) per annum with the majority (around 63%) falling during the cooler months of May to September (BoM 2020).

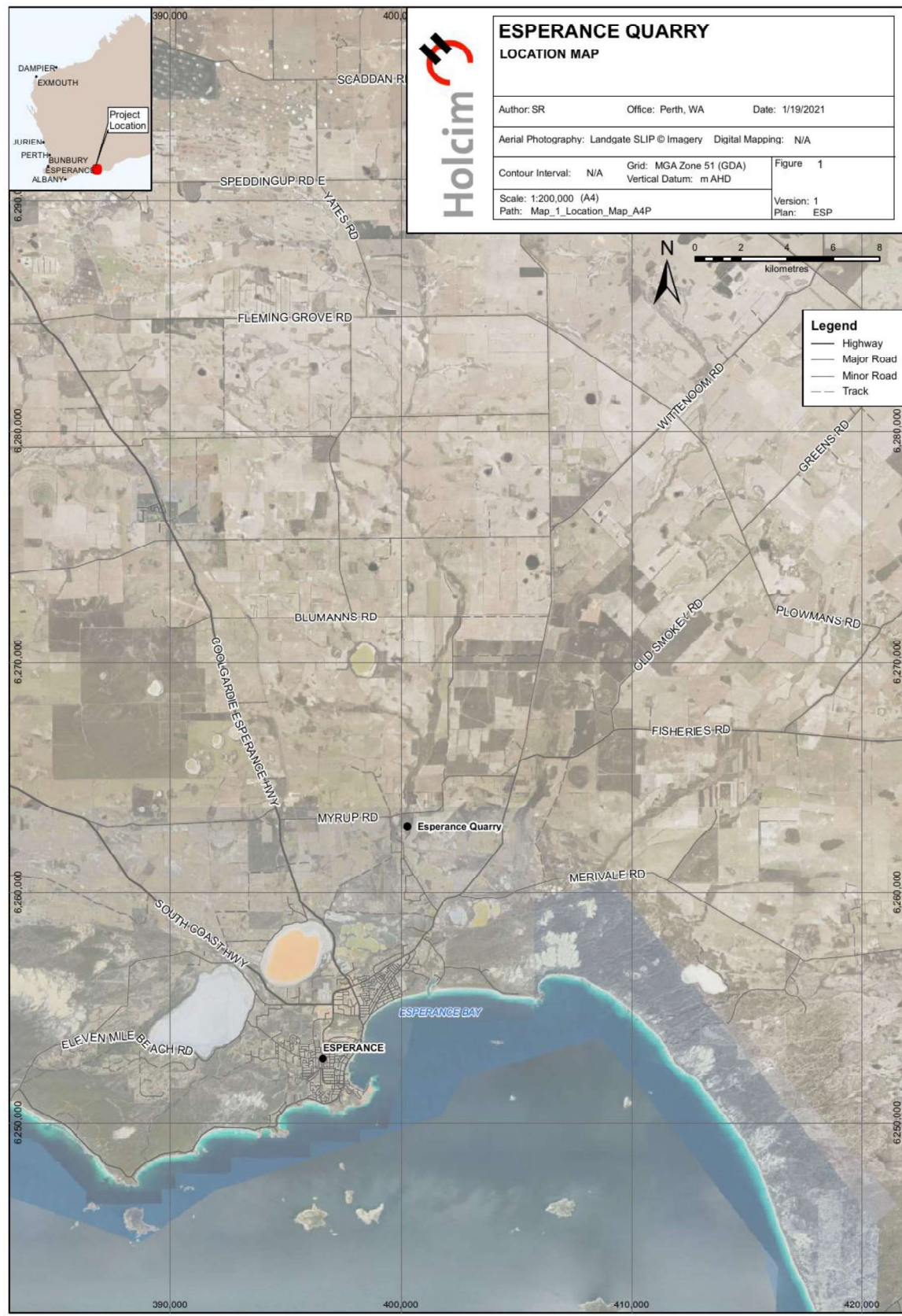


Figure 1 – Location of Esperance quarry and Myrup Road

1.3 Previous studies

A number of desktop and field surveys have already been carried out for the Esperance quarry over the past 12 years:

- 1) Bennett Environmental Consulting Pty Ltd (2007) conducted a desktop study of the flora and vegetation of the Esperance quarry.
- 2) Mattiske Consulting Pty Ltd undertook three vegetation and flora surveys between December 2007 and October 2008 to determine species abundance and composition within and adjacent to the proposed quarry extension area. The survey effort was comprehensive and undertaken over several seasons (Mattiske 2008a, 2008b).
- 3) A desktop fauna assessment was prepared by Umwelt (Australia) Pty Ltd (2008).
- 4) A Rapid Biodiversity Assessment was conducted by MWH Australia Pty Ltd which was used to prepare the *Esperance Quarry - Biodiversity Action Plan* (MWH 2015). This included information from previous studies and identified seven vegetation units within four broad fauna habitat types (woodland, shrubland, granite ridge and creekline).

1.4 Objectives

The objectives of the survey include:

- identify the vascular plant species present in the four sites within the Esperance Quarry development area and the Myrup Road area;
- review the conservation status of the vascular plant species by reference to Department of Biodiversity, Conservation and Attractions' (DBCA) Threatened and Priority flora list and the *Environment Protection and Biodiversity Conservation Act 1999* [Commonwealth];
- map the native vegetation communities and their condition;
- identify whether the sites are Threatened or Priority Flora Ecological Communities;
- document potential habitat and opportunistic sightings of conservation fauna;
- assess the sites according to the ten clearing principles are specified in Schedule 5 of the *Environmental Protection Act 1986*;
- prepare an *Index of Biodiversity Surveys for Assessments* (IBSA) data package of the findings.

2. Methods

2.1 Desktop

DBCA's *Naturemap* website was interrogated for known conservation taxa occurring within a 10 km radius of the Esperance quarry.

A search was made of DBCA's Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs), and of the Commonwealth government's TECs listed under the EPBC Act (s266B). An EPBC Act Protected Matters Report was also created (Appendix A).

2.2 Field Survey

The vegetation and flora survey followed the Environmental Protection Authority's *Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment – December 2015*. The survey was carried out on the 4th November 2020 on a cool (max 18°C), overcast day with a south-east wind.

Quarry

Sites 1, 2 and 3 around the top of the quarry were accessed on foot, but found to be too close to the vertical edge to safely survey the sites. Subsequently the sites were viewed from 10-50 m away and only the flora that could be seen within the sites or adjacent to them was recorded. Site 3 included a vegetated rubble pile at the base of the quarry which was readily accessed. Site 4 was added after the field survey, so was a desktop assessment only.

Myrup Road

Both the north and south road reserves were surveyed on foot with all plant species, vegetation structure (NVIS 2017) and condition recorded. Opportunistic observations of fauna were made.

Locations of significant plant taxa, weeds of national significance (WONS) and declared pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) seen within the survey area were marked as waypoints with a GPS (Garmin II) using the Geocentric Datum Australia 1994 (GDA94). QGIS mapping software was used to prepare shapefiles. AECOM prepared the final maps with data provided by the author.

Plant specimens were identified at the Esperance Regional Herbarium. Nomenclature follows the WA Herbarium. Plant species were recorded in a MAX V3 data table, a software program developed by DBCA which links datasets to the Census of Western Australian Plants master list.

2.3 Survey limitations

The limitations to the survey are outlined in Table 1.

Table 1 – Limitations of Esperance quarry and Myrup Road survey

Possible Limitations	Constraints (Yes/No): Significant, Moderate Or Negligible	Comment
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	No	Dr Gillian Craig is a Senior Botanist who has carried out vegetation and flora surveys in the Esperance bioregion over the past 30 years.
Availability of contextual information at a regional and local scale	No	Published reports are available on the vegetation, geology and soil-landscape in the Shire. Previous unpublished reports of the Esperance quarry have collated this information.
Proportion of flora recorded and/or collected, any identification issues	No	All species were known to the botanist and were confirmed at the Esperance regional herbarium.
Completeness (was the appropriate area fully surveyed - effort and extent)	Yes: significant	Sites 1, 2 and 3 around the quarry were too dangerous to access being at the top edge of the quarry face, so were viewed from a 10-50 m distance. Site 4 was a desktop assessment only.
Remoteness and/or access problems	Yes	As above. No problems with Myrup Road access.
Survey timing, weather, season of survey	No	The survey was carried out in spring 2020 when all plant species were identifiable.
Disturbance that may have affected the results of survey such as fire, flood or clearing.	No	
Vegetation type descriptions	No	Previous surveys MWH (2015) provided vegetation descriptions that corresponded with the current study.

3. Results

3.1 Flora

A species list and a matrix of plant species identified at each of the survey sites is given in Appendix B.

Esperance quarry

Within and beside the three quarry sites, 37 taxa were recorded of which 6 were weed species. The most represented families were Myrtaceae (6 taxa) and Fabaceae (6 taxa).

Myrup Road

A total of 64 vascular plants were recorded in the road reserves of which 17 were weed species. The most represented families of native vegetation were Proteaceae (8 taxa), Myrtaceae (6 taxa), Fabaceae (4 taxa) and Restionaceae (4 taxa). Two non-local native species, *Corymbia calophylla* and *Melaleuca nesophila* had been planted within the survey area.

3.2 Threatened and Priority Flora

The desktop review identified 8 Priority species were known within a 10 km radius of the survey areas (Table 2). No conservation taxa were found during the field survey.

Table 2 – Conservation plant taxa located within a 10 km radius of the Esperance quarry (Naturemap 2/11/2020)

Species Name	Conservation Code	Likelihood of Occurrence
<i>Myriophyllum muelleri</i>	P1	Unlikely, freshwater plant
<i>Leucopogon corymbiformis</i>	P2	Possible, sandplain habitat
<i>Tecticornia indefessa</i>	P2	Unlikely, saline habitat
<i>Comesperma calcicola</i>	P3	Possible, sandplain habitat
<i>Dampiera sericantha</i>	P3	Possible, sandplain habitat
<i>Daviesia pauciflora</i>	P3	Possible, sandplain habitat
<i>Eucalyptus semiglobosa</i>	P3	Possible, sandplain habitat
<i>Grevillea baxteri</i>	P4	Possible, sandplain habitat

3.3 Weeds

Bridal creeper (*Asparagus asparagoides*), a Weed of National Significance and Declared Plant (BAM Act), was found growing in the Myrup Road survey site. Another 19 exotic plants, plus two non-local natives were identified during the survey (Appendix B). The sites where the most invasive species were found have been summarised in Table 3.

Table 3 – Weeds of National Significance (WONS) and invasive weed species located at the survey sites.

Common Name	Species Name	Importance	Myrup Road	Quarry
Bridal Creeper	* <i>Asparagus asparagoides</i>	WONS	yes	
African Cornflag	* <i>Chasmanthe floribunda</i>	Significant Environmental Weed	yes	
Annual Veldt Grass	* <i>Ehrharta longiflora</i>	Invasive	yes	Sites 1 & 3
African Lovegrass	* <i>Eragrostis curvula</i>	Invasive	yes	Site 3
Coast Teatree	* <i>Leptospermum laevigatum</i>	Invasive	yes	
Pimpernel	* <i>Lysimachia arvensis</i>	Invasive		Site 3

3.4 Vegetation

Vegetation communities were mapped (Fig 2) for the survey areas and NVIS descriptions and photos given in Appendix C. Note that the vegetation descriptions given by MWH (2015) have been modified to conform to the NVIS structural formation terminology (NVIS Technical Working Group, 2017).

The survey areas are located within in the Recherche (ESP2) subregion of the Esperance Plains (ESP) bioregion (Thackway and Cresswell 1995). Beard (1973) mapped the area as 'bSZc - Shrublands; banksia scrub-heath on sandplain in the Esperance Plains region', which has only 15.3% remaining (Table 4) (Shepherd et al, 2002).

Table 4 - Beard Vegetation Association statistics (Shepherd et al, 2002)

	Pre-European (ha)	Current Extent (ha)	Remaining (%)	Current Extent in DBCA Managed Lands (%)
Assoc_6048 Shrublands; banksia scrub-heath on sandplain in the Esperance Plains region	135,614	20,728	15.3	5.8

Esperance quarry

There was considerable species overlap between six of the vegetation associations described by Matiske (2008b) close to the quarry. MWH (2015) combined these granite ridge associations into one unit. The three quarry survey sites corresponded with the MWH 'Granite Ridge' habitat, on outcropping granite with shallow coarse sandy clay soil, as *Calothamnus villosus* was characteristic at all sites:

Granite Ridge: *Eucalyptus pleurocarpa* sparse mallee shrubland over *Acacia cyclops*, *Calothamnus villosus*, *Leptospermum incanum*, *Xanthorrhoea platyphylla* heathland over sparse sedgeland/forbland.

Myrup Road

Two vegetation types on pale grey, sandy duplex soil were present in the Myrup Road reserves and are congruent with the areas previously mapped by MWH (2015) for Lot 835.

East of Cook Road the vegetation is:

Banksia Heathland: *Eucalyptus pleurocarpa* sparse mallee shrubland over *Banksia speciosa*, *Nuytsia floribunda*, *Adenanthos cuneata* heathland over *Anarthria scabra*, *Caustis dioica*, *Chordifex crispatus* sedgeland.

West of Cook Road the vegetation is:

Acacia Heathland: *Acacia cyclops*, **Leptospermum laevigatum* heathland over closed grassland.

3.5 Vegetation Condition

Vegetation condition was mapped (Fig 3) for the survey areas. Photos are provided in Appendix C.

Esperance quarry

The vegetation at the three quarry sites varied in condition:

- Site 1 was Very Good, having most of the vegetation layers intact, however some land slippage and old disturbance was present, plus a few weeds.
- Site 2 was Good, being on an old bench below the natural land contour. It had rehabilitated, although sparsely, with local native species.
- Site 3 was Degraded, consisting mainly of a rubble heap at the base of the quarry edge. A large number of weed species had invaded the disturbed site. The site also included a small area at the top of the quarry face, which supported native plants.

- Site 4 was interpreted from aerial photography as Good. The site has been previously cleared with some of the site including a bench mid-way up the quarry face and another near the top of the face. Inspection of areas nearby noted that there has been good rehabilitation with native species further along the same benches.

Myrup Road

The native vegetation on both the north and south sides of Myrup Road reached a maximum width of 15 m and varied from excellent to degraded condition. The disturbed road verges have been invaded by exotic grasses and **Leptospermum laevigatum* and have been mown recently.

At the intersection and west of Cook Rd, on the north side of Myrup Road, all native vegetation has been cleared. Only exotic weeds are present in the road reserve. Non-local native eucalypts and *Melaleuca nesophila* have been planted on private property, north of the fenceline (within the survey area).

3.6 Threatened and Priority Ecological Communities

The desktop review identified one TEC/PEC that had the potential to occur in the survey area (Table 5).

Table 5 – Threatened/Priority Ecological Community within 10 km radius of the survey areas

Name	State Category	Commonwealth Category
Proteaceae dominated kwongan shrublands of the southeast coastal floristic province of Western Australia	Priority 3(iii)	Endangered TEC

Neither the Esperance quarry nor the Myrup Road survey sites are considered to be a TEC or PECs. Although a relatively large number of proteaceous species were recorded during Myrup Road survey, the *Banksia* heathland vegetation did not have 30% or greater cover of Proteaceae across all structural layers, i.e. a key diagnostic feature of the 'kwongan shrublands' TEC/PEC.

3.7 Fauna

The *Naturemap* search identified 35 conservation fauna species occurring within a 10 km radius of the survey area (Appendix D), however the majority of these were animals requiring freshwater or marine habitats. Previous studies (MWH 2015) have identified the potential for three listed conservation significant fauna to occur within the survey areas (Table 6).

Table 6 – Conservation fauna likely to occur within the Esperance quarry and Myrup Road survey areas

Common Name	Species Name	Likelihood of Occurrence	Conservation Status	
			DBCA	EPBC Act
Carnaby's Cockatoo	<i>Calyptorhynchus latirostris</i>	Likely	Threatened	Endangered
Blue-billed Duck	<i>Oxyura australis</i>	Likely	P4	
Quenda	<i>Isodon obesulus fusciventer</i>	Very Likely	P4	

No conservation fauna were observed during the current survey. The *Banksia* Heathland community could provide foraging habitat for Carnaby's Cockatoo due to the presence of flora species commonly utilised for food. All survey sites may be occasionally used for opportunistic feeding.

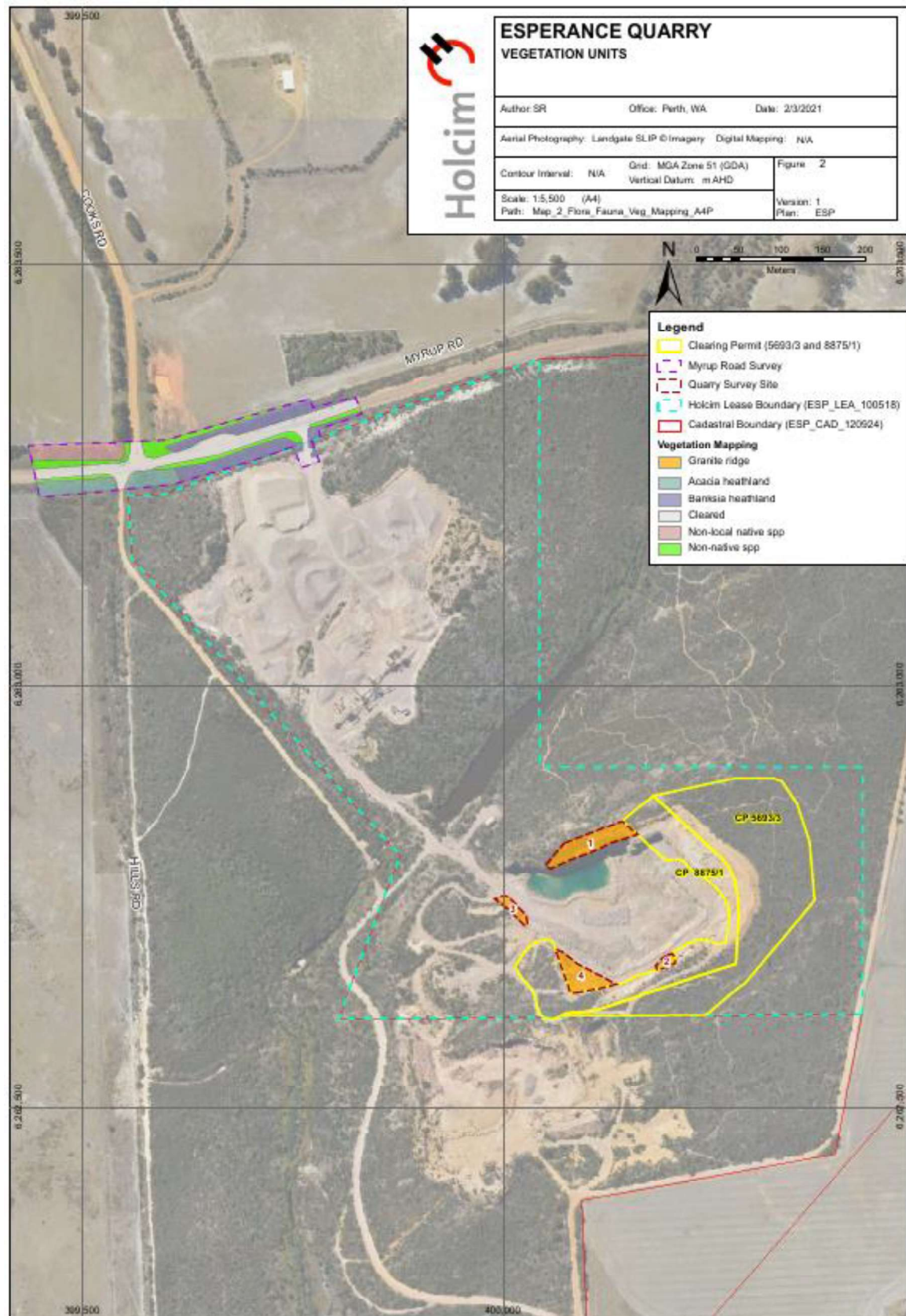
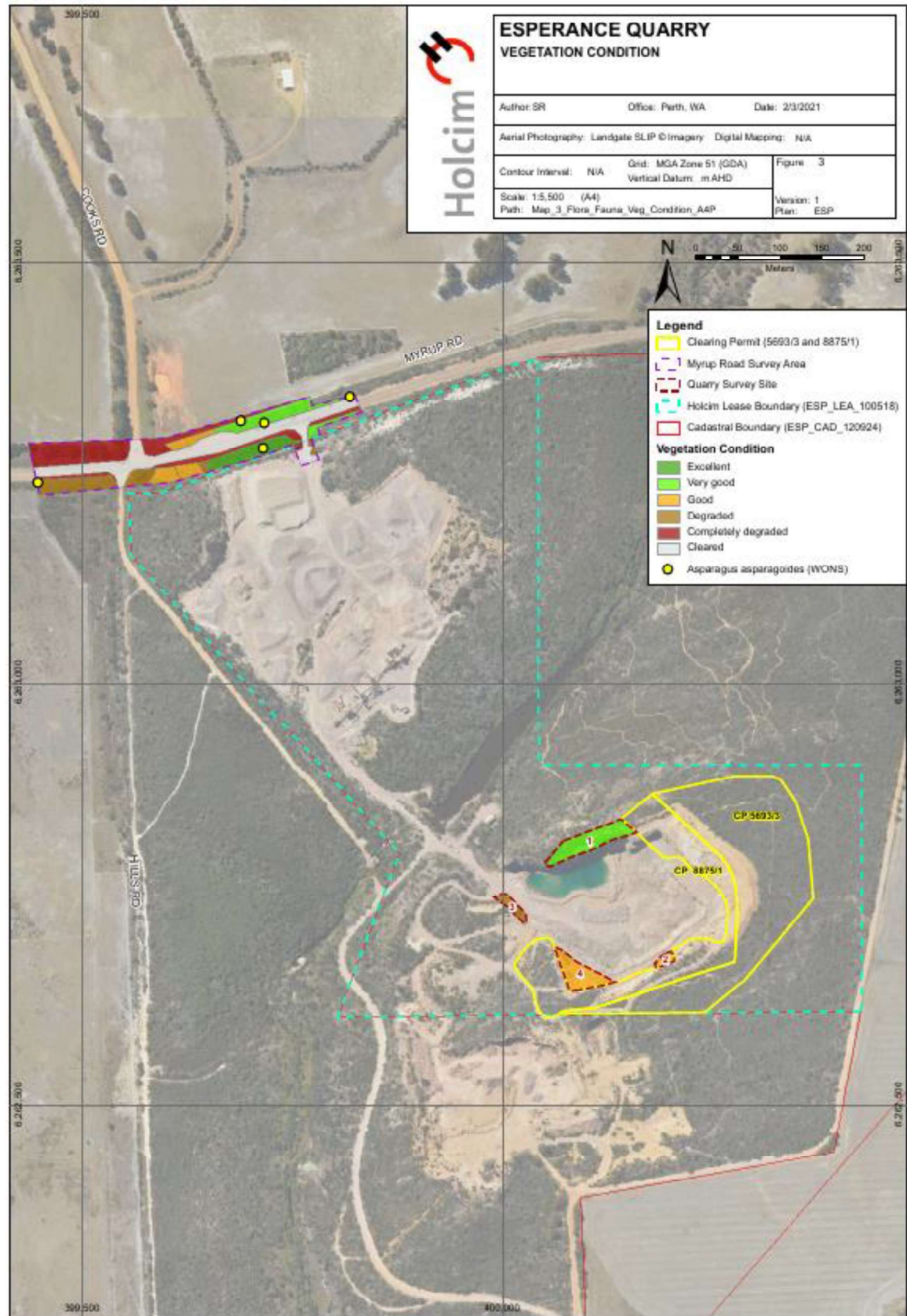


Figure 2 - Vegetation Units in Esperance quarry and Myrup Road survey sites



4. Assessment of application against clearing principles

(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Proposed not likely to be at variance with this principle

No conservation significant taxa were found during the survey.

The EPBC Act Threatened Ecological Community 'Proteaceae dominated kwongkan shrublands of the southeast coastal floristic province of Western Australia' (Kwongkan Shrubland; Priority 3) has been recorded in the local area. The *Banksia* Heathland community at Myrup Road did not have >30% cover of proteaceous species and the granite soils associated with the quarry sites are not typical of this TEC.

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna.

Proposed clearing not likely to be at variance with this principle

A total of 35 conservation significant fauna species have been recorded in the local area; the majority of which are associated with coastal habitat or wetlands and it was determined that the application area does not provide suitable habitat for these species. Of the three species for which the application area may provide suitable habitat, it was determined that the proposed clearing was not likely to provide significant habitat, based on the wide distribution of habitat and mobility of the species. The *Banksia* Heathland community on Myrup Road could provide occasional foraging habitat for Carnaby's Cockatoo.

(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, Threatened flora.

Proposed clearing is not likely at variance with this principle

No conservation taxa are known from the survey sites.

(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Proposed clearing is not likely to be at variance with this principle

No ecological communities listed as Threatened under the *Biodiversity Conservation Act 2016* have been recorded in the local area.

(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Proposed clearing may be at variance with this principle

The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001). The vegetation is within Beard's 'bSZc' association_6048 'Shrublands; banksia scrub-heath on sandplain in the Esperance Plains region' which has only 15.3 per cent remaining.

(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

Proposed clearing is not likely to be at variance with this principle

The closest quarry site (site 1) is located approximately 160 m from Coramup Creek, while the Myrup Road application area is 460 m from the creek. Based on the flora and vegetation survey of the survey areas and the topography, the vegetation was not consistent with riparian vegetation; the proposed clearing is not associated with a wetland or watercourse.

(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Proposed clearing is not likely to be at variance with this principle

Based on the low land degradation risk associated with the mapped soil type and the small size of the application areas, the proposed clearing is not likely to cause appreciable land degradation.

(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Proposed clearing not likely to be at variance with this principle

The closest conservation area, Woody Lake Nature Reserve, is located 1.2 km south of the application area; the proposed clearing is not likely to impact on conservation areas located nearby.

(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

Proposed clearing not likely to be at variance with this principle

Based on the small size of the application areas, the proposed clearing is not likely to impact on the quality of surface or groundwater.

(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Proposed clearing not likely to be at variance with this principle

Based on the small size of the application areas the proposed clearing is not likely to cause or exacerbate flooding.

Acknowledgments

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www.biosecurity.wa.gov.au/organisms/export/PER-DP (Declared Plant download list)

www.dec.wa.gov.au/florabase

www.dec.wa.gov.au/naturemap

Appendix A: EPBC Act Protected Matters Report

Refer to attached file: 'HOLCIM_A_MNES report.pdf'

Appendix B: Plant species lists

1. Esperance quarry species list

FAMILY NAME	SPECIES NAME	COMMON NAME
Asteraceae	<i>*Ursinia anthemoides</i>	Ursinia
Casuarinaceae	<i>Allocasuarina humilis</i>	Dwarf Sheoak
Cyperaceae	<i>Lepidosperma squamatum</i>	
Dilleniaceae	<i>Hibbertia acerosa</i>	Needle Leaved Guinea Flower
	<i>Hibbertia racemosa</i>	Stalked Guinea Flower
Ericaceae	<i>Leucopogon obovatus</i>	
Fabaceae	<i>Acacia cyclops</i>	Coastal Wattle
	<i>Acacia myrtifolia</i>	
	<i>Acacia saligna</i>	Orange Wattle
	<i>Acacia subcaerulea</i>	
	<i>Kennedia prostrata</i>	Scarlet Runner
	<i>Viminaria juncea</i>	Swishbush
Geraniaceae	<i>*Pelargonium capitatum</i>	Rose Pelargonium
Hemerocallidaceae	<i>Agrostocrinum scabrum</i>	Blue Grass Lily
	<i>Dianella brevicaulis</i>	
	<i>Tricoryne elatior</i>	Yellow Autumn Lily
Loranthaceae	<i>Nuytsia floribunda</i>	Christmas Tree
Malvaceae	<i>Guichenotia micrantha</i>	Small Flowered Guichenotia
Myrtaceae	<i>Calothamnus villosus</i>	
	<i>Eucalyptus macrandra</i>	Long-flowered Marlock
	<i>Eucalyptus pleurocarpa</i>	Blue Mallee
	<i>Leptospermum incanum</i>	
	<i>Melaleuca striata</i>	
	<i>Taxandria spathulata</i>	
Orchidaceae	<i>Microtis media</i>	White Mignonette Orchid
Phyllanthaceae	<i>Phyllanthus calycinus</i>	False Boronia
Pittosporaceae	<i>Billardiera fusiformis</i>	Australian Bluebell
Poaceae	<i>*Avena sativa</i>	Wild Oat
	<i>*Briza minor</i>	Shivery Grass
	<i>*Ehrharta longiflora</i>	Annual Veldt Grass
	<i>*Eragrostis curvula</i>	African Lovegrass
	<i>Austrostipa elegantissima</i>	
	<i>Austrostipa mollis</i>	
	<i>Neurachne alopecuroidea</i>	Foxtail Mulga Grass
Primulaceae	<i>*Lysimachia arvensis</i>	Pimpernel
Proteaceae	<i>Lambertia inermis</i>	Chittick
Rhamnaceae	<i>Spyridium globulosum</i>	Basket Bush
Rubiaceae	<i>Opercularia vaginata</i>	Dog Weed
Xanthorrhoeaceae	<i>Xanthorrhoea platyphylla</i>	
Zamiaceae	<i>Macrozamia dyeri</i>	Zamia

2. Myrup Road species list

FAMILY NAME	SPECIES NAME	COMMON NAME
Anarthraceae	<i>Anarthria scabra</i>	
	<i>Lyginia barbata</i>	
Asparagaceae	* <i>Asparagus asparagoides</i>	Bridal Creeper
	<i>Lomandra hastilis</i>	
Asteraceae	* <i>Hypochaeris radicata</i>	Flat Weed
	* <i>Ursinia anthemoides</i>	Ursinia
Brassicaceae	* <i>Brassica tournefortii</i>	Mediterranean Turnip
Casuarinaceae	<i>Allocasuarina humilis</i>	Dwarf Sheoak
	<i>Allocasuarina thuyoides</i>	Horned Sheoak
Cyperaceae	<i>Caustis dioica</i>	
	<i>Lepidosperma squamatum</i>	
	<i>Mesomelaena tetragona</i>	Semaphore Sedge
Dilleniaceae	<i>Hibbertia andrewsiana</i>	
	<i>Hibbertia racemosa</i>	Stalked Guinea Flower
Ericaceae	<i>Leucopogon obovatus</i>	
	<i>Leucopogon</i> sp. Coujinup (M.A. Burgman 1085)	
Fabaceae	<i>Acacia cyclops</i>	Coastal Wattle
	<i>Acacia saligna</i>	Orange Wattle
	<i>Gompholobium tomentosum</i>	Hairy Yellow Pea
	<i>Jacksonia spinosa</i>	
Geraniaceae	* <i>Pelargonium capitatum</i>	Rose Pelargonium
Haemodoraceae	<i>Anigozanthos rufus</i>	Red Kangaroo Paw
	<i>Haemodorum spicatum</i>	Mardja
Hemerocallidaceae	<i>Dianella brevicaulis</i>	
Iridaceae	* <i>Chasmanthe floribunda</i>	African Cornflag
	<i>Patersonia lanata</i>	Woolly Patersonia
Loranthaceae	<i>Nuytsia floribunda</i>	Christmas Tree
Myrtaceae	# <i>Corymbia calophylla</i>	Marri
	# <i>Melaleuca nesophila</i>	Mindiyed
	* <i>Leptospermum laevigatum</i>	Coast Teatree
	<i>Eucalyptus pleurocarpa</i>	Blue Mallee
	<i>Leptospermum maxwellii</i>	
	<i>Leptospermum spinescens</i>	
	<i>Melaleuca striata</i>	
	<i>Melaleuca thymoides</i>	
	<i>Taxandria spathulata</i>	
Onagraceae	* <i>Oenothera stricta</i>	Common Evening Primrose
Orobanchaceae	* <i>Orobanche minor</i>	Lesser Broomrape
Pittosporaceae	<i>Billardiera fusiformis</i>	Australian Bluebell
Poaceae	* <i>Aira cupaniana</i>	Silvery Hairgrass
	* <i>Avena sativa</i>	Wild Oat
	* <i>Briza maxima</i>	Blowfly Grass
	* <i>Bromus diandrus</i>	Great Brome
	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
	* <i>Eragrostis curvula</i>	African Lovegrass
	* <i>Polypogon monspeliensis</i>	Annual Beardgrass

FAMILY NAME	SPECIES NAME	COMMON NAME
Proteaceae	<i>Adenanthos cuneatus</i>	Coastal Jugflower
	<i>Banksia pulchella</i>	Teasel Banksia
	<i>Banksia speciosa</i>	Showy Banksia
	<i>Hakea nitida</i>	Frog Hakea
	<i>Hakea trifurcata</i>	Two-leaf Hakea
	<i>Lambertia inermis</i>	Chittick
	<i>Stirlingia anethifolia</i>	
	<i>Synaphea</i> aff. <i>obtusata</i>	
Restionaceae	<i>Chordifex crispatus</i>	
	<i>Desmocladius flexuosus</i>	
	<i>Desmocladius lateriflorus</i>	
	<i>Hypolaena exsulca</i>	
Rhamnaceae	<i>Spyridium globulosum</i>	Basket Bush
Solanaceae	* <i>Solanum nigrum</i>	Black Berry Nightshade
Stylidiaceae	<i>Levenhookia pusilla</i>	Midget Stylewort
	<i>Stylidium breviscapum</i>	Boomerang Triggerplant
Thymelaeaceae	<i>Pimelea ferruginea</i>	
Xanthorrhoeaceae	<i>Xanthorrhoea platyphylla</i>	

3. Matrix of plant species at Esperance quarry and Myrup Road survey sites

Species	Quarry site 1	Quarry site 2	Quarry site 3	Myrup Rd
<i>Acacia cyclops</i>	1	1	1	1
<i>Calothamnus villosus</i>	1	1	1	
<i>Viminaria juncea</i>	1	1	1	
<i>Austrostipa mollis</i>	1	1		
<i>Billardiera fusiformis</i>	1	1		1
* <i>Ehrharta longiflora</i>	1		1	1
* <i>Avena sativa</i>	1			1
* <i>Briza minor</i>	1			
* <i>Ursinia anthemoides</i>	1			1
<i>Acacia myrtifolia</i>	1			
<i>Acacia subcaerulea</i>	1			
<i>Agrostocrinum scabrum</i>	1			
<i>Allocasuarina humilis</i>	1			1
<i>Austrostipa elegantissima</i>	1			
<i>Dianella brevicaulis</i>	1			1
<i>Eucalyptus macrandra</i>	1			
<i>Eucalyptus pleurocarpa</i>	1			1
<i>Guichenotia micrantha</i>	1			
<i>Hibbertia acerosa</i>	1			
<i>Hibbertia racemosa</i>	1			1
<i>Lambertia inermis</i>	1			1
<i>Lepidosperma squamatum</i>	1			1
<i>Leptospermum incanum</i>	1			
<i>Leucopogon obovatus</i>	1			1
<i>Macrozamia dyeri</i>	1			
<i>Melaleuca striata</i>	1			1
<i>Neurachne alopecuroidea</i>	1			
<i>Nuytsia floribunda</i>	1			1
<i>Opercularia vaginata</i>	1			
<i>Phyllanthus calycinus</i>	1			
<i>Spyridium globulosum</i>	1			1
<i>Taxandria spathulata</i>	1			1
<i>Tricoryne elatior</i>	1			
<i>Xanthorrhoea platyphylla</i>	1			1
<i>Kennedia prostrata</i>		1		
<i>Microtis media</i>		1		
* <i>Eragrostis curvula</i>			1	1
* <i>Lysimachia arvensis</i>			1	
* <i>Pelargonium capitatum</i>			1	1
<i>Acacia saligna</i>			1	1
* <i>Aira cupaniana</i>				1
* <i>Asparagus asparagoides</i>				1
* <i>Brassica tournefortii</i>				1
* <i>Briza maxima</i>				1
* <i>Bromus diandrus</i>				1

Species	Quarry site 1	Quarry site 2	Quarry site 3	Myrup Rd
* <i>Chasmanthe floribunda</i>				1
* <i>Hypochaeris radicata</i>				1
* <i>Leptospermum laevigatum</i>				1
* <i>Oenothera stricta</i>				1
* <i>Orobanche minor</i>				1
* <i>Polypogon monspeliensis</i>				1
* <i>Solanum nigrum</i>				1
<i>Adenanthos cuneatus</i>				1
<i>Allocasuarina thuyoides</i>				1
<i>Anarthria scabra</i>				1
<i>Anigozanthos rufus</i>				1
<i>Banksia pulchella</i>				1
<i>Banksia speciosa</i>				1
<i>Caustis dioica</i>				1
<i>Chordifex crispatus</i>				1
<i>Corymbia calophylla</i> (planted)				1
<i>Desmoclados flexuosus</i>				1
<i>Desmoclados lateriflorus</i>				1
<i>Gompholobium tomentosum</i>				1
<i>Haemodorum spicatum</i>				1
<i>Hakea nitida</i>				1
<i>Hakea trifurcata</i>				1
<i>Hibbertia andrewsiana</i>				1
<i>Hypolaena exsulca</i>				1
<i>Jacksonia spinosa</i>				1
<i>Leptospermum maxwellii</i>				1
<i>Leptospermum spinescens</i>				1
<i>Leucopogon</i> sp. Coujinup (M.A. Burgman 1085)				1
<i>Levenhookia pusilla</i>				1
<i>Lomandra hastilis</i>				1
<i>Lyginia barbata</i>				1
<i>Melaleuca nesophila</i> (planted)				1
<i>Melaleuca thymoides</i>				1
<i>Mesomelaena tetragona</i>				1
<i>Patersonia lanata</i>				1
<i>Pimelea ferruginea</i>				1
<i>Stirlingia anethifolia</i>				1
<i>Stylidium breviscopum</i>				1
<i>Synaphea</i> aff. <i>obtusata</i>				1
Grand Total	34	7	8	64

4. Myrup Road - GPS locations of Weed of National Significance

Datum: Geocentric Datum Australia 1994 (GDA94)

	Wpt	Latitude	Longitude
<i>*Asparagus asparagoides</i> (bridal creeper)	5	-33.76532	121.91817
<i>*Asparagus asparagoides</i> (bridal creeper)	8	-33.76558	121.91706
<i>*Asparagus asparagoides</i> (bridal creeper)	9	-33.76557	121.91677
<i>*Asparagus asparagoides</i> (bridal creeper)	17	-33.7662	121.91415
<i>*Asparagus asparagoides</i> (bridal creeper)	37	-33.76586	121.91705

APPENDIX C: Vegetation units

1. Granite Ridge

Description: *Eucalyptus pleurocarpa* sparse mallee shrubland over *Acacia cyclops*, *Calothamnus villosus*, *Leptospermum incanum*, *Xanthorrhoea platyphylla* heathland over sparse sedgeland/forbland.

Soil: Coarse sandy clay.

Landform: Granite ridge.

Lifeform	% Cover	Dominant taxa
Mallee <10 m	<10 %	<i>Eucalyptus pleurocarpa</i>
Shrubs >2 m	10-30%	<i>Nuytsia floribunda</i> , <i>Acacia cyclops</i> , <i>Lambertia inermis</i>
Shrubs 1-2 m	30-70%	<i>Calothamnus villosus</i> , <i>Allocasuarina humilis</i> , <i>Lambertia inermis</i> , <i>Leptospermum incanum</i> , <i>Melaleuca striata</i> , <i>Viminaria juncea</i> , <i>Billardiera fusiformis</i> , <i>Xanthorrhoea platyphylla</i>
Ground	<10%	<i>Agrostocrinum scabrum</i> , <i>Lepidosperma squamatum</i> , <i>Neurachne alopecuroidea</i>



Plate 1. SITE 1 is on the north edge of the quarry and in very good condition.

Plate 2. Typical vegetation along the northern edge of SITE 1, on top of the granite ridge.



Plate 3. Close-up of SITE 1 on the north edge of the quarry.



Plate 4. SITE 2 is on an old bench above the quarry and in good condition.



Plate 5. SITE 3 includes a rubble heap at the base of the quarry where the vegetation is degraded. The top of the quarry site and face support some native vegetation.



Plate 6. SITE 4 includes an old bench mid-way up the quarry face (middle distance). Native vegetation in good condition has rehabilitated on the bench.

2. Acacia Heathland

Description: *Acacia cyclops*, **Leptospermum laevigatum* heathland over closed grassland.

Soil: Pale grey sandy duplex. **Landform:** Sandplain.

Lifeform	% Cover	Dominant taxa
Shrubs >2 m	30-70%	<i>Acacia cyclops</i> , <i>Acacia saligna</i> , <i>*Leptospermum laevigatum</i> , <i>Spyridium globulosum</i>
Ground	>70%	<i>*Ehrharta longifolia</i> , <i>*Eragrostis curvula</i> , <i>Lyginia barbata</i>



Plate 7. Myrup Road at west limit of survey area, looking east at degraded *Acacia* shrubland.

Plate 8. South road reserve of Myrup Road, looking west from Hills Road.



Plate 9. A marri (*Eucalyptus calophylla*) has been planted on the intersection of Myrup Road and Hills Road. Coast tea tree (**Leptospermum laevigatum*) (background) has invaded the disturbed southern road reserve.

3. Banksia Heathland

Description: *Eucalyptus pleurocarpa* sparse mallee shrubland over *Banksia speciosa*, *Nuytsia floribunda*, *Adenanthos cuneata* heathland over *Anarthria scabra*, *Caustis dioica*, *Chordifex crispatus* sedge/land.

Soil: Pale grey sandy duplex. **Landform:** Sandplain.

Lifeform	% Cover	Dominant taxa
Mallee <10m	<10%	<i>Eucalyptus pleurocarpa</i>
Shrubs >2m	10-30%	<i>Banksia speciosa</i> , <i>Nuytsia floribunda</i> , <i>Lambertia inermis</i> , <i>Spyridium globulosum</i>
Shrubs 0.5-2m	30-70%	<i>Melaleuca thymoides</i> , <i>Adenanthos cuneata</i> , <i>Taxandria spathulata</i> , <i>Leucopogon obovatus</i> , <i>Xanthorrhoea platyphylla</i>
Ground	30-70%	<i>Anarthria scabra</i> , <i>Caustis dioica</i> , <i>Chordifex crispatus</i> , <i>Desmocladius flexuosus</i>



Plate 10. The vegetation west of the quarry site entrance on Myrup Road (south side) is in excellent condition.



Plate 11. At the east limit of the Myrup Road survey area (south side) the *Banksia* woodland is in very good condition.



Plate 12. Opposite the quarry site entrance, on the north side of Myrup Road, the *Banksia* woodland is in very good condition.



Plate 13. The quarry site entrance is degraded.

4. Very Degraded vegetation



Plate 14. The intersection of Myrup Road and Cook Road has been cleared of native vegetation. Weedy species have invaded the disturbed sites.

Plate 15. West of Cook Rd, the north road reserve has been invaded by weeds. Non-native eucalypts and *Melaleuca nesophila* have been planted in the private property.

Appendix D: Fauna species list

Method='By Circle'; Centre=121° 55' 10" E, 33° 46' 10" S; Buffer=10km; Kingdom=Animalia;
Conservation Status=Conservation Taxon (T, X, IA, S, P1-P5) (*Naturemap* 11/1/2021)

	Names	Records
TOTAL	35	648

Species List

Actitis hypoleucos Common Sandpiper	IA	35
Apus pacificus Fork-tailed Swift, Pacific Swift	IA	2
Arenaria interpres Ruddy Turnstone	IA	2
Calidris acuminata Sharp-tailed Sandpiper	IA	37
Calidris alba Sanderling	IA	2
Calidris canutus Red Knot, knot	IA	1
Calidris canutus subsp. rogersi Red Knot (north-eastern Siberia)	T	1
Calidris ferruginea Curlew Sandpiper	T	20
Calidris melanotos Pectoral Sandpiper	IA	2
Calidris ruficollis Red-necked Stint	IA	99
Calidris tenuirostris Great Knot	T	2
Calyptorhynchus latirostris Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo	T	57
Calyptorhynchus sp. white-tailed black cockatoo	T	1
Cereopsis novaehollandiae Cape Barren Goose	T	27
Cereopsis novaehollandiae subsp. grisea Recherche Cape Barren Goose, Cape Barren Goose	T	6
Charadrius leschenaultii Greater Sand Plover	T	1
Dermochelys coriacea Leatherback Turtle	T	1
Eubalaena australis Southern Right Whale	T	4
Falco peregrinus Peregrine Falcon	S	4
Hydroprogne caspia Caspian Tern	IA	28
Isodon fusciventer Quenda, southwestern brown bandicoot	P4	2
Leipoa ocellata Malleefowl	T	1
Limosa lapponica Bar-tailed Godwit	IA	7
Neophoca cinerea Australian Sea-lion	T	1
Oxyura australis Blue-billed Duck	P4	36
Plegadis falcinellus Glossy Ibis	IA	4
Pluvialis squatarola Grey Plover	IA	3
Thalassarche chlororhynchos Atlantic Yellow-nosed Albatross	T	1
Thalasseus bergii Crested Tern	IA	9
Thinornis rubricollis Hooded Plover, Hooded Dotterel	P4	147
Tringa brevipes Grey-tailed Tattler	P4	1
Tringa glareola Wood Sandpiper	IA	5
Tringa nebularia Common Greenshank, greenshank	IA	95
Tringa stagnatilis Marsh Sandpiper, little greenshank	IA	3
Westralunio carteri Carter's Freshwater Mussel	T	1

35 names, 648 records