Western Botanical

Detailed Flora and Vegetation Assessment of the Nifty Copper Mine

June 2021

Prepared for: Cyprium Mentals Limited

Report Ref: WB961

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1. Executive Summary

Cyprium Metals Limited (Cyprium) recently acquired the Nifty Copper Mine from Metals X Limited; located within the Great Sandy Desert Bioregion, approximately 150 km east of Nullagine, Western Australia. Cyprium commissioned Western Botanical to conduct a Detailed Flora and Vegetation Survey of three proposed clearing sites (the Study Area) contiguous with the existing development, encompassing approximately 565 ha. An additional buffer encompassing approximately 5000 ha outside the Study Area was proposed to provide context to the survey; however, due to poor access and time constraints this additional area was not surveyed comprehensively.

This report describes the flora and vegetation within the Study Area, providing i) results of a desktop review of the likelihood of encountering Conservation Significant Flora; ii) vegetation mapping at NVIS Level 5 '*Association'* level, supported by 33 permanent; iii) a flora species inventory including both opportunistic and targeted recording of known Priority Flora; iv) descriptions of Conservation Significant species; v) a vegetation condition assessment; and vi) an impact assessment against the 10 clearing principles.

The desktop assessment identified 26 Conservation Significant Flora occurring within a 110 km radius of the Study Area. The likelihood of encountering two of these species was considered 'Probable', while a further nine were highlighted as 'Possible'. No Priority Ecological Communities (PEC) or Threatened Ecological Communities (TEC) were identified within or around the Nifty Copper Mine. One Land System, The Little Sandy Desert System, is present within the Study Area. The region is composed of sandplains with linear and reticulate dunes and swales supporting shrubby hard and soft spinifex hummock grasslands; with occasional claypans supporting low halophytic shrubs.

The field assessment was conducted over two trips between May and July 2021. A total of 174 species from 94 genera and 41 families were encountered during the field assessment, all of which were collected at least once, for reference or identification. 128 (74%) species were recorded within quadrat sites, while 36 (26%) were encountered outside but within the Study Area and ten (6%) were recorded outside the Study Area.

Six Priority Flora were encountered during the field assessment. These included; 11 *Goodenia hartiana* (P2) populations (2484 individuals – 615 within the Study Area and 1869 outside); one population of *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2) (3 plants within the Study Area); 9 *Corynotheca asperata* (P3) populations (137 individuals – 118 within the Study Area and 19 outside); one *Dasymalla chorisepala* (P3) populations (20+ plants – all outside of the Study Area; 23 *Indigofera ammobia* (P3) populations (12,105 individuals – 5177 within the Study Area and 6928 outside); and one population of *Sauropus arenosus* (P3) (8 individuals, all outside).

One taxon representing a species of taxonomic interest, *Dampiera cinerea* sens. lat. was encountered during the field survey. Three taxa that represent weed species were identified during the survey, including *Cenchrus ciliaris* (Buffel grass), *Rumex vesicarius* (Ruby Dock), and *Aerva*

javanica (Kapok). A total of 15 taxa that represent extensions to currently known distributions were also encountered.

Twelve Vegetation Associations at NVIS Level V '*Association'* level, were recognised within the Study Area – strongly corresponding to the landforms they occurred on. These include, 1) Sand Dunes, 2) Sandplains, 3) Stony Plains and Low Hills, and 4) Claypans Playas. Sand Dunes supported i) the *Corymbia chippendalei* Scattered Low Trees and ii) the *Aluta maisonneuvei* subsp. *maisonneuvei* Shrubland Vegetation Associations; Sandplains supported a variety of shrublands, including ii) *Acacia ancistrocarpa*, iv) *Acacia stellaticeps*, v) *Grevillea stenobotrya*, vi), *Melaleuca glomerata,* vii) *Melaleuca lasiandra;* as well as viii) *Triodia basedowii* and ix) *Triodia* aff. *lanigera* Hummock Grasslands; Stony Plains and Low Hills supported x) *Acacia hilliana* Low Shrubland; and low-relief Claypan Playas supported xi) *Eragrostis falcata* Grasslands and xii) *Tecticornia auriculata* Low Shrublands. The Vegetation Associations observed are representative of those previously described within the Great Sandy Desert Bioregion. The Condition of the vegetation within the Study Area was considered mostly Excellent, with some minor areas adjacent to the existing development appearing Poor to Degraded.

Overall, the survey was considered adequate in capturing the Flora and Vegetation within the Study Area. While the survey was completed in a single season, the preceding conditions of above average summer rainfall, and encountering the vegetation three years following fire disturbance resulted in the maximum level of taxa present and observable within the system. A total of 15 days were spent on ground, including approximately 10 days allocated to vegetation mapping and 5 days traversing areas likely supporting Priority Flora, both within and outside the Study Area. Notably, one sand dune within the south-western polygon was not traversed completely; whilst further survey work may also be required regionally to quantify potential impacts.

2. Introduction

2.1. Project Background

Cyprium Metals Limited (Cyprium) recently acquired the Nifty Copper Mine (Nifty) from Metals X Limited and are planning to operate the mine under new development plans. Nifty is located on the western edge of the Great Sandy Desert, approximately 150 km east of Nullagine in the Shire of East Pilbara, and is currently in care and maintenance, Figure 1. Cyprium plan on making changes to the layout of the mine site to allow for more efficient operations. The layout changes will require clearing of an additional ~300 ha of native vegetation.

Cyprium commissioned Western Botanical to conduct a Detailed Flora and Vegetation Survey of the proposed development area. The survey and report were prepared to meet the requirements for Impact Assessment in accordance with the Environmental Protection Authority (2016), *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment.*

2.2. Previous surveys

No recent surveys have been conducted by Western Botanical around the study region. A Flora and Vegetation Survey of the Access Road to Telfer, 50 km east, conducted by Bennett Environmental Consulting Pty. Ltd. (2011) provides good contextual information on the flora and vegetation on similar landforms in the region.

Of greater relevance to the survey, the Botanic Gardens and Parks Authority (BGPA) undertook a Targeted Survey of a proposed discharge area in 2014 (Department of Mines, Industry Regulation and Safety DMIRS 2014). The clearing permit decision report states that two broad vegetation types were identified, including i) "Sand Plains: *Triodia basedowii* hummock grasslands with scattered shrubs grading to shrublands of *Acacia* species, most commonly *A. stellaticeps"*; and ii) "Sand Dunes: Vegetation gradient from the lower slope to the crest with *Triodia schinzii* on the crest, grading to *Triodia basedowii* on the lower slopes, with a variety of shrubs, herbs and grasses. Common species found include *Corymbia chippendalei, Acacia dictyophleba, Dicrastylis doranii, Aluta maisonneuvei* and *Grevillea stenobotrya".* A population of six *Goodenia hartiana* (P2) were also identified during the survey, located north of the current development.

2.3. Current Survey

The current survey describes the flora and vegetation within the Study Area and provides the following:

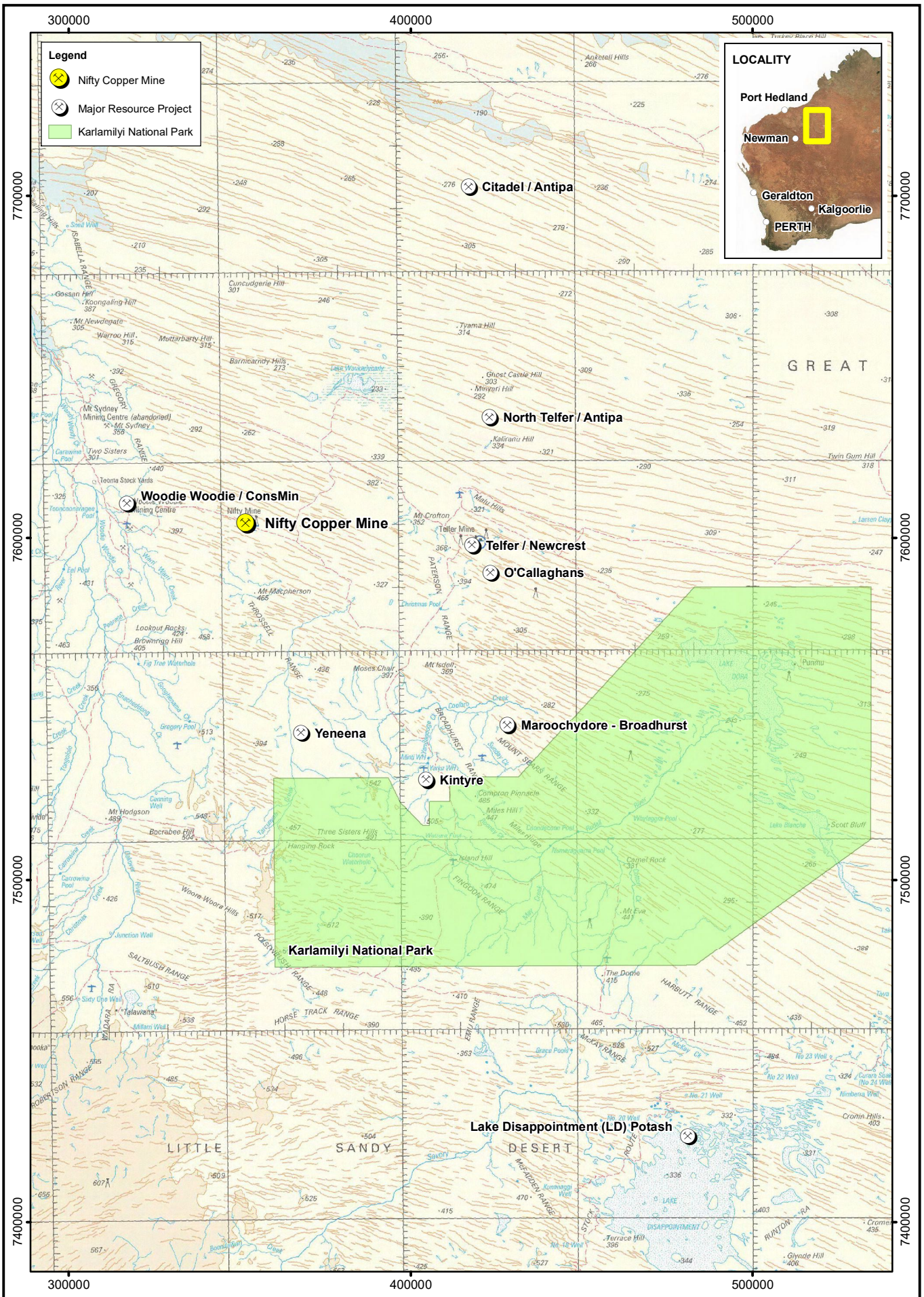
- A desktop review of flora, vegetation, land systems, Threatened Ecological Communities and Priority Ecological Communities.

- Vegetation mapping of the Study Area at NVIS Level 5 '*Association'* level supported by 35 permanent quadrats with statistical confirmation of 12 Vegetation Associations and a Vegetation Condition map.
- Flora species inventory of the Study Area incorporating both opportunistic and targeted recording of known Priority Flora species.
- Descriptions of Priority Flora species, as well as species with uncertain taxonomic status.
- Impact Assessment against the 10 Clearing Principles.

2.3.1. Study Area

The Study Area comprises three survey polygons, each roughly 1 km wide and 3.5 km long, positioned to the north-east, south-western and south-eastern edges of the existing development, within mining tenement M7000271. The survey polygons encompass 94.6 ha, 256 ha and 214 ha, respectively, Figure 2. The south-eastern polygon was added to the proposal at a later stage to provide flexibility for the planning and final positioning of potential infrastructure in the future. All mapping images depict the two southern polygons one.

Figure 1. Regional Location Map of the Nifty Study Area.



Ref: Mindex (DMIRS), Legislated Lands and Waters (DBCA)

0 10 20 30km

Scale: 1:1,500,000
MGA94 (Zone 51)

CAD Ref: a2819_F006

Date: June 2021 | Rev: A | A4

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Cyprium Metals Pty Ltd
Nifty Copper Mine
Location

Figure 2. Location Map of the Nifty Study Area.

Imagery: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 400 800m

Scale: 1:40,000
MGA94 (Zone 51)

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Nifty Copper Mine
Survey Area

2.4. Physical Environment

2.4.1. Climate

The Study Area experiences a hot arid climate (Köppen BWh), characterised by extremely hot summers and very warm winters, with majority of the rainfall received during the summer months, related to cyclonic activity in the north of the state. Historic (1974-2021) and recent (2020-2021) monthly rainfall; and mean maximum temperatures (2003-2020) (Telfer Aero weather station - 13030) are presented in Figure 3. Total rainfall for the four months preceding the field assessment was 84 mm. While rainfall data were unavailable for the months between November 2020 and January 2021 observations recorded at the two closest weather stations, Warrawagine – 4041 and Meenthema – 4102, (approx. 150 km away) indicate that several significant rainfall events took place in the region during this time, with 230.6 mm and 298.3 mm recorded, respectively. These equate to above average rainfall for the region over this period.

Monthly mean-maximum temperatures depict a typical unimodal pattern, with June-July experiencing the lowest temperatures (~25°C) and December-January experiencing the highest (~40°C).

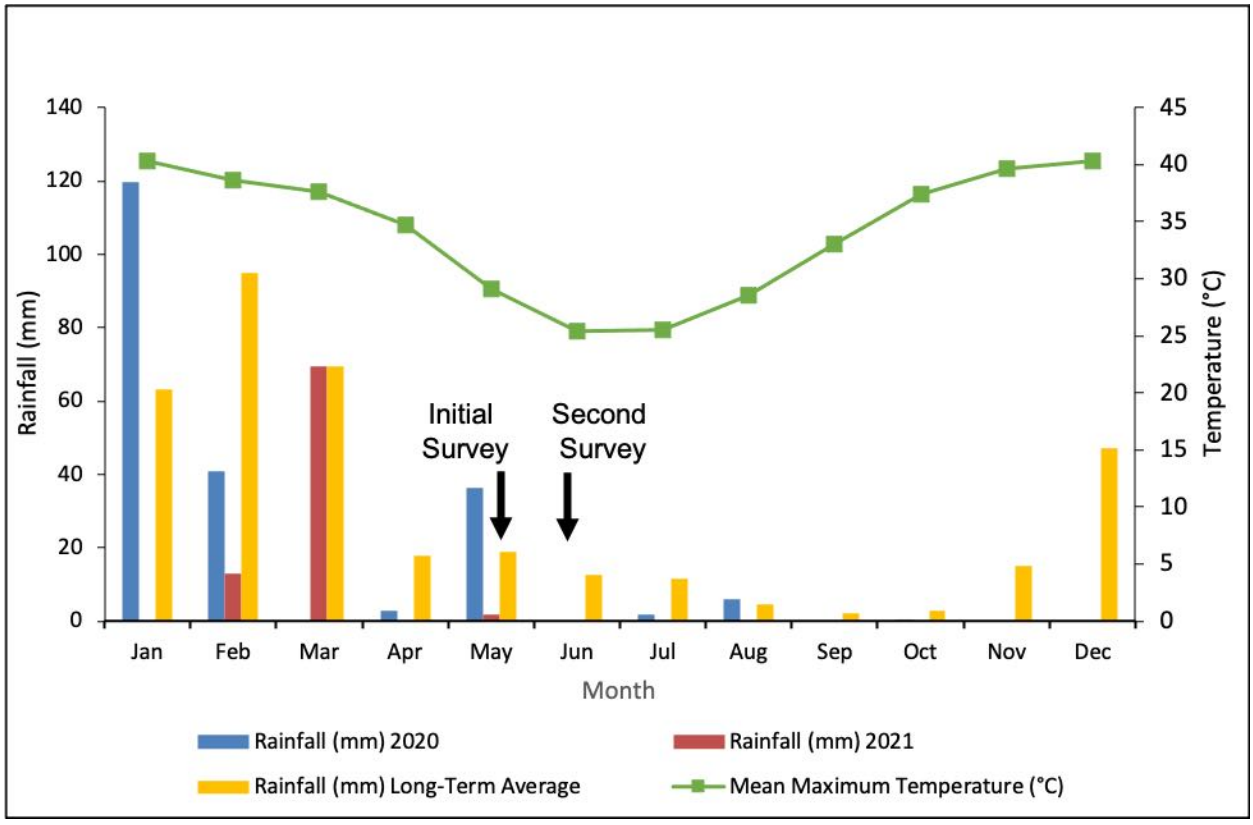


Figure 3. Monthly (2020-2021) and Long-Term Average Rainfall (mm); and Mean Maximum Temperature (°C) (Telfer) (Bureau of Meteorology 2021).

2.4.2. Geology

The Study Area is located in the Paterson Province, to the east of the Pilbara Craton (Maidment et al. 2010). It lies within a small, disjunct occurrence of the Broadhurst Formation (Ns) geology described as "Interbedded fine to coarse sandstone, siltstone, silty shale, pyritic and pyrrhotitic shale, dolomite, stromatolitic dolomite, local basalt". This lies within broader Quaternary dunes (Qd) described as "Dunes, sandplain with dunes and swales; may include numerous interdune claypans; may be locally gypsiferous".

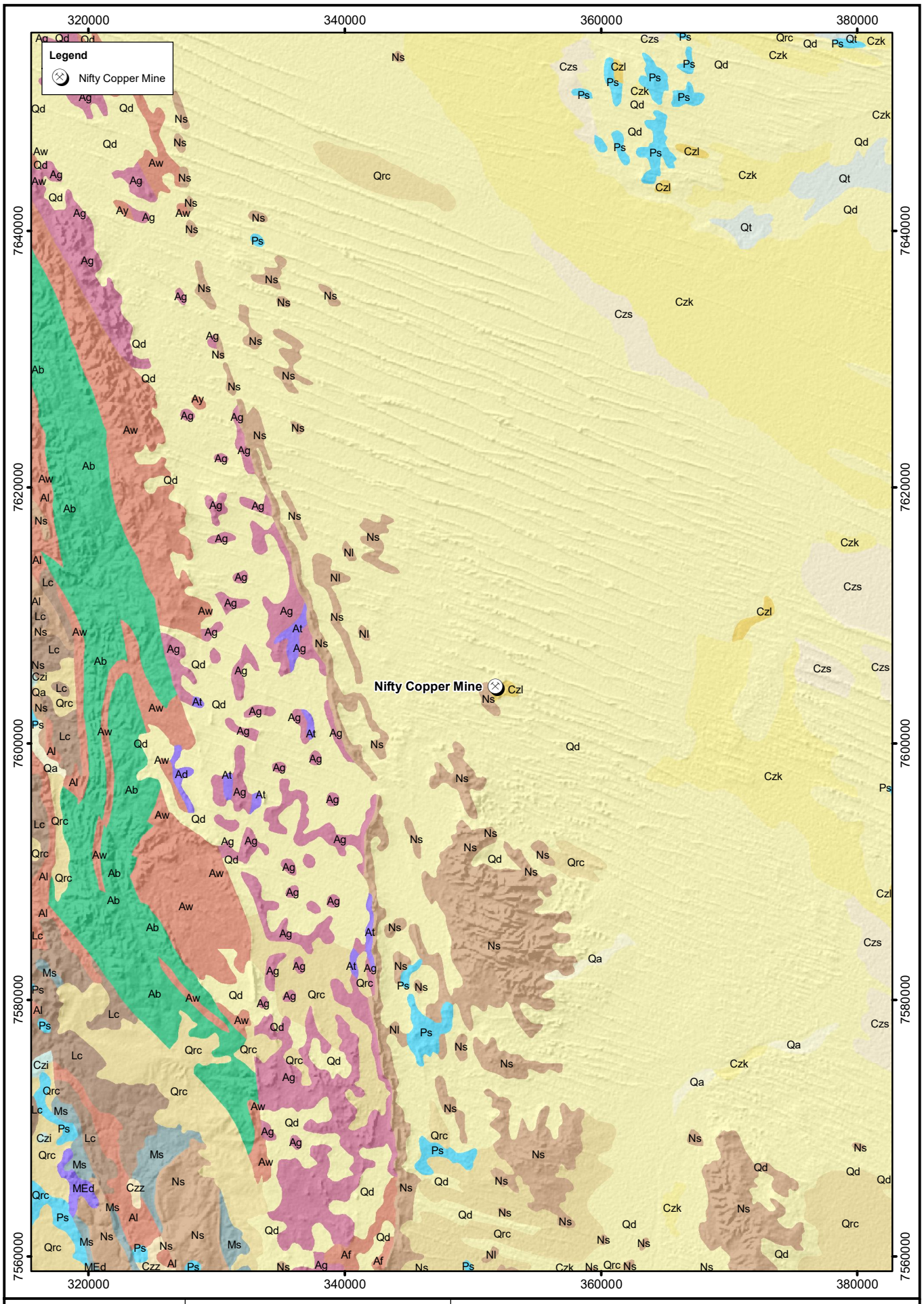
A list of names and descriptions of the regional geology is presented in Table 1. A map illustrating regional surface geology is presented in Figure 4.

Table 1. Descriptions of the Surface Geology Around the Nifty Copper Mine.

Symbol	Name	Description
Ab	Kylena Formation	Basalt, andesite, dacite, high-Mg basalt, rhyolite; basaltic agglomerate; dolerite; grey carbonate rock with microbial laminations and stromatolites; sandstone; pillow breccia; tuff, limestone, conglomerate
Ac	Marra Mamba Iron Formation	Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone.
Ad	Fortescue Group - mafic intrusions	Metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated
Af	felsic porphyry, rhyolite dykes 74287	Feldspar-phyric porphyry, rhyolite
Ag	Gregory Range Suite	Metamorphosed and foliated granite, syenogranite, granitic augen gneiss, granophyre and granophyre gneiss
Al	Carawine Dolomite	Massive to well-bedded, recrystallised dolomite and stromatolitic dolomite; minor chert.
At	metamorphosed mafic rocks 74327	Metamorphosed mafic rocks; metabasalt, metagabbro, metadolerite, amphibolite, mafic schist; minor metamorphosed ultramafic rocks and metasedimentary rocks; amphibolite schist; quartz-sericite schist, volcaniclastic rocks, local granitic dykes and veins
Aw	Hardey Formation	Pisolitic tuff, siliceous limestone and dolomite, mudstone, tuffaceous shale, siltstone, sandstone, volcaniclastic sandstone and siltstone, calcareous sandstone, local basalt and basaltic breccia, chert, local conglomerate, shale, jasper
Ay	quartzite, schist 74463	Quartzite, schist, paragneiss; may include some meta-igneous rocks
Czi	Oakover Formation	Lacustrine carbonate deposits; limestone and calcareous sandstone; includes undivided variously silicified limestone, silty limestone, calcareous sandstone, siltstone and marl.

Symbol	Name	Description
Czk	calcrete 38497	Calcrete, travertine; calcareous cementing of bedrock and transported materials; pisolitic to nodular or massive; as low mounds, in playa lakes, valley calcrete, or in subsurface; may contain intercalated chalcedony; locally dissected and karstified
Czl	ferruginous duricrust 38498	Ferruginous duricrust, laterite; pisolitic, nodular, vuggy; may include massive to pisolitic ferruginous subsoil, mottled clays, magnesite, reworked products of ferruginous and siliceous duricrusts, calcrete, gossan; residual ferruginous saprolite
Czs	sand plain 38499	Sand or gravel plains; may include some residual alluvium; quartz sand sheets commonly with ferruginous pisoliths or pebbles; local clay, calcrete, laterite, silcrete, silt, colluvium
Czz	silcrete 42026	Silcrete, silicified gravel, siliceous duricrust, siliceous breccia; opaline silica, jasperoidal chalcedony, local chrysoprase caprock over ultramafic rock
Lc	Pinjian Chert Breccia	Chert breccia and poorly bedded chert. Interpreted to be a siliceous replacement deposit formed by karstic weathering of the Carawine Dolomite.
MEd	Davis Dolerite	Fine- to medium-grained dolerite sills.
Ms	Woblegun Formation	Interbedded shale, siltstone, sandstone and conglomerate; local dolostone and stromatolitic dolostone.
Nl	Nooloo Formation	Laminated to massive dolomite, stromatolitic dolomite, sandy dolomite, siliceous oolite, sandstone, siltstone and shale; evaporite pseudomorphs.
Ns	Broadhurst Formation	Interbedded fine to coarse sandstone, siltstone, silty shale, pyritic and pyrrhotitic shale, dolomite, stromatolitic dolomite, local basalt
Ps	Paterson Formation	Fossiliferous, locally carbonaceous, commonly ripple marked and cross bedded red-yellow/brown fine and thin-bedded to coarse quartzose sandstone; lenses of white claystone and siltstone and thinly bedded matrix-supported conglomerate; minor coal seams.
Qa	alluvium 38485	Channel and flood plain alluvium; gravel, sand, silt, clay; may be locally calcreted
Qd	dunes 38496	Dunes, sandplain with dunes and swales; may include numerous interdune claypans; may be locally gypsiferous
Qrc	colluvium 38491	Colluvium and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; may include minor alluvial or sand plain deposits, local calcrete and reworked laterite
Qt	lake deposits 38492	Lake and swamp deposits; mud, silt, evaporites, limestone; minor sand, peat

Figure 4. Surface Geology Around the Nifty Copper Mine.



0 4 8km
Scale: 1:400,000
MGA94 (Zone 51)

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Nifty Copper Mine
Surface Geology of Australia, 1:1 000 000

Ref: Surface Geology of Australia, 1:1 000 000 (Geoscience Australia)

2.5. Biological Environment

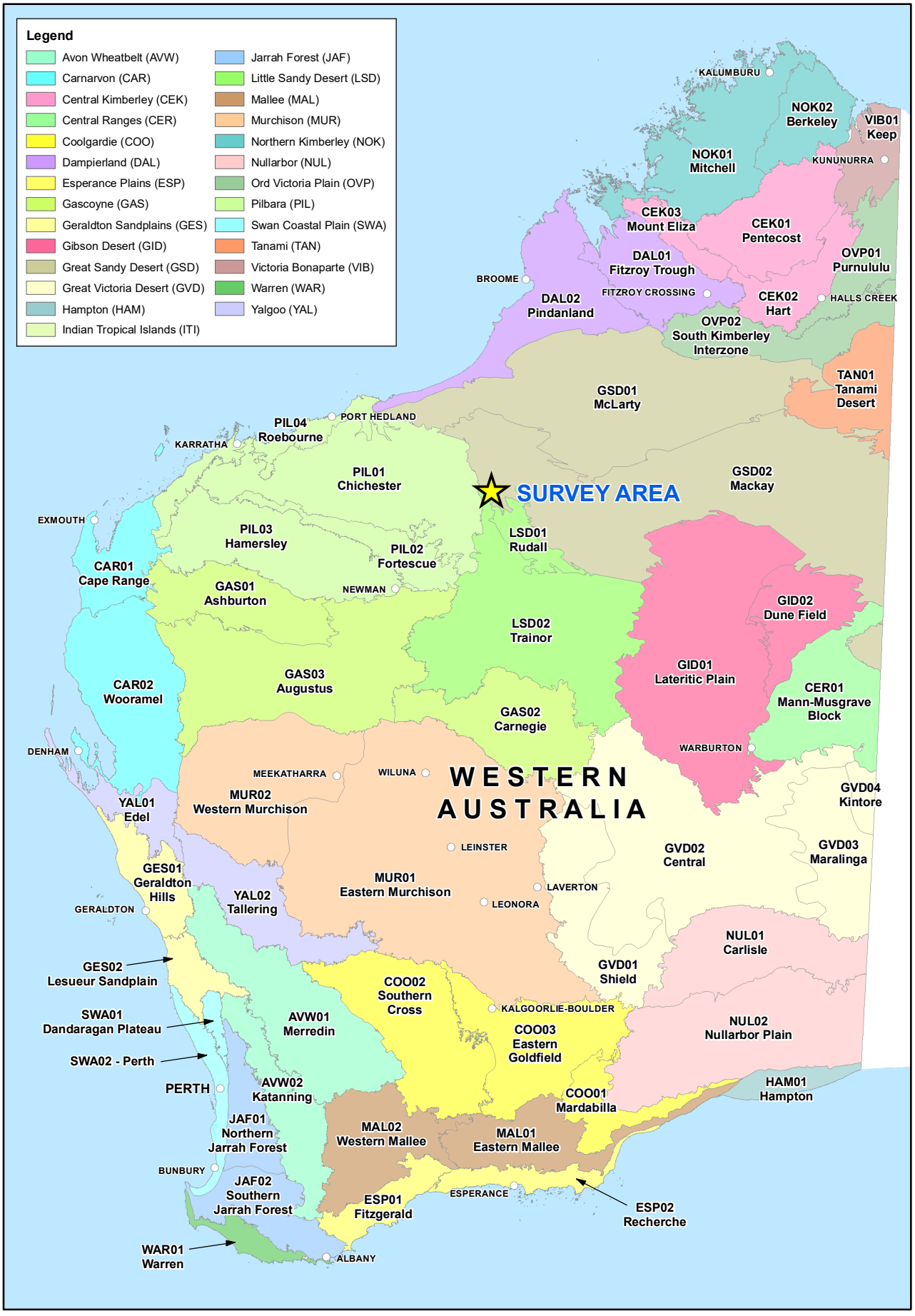
2.5.1. Interim Biogeographic Regionalisation of Australia

The Nifty Copper Mine is located within south-western margin of the Great Sandy Desert IBRA region, an area dominated by sand-dune systems, sandstone mesas and rocky plains (van Etten 2020), Figure 5. More specifically, it is located within the Mackay IBRA subregion; bordered by the Trainer and Rudall IBRA subregions.

In Western Australia, the Mackay subregion is described as "Tropical inland 'red-centre' desert. Includes 'Percival' and 'Auld' palaeo-river systems. Mainly tree steppe grading to shrub steppe in south; comprising open hummock grassland of *Triodia pungens* and *Triodia schinzii* with scattered trees of *Owenia reticulata* and bloodwood (*Corymbia* spp.), and shrubs of *Acacia* spp., *Grevillea* wickhamii and *G. refracta*, on Quaternary red longitudinal sand dune fields overlying Jurassic and Cretaceous sandstones of the Canning and Armadeus Basins. *Casuarina decaisneana* (Desert Oak) occurs in the south and east of the region. Gently undulating lateritised uplands support shrub steppe such as Acacia pachycarpa shrublands over *Triodia pungens* hummock grass. Calcrete and evaporite surfaces are associated with occluded palaeo-drainage systems that traverse the desert; these include extensive salt lake chains with samphire low shrublands, and *Melaleuca glomerata* - *M. lasiandra* shrublands. Monsoonal influences are apparent in the north-western sector of this region. The climate is arid tropical with summer rainfall. Subregional area is 18,636,695 ha." Kendrick, P. (2001).

The Mackay subregion also extends into the Northern Territory: 'The Mackay subregion forms a large area south of the Tanami Desert and west of the MacDonnell Ranges. The major geological units are the Arunta Inlier and the Amadeus and Ngalia Basins. It is made up of a complex of sedimentary and metamorphic rocks of various ages. Soils are predominantly shallow sands. The climate is arid with annual average rainfall varying between 300 to 400 mm, and there are temperature extremes between summer and winter. Elevation varies between 350 and 800 m. Vegetation is dominated by hummock grassland (*Triodia basedowii* and *T. pungens*) with areas of tall shrubland (*Acacia* spp.) or low open woodland (*Allocasuarina decaisneana*). There is little drainage in the subregion, although a large playa lake, Lake Mackay, occurs on the Western Australia border." Kendrick, P. (2001).

Figure 5. Location of Nifty Study Area relative to IBRA Regions



Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Subregions): Australian Government Department of the Environment

0 200 km
Scale
MGA94 (Zone 51)

CAD Ref: a2819_F007
Date: June 2021 | Rev: A | A4

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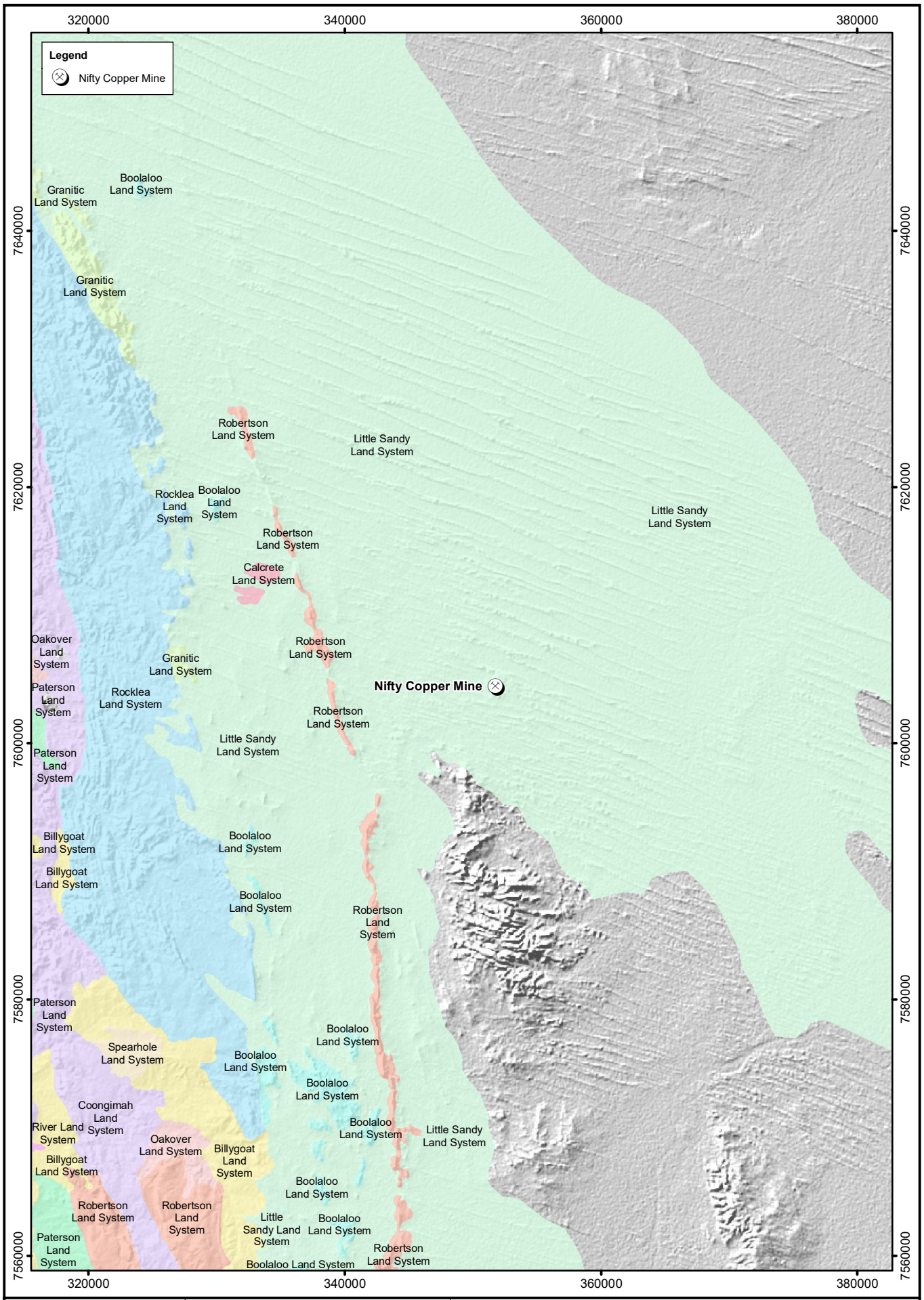
Nifty Copper Mine
Interim Biogeographic Regionalisation for Australia (IBRA)

2.5.2. Land Systems

In the late 1990s, the Department of Agriculture and Food, Western Australia (DAFWA) conducted extensive Land System mapping and condition assessments of pastural lands within the Pilbara region (van Vreeswyk et al. 2004). The existence and condition of soils, landforms, vegetation, habitat, ecosystems and declared plants and animals were catalogued, with the goal of improving overall understanding of the area's natural resources, and to assist with planning and implementation of resource management practices. While the Great Sandy Desert region has not yet been mapped to this extent, some Land Systems mapped within the Pilbara region extend beyond this, and into the Study Region.

One Land System, the Little Sandy System, is present within the Study Area. The Little Sandy Land System is characterised by sandplains with linear and reticulate dunes supporting shrubby hard and soft spinifex grasslands (van Vreeswyk et al. 2004) Figure 6.

Figure 6. Land Systems Map of the Nifty Study Area.



Ref: Soil Landscape Mapping - Rangelands (Department of Primary Industries and Regional Development)

0 4 8km

Scale: 1:400,000
MGA94 (Zone 51)

CAD Ref: a2819_F005

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Nifty Copper Mine
Soil Landscape Mapping - Rangelands

2.5.3. Beard Pre-European Vegetation

The first broad-scale vegetation mapping of Western Australia was conducted by J.S. Beard in 1979. Several revisions and updates have been made since then, resulting in the most recent and comprehensive iteration, detailed in Beard et al. (2013). The Nifty Study Area lies within the Telfer District of the Eremaean Province.

J.S. Beard describes one vegetation unit across the Study Area; sparse low tree-steppe / sparse shrub-steppe (Great Sandy Desert 134), Figure 7.

Figure 7. Map of Pre-European Vegetation of the Study Area.

Ref: Pre-European Vegetation, Western Australia (Department of Primary Industry and Regional Development Western Australia)

0 4 8km

Scale: 1:400,000
MGA94 (Zone 51)

CAD Ref: a2819_F004

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Cyprium Metals Pty Ltd
Nifty Copper Mine
Pre-European Vegetation, Western Australia

3. Methods

3.1. Desktop Survey

In preparation for the field assessment, several database searches were conducted to identify potential Threatened and Priority Flora species, Threatened Ecological Communities (TEC's), Priority Ecological Communities (PEC's), or other areas of conservation significance that may be encountered during the study. The Department of Biodiversity Conservation and Attractions (DBCA) Framework for Conservation Significant Flora; and the Definitions of TEC's and PEC's are presented in Appendix 1 & 2, respectively.

Database searches were centred at 121° 34' 16" E, 21° 39' 31" S. The resources assessed included:

- Department of Biodiversity, Conservation and Attraction databases:
  - Threatened (Declared Rare) and Priority Flora database, 110 km radius (Ref:18-0521FL)
  - Western Australian Herbarium Specimen database, 110 km radius
  - TEC database, 50 km radius (Ref:23-0521EC)
- NatureMap Search with 20 km search radius for all flora records (Department of Biodiversity, Conservation and Attractions 2021)
- Protected Matters Search Tool with 50 km radius (Department of Agriculture, Water and the Environment 2021).

Subsequent to the database searches, a desktop assessment of the likelihood of each Threatened and Priority flora species, TEC's or PEC's occurring within the Study Area was performed, by considering a) the proximity of known Conservation Significant flora species and communities, and b) similarities between habitat information of those flora species and communities, and the environmental characteristics of the Study Area.

3.2. Field Assessment

The field assessment was conducted over two trips between May and July 2021. The initial survey was conducted by Western Botanical botanists, Jonathan Warden and Jason Paterson, between May 31st and June 3rd 2021. The final survey was conducted Jonathan Warden and Malcolm Trudgen between June 21st and July 1st 2021. Following techniques described in Environmental Protection Authority (EPA) (2016), thirty-five quadrats were installed and assessed to capture and catalogue all flora and vegetation within the Study Area.

3.3. Vegetation Mapping

Vegetation Association mapping within the Study Area was conducted using Google Earth imagery. While the use of high-resolution aerial photography was anticipated, extensive fire scars and fine-scale changes in vegetation were not able to distinguished at the 1:10,000 scale provided. The boundaries of Vegetation Associations were defined on the ground and confirmed through

extensive traverses across the Study Area. Polygons were created on Google Earth, and transferred to aerial imagery maps following the field assessment.

3.3.1. Quadrats

A series of 50 m x 50 m (or equal area) quadrats were constructed within each Vegetation Association, using wooden posts and measuring tapes to demarcate corners and boundaries. Where possible, at least three representative quadrat sites per described Vegetation Association were installed, taking care to avoid disturbed or interzonal areas. Photographs were taken from the two permanent corners (usually north-west and south-east), while data pertaining to the following parameters was recorded into notebooks at each quadrat site.

General: Vegetation Association, Date, Persons recording, Quadrat size;
Location: Unique site number, Project name, Co-ordinates recorded on handheld GPS, Datum GDA94 (accuracy +/- 5 m), Digital photograph;
Vegetation: Species present, Height and Projected Foliar Cover (PFC) for each species, Species outside of the quadrat (but not noted within), Structural description (Based on NVIS level 5 *'Association'* descriptions);
Disturbance:
Vegetation Condition, Fire age;
Physical Conditions: Rock type, Soil, Landform Description, Runoff.

All taxa recorded during quadrat assessments were collected at least once, and given unique collection numbers. To avoid unnecessary duplication, taxa occurring within the quadrats were compared against previous collections. When the PFC for an individual taxon was lower than 0.5%, it was recorded as a presence (+) only.

Due to the limited size of the Study Area, several quadrat sites were installed outside of the Study Area, in order to obtain the desired number of replicates for each Vegetation Association.

3.4. Flora Specimen Identification

At least one representative sample of each taxon was collected and pressed for identification or verification, together with information pertaining to the date, location, and field description. The identification of samples was carried out using the resources of both the Western Botanical herbarium and the Western Australian Herbarium. Taxa unable to be identified, or exhibiting uncertain taxonomy, were submitted to the Western Australian Herbarium for further examination.

3.5. Significant Flora

The locations of all Priority Flora recognised during the field survey were recorded using Garmin GPS devices. Counts of individuals were recorded to provide information on population sizes.

Specimens of Priority Flora, Range Extensions, or Species of taxonomic Interest (SOI) were retained to be vouchered at the WA Herbarium.

3.6. Weeds

Any weed species encountered during the survey were way-pointed using Garmin GPS devices, recording estimates of population sizes. All taxa unable to be identified in the field were collected for later identification.

3.7. Vegetation Condition

Vegetation condition was assessed at each quadrat site against the Vegetation Condition Scale presented in EPA (2016), Appendix 3.

3.8. Floristic Analysis

Statistical analyses were conducted following the second field assessment and the identification of all collected specimens. Flora data from all 35 quadrat sites were entered into a proprietary Microsoft Access database (Griffin 2012). The purpose of the analysis was to investigate floristic similarity amongst sites, groupings of sites, and to assess relationships amongst groupings.

Percent Foliar Coverage (PFC) scores of flora were used for each species to incorporate dominance of key species within vegetation groupings. To optimise interpretive output, PFCs were standardised to cover scores, scaled from 0-5. Species recorded outside quadrats were excluded from the final analysis, as were dead species recorded within the quadrats. The effects of excluding singleton sample sites and retaining ‘outs’ were examined during initial runs– the results guiding later iterations of the analysis.

Analysis of flora data was conducted using PATN v3.12 statistical package software (Belbin 2010). Association (Bray and Curtis), Classification (Flexible UPGMA Agglomerative Hierarchical Fusion), and Ordination (Semi-Strong Hybrid) components of PATN were utilised in the analysis; primarily producing a dendrogram of site similarity/dissimilarity with suggested Vegetation Association groupings provided by PATN.

4. Results and Discussion

4.1. Desktop Survey

4.1.1. Species with Conservation Significance

Results of the desktop survey and assessment of the likelihood of encountering any species with Conservation Significance (Threatened Flora or Priority Flora) or representing Species of Interest (SOI) are presented in Table 2. This included one Threatened Flora (*Seringia exastia*[1]), ten Priority 1, three Priority 2, eleven Priority 3 and one Priority 4 taxon.

Of these, two were considered as Probably occurring within the Study Area (*Seringia exastia* (T) and *Goodenia hartiana* (P2)) while a further nine are considered Possibly occurring within the Study Area.

Table 2. Summary of Conservation Significant flora database search results for the vicinity of the Nifty Study Area (sorted by conservation rank) and their likelihood of occurrence within the Study Area.

Taxon	Cons Status	TPFL	WA HERB	Likelihood of Occurrence	Reasoning
Seringia exastia[1]	T		1	Probable	Widespread species of sandplains
Acacia aphanoclada	1	1	1	Unlikely	Pilbara bioreigon
Acacia fecunda	1	1	1	Unlikely	Pilbara bioreigon
Atriplex spinulosa	1	1	1	Unlikely	Pilbara bioreigon
Eremophila tenella	1	1	1	Unlikely	GSD bioregion, stony hills
Goodenia pedicellata	1	1	1	Unlikely	Pilbara bioreigon, stony hills
Lepidium amelum	1	1	1	Possible	GSD bioregion, sandplains near calcrete
Ptilotus wilsonii	1		1	Unlikely	Pilbara bioreigon, stony hills
Scaevola sp. Isabella Range (R.D. Royce 1918)	1		1	Unlikely	Pilbara bioreigon, stony hills
Solanum sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795)	1		1	Unlikely	Pilbara bioreigon
Tribulus minutus	1		1	Unlikely	Pilbara bioregion, calcrete, silcrete geology
Eremophila sp. Rudall River (P.G. Wilson 10512)	2		1	Possible	GSD bioregion, sand and rocky quartz hills
Goodenia hartiana	2	1	1	Probable	GSD bioregion, sandplains, known nearby Nifty
Thysanotus sp. Desert East of Newman (R.P. Hart 964)	2		1	Possible	GSD bioregion, sandplains, known nearby Nifty
Comesperma sabulosum	3	1	1	Possible	GSD bioregion, sand dunes

[1] *Seringia exastia* is listed as Threatened due to a technicality and does not warrant Conservation Listing and will be removed from the Threatened Flora List following the next census.

Taxon	Cons Status	TPFL	WA HERB	Likelihood of Occurrence	Reasoning
Dampiera atriplicina	3	1		Possible	GSD bioregion, sand dunes
Eragrostis lanicaulis	3		1	Possible	GSD bioregion, sand dunes
Eucalyptus rowleyi	3		1	Unlikely	Pilbara bioreigon, creek systems
Euphorbia clementii	3	1	1	Unlikely	Pilbara bioreigon, stony hills
Fuirena incrassata	3		1	Unlikely	Kimberley and eastern Pilbara bioregions, swamps, damplands
Indigofera ammobia	3		1	Possible	GSD bioregion, sand plains and sand dunes, known nearby Nifty
Pterocaulon xenicum	3		1	Possible	GSD bioregion, stony hills
Rostellularia adscendens var. latifolia	3		1	Unlikely	Pilbara bioreigon, stony hills
Sauropus arenosus	3		1	Possible	GSD bioregion, sand plains and sand dunes
Sida sp. Barlee Range (S. van Leeuwen 1642)	3		1	Unlikely	Pilbara bioreigon, stony hills
Ptilotus mollis	4		1	Unlikely	Pilbara bioreigon, stony hills

Results generated from the NatureMap search are presented in Appendix 4.

4.1.2. Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat (Department of Environment and Conservation 2013). A TEC is one that is categorised as being either; “presumed totally destroyed”, “critically endangered”, “endangered”, or “vulnerable”.

No TEC’s were found within the Nifty Study Area.

PEC’s are defined as possibly TEC’s that do not meet survey criteria or that are not adequately defined due to lack of knowledge. They are ranked in order of priority based on their frequency and extent (Priority 1, 2 and 3), and the likelihood of becoming threatened in the future (Priority 4 and 5).

No PEC’s were found within the Nifty Study Area.

4.1.3. Areas of Conservation Significance

Results of the Protected Matters Search Tool (Department of Agriculture, Water and the Environment 2021) found the Project Area to be outside any nationally protected conservation areas protected under the *EBPC Act 1999*

Results of the Protected Matters Search Tool are Presented in Appendix 5.

4.2. Field Survey

4.2.1. Flora

One hundred and seventy-four flora species from 94 genera and 41 families were recorded during the field assessment. All taxa were collected at least once for identification or verification using the resources of the WA Herbarium and the Western Botanical reference herbarium. The most prevalent family was the Fabaceae (38 species observed), while the most well represented genera were *Acacia* (15 species) and *Ptilotus* (10 species). Lists of the most dominant families and genera are presented in Table 3 & 4. The full systematic species list presented in Appendix 6.

Table 3. Most dominant families of the Nifty Study Area.

Family	Number of observed genera
Fabaceae	15
Poaceae	9
Malvaceae	6
Lamiaceae	5
Myrtaceae	5

Table 4. Most dominant genera of the Nifty Study Area.

Genera	Number of observed species
Acacia	15
Ptilotus	10
Senna	7
Goodenia	7
Sida	5

Four taxa representing individuals from the *Acacia, Calandrinia, Cyperus* and *Triodia* genera were unable to be identified to species level. The collection of *Acacia* aff. *sericophylla* consisted of sterile material from a small plant regenerating from fire. While the specimen had strong affinities to *A. sericophylla,* a conclusive identification was unable to be made due to inconsistent phyllode features. The collection of *Calandrinia ?tepperiana* has strong affinities to *C. tepperiana* – differing only in the lengths of fruit capsule (50 % shorter), and the markings on the seed (less conspicuous) (Frank Obbens, personal communication, 16 July 2021). The *Calandrinia* genus is a complex group and further taxonomic work is required to identify potential hybridization between species, particularly in the lesser-explored parts of Australia.

Cyperus is a prevalent genus within the Great Sandy Desert, with as many as 19 occurring in the bioregion. None of these, however, hold conservation status thus the collection is not considered to be significant. The collection of *Triodia* has strong affinities to *T. lanigera*, is slightly different

in the lemma characteristics. Both the *Cyperus* and *Triodia,* specimens have been submitted to the Western Australian Herbarium for further examination and identification.

Overall, the species encountered are widespread and well represented in the Great Sandy Desert Bioregion. Of the 174 species encountered, 128 (74%) were recorded within quadrat sites; 36 (20%) were encountered outside quadrats but within the Study Area, and 10 (6%) were encountered outside of the Study Area during the regional search. The species accumulation curve commences at 36 in order to include species encountered outside quadrat sites but within the Study Area It largely displays an asymptotic progression, demonstrating that the survey effort was sufficient in capturing most of the species present across the Study Area, Figure 8. A slight rise in the number of new species encountered in the final two quadrat sites is most likely due to their location outside of the Study Area (in efforts to obtain the desired number of replicate sites).

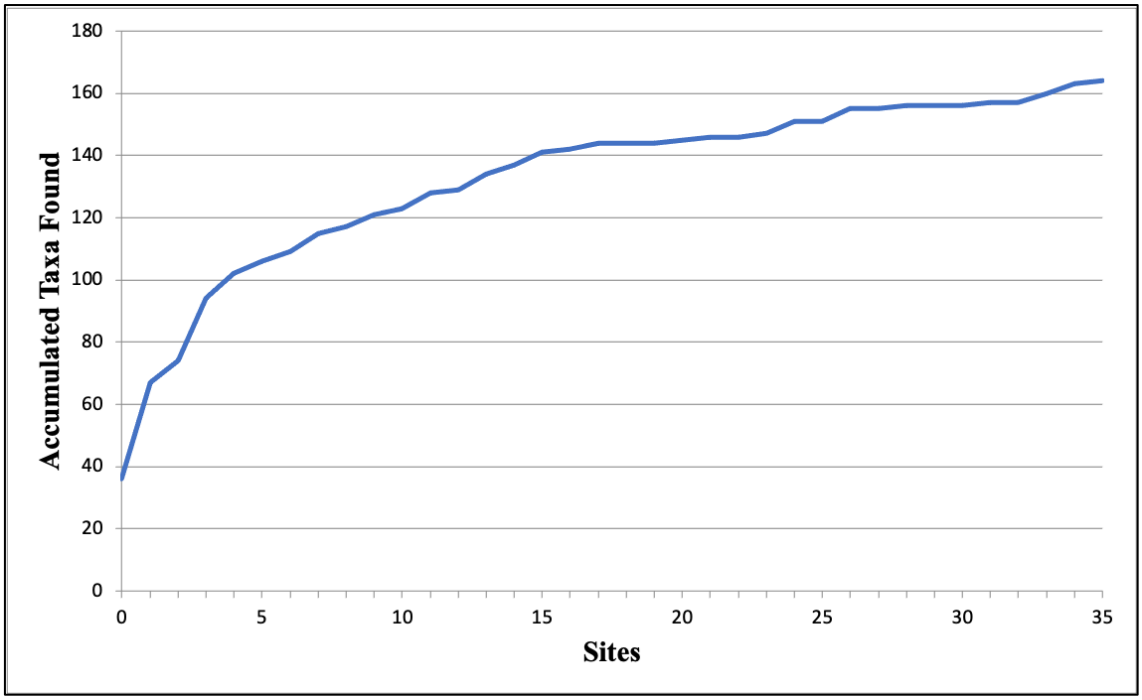

Figure 8. Species Accumulation Curve for the Nifty Study Area.

4.2.2. Significant Flora

Six Priority Flora were identified during the field assessment, including *Goodenia hartiana* (P2), *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2), *Corynotheca asperata* (P3), *Indigofera ammobia* (P3) within the Study Area; and *Dasymalla chorisepala* (P3) and *Sauropus arenosus* (P3) located outside the Study Area, encountered during the regional search. A summary of the numbers of Priority Flora recorded within and outside of the Study Area is presented in Table 5. Locations of Priority Flora are presented in Figure 9.

Table 5. Summary of Priority Flora recorded within and outside of the Nifty Study Area.

Species	# Populations	# Within Study Area	# Outside Study Area	# Total
Goodenia hartiana (P2)	11	615	1896	2484
Thysanotus sp. Desert East of Newman (R.P. Hart 964) (P2)	1	3	0	3
Corynotheca asperata (P3)	9	118	19	137
Dasymalla chorisepala (P3)	1	0	20+	20+
Indigofera ammobia (P3)	23	5177	6928	12,105
Sauropus arenosus (P3)	1	0	8	8

Figure 9. Locations of Priority Species Recorded Within the Nifty Study Area.

344000 346000 348000 350000 352000 354000 356000

7608000 7606000 7604000 7602000 7600000

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area
- *Goodenia hartiana* (P2)
- *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2)
- *Corynotheca asperata* (P3)
- *Dasymalla chorisepala* (P3)
- *Sauropus arenosus* (P3)
- *Indigofera ammobia* (P3)

N

0 400 800m

Scale: 1:40,000
MGA94 (Zone 51)

CAD Ref: a2819_F010

Date: Jul 2021 | Rev: A | A3

Western Botanical

Author: J. Warden | WB Ref:

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***Goodenia hartiana* (Priority 2)**

Goodenia hartiana (P2) is an erect to spreading, multi-stemmed perennial herb or shrub to sub-shrub with blue/purple flowers, growing to a height of 0.5-0.8 m, Plate 1 (WA Herbarium 1998-2021). It commonly occurs on red sand of sand dunes and swales, distributed from Newman to Eighty Mile Beach. There are currently 25 records of *Goodenia hartiana* (P2) recognised by the Western Australian Herbarium (WA Herbarium 1998-2021), and a further nine recognised by the Australasian Virtual Herbarium (2021), Figure 10. Associated species include, *Triodia basedowii, Triodia schinzii, Jacksonia aculeata, Gompholobium polyzygum, Eucalyptus kingsmillii, Acacia ancistrocarpa* and *Acacia stellaticeps*.

Plate 1. *Goodenia hartiana* (P2) flower and habit (WA Herbarium 1998-2021)

A total of 2,484 individuals from 11 populations were identified from both within and outside the Nifty Study Area. Five of these populations with a total of 1869 individuals are outside and six within with 615 individuals. These primarily occurred within the interdunal swales within the lower part of the landscape in the moisture gathering sites.

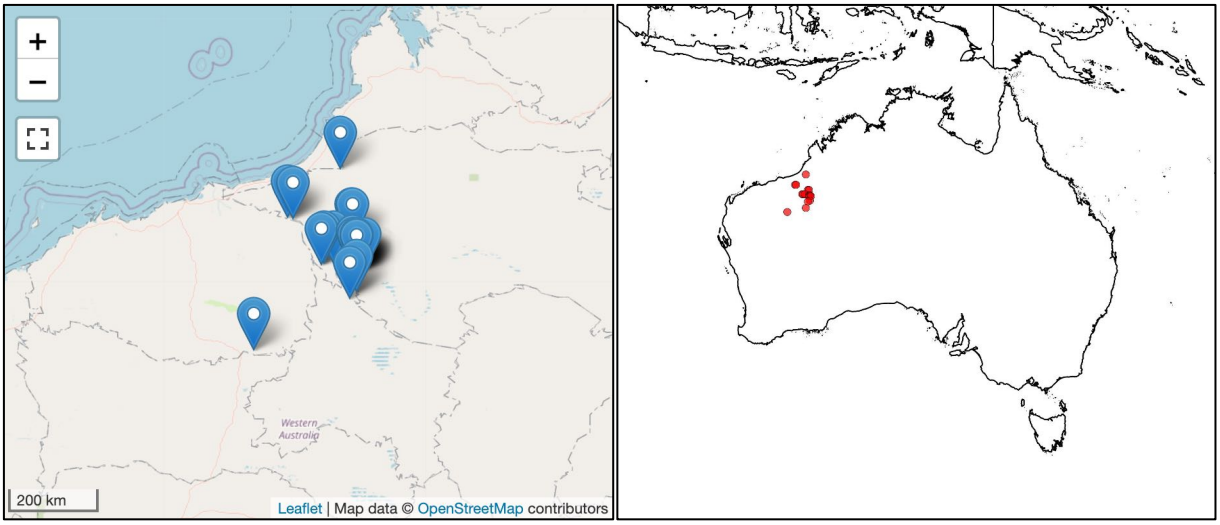


Figure 10. Current *Goodenia hartiana* (P2) distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Thysanotus sp. Desert East of Newman (R.P. Hart 964) (Priority 2)

Thysanotus sp. Desert East of Newman (R.P. Hart 964) (P2) is a member of the Asparagaceae family. It is described as a self-supporting perennial herb with tuberous roots, and commonly occurs on red to red-brown loamy/silty sand in sandplains and pisolitic buckshot plains in central Western Australia (WA Herbarium 1998-2021) Plate 2 & Figure 11. During the survey three plants were recorded within the *Acacia ancistrocarpa* Association, these plants were concealed within *Triodia basedowii* hummocks making them very challenging to locate when not in flower.

The Western Australian Herbarium currently recognises seven records of *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2), with one of these collected in 1997 from the Nifty Mine Site (PERTH 05342368). This record was from within the same interdunal swale some 10 km south east of the current record. These seven records were all recorded in flower from late August to mid-October, demonstrating the most appropriate time to survey for this species.

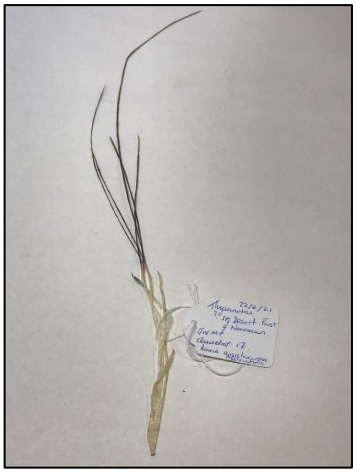


Plate 2. Thysanotus sp. Desert East of Newman (R.P. Hart 964) (P2)

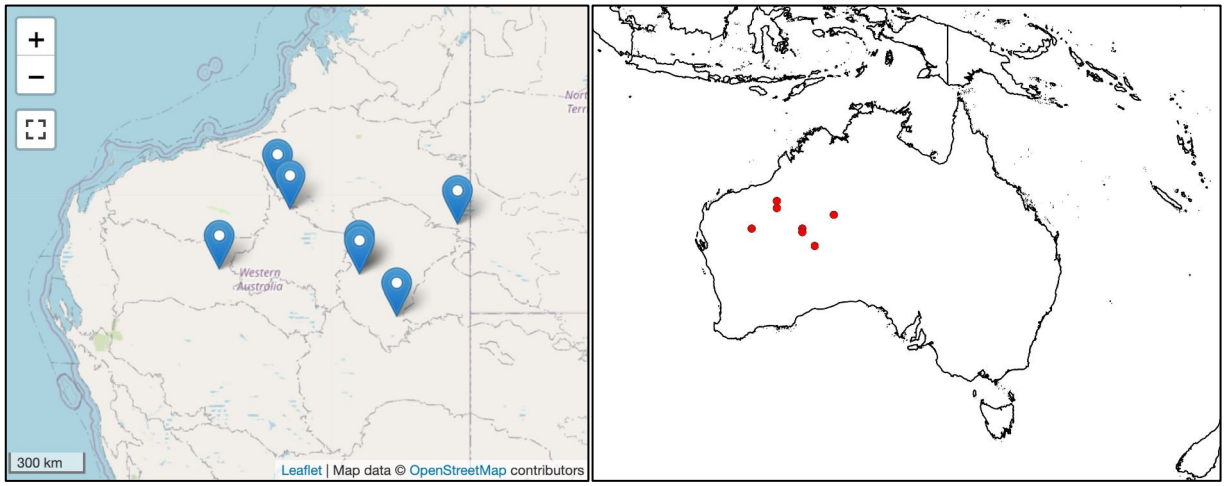


Figure 11. Current *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2) distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

***Corynotheca asperata* (Priority 3)**

Corynotheca asperata (P3) is a rhizomatous, divaricately branched perennial herb with green-white flowers, growing to 0.6 m high (WA Herbarium 1998-2021), Plate 3. It occurs on red sand dunes, in several disjunct locations across the Great Sandy Desert from Marble Bar, Western Australia to Tanami in the Northern Territory. There are currently four records of *Corynotheca asperata* (P3) recognised by the Western Australian Herbarium (WA Herbarium 1998-2021) (two records from Lake Auld area, one from Lake Tobin and the other from Mt Cecelia), and sixteen recognised by the Australasian Virtual Herbarium (2021), Figure 12.

A total of 137 individuals from nine subpopulations were encountered (118 within the Study Area and 19 outside). Five of these subpopulations consisted of only one or two plants. They primarily occurred on the Mid to lower foot slopes of the Sand Dune Vegetation Association with associated species including *Triodia schinzii*, *Dicrastylis doranii*, *Gompholobium simplicifolium*, *Eriachne aristidea*, *Aristida holathera* and *Dicrastylis cinerea*.

The collection of *Corynotheca asperata* at Nifty represents a fifth record for this taxon in Western Australia and represents the fourth known location for this taxon. This collection represents a 100 km range infill for this species which is likely to be more wide spread than the current understanding implies. The population recorded by Western Botanical at Mt Cecelia WA herbarium record 08643520 reports frequencies of 10,000 individuals across a 60 ha area.

Plate 3. *Corynotheca asperata* (P3)

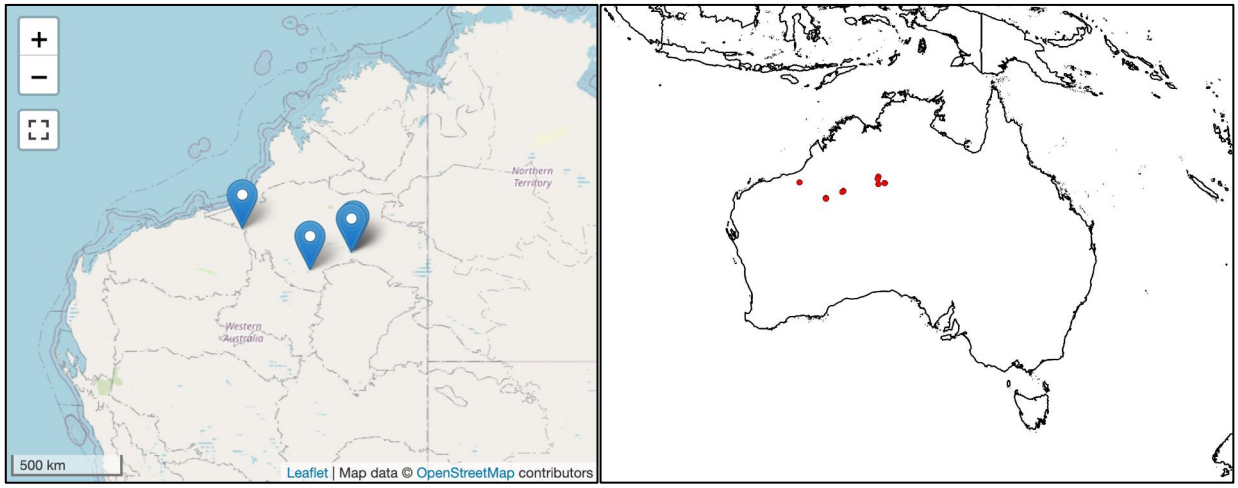


Figure 12. Current *Corynotheca asperata* (P3) distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

***Dasymalla chorisepala* (Priority 3)**

Dasymalla chorisepala (P3), a member of the Lamiaceae family, is described as a low shrub growing to 0.5m tall. *Dasymalla chorisepala* (P3) was recorded opportunistically during the regional search outside of the Study Area. It was located 2.5 km north-west of the Nifty Copper Mine within a swale that was burnt between 3-5 years ago. The recording of this population represents a 100 km southerly range extension for this species, and is currently the most southerly record for this species within Western Australia. There are currently eight records of *Dasymalla chorisepala* (P3) recognised by the Western Australian Herbarium (WA Herbarium 1998-2021), all from the Great Sandy Desert IBRA region. The Australian Virtual herbarium has 11 records including the 8 within Western Australia and a further 3 from the Northern Territory Tanami and Great Sandy Desert bioregions, Figure 12.

As this species was not recognised during the field survey and was subsequently identified the population counts and boundaries were not assessed. From field notes the population was estimated conservatively to be greater than 20 plants. These plants primarily occurred on the lower foot slopes of a sand dune swale, with a sample collection point recorded on the eastern side of the sand dune, however plants were also located on the western side of the sand dune. Associated species included *Triodia schinzii*, *Dicrastylis doranii*, *Gompholobium simplicifolium* and *Jacksonia aculeata*.

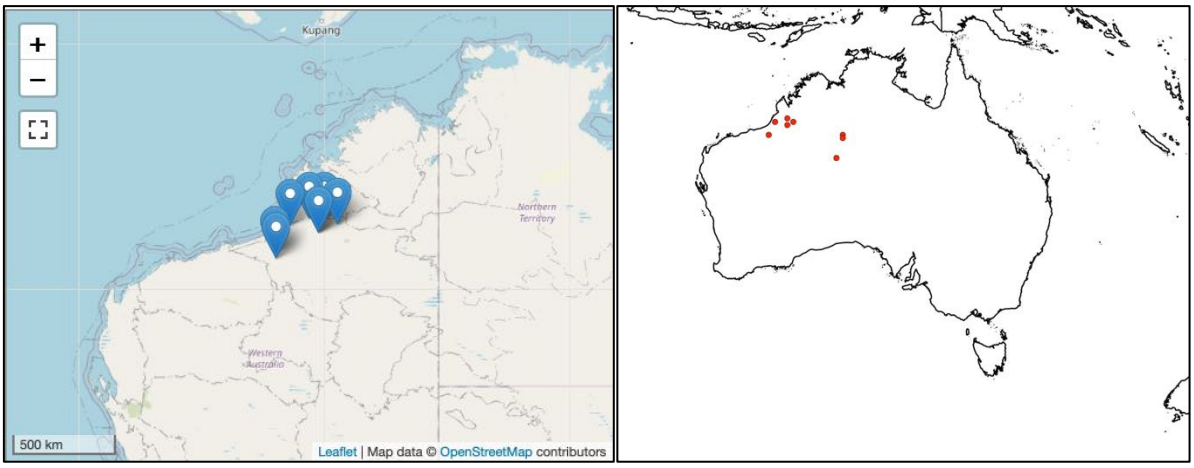


Figure 13. Current *Dasymalla chorisepala* (P3) distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Indigofera ammobia (Priority 3)

Indigofera ammobia (P3) is a member of the Fabaceae family. It is described as a many-stemmed shrub with green and purple flowers, growing to 0.5 m high (WA Herbarium 1998-2021), Plate 4. It commonly occurs on red sand dunes, and is reasonably well represented throughout the Great Sandy Desert Bioregion – distributed from Marble Bar to north of Alice Springs in the Northern Territory, Figure 14. The Western Australian Herbarium currently recognises 15 records of *Indigofera ammobia* (P3) within Western Australia, while it is known from 47 records across Australia (Australasian Virtual Herbarium 2021). Associated species include *Grevillea wickhamii*, *Thinicola incana*, *Sida* sp. Western sand dunes (P.K. Latz 11980) and *Triodia* spp.

A total of 12,105 individuals from 23 populations were identified both within and outside of the Nifty Study Area. A total of 5177 were recorded within the study area and a further 6928 individuals were recorded outside. These records primarily occurred within the Cc-SLT Vegetation Association, with large numbers present where the vegetation had been recently burnt in the last five years.

Plate 4. *Indigofera ammobia* (P3) plant, seed pods and flower.

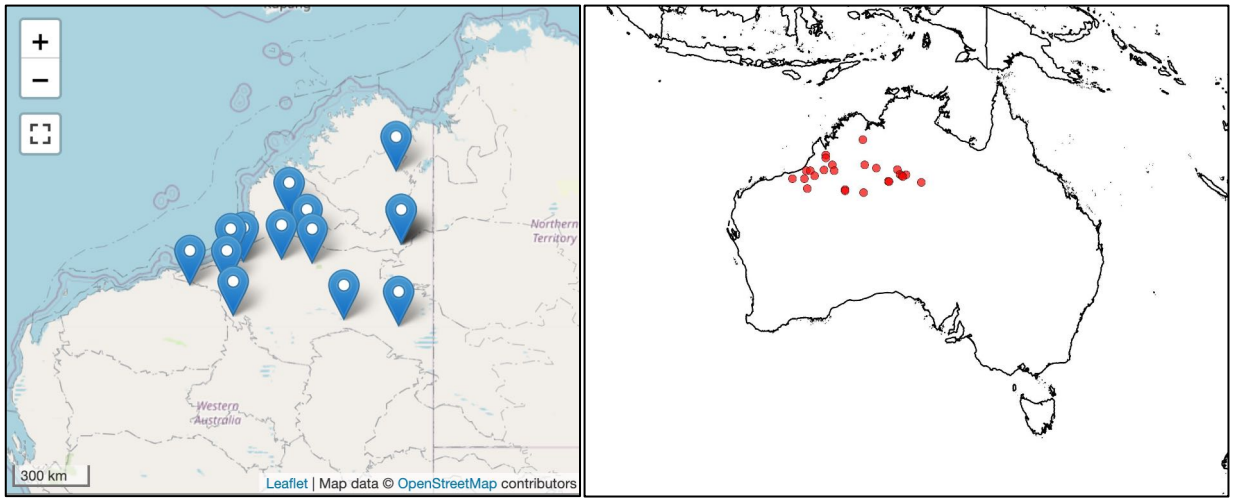


Figure 14. Current *Indigofera ammobia* (P3) distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Sauropus arenosus (Priority 3)

Sauropus arenosus (P3) is a member of the *Phyllanthaceae* family. It is described as a spreading shrub, growing to 1 m high, with flowers that are initially yellow/green, turning red/pink with age. *Sauropus arenosus* has been recorded associated with red Sand Dunes (WA Herbarium 1998-2021) Plate 5. The Western Australian Herbarium currently has seven records from the Great Sandy Desert, Little Sandy Desert and Gibson Desert IBRA regions in Western Australia, with a further four records stretching into the Northern Territory north west of Alice Springs (Australasian Virtual Herbarium 2021) Figure 15.

A total of eight individuals were identified outside of the Nifty Study Area, during the regional search. These records were from a Sand Dune located 5.5 km South East of the Nifty mine.

Plate 5. *Sauropus arenosus* (P3) Plant, Flower and fruits

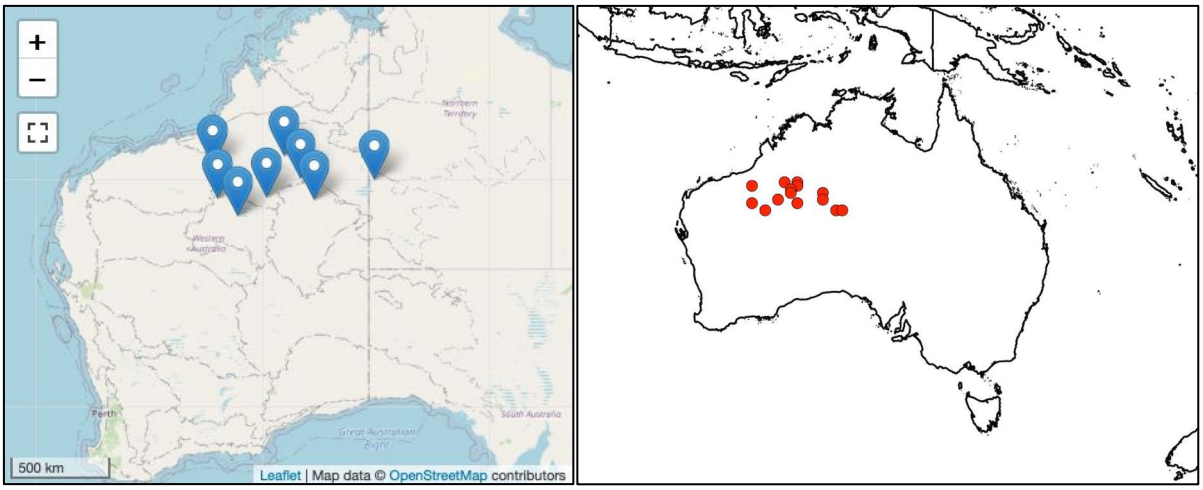


Figure 15. Current *Sauropus arenosus* (P3) distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021)

4.2.3. Range Extensions

Fifteen collections of species representing extensions to previously known distributions were made during the field assessment. A list of these species is presented in Table 6. Information on these taxa is presented in Appendix 7.

Table 6: Species Collected Representing Extensions to Previously Known Distributions

Species	Extension/Infill	Distance
Chrysocephalum puteale	Range extension	350 km
Stackhousia megaloptera	Range extension	250 km
Bonamia alatisemina	Range extension	200 km
Acacia hilliana × *stellaticeps*	Range extension	200 km
Crotalaria cunninghamii subsp. *sturtii*	Range extension	200 km
Hibiscus brachychlaenus	Range extension	200 km
Clerodendrum floribundum var. *ovatum*	Range Extension	150 km
Tecticornia auriculata	Range extension	150 km
Abutilon cunninghamii	Range extension	New IBRA
Acacia coriacea subsp. *pendens*	Range extension	New IBRA
Goodenia cusackiana	Range extension	New IBRA
Cassytha filiformis	Range infill	200 km
Amphipogon caricinus var. *caricinus*	Range infill	150 km
Aristida inaequiglumis	Range infill	150 km
Pluchea ferdinandi-muelleri	Range infill	150 km

4.2.4. Weeds

Three weed species were identified during the field survey, including.

- *Cenchrus ciliaris* (Buffel grass)
- *Rumex vesicarius* (Ruby Dock), and
- *Aerva javanica* (Kapok)

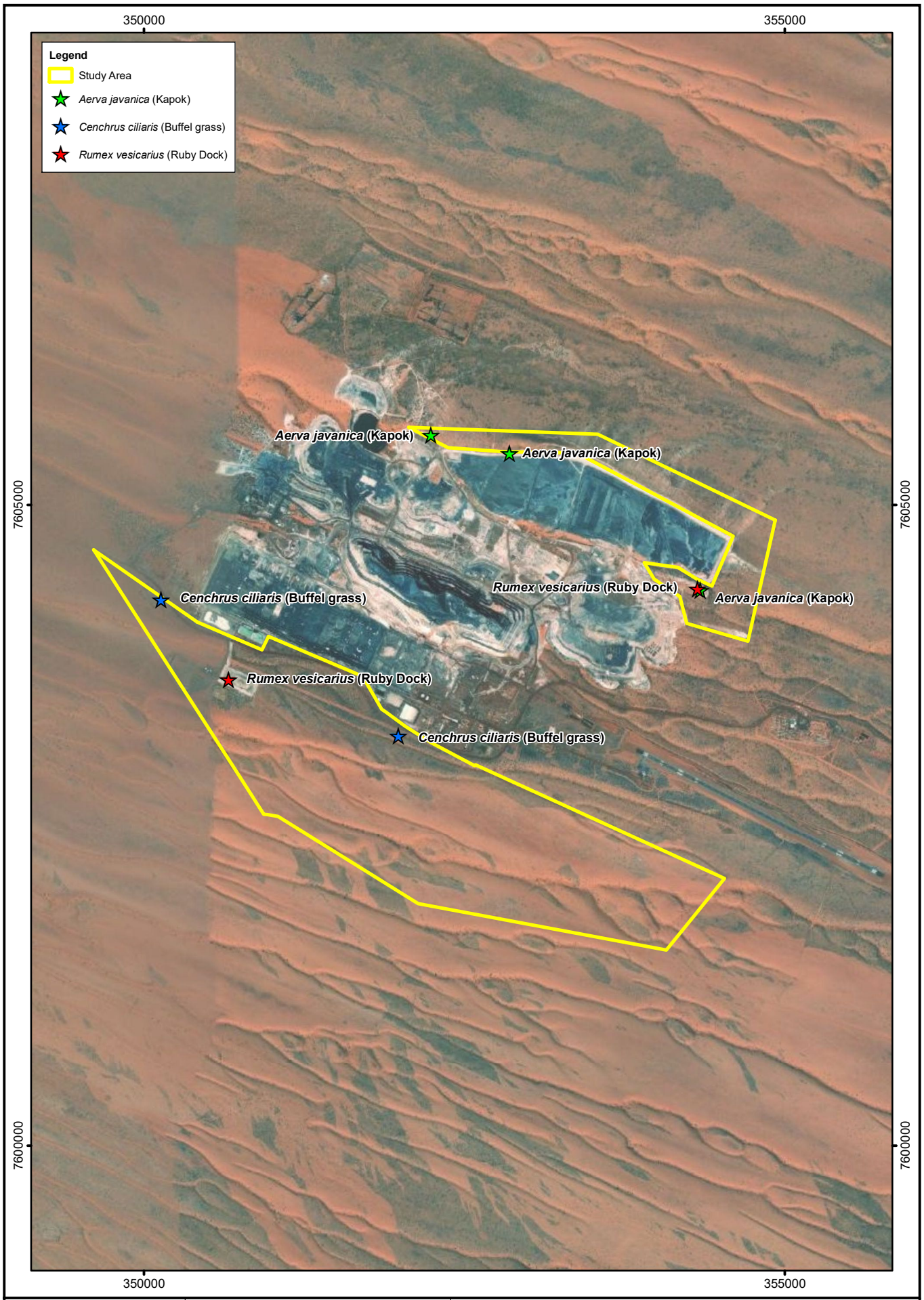
A map of weed locations within the Nifty Study Area is presented in Figure 16, with the weed location data presented in Table 7.

Efforts to control and minimise the spread of weeds should be taken in the development and management of the Nifty Copper Mine, particularly in the years following soil disturbance.

Table 7: Weed Locations Within the Nifty Study Area

Species	# plants	Area	Grid	Easting	Northing
Aerva javanica (Kapok)	50+	1ha	51K	352238	7605545
Aerva javanica (Kapok)	10+	2 ha	51K	354338	7604337
Aerva javanica (Kapok)	10+	0.1ha	51K	352849	7605408
Cenchrus ciliaris (Buffel grass)	4 plants	0.1ha	51K	350132	7604264
Cenchrus ciliaris (Buffel grass)	10 plants	0.1ha	51K	351982	7603204
Rumex vesicarius (Ruby Dock)	20 plants	0.1ha	51K	350661	7603640
Rumex vesicarius (Ruby Dock)	10 plants	0.1ha	51K	354321	7604349

Figure 16. Locations of Weed Species Across the Nifty Study Area



Imagery: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 400 800m

Scale: 1:40,000
MGA94 (Zone 51)

CAD Ref: a2819_F012

Date: July 2021 | Rev: A | A4

Western Botanical

Author: J. Warden | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

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Nifty Copper Mine
Weeds

4.2.5. Species of Interest

One species of taxonomic interest (SOI) was encountered during the field survey, including *Dampiera cinerea* sens. lat., as described below.

***Dampiera cinerea* sens. lat.** is noted as a variable species, consisting of at least two forms separated by hair characters on the flower;

- Form 1 – Corolla and calyx tube hairs long, open long dendritic and woolly,
- Form 2 – Corolla and calyx tube hairs densely and closely dendritic, felty, short and long.

Both forms appeared to be present within the Study Area, and field observations noted additional details including differences in flower colour, leaf structure and location within the landscape, as presented in Table 8.

Table 8. Field observations of *Dampiera cinerea* sens. lat.

Character	Form 1	Form 2
Corolla colour	Purple to blue	Pink to red.
Corolla and calyx tube hairs	Open long dendritic and woolly	Densely and closely dendritic, felty, short and long
Leaf	Narrow (5-8mm), recurved (sickle-shaped), consistently folded.	Wide (10-25mm), open or folded.
Distribution	Sand dune (crest & mid-slope)	Sandplain swales

These characteristics are clearly evident and distinguishable within the FloraBase website image (Plate 6). Further taxonomic work is required to sort and separate the two entities within the *D. cinerea* complex.

Plate 6. *Dampiera cinerea* Form 1 (left) and Form 2 (right)

4.3. Vegetation Mapping

Twelve Vegetation Associations were recognised within the Nifty Study Area. These Vegetation Associations fell into four broad groups strongly reflective of the landforms occupying the Study Area. These landforms included 1) Sand Dunes, 2) Sandplains & Swales, 3) Stony Plains & Low Hills, and 4) Claypan Playas.

A list of Vegetation Associations and their relative extents across the Nifty Study Area is presented in Table 9. A map displaying the distribution of Vegetation Associations is presented in Figure 17. Descriptions of Vegetation Associations and representative photographs are presented in Appendix 8.

Table 9. Vegetation Associations recorded across the Nifty Study area

Land form	Vegetation Code	Vegetation Association	Within Study Area (ha)
Sand Dune	Cc-SLT	*Corymbia chippendalei* Scattered Low Trees	145.5
	Am-LS	*Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland	1.4
Sandplain Swale	Aa-S	*Acacia ancistrocarpa* Shrubland	58.6
	As-LS	*Acacia stellaticeps* Low Shrubland	9.7
	Gs-S	*Grevillea stenobotrya* Shrubland	4.3
	Mg-S	*Melaleuca glomerata* Shrubland	14.7
	Ml-OS	*Melaleuca lasiandra* Open Shrubland	51.9
	Tb-HG	*Triodia basedowii* Hummock Grassland	69.4
	Tl-HG	*Triodia* aff. *lanigera* Hummock Grassland	131.8
Stoney Plain & Low Hill	Ah-LS	*Acacia hilliana* Low Shrubland	39.4
Clay Pan Playa	Ef-G	*Eragrostis falcata* Grassland	1.4
	Ta-LS	*Tecticornia auriculata* Low Shrubland	1.5
Disturbed		Disturbed	29.3

A minimum of three representative quadrat sites was anticipated for each Vegetation Association, however due to the limited extent of several Associations, both within and outside of the Study Area, this was not achieved. Both the *Eragrostis falcata* Grassland (Ef-G) and the *Tecticornia auriculata* Low Shrubland (Ta-LS) on Clay Pan Playas were encountered once each during the field assessment; while the *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland is a small distinctive association that was only encountered twice within the Study Area.

Locations of sample quadrat sites area presented in Figure 18. Descriptions of quadrat sites including species lists and photographs are presented in Appendix 9.

Figure 17. Vegetation Association Mapping Across the Nifty Study Area

350000 352000 354000 356000

7606000 7604000 7602000

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area

Sand Dune

- 1: Cc-SLT: *Corymbia chippendalei* Scattered Low Trees
- 2: Am-LS: *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland

Sand Plain

- 3: Aa-S: *Acacia ancistrocarpa* Shrubland
- 4: As-LS: *Acacia stellaticeps* Low Shrubland
- 5: Gs-S: *Grevillea stenobotrya* Shrubland
- 6: Mg-S: *Melaleuca glomerata* Shrubland
- 7: Ml-OS: *Melaleuca lasiandra* Open Shrubland
- 8: Tb-HG: *Triodia basedowii* Hummock Grassland
- 9: Tl-HG: *Triodia lanigera* Hummock Grassland

Stoney Plain and Low Hill

- 10: Ah-LS: *Acacia hilliana* Low Shrubland

Clay Pan Playa

- 11: Ef-G: *Eragrostis falcata* Grassland
- 12: Ta-LS: *Tecticornia auriculata* Low Shrubland

Disturbed

- 13: Disturbed

N

0 200 400m

Scale: 1:20,000
MGA94 (Zone 51)

CAD Ref: a2819_F013

Date: Jul 2021 | Rev: A | A3

Western Botanical

Author: J. Warden | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
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Cyprium Metals Pty Ltd
Nifty Copper Mine
Vegetation Associations

Figure 18. Quadrat Site Locations

344000 346000 348000 350000 352000 354000 356000

7608000 7606000 7604000 7602000 7600000

Q01 Q02 Q03 Q04 Q05 Q06 Q07 Q08 Q09 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33 Q34 Q35

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area
- Quadrat

N

0 400 800m

Scale: 1:40,000
MGA94 (Zone 51)

CAD Ref: a2819_F009

Date: Jul 2021 | Rev: A | A3

Western Botanical

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Cyprium Metals Pty Ltd
Nifty Copper Mine
Quadrats

4.4. Statistical Analysis

The final PATN analysis incorporated a total of 33 quadrat sites. Singleton sites Q09 (Ef-LG – *Eragrostis* falcata Low Grassland) and Q34 (Ta-LS – *Tecticornia auriculata* Low Shrubland) were removed from the analysis to reduce bias. Ordination analysis performed for 116 species from 33 sites found a stable 3-dimensional solution, producing a final stress value of 0.1661. While this value is marginally higher than the preferred threshold of 0.15, the option of reducing non-discriminatory (less important) species from the analysis to reduce the final stress value was discounted, in order to preserve the original dataset and retain species important in determining finer-scale floristic units.

The dendrogram (Figure 19) produced in the PATN analysis illustrates an initial division which corresponds to 1) groups associated with sand dunes, and 2) groups associated with sandplains. Subsequent divisions produce six major branches, which largely correspond to specific locations within the two predominating landforms. These include, i) upper dune slopes, supporting the Cc- SLT Vegetation Association; ii) lower dune slopes and upper sandplains dominated by *Triodia* aff. *lanigera,* supporting the Tl-HG, the Gs-S and the Am-LS Associations; iii) lower sandplains dominated by *Triodia basedowii*, supporting the Tb-HG, the Ml-OS and the Mg-S Associations; iv) sandplains dominated by *Acacia* species, supporting the Aa-S and the As-LS Associations; v) stony plains supporting the Ah-LS Association; and finally vi) an outlier to the Mg-S group. Further divisions within these broader groups remain unsupported by the statistics.

The grouping of the *Triodia* aff. *lanigera* Hummock Grassland (Tl-HG), the *Grevillea stenobotrya* Shrubland (Gs-S) and the *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland (Am-LS) Vegetation Associations within the second major dendrogram branch is explained by their position within the landscape and the associated dominance of *Triodia* aff. *lanigera* within each. Each of these Vegetation Associations occurred on the lower dune slopes and areas adjacent to dunes; described as being of greater elevation and having slightly deeper sands compared to the lower *Triodia basedowii* dominated sand dune sites. *Triodia* aff. *lanigera* was ubiquitous throughout this grouping while *Acacia melleodora* and *Triodia schinzii* were also dominant. Although these subgroups are not clearly separate within the dendrogram, consideration of the PFC of the dominant taxa used to describe each Vegetation Association (i.e., *Triodia* aff. *lanigera, Grevillea stenobotrya* and *Aluta maisonneuvei* subsp. *maisonneuvei,* respectively) provides reason to maintain them as distinct Vegetation Associations.

Similarly, the grouping of the *Triodia basedowii* Hummock Grassland (Tb-HG), the *Melaleuca glomerata* Shrubland (Mg-S) and the *Melaleuca lasiandra* Open Shrubland (Ml-OS) Vegetation Associations is explained by their lower position in the landscape and the dominance of *Triodia basedowii*. While two of *Melaleuca glomerata* Shrubland (Mg-S) sites (i.e., Q26 and Q31) formed a good subgroup, the *Melaleuca lasiandra* Open Shrubland (Ml-OS) appears to be mixed in, and strongly related with the *Triodia basedowii* Hummock Grassland (Tb-HG). Once again, considering the dominance of *Melaleuca lasiandra* within the *Melaleuca lasiandra* Open

Shrubland sites only, these Vegetation Associations should still be considered as distinct from one another.

The subgroup formed by Q14 (Gs-S), Q15 (Tb-HG), and Q16 (Tl-HG) can be explained both by their close proximity to one another and the relatively high *Cassytha filiformis* PFC's recorded within each site. These sites all occur north of the tailings dam in the north-eastern polygon, within 100 metres of each other, at the base of a common sand dune – their close proximity contributing to their high floristic similarity. *Cassytha filiformis* is a parasitic climber that can develop into extremely dense vegetative masses given appropriate conditions (i.e., long fire intervals). Percent Foliar Cover recorded for this taxon within Q14, Q15,and Q16 was 10%, 3.5% and 3.5%, respectively, indicative of a long period since fire; and significantly contrasting from other recently burnt sites where it was only recorded as being present, if at all.

Notably, Q15 (*Triodia basedowii* Hummock Grassland - Tb-HG) is the only unburnt site out of the three Tb-HG sites established. These sites vary considerably between their burnt and unburnt states – in both vegetation assemblage and structure. In an unburnt state *Triodia basedowii* commonly exhibited PFC's between 35-50%; while in a post-fire state it was between 5-10% with greater species richness and species abundance. Fire ephemeral species that are present during early successional stages gradually leave the system, returning to a dormant state within in the soil seed bank. It would have been preferable to establish additional sites to examine how the burnt and unburnt *Triodia basedowii* Hummock Grassland Vegetation Associations compare against each other, however, this was not possible within the project timeframe.

Q08 *Melaleuca glomerata* Shrubland (Mg-S) appears to form its own major branch. This site was markedly species-poor, containing a total of only seven species; while Q26 and Q31 contained 37 and 28 species, respectively. Considering the high levels of *Melaleuca glomerata* cover recorded within this site (i.e., 30% PFC), it should still be treated as part of the *Melaleuca glomerata* Shrubland Vegetation Association.

Q25 *Acacia stellaticeps* Low Shrubland (As-LS) appears to be more closely related to the *Acacia ancistrocarpa* Shrubland (As-S) group. Examination of the species composition between both groups revealed major similarities between the each Association, Q24 in particular, having 13 species in common with Q25. The remaining As-LS and As-S sites formed relatively neat groups within the dendrogram, as did the Cc-SLT and Ah-LG Vegetation Associations.

A table of analysis notes is presented in Table 10.

Table 10. Key Discussion Points of Statistical Analysis

Vegetation Association	Analysis comments	# Quadrats
Aa-S	Strong group: determined by the dominance of *Acacia ancistrocarpa*	3
Ah-LS	Strong group: determined by dominance of *Acacia hilliana*, *Triodia basedowii* and *Ptilotus calostachyus*	3
Am-LS	Weak group: Determined by the dominance of *Aluta maisonneuvei* subsp. *maisonneuvei.* Strongly related to other sandplain groups dominated by *Triodia* aff. *lanigera* (i.e., Gs-S and Am-LS). Insufficient number of replicates.	2
As-LS	Moderate group. Determined by the dominance of *Acacia stellaticeps*. One partial outlier (Q25) more closely related to the *Acacia ancistrocarpa* Shrubland group due to high number of similar species with Q24 in particular.	3
Cc-SLT	Strong group: Determined by the presence of *Corymbia chippendalei* and dominance of a number of sand dune species including, *Sida* sp. Western sand dunes (P.K. Latz 11980), *Aristida holathera* var. *holathera*, *Paranotis pterosperma, Euphorbia wheelier*, *Ptilotus arthrolasius,* etc.	5
Ef-LG	Singleton group, removed from analysis. Insufficient number of replicates.	1
Gs-S	Weak group: Determined by the dominance of *Grevillea stenobotrya*. Strongly related to other sandplain groups dominated by *Triodia* aff. *lanigera* (i.e., Tb-HG and Am-LS).	3
Mg-S	Weak group with one outlier (Q08), determined by the dominance of *Melaleuca glomerata*. Principal group (Q26 & Q31) occurs within sandplain groups dominated by *Triodia basedowii* (i.e., Tb-HG, Tb- HG and Ml-OS)	3
Ml-OS	Weak group: Determined by dominance of *Melaleuca lasiandra*. Strongly related to burnt *Triodia basedowii* Hummock Grassland (Tb-HG) and other sandplain groups dominated by *Triodia basedowii* (i.e., Tb-HG and Mg-S)	3
Ta-LS	Singleton group, removed from analysis. Insufficient number of replicates.	1
Tb-HG	Weak group: Determined by dominance of *Triodia basedowii* but mixed up with *Melaleuca* groups containing *Triodia basedowii* understoreys (i.e., Ml-OS and Mg-S)	3
Tl-HG	Weak group: Determined by dominance of *Triodia* aff. *lanigera*. Strongly related to other sandplain groups dominated by *Triodia* aff. *lanigera* (i.e., Gs-S and Am-LS)	5

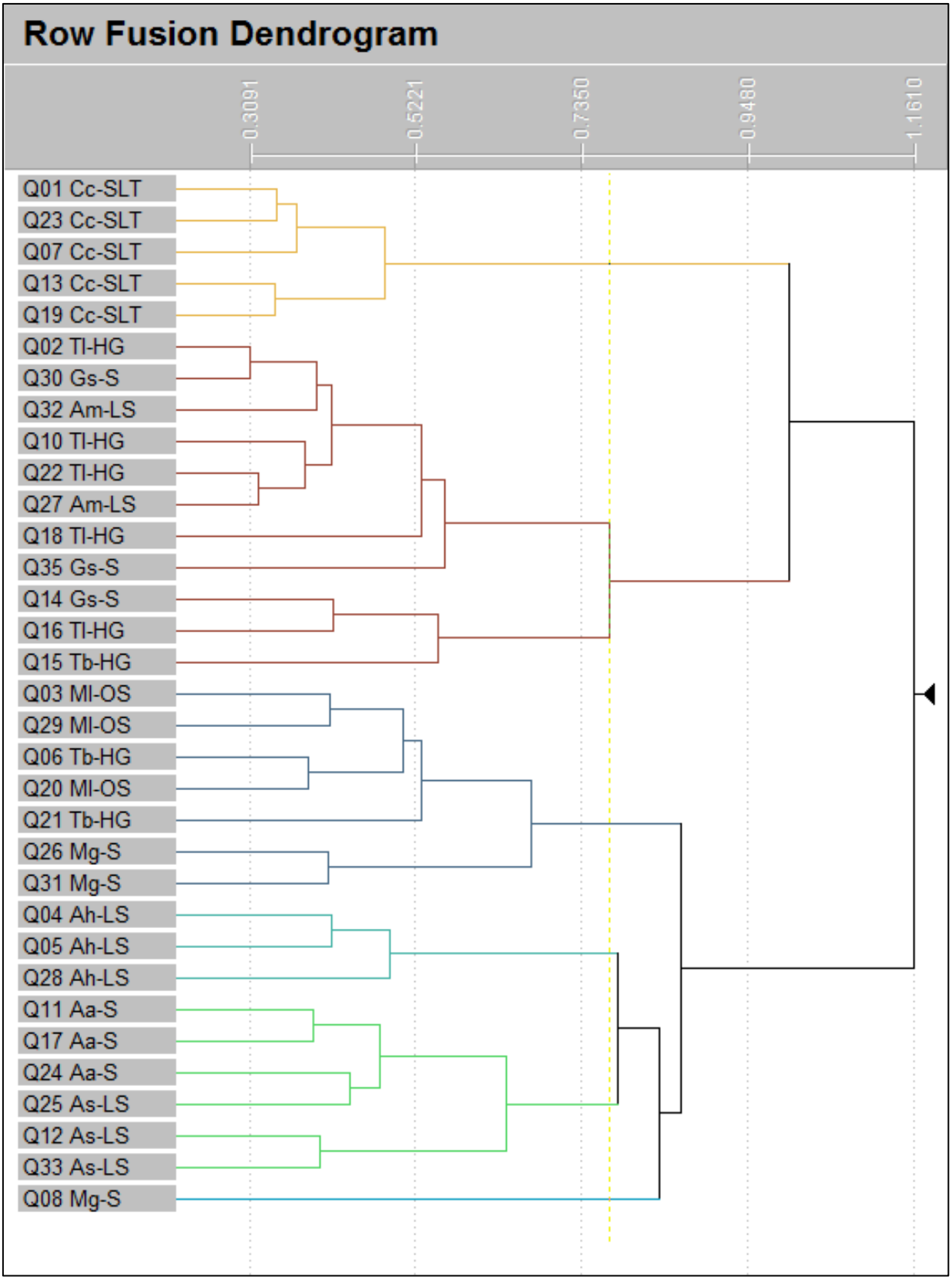

Figure 19. Dendrogram of Site vs. Species Analysis produced in PATN

4.5. Vegetation Condition

The overall condition of the vegetation within the Nifty Study Area, based on the Vegetation Condition Scale as reported by Keighery (1994) (Appendix 1) was considered Excellent, with some minor areas that were Poor or Degraded.

Impacts towards Vegetation from fire were widespread throughout much of the Study Area, particularly within the southern polygons. Areas abutting the existing development, i.e., the tailings dam to the north, and the leach heap to the south were considered Poor to Degraded – with material transported from these infrastructures commonly visible on the soil surface. Two sections of the south-western polygon and had been previously cleared with the rehabilitated vegetation appearing to be in a Poor condition. A vegetation condition map is presented in Figure 20.

Figure 20. Condition Map of Vegetation Within the Nifty Study Area.

350000 352000 354000 356000

7606000

7604000

7602000

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area
- **Condition**
  - Excellent
  - Poor
  - Degraded

N

0 200 400m

Scale: 1:20,000
MGA94 (Zone 51)

CAD Ref: a2819_F014

Date: Jul 2021 | Rev: A | A3

Western Botanical

Author: J. Warden | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
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Nifty Copper Mine
Vegetation Condition

5. Assessment Against the 10 Clearing Principles

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

While the Study Area comprises a moderate number of Vegetation Associations (at NVIS level 5 'Association' level); the diversity of flora within each community was consistent with levels expected in like communities across the Great Sandy Desert Bioregion. A total of 174 species were encountered during the field assessment, majority of which were recorded within the ~650 ha Study Area. Favorable conditions (i.e., above average summer rainfall) also preceded the survey, so this number is not expected to rise to any significant degree.

The Project is not at variance with this principle.

Principle (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 indigenous to Western Australia.

While flora and vegetation are utilised by fauna for food and habitat, there are no known obligate fauna-flora correlations within the Study Area.

The Project is not at variance with this principle.

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

The Study Area does not contain any Threatened (Declared Rare) flora. The results of the Desktop Review, showed none were expected to occur, and the field results supported this finding in the Vegetation Associations present.

Six Priority Flora were encountered during the field assessment including 2484 *Goodenia hartiana* (P2) (615 within the Study Area); three *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2) (all within the Study Area); 137 *Corynotheca asperata* (P3) (118 within the Study Area); 12,103 *Indigofera ammobia* (P3) (5177 within the Study Area); as well as 20+ *Dasymalla chorisepala* (P3) and 8 *Sauropus arenosus* (P3) – both outside of the Study Area. Considering the uniformity of the landforms present within the Study Area (i.e., repetitious linear sand dunes and sandplain swales), and across the Great Sandy Desert bioregion, these taxa are expected to occur in significant numbers outside of the Study Area.

The Project is not likely to be at variance with this principle.

Principle (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.

The Study Area does not lie within any Threatened Ecological Communities (TEC).

The Project is not at variance with this principle.

Principle (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.

The Study Area does not represent a significant remnant of native vegetation in an extensively cleared area. The Great Sandy Desert bioregion remains at approximately 99% of its pre-European extent.

The Project is not at variance with this principle.

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

No watercourses or permanent wetlands are present within the Study Area.

The Project is not at variance with this principle.

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

The proposed development is not likely to cause significant land degradation beyond that caused by the mining and development of infrastructure, itself.

The Project is not at variance with this principle.

Principle (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.

The closest conservation area is the Karlamilyi National Park, some 80 km south. Given the distance, the development does not present a risk to the National Park.

The Project is not at variance with this principle.

Principle (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.

Not assessed.

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

The development is unlikely to cause or exacerbate any flooding.

The Project is not at variance with this principle.

6. Limitations

Limitation	Discussion
Available sources of contextual information	Excellent contextual information was available for this project, including a Flora and Vegetation report of the Telfer Access Road (which partially covers similar landforms 50 km east); as well as the DBCA Threatened and Priority species and communities datasets. Regional scale work on Land Systems by the DoA provided a good information on the geology, landforms, vegetation and their patterns in the region. This is not considered a limitation.
The Scope of the survey	The Scope of the survey was adequate to assess the flora and vegetation in the Study Area. While the survey was not conducted over two seasons, conditions preceding the survey (i.e., above average rainfall & 3-years post fire), ensured that the flora visible at the time of the field assessment was approaching a maximum within the system. Limited time was allocated to conduct targeted Priority Flora searches beyond the Study Area. Given the uniformity of the landforms, however, many of the observations made within the Study Area are expected to extend well beyond the Nifty Copper Mine. This may be a slight limitation.
Proportion of flora collected and identified	174 flora species were encountered during the field assessment, including 128 (74%) within quadrats, 36 (20%) outside quadrats but within the Study Area, and 10 (6%) outside the Study Area. All species were collected at least once. Four taxa were only identified to genus level; including one from the *Cyperus* genus, one from the *Calandrinia*, one from the *Acacia, and one from the Triodia.* The *Calandrinia* has strong affinities to *C. tepperiana,* while the *Acacia* has strong affinities to *A. sericophylla*. Neither of these species are believed to represent Conservation Significant flora. The *Cyperus* and the *Triodia* have been submitted to the herbarium for further examination and identification. This is not considered a limitation.
Completeness and further work which may be needed	The Study Area was adequately covered during the field assessment, as illustrated by the dispersion of quadrat sites (Figure 18) and tracklog files (Appendix 10). One sand dune in the southern polygon was not completely traversed during the field assessment and may require further survey work to ensure all Priority Flora are accounted for within Study Area. Given the number of Priority Flora observed within the Study Area, compared to the number observed outside, a subsequent Targeted Priority Flora Survey may also be required to ensure that numbers taken do not exceed those stipulated in the Biodiversity Conservation Act. This is considered a limitation.
Mapping reliability	The use of high-resolution aerial photography at a scale of 1:10,000 was anticipated for the project, however, due to extensive fire scars within the maps provided these could not be utilized. Mapping was instead captured on Google Earth during the field survey – allowing for enhanced visualization of vegetation patterns. However, Google Earth does not have a projected map datum and can thereby give rise to distortions in the imagery; so to ensure the mapping conformed to the true ground location, the final mapping configuration was transferred to the original high-resolution aerial imagery. This is not considered a limitation.
Timing: weather, season	The conditions preceding the survey were excellent, with above average rainfall recorded in the region. Given these conditions, annuals which may have otherwise been absent from the system were believed to be present. Such conditions allowed for a single-season survey, rather than the typical two-season that is often required under arid conditions were minimal rainfall has occurred. This is not considered a limitation.

Limitation	Discussion
Disturbances	A large portion of the southern polygons was recovering from a fire that occurred within the last 3-4 years. Differences in vegetation between burnt and unburnt sites from the same Vegetation Associations appeared to have an effect on the final groupings of the some of the sites within the dendrogram (i.e., *Triodia basedowii* Hummock Grasslands). Splitting these groups into their burnt and unburnt counterparts would be more desirable, but was not possible due to time constraints. This may be a slight limitation.
Intensity	The Study Area was relatively small, covering only 565 ha. This allowed for adequate coverage across the Study Area. Traverses were conducted on all sand dunes within the Study Area, as these landforms were found to support the greatest numbers of Priority Flora. One sand dune in the southern polygon was not completely traversed during the field assessment. This may be a slight limitation.
Resources	Adequate resources were available over the total duration of each survey. This is not a limitation.
Access	Given the small size of the Study Area access was usually good throughout, as reflected by the reasonably well distributed quadrat locations and tracklogs within the project polygons. Only a very limited number of tracks existed beyond the Nifty Copper Mine, thus the regional search was only limited to several areas west of the mine site. This is not considered a limitation.
Experience levels	Jonathan Warden has over 15 years of experience as a botanical consultant, and has conducted a number of Flora surveys in the Pilbara region. He was assisted in the field be Malcolm Trudgen, who has had over 50 years of experience as a botanist, and is considered to be the principle Pilbara specialist. This is not a limitation.

7. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology). *License No. – FB62000046*		✓	✓	✓
Jonathan Warden B.Sc. (Environmental Biology). *License No. – FB62000044*	✓	✓	✓	✓
Jason Paterson B.Sc (Hons) (Environmental Science) *License No. – FB62000299*	✓	✓	✓	✓
Malcolm Trudgen B.Sc. (Botany) *License No. – FB620002945*	✓	✓		

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Appendix 1. Department of Biodiversity Conservation and Attractions (DBCA) Framework for Conservation Significant Flora.

DBCA Conservation Codes for Western Australian Flora

Under the Wildlife Conservation Act 1950, the Minister for the Environment may declare species of flora to be protected if they are considered to be in danger of extinction, rare or otherwise in need of special protection.

Specially protected flora are species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected flora are:

T

Threate

ned species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR

Critical

ly endangered species

Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

VU **Vulnerable species**

Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX **Extinct species**

Species where "there is no reasonable doubt that the last member of the species has died", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.

EW **Extinct in the wild species**

Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI **Migratory species**

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under

immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy

Last updated 3 January 2019

Appendix 2. DBCA Definitions of Threatened Ecological Communities (TECs) and Priority Ecological Communities (PECs)

DEFINITIONS, CATEGORIES AND CRITERIA FOR THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

1. GENERAL DEFINITIONS

Ecological Community
A naturally occurring biological assemblage that occurs in a particular type of habitat.

Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.

A **threatened ecological community** (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable".

Possible threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

An **assemblage** is a defined group of biological entities.

Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.

Occurrence: a discrete example of an ecological community, separated from other examples of the same community by more than 20 meters of a different ecological community, an artificial surface or a totally destroyed community.

By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.

Adequately Surveyed is defined as follows:

"An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts."

Community structure is defined as follows:

"The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage" (e.g. *Eucalyptus salmonophloia* woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).

Definitions of Modification and Destruction of an ecological community:

Modification: "changes to some or all of ecological processes (including abiotic processes such as hydrology), species composition and community structure as a direct or indirect result of human activities. The level of damage involved could be ameliorated naturally or by human intervention."

Destruction: "modification such that reestablishment of ecological processes, species composition and community structure within the range of variability exhibited by the original community is unlikely within the foreseeable future even with positive human intervention."

Note: Modification and destruction are difficult concepts to quantify, and their application will be determined by scientific judgment. Examples of modification and total destruction are cited below:

Modification of ecological processes: The hydrology of Toolibin Lake has been altered by clearing of the catchment such that death of some of the original flora has occurred due to dependence on fresh water. The

system may be bought back to a semblance of the original state by redirecting saline runoff and pumping waters of the rising water table away to restore the hydrological balance. Total destruction of downstream lakes has occurred due to hydrology being altered to the point that few of the original flora or fauna species are able to tolerate the level of salinity and/or water logging.

Modification of structure: The understorey of a plant community may be altered by weed invasion due to nutrient enrichment by addition of fertiliser. Should the additional nutrients be removed from the system the balance may be restored, and the original plant species better able to compete. Total destruction may occur if additional nutrients continue to be added to the system causing the understorey to be completely replaced by weed species, and death of overstorey species due to inability to tolerate high nutrient levels.

Modification of species composition: Pollution may cause alteration of the invertebrate species present in a freshwater lake. Removal of pollutants may allow the return of the original inhabitant species. Addition of residual highly toxic substances may cause permanent changes to water quality, and total destruction of the community.

Threatening processes are defined as follows:
"Any process or activity that threatens to destroy or significantly modify the ecological community and/or affect the continuing evolutionary processes within any ecological community."

Examples of some of the continuing threatening processes in Western Australia include: general pollution; competition, predation and change induced in ecological communities as a result of introduced animals; competition and displacement of native plants by introduced species; hydrological changes; inappropriate fire regimes; diseases resulting from introduced microorganisms; direct human exploitation and disturbance of ecological communities.

Restoration is defined as returning an ecological community to its pre-disturbance or natural state in terms of abiotic conditions, community structure and species composition.

Rehabilitation is defined as the re-establishment of ecological attributes in a damaged ecological community although the community will remain modified.

2. DEFINITIONS AND CRITERIA FOR PRESUMED TOTALLY DESTROYED, CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE ECOLOGICAL COMMUNITIES

Presumed Totally Destroyed (PD)
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B):

A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or

B) All occurrences recorded within the last 50 years have since been destroyed

Critically Endangered (CR)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and s found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);

ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and one or more of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);

ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more of** the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Vulnerable (VU)
An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes

3. DEFINITIONS AND CRITERIA FOR PRIORITY ECOLOGICAL COMMUNITIES

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly-known ecological communities

Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are

comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;

(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.

(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

(Department of Environment and Conservation January 2013)

Appendix 3. Vegetation Condition Assessment Scale.

Summary of Vegetation Condition Scale as reported by Keighery (1994) and as summarized in Bush Forever (Government of Western Australia 2000) Condition Scale Description.

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

Appendix 4. Nature Map Search Results

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 18/05/2021

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	121° 34' 16" E,21° 39' 31" S
Buffer	20km
Group By	Kingdom

Kingdom	Species	Records
Animalia	77	1680
Plantae	52	67
TOTAL	**129**	**1747**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Animalia					
1.	30833	*Amphibolurus longirostris (Long-nosed Dragon)*			
2.	25448	*Antaresia stimsoni (Stimson's Python)*			
3.	42374	*Brachyurophis fasciolatus subsp. fasciatus (Narrow-banded Shovel-nosed Snake)*			
4.	24181	*Chaerephon jobensis (Greater Northern Freetail-bat, Northern Mastiff Bat)*			
5.	25339	*Chelodina steindachneri (Flat-shelled Turtle)*			
6.	25458	*Ctenophorus caudicinctus (Ring-tailed Dragon)*			
7.	24868	*Ctenophorus clayi (Collared Dragon)*			
8.	25459	*Ctenophorus isolepis (Crested Dragon, Military Dragon)*			
9.	24876	*Ctenophorus isolepis subsp. isolepis (Crested Dragon, Military Dragon)*			
10.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
11.	25025	*Ctenotus ariadnae*			
12.	25461	*Ctenotus brooksi*			
13.	25032	*Ctenotus calurus*			
14.	25033	*Ctenotus colletti*			
15.	25462	*Ctenotus grandis*			
16.	25041	*Ctenotus grandis subsp. grandis*			
17.	25045	*Ctenotus helenae*			
18.	25050	*Ctenotus leae*			
19.	25057	*Ctenotus nasutus*			
20.	25064	*Ctenotus pantherinus subsp. ocellifer (Leopard Ctenotus)*			
21.	25062	*Ctenotus piankai*			
22.	25066	*Ctenotus quattuordecimlineatus*			
23.	25375	*Cyclorana maini (Sheep Frog)*			
24.	30903	*Dasycercus blythi (Brush-tailed Mulgara, Ampurta)*		P4	
25.	24091	*Dasykaluta rosamondae (Little Red Kaluta)*			
26.	24093	*Dasyurus hallucatus (Northern Quoll)*		T	
27.	25000	*Delma haroldi*			
28.	25001	*Delma nasuta*			
29.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
30.	42401	*Diporiphora paraconvergens (Grey-striped Western Desert Dragon)*			
31.	43381	*Eremiascincus pallidus (Western Narrow-banded Skink, Narrow-banded Sand Swimmer)*			
32.		*Ethmostigmus curtipes*			
33.	24956	*Gehyra pilbara*			
34.	24958	*Gehyra punctata*			
35.	24957	*Gehyra purpurascens*			
36.	24959	*Gehyra variegata*			
37.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
38.	25125	*Lerista bipes*			
39.	25142	*Lerista ips*			
40.	25181	*Lerista xanthura*			
41.	25005	*Lialis burtonis*			
42.	25392	*Litoria rubella (Little Red Tree Frog)*			
43.	30933	*Lucasium stenodactylum*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
44.	24168	*Macrotis lagotis (Bilby, Dalgyte, Ninu)*		T	
45.	25184	*Menetia greyii*			
46.	24904	*Moloch horridus (Thorny Devil)*			
47.	24223	*Mus musculus (House Mouse)*	Y		
48.	25422	*Neobatrachus aquilonius (Northern Burrowing Frog)*			
49.	24966	*Nephrurus laevissimus*			
50.	25497	*Nephrurus levis*			
51.	24967	*Nephrurus levis subsp. levis*			
52.	24094	*Ningaui ridei (Wongai Ningaui)*			
53.	25430	*Notaden nichollsi (Desert Spadefoot)*			
54.	24224	*Notomys alexis (Spinifex Hopping-mouse)*			
55.	24147	*Notoryctes caurinus (Northern Marsupial Mole, Kakarratul)*		P4	
56.	25499	*Notoscincus ornatus*			
57.	25197	*Notoscincus ornatus subsp. ornatus*			
58.	24105	*Pseudantechinus roryi (Rory's Pseudantechinus)*			
59.	25261	*Pseudechis australis (Mulga Snake)*			
60.	24235	*Pseudomys desertor (Desert Mouse)*			
61.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
62.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
63.	25263	*Pseudonaja modesta (Ringed Brown Snake)*			
64.	25009	*Pygopus nigriceps*			
65.	24982	*Rhynchoedura ornata (Western Beaked Gecko)*			
66.	25305	*Simoselaps anomalus (Desert Banded Snake)*			
67.	24120	*Sminthopsis youngsoni (Lesser Hairy-footed Dunnart)*			
68.	24924	*Strophurus ciliaris subsp. aberrans*			
69.	24927	*Strophurus elderi*			
70.	24932	*Strophurus jeanae*			
71.		*Thereuopoda lesueurii*			
72.	25202	*Tiliqua multifasciata (Central Blue-tongue)*			
73.	25442	*Uperoleia micromeles (Tanami Toadlet)*			
74.	25209	*Varanus acanthurus (Spiny-tailed Monitor)*			
75.	25210	*Varanus brevicauda (Short-tailed Pygmy Monitor)*			
76.	25212	*Varanus eremius (Pygmy Desert Monitor)*			
77.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
Plantae					
78.	3212	*Acacia anaticeps*			
79.	3241	*Acacia bivenosa*			
80.	3394	*Acacia jensenii*			
81.	3476	*Acacia pachycarpa*			
82.	19456	*Acacia stellaticeps*			
83.	17454	*Adriana tomentosa var. hookeri*			
84.	39780	*Aenictophyton reconditum subsp. reconditum*			
85.	19835	*Amphipogon sericeus*			
86.	40917	*Androcalva loxophylla*			
87.	29101	*Cleome uncifera subsp. uncifera*			
88.	17094	*Corymbia chippendalei*			
89.	7424	*Dampiera candicans*			
90.	6754	*Dicrastylis cordifolia*			
91.	6757	*Dicrastylis doranii*			
92.	2504	*Dysphania plantaginella*			
93.	395	*Eragrostis speciosa (Handsome Lovegrass)*			
94.	5655	*Eucalyptus gamophylla (Twin-leaf Mallee, Warilu)*			
95.	5684	*Eucalyptus kingsmillii (Kingsmill's Mallee)*			
96.	14548	*Eucalyptus victrix*			
97.	42840	*Euphorbia albrechtii*			
98.	42876	*Euphorbia vaccaria var. vaccaria*			
99.	6152	*Gonocarpus eremophilus*			
100.	20523	*Goodenia azurea subsp. hesperia*			
101.	18638	*Goodenia hartiana (Hart's Goodenia)*		P2	
102.	7544	*Goodenia ramelii*			
103.	17494	*Halgania solanacea var. solanacea*			
104.	6709	*Heliotropium epacrideum*			
105.	10992	*Heliotropium glabellum*			
106.	4933	*Hibiscus leptocladus*			
107.	3969	*Indigofera ammobia*		P3	
108.	17870	*Indigofera boviperda subsp. eremaea*			
109.	7669	*Levenhookia chippendalei*			
110.	5915	*Melaleuca glomerata*			
111.	5923	*Melaleuca lasiandra*			
112.	6789	*Newcastelia cladotricha (Lambs Tail)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
113.	514	*Paractaenum refractum*			
114.	523	*Paspalidium rarum (Rare Paspalidium)*			
115.	12075	*Polycarpaea corymbosa var. corymbosa*			
116.	2695	*Ptilotus arthrolasius*			
117.	2704	*Ptilotus calostachyus (Weeping Mulla Mulla)*			
118.	12723	*Scaevola amblyanthera*			
119.	7633	*Scaevola parvifolia (Camel Weed)*			
120.	4966	*Sida arenicola*			
121.	48435	*Sida sp. Western sand dunes (P.K. Latz 11980)*			
122.	12923	*Sorghum amplum*			
123.	4235	*Swainsona microphylla (Small-leaf Swainsona)*			
124.	4259	*Tephrosia arenicola*			
125.	15949	*Tephrosia sp. D Kimberley Flora (R.D. Royce 1848)*			
126.	19862	*Thinicola incana*			
127.	14391	*Thysanotus sp. Desert East of Newman (R.P. Hart 964)*		P2	
128.	17873	*Triodia schinzii*			
129.	7654	*Velleia connata (Cup Velleia)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix 5. Protected Matters Search Results

Australian Government

Department of Agriculture, Water and the Environment

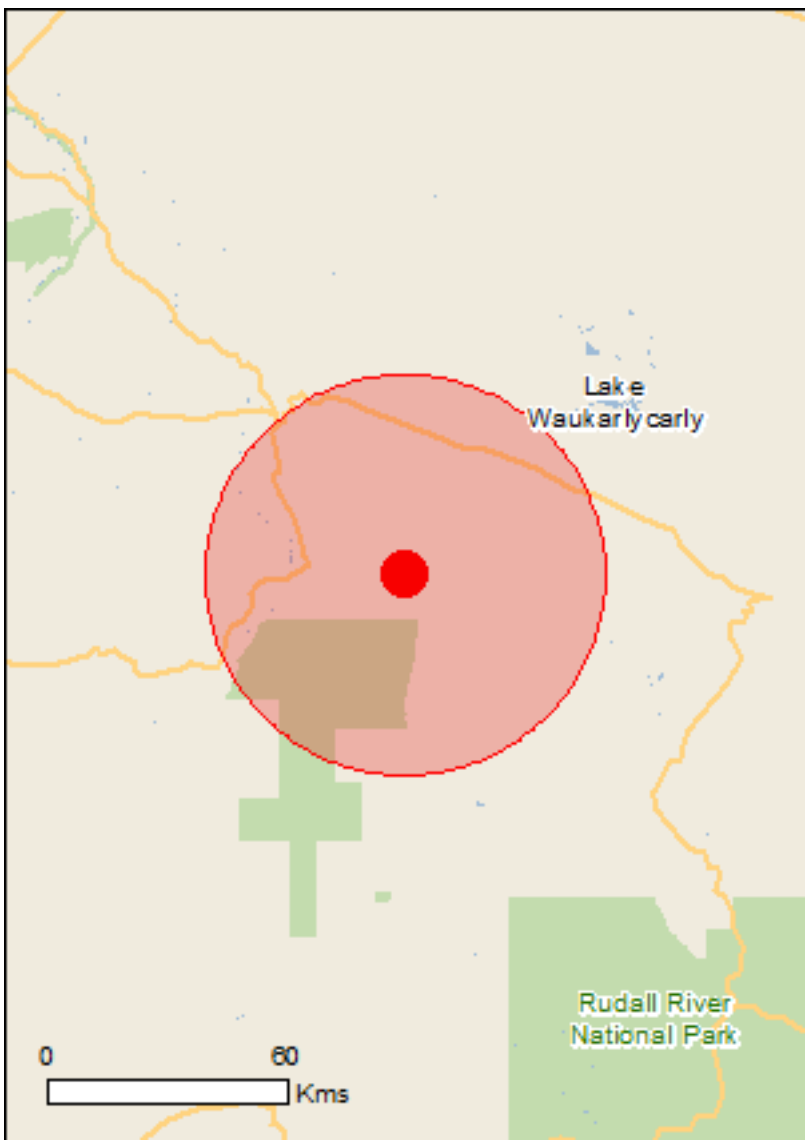
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

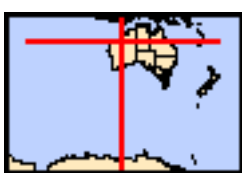
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 29/06/21 14:30:50



Coordinates

Buffer: 50.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	11
Listed Migratory Species:	11

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-21.65861 121.40444

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix 6. Systematic Species List of the Flora Recorded within the Nifty Study Area

Family	Species	Cons Status
Aizoaceae	Trianthema pilosum	
Aizoaceae	Trianthema triquetrum	
Amaranthaceae	Aerva javanica	Weed
Amaranthaceae	Gomphrena affinis subsp. pilbarensis	
Amaranthaceae	Gomphrena lanata	
Amaranthaceae	Ptilotus arthrolasius	
Amaranthaceae	Ptilotus astrolasius	
Amaranthaceae	Ptilotus axillaris	
Amaranthaceae	Ptilotus calostachyus	
Amaranthaceae	Ptilotus clementii	
Amaranthaceae	Ptilotus exaltatus	
Amaranthaceae	Ptilotus fusiformis	
Amaranthaceae	Ptilotus latifolius	
Amaranthaceae	Ptilotus polystachyus	
Amaranthaceae	Ptilotus schwartzii var. schwartzii	
Anthericaceae	Corynotheca asperata	Priority 3
Asaparagaceae	Thysanotus sp. Desert East of Newman (R.P. Hart 964).	Priority 2
Asteraceae	Chrysocephalum puteale	Range extension (350km)
Asteraceae	Pluchea ferdinandi-muelleri	Range infill (150km)
Asteraceae	Pluchea rubelliflora	
Asteraceae	Pluchea tetranthera	
Asteraceae	Streptoglossa macrocephala	
Boraginaceae	Halgania solanacea var. solanacea	
Boraginaceae	Heliotropium diversifolium	
Boraginaceae	Heliotropium glabellum	
Boraginaceae	Heliotropium transforme	
Boraginaceae	Trichodesma zeylanicum	
Byblidaceae	Byblis filifolia	
Caryophyllaceae	Polycarpaea holtzei	
Celastraceae	Macgregoria racemigera	
Chenopodiaceae	Dysphania plantaginella	
Chenopodiaceae	Dysphania rhadinostachya subsp. rhadinostachya	
Chenopodiaceae	Salsola australis	
Chenopodiaceae	Tecticornia auriculata	Range extension (150km)
Cleomaceae	Arivela viscosa	
Convolvulaceae	Bonamia alatisemina	Range extension (200km)
Cucurbitaceae	Cucumis variabilis	
Cyperaceae	Abildgaardia oxystachya	
Cyperaceae	Cyperus blakeanus	
Cyperaceae	Cyperus sp. Indet.	
Cyperaceae	Schoenoplectus subulatus	

Elatinaceae	Bergia henshallii	
Euphorbiaceae	Adriana tomentosa var. hookeri	
Euphorbiaceae	Euphorbia myrtoides	
Euphorbiaceae	Euphorbia wheeleri	Range infill (100km)
Fabaceae	Acacia aff. sericophylla	
Fabaceae	Acacia anaticeps	
Fabaceae	Acacia ancistrocarpa	
Fabaceae	Acacia bivenosa	
Fabaceae	Acacia colei var. colei	
Fabaceae	Acacia coriacea subsp. pendens	Range extension (new IBRA)
Fabaceae	Acacia eriopoda	
Fabaceae	Acacia hilliana	
Fabaceae	Acacia hilliana x stellaticeps	Range extension (200km)
Fabaceae	Acacia jensenii	
Fabaceae	Acacia melleodora	
Fabaceae	Acacia sphaerostachya	
Fabaceae	Acacia stellaticeps	
Fabaceae	Acacia trachycarpa	
Fabaceae	Acacia tumida var. kulparn	
Fabaceae	Aenictophyton reconditum subsp. reconditum	
Fabaceae	Crotalaria cunninghamii subsp. sturtii	Range extension (200km)
Fabaceae	Cullen martinii	
Fabaceae	Gompholobium polyzygum	
Fabaceae	Gompholobium simplicifolium	
Fabaceae	Indigofera ammobia	Priority 3
Fabaceae	Indigofera boviperda subsp. eremaea	
Fabaceae	Jacksonia aculeata	
Fabaceae	Leptosema chambersii	
Fabaceae	Mirbelia viminalis	
Fabaceae	Petalostylis cassioides	
Fabaceae	Senna artemisioides subsp. oligophylla	
Fabaceae	Senna curvistyla	
Fabaceae	Senna glaucifolia	Range extension (100km)
Fabaceae	Senna glutinosa subsp. glutinosa	
Fabaceae	Senna notabilis	
Fabaceae	Senna sericea	
Fabaceae	Senna symonii	
Fabaceae	Sesbania cannabina	
Fabaceae	Swainsona microphylla	
Fabaceae	Tephrosia arenicola	
Fabaceae	Tephrosia sp. D Kimberley Flora (R.D. Royce 1848)	
Fabaceae	Thinicola incana	

Goodeniaceae	Brunonia australis var. A Kimberley Flora (K.F. Kenneally 5452)	
Goodeniaceae	Dampiera candicans	
Goodeniaceae	Dampiera cinerea (purple flower form)	SOI
Goodeniaceae	Dampiera cinerea (red flower form)	SOI
Goodeniaceae	Goodenia armitiana	
Goodeniaceae	Goodenia azurea subsp. hesperia	
Goodeniaceae	Goodenia connata	
Goodeniaceae	Goodenia cusackiana	Range extension (new IBRA)
Goodeniaceae	Goodenia hartiana	Priority 2
Goodeniaceae	Goodenia stobbsiana	
Goodeniaceae	Goodenia triodiophila	
Goodeniaceae	Scaevola parvifolia subsp. pilbarae	
Gyrostemonaceae	Codonocarpus cotinifolius	
Gyrostemonaceae	Gyrostemon tepperi	
Haloragaceae	Gonocarpus ephemerus	
Lamiaceae	Clerodendrum floribundum var. ovatum	Range infill (150km)
Lamiaceae	Cyanostegia cyanocalyx	Range extension (100km)
Lamiaceae	Dasymalla chorisepala	Priority 3 & Range Extension (100km)
Lamiaceae	Dicrastylis cordifolia	
Lamiaceae	Dicrastylis doranii	
Lamiaceae	Newcastelia cladotricha	
Lamiaceae	Newcastelia spodiotricha	
Lauraceae	Cassytha filiformis	Range infill (200km)
Malvaceae	Abutilon cunninghamii	Range extension (new IBRA)
Malvaceae	Androcalva loxophylla	
Malvaceae	Corchorus sidoides subsp. sidoides	Range extension (200km)
Malvaceae	Hibiscus brachychlaenus	Range extension (200km)
Malvaceae	Hibiscus leptocladus	
Malvaceae	Sida arenicola	Range Infill (100km)
Malvaceae	Sida sp. Pilbara (A.A. Mitchell PRP 1543)	
Malvaceae	Sida sp. Pindan (B.G. Thomson 3398)	
Malvaceae	Sida sp. Rabbit Flat (B.J. Carter 626)	
Malvaceae	Sida sp. Western sand dunes (P.K. Latz 11980)	
Malvaceae	Waltheria virgata	
Molluginaceae	Trigastrotheca molluginea	
Montiaceae	Calandrinia ?tepperiana	
Myrtaceae	Aluta maisonneuvei subsp. maisonneuvei	
Myrtaceae	Calytrix carinata	
Myrtaceae	Corymbia chippendalei	
Myrtaceae	Corymbia opaca	
Myrtaceae	Eucalyptus gamophylla – odontocarpa	

Myrtaceae	Eucalyptus kingsmillii	
Myrtaceae	Eucalyptus victrix	
Myrtaceae	Melaleuca glomerata	
Myrtaceae	Melaleuca interioris	Range extension (100km)
Myrtaceae	Melaleuca lasiandra	
Nyctaginaceae	Boerhavia coccinea	
Phyllanthaceae	Sauropus arenosus	Priority 3
Plantaginaceae	Stemodia grossa	Range extension (100km)
Plantaginaceae	Stemodia linophylla	
Poaceae	Amphipogon caricinus var. caricinus	Range infill (150km)
Poaceae	Amphipogon sericeus	
Poaceae	Aristida holathera var. holathera	
Poaceae	Aristida inaequiglumis	Range infill (150km)
Poaceae	Cenchrus ciliaris	Weed
Poaceae	Eragrostis speciosa	
Poaceae	Eragrostis eriopoda	
Poaceae	Eragrostis falcata	
Poaceae	Eriachne aristidea	
Poaceae	Eriachne helmsii	
Poaceae	Eriachne mucronata	
Poaceae	Paractaenum refractum	
Poaceae	Paraneurachne muelleri	
Poaceae	Triodia basedowii	
Poaceae	Triodia aff. lanigera	SOI
Poaceae	Triodia schinzii	
Poaceae	Yakirra australiensis var. australiensis	
Polygalaceae	Polygala glaucifolia	
Polygalaceae	Polygala isingii	
Polygonaceae	Rumex vesicarius	Weed
Proteaceae	Grevillea eriostachya	
Proteaceae	Grevillea stenobotrya	
Proteaceae	Grevillea wickhamii subsp. aprica	
Proteaceae	Hakea chordophylla	
Proteaceae	Hakea lorea subsp. lorea	
Rubiaceae	Paranotis pterospora	
Santalaceae	Exocarpos sparteus	
Santalaceae	Santalum lanceolatum	
Sapindaceae	Diplopeltis stuartii var. stuartii	
Sapindaceae	Dodonaea coriacea	
Solanaceae	Duboisia hopwoodii	
Solanaceae	Solanum centrale	
Solanaceae	Solanum gilesii	
Solanaceae	Solanum horridum	
Celastraceae	Stackhousia megaloptera	Range extension (250km)

Celastraceae	Stackhousia sp. swollen gynophore (W.R. Barker 2041)	
Surianaceae	Stylobasium spathulatum	
Thymelaeaceae	Pimelea ammocharis	
Violaceae	Afrohybanthus aurantiacus	
Zygophyllaceae	Tribulus hirsutus	
Zygophyllaceae	Tribulus macrocarpus	

Appendix 7. Range Extensions

Chrysocephalum puteale

Chrysocephalum puteale, a member of the Asteraceae family, is an erect, compact perennial herb or shrub with yellow flowers, growing to 0.75 m tall. It commonly occurs on sand ridges, sandplains and rocky hills in the central parts of Western Australia.

Chrysocephalum puteale is currently known from 64 vouchered records in Western Australia, occurring in the Central Ranges, Coolgardie, Gascoyne, Gibson Desert, Great Victoria Desert, Little Sandy Desert, Murchison and Nullarbor IBRA regions (WA Herbarium 1998-2021). One population of *Chrysocephalum puteale* was recorded during the field survey, within the sand dune *Corymbia chippendalei* Scattered Low Trees (Cc-SLT) Vegetation Association. The presence of this taxon within the Study Area represents an extension of approximately 350 km north of its current range.

Plate 7. *Chrysocephalum puteale* (WA Herbarium 1998-2021).

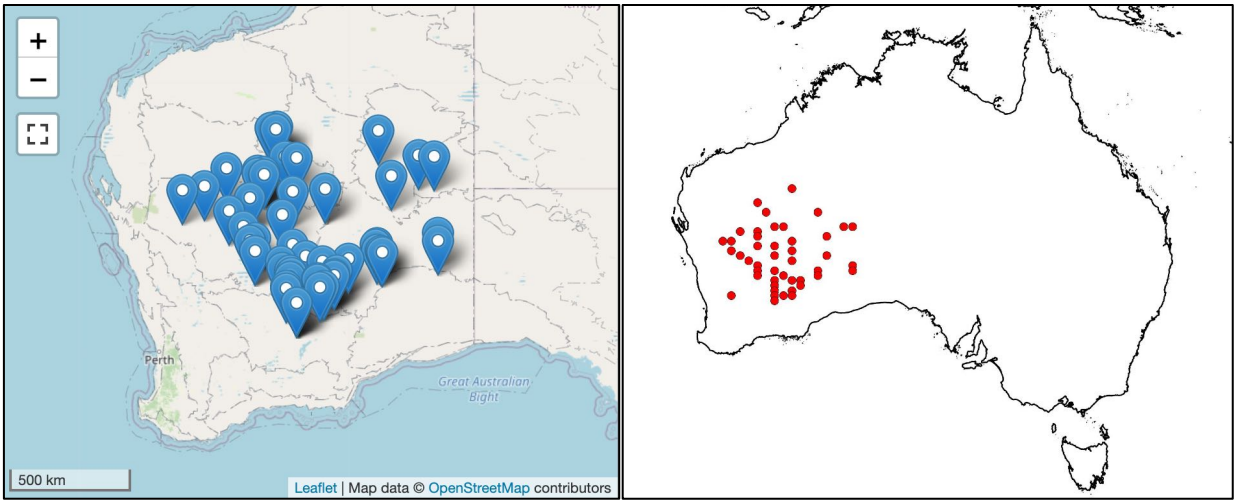


Figure 21. Current *Chrysocephalum puteale* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Stackhousia megaloptera

Stackhousia megaloptera, a member of the Celastraceae family, is a spreading perennial herb, with green-yellow flowers, growing to 0.1-0.7 m high. It commonly occurs on red, orange or yellow sand on sand dunes and sandplains. It is widespread throughout central Western Australia with disjunct occurrences in South Australia.

Stackhousia megaloptera is currently known from 39 vouchered records in Western Australia, occurring in the Carnarvon, Central Ranges, Gascoyne, Gibson Desert, Great Sandy Desert, Great Victoria Desert, Little Sandy Desert and Murchison IBRA regions (WA Herbarium 1998-2021). Multiple records of *Stackhousia megaloptera* were recorded during the field survey, typically within the sand dune *Corymbia chippendalei* Scattered Low Trees (Cc-SLT) Vegetation Association. The presence of this taxon within the Study Area represents a range extension of approximately 250 km.

Plate 8. *Stackhousia megaloptera* (WA Herbarium 1998-2021).

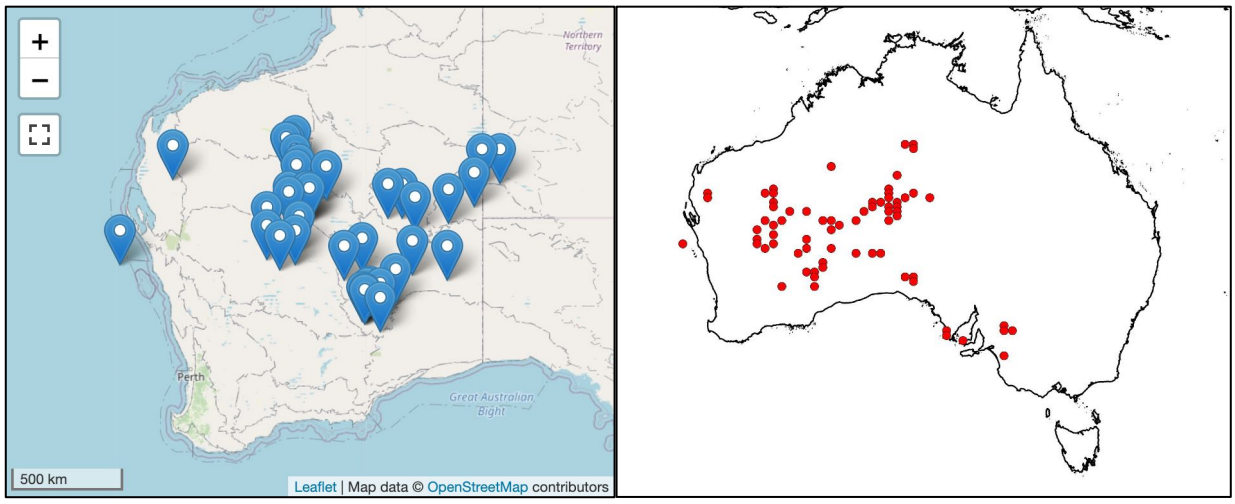


Figure 22. Current *Stackhousia megaloptera* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Western Botanical

Bonamia alatisemina

Bonamia alatisemina is a member of the Convolvulaceae family. It is a creeping perennial herb with pink/white flowers, growing to 0.2 m high PLATE. It commonly occurs on sand and sandplains, in the North of Australia from Nanutarra to Tablelands in the Northern Territory.

Bonamia alatisemina is currently known from 21 vouchered records in Western Australia in the Dampierland, Great Sandy Desert, Ord Victoria Plain and Pilbara IBRA regions (WA Herbarium 1998-2021); and from 42 records in the Australasian Virtual Herbarium (2021). This taxon is both sympatric and has very strong affinities to *Bonamia linearis*, separated only by flower colour (*B. linearis* has blue/white flowers), and the presence of a wing-like appendage on its seeds. The presence of *Bonamia alatisemina* within the Study Area represents a range extension of approximately 200 km south of its current distribution.

Plate 9. *Bonamia alatisemina,* flower and habit (WA Herbarium 1998-2021)

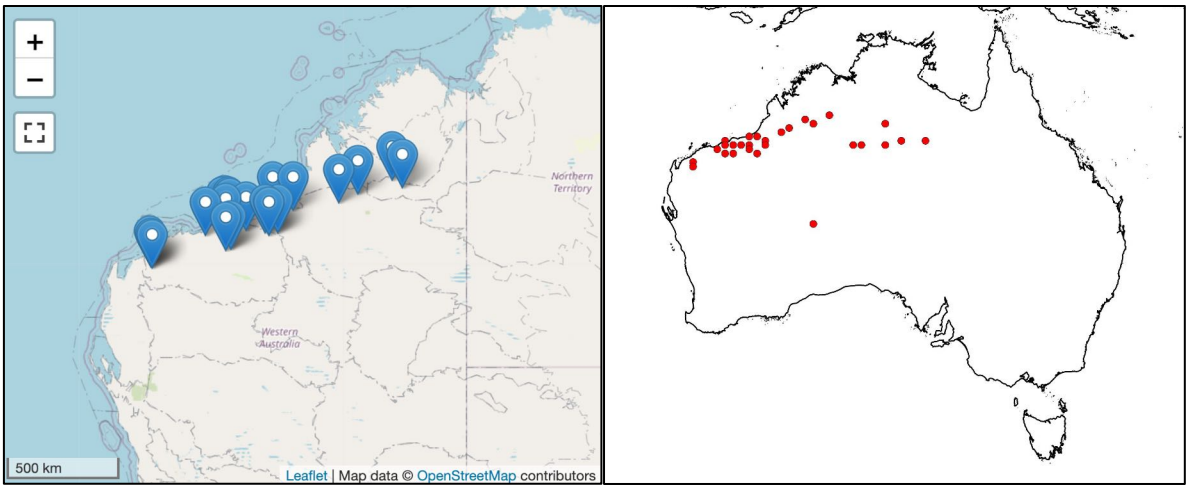


Figure 23. Current *Bonamia alatisemina* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Acacia hilliana × *stellaticeps*

Acacia hilliana × *stellaticeps* is a member of the Fabaceae family. It is a spreading, multi-stemmed, resinous, glabrous shrub growing to 0.3-0.4 m tall. It grows in deep red, sometimes gravelly sand or less frequently on low rocky hills, in Pindan country with spinifex ground cover (Wattle 2021). It occurs in north-west Western Australia, from the NW edge of the Pilbara region, to Anna Plains Station, adjacent to Eighty Mile Beach.

Acacia hilliana × *stellaticeps* is a putative hybrid between *A. hilliana,* a low-growing resinous shrub with terete phyllodes, and *A. stellaticeps,* a low-growing shrub with asymmetrically flat phyllodes. One collection of *Acacia hilliana* × *stellaticeps* was made within the *Acacia hilliana* Low Shrubland (Ah-LS) Vegetation Association. It is noted that most collections record the two putative parents as growing with or near the putative hybrid (Wattle 2021). While no vouchered records of this taxon are maintained by the Western Australian Herbarium or the Australasian Virtual Herbarium, location data published on FloraBase indicate that the collection represents a 200 km extension, southwards of its current range (WA Herbarium 1998-2021).

Plate 10. *Acacia hilliana* × *stellaticeps* (Wattle 2021).

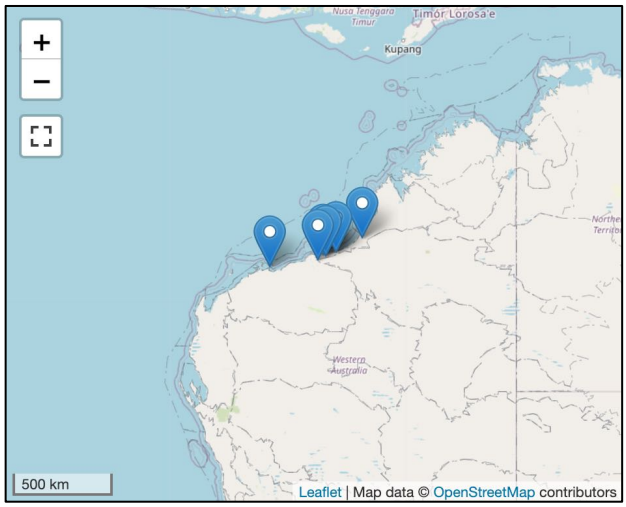


Figure 24. Current *Acacia hilliana* × *stellaticeps* distribution recognised by the Western Australian Herbarium (1998-2021).

Crotalaria cunninghamii subsp. *sturtii*

Crotalaria cunninghamii subsp. *sturtii,* a member of the Fabaceae family, is an erect shrub with yellow/green flowers, growing to 4 m tall. It occurs on sand, crests of sand dunes, sandplains, drainage lines; and is widespread throughout north-west and central Australia.

Crotalaria cunninghamii subsp. *sturtii* is currently known from 14 vouchered records in Western Australia, occurring in the Carnarvon, Dampierland, Gascoyne, Little Sandy Desert, Ord Victoria Plain and Pilbara IBRA regions (WA Herbarium 1998-2021). It was commonly observed during the field survey within the sand dune *Corymbia chippendalei* Scattered Low Trees (Cc-SLT) Vegetation Association. The presence of *Crotalaria cunninghamii* subsp. *sturtii* within the Study Area represents a range extension of approximately 200 km east of its western distribution.

Plate 11. *Crotalaria cunninghamii subsp. sturtii.*

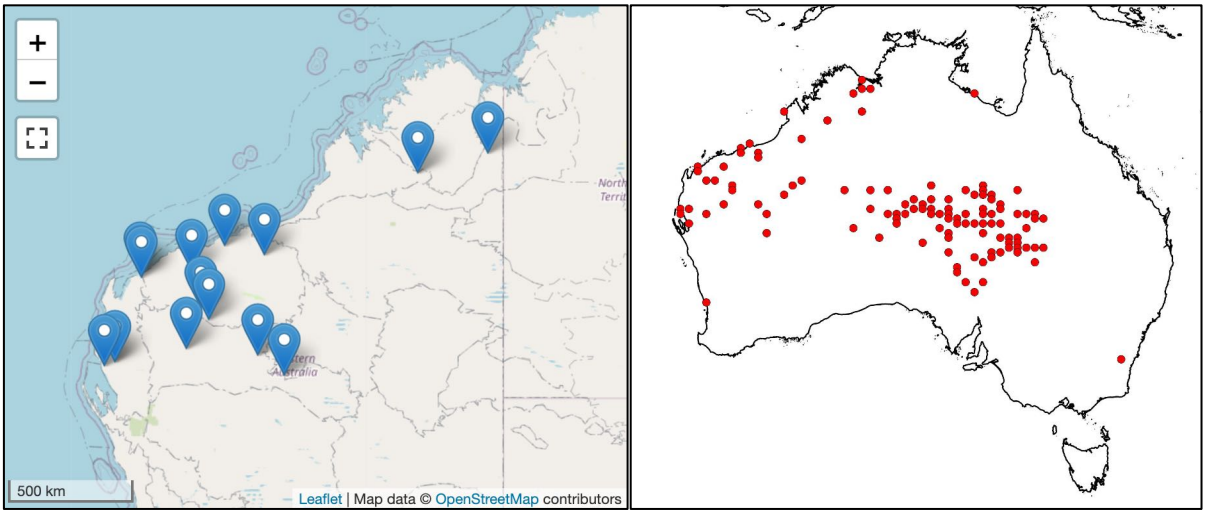


Figure 25. Current *Crotalaria cunninghamii subsp. sturtii* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Hibiscus brachychlaenus

Hibiscus brachychlaenus is a member of the Malvaceae family. It is an upright, spreading perennial herb or shrub with blue-purple-pink flowers, growing to 0.4-1.8 m high. It commonly occurs on sandy and loamy soils, sandstone, on sandplains, dunes from the north to the north-west of Australia.

Hibiscus brachychlaenus is currently known from 25 vouchered records in Western Australia, occurring in the Carnarvon, Central Ranges, Gascoyne, Great Sandy Desert and Pilbara IBRA regions (WA Herbarium 1998-2021). During the field survey it was observed within the sand dune *Corymbia chippendalei* Scattered Low Trees (Cc-SLT) Vegetation Association. The presence of *Hibiscus brachychlaenus* within the Study Area represents a range extension of approximately 200 km east of its western distribution.

Plate 12. *Hibiscus brachychlaenus* flower and plant (WA Herbarium 1998-2021).

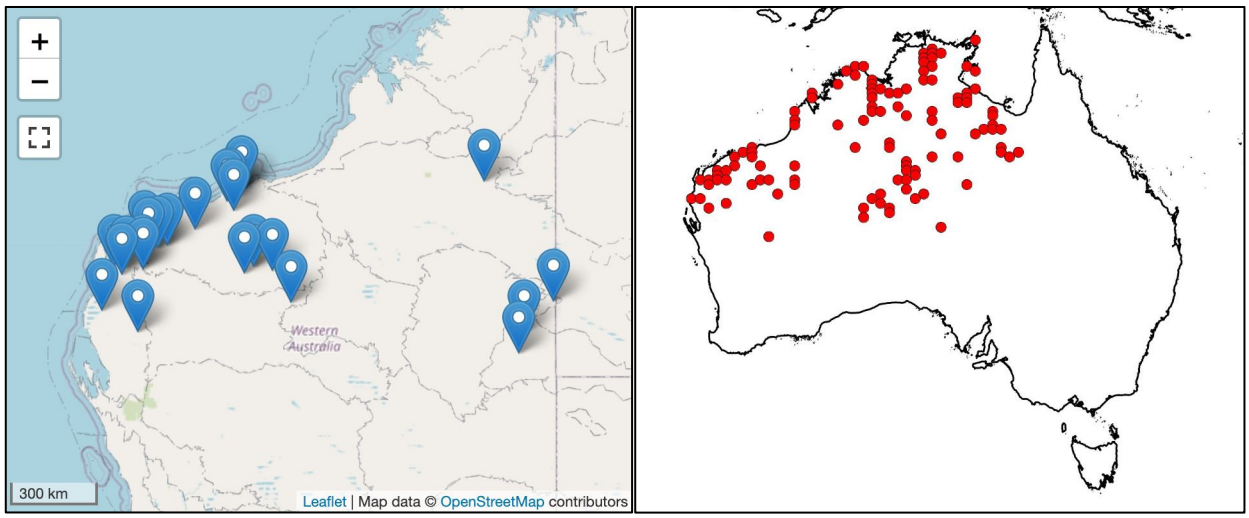


Figure 26. Current Hibiscus brachychlaenus distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Clerodendrum floribundum var. *ovatum*

Clerodendrum floribundum var. *ovatum* is a member of the Lamiaceae family. It is described as a tree or shrub with white-cream flowers and red fruit, growing to 1-5m. It occurs on skeletal soils, sandy & loamy soils, sandstone, basalt; on rocky hills & slopes, floodplains. It is widespread through northern Australia.

Clerodendrum floribundum var. *ovatum* is currently known from 38 vouchered records in Western Australia (WA Herbarium 1998-2021), and 267 across Australia (Australasian Virtual Herbarium 2021). It was encountered in the sand dune *Corymbia chippendalei* Scattered Low Trees (Cc-SLT) Vegetation Association. The presence of this taxon within the Study Area represents a 150 km extension southwards of its current range.

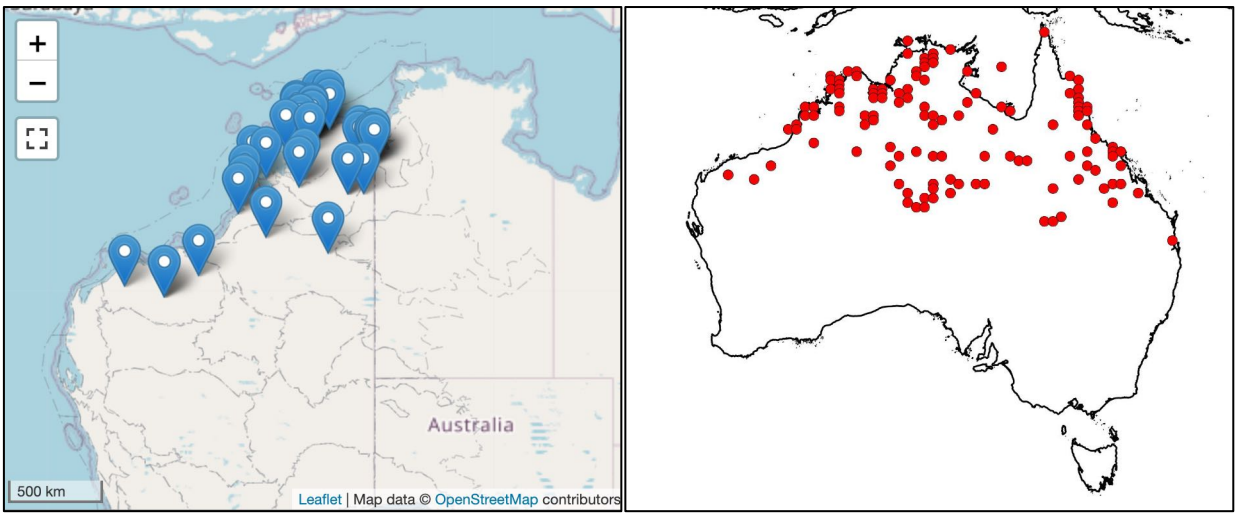


Figure 27. Current Clerodendrum floribundum var. ovatum distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021)

Tecticornia auriculata

Tecticornia auriculata is a member of the Chenopodiaceae family. It is described as a much-branched, spreading shrub growing to 0.2-1.3 m high. It commonly occurs in red clay loam to sandy clay in salt marshes and seasonally waterlogged saline flats, in northwest Western Australia.

Tecticornia auriculata is currently known from 74 vouchered records in Western Australia, occurring in the Carnarvon, Dampierland, Great Sandy Desert, Little Sandy Desert and Pilbara IBRA regions (WA Herbarium 1998-2021). It was observed growing in large quantities within a claypan; comprising its own Vegetation Association (*Tecticornia auriculata* Low Shrubland). Its presence within the Study Area represents a range extension of approximately 200 km east of its current distribution.

Plate 13. *Tecticornia auriculata* (WA Herbarium 1998-2021)

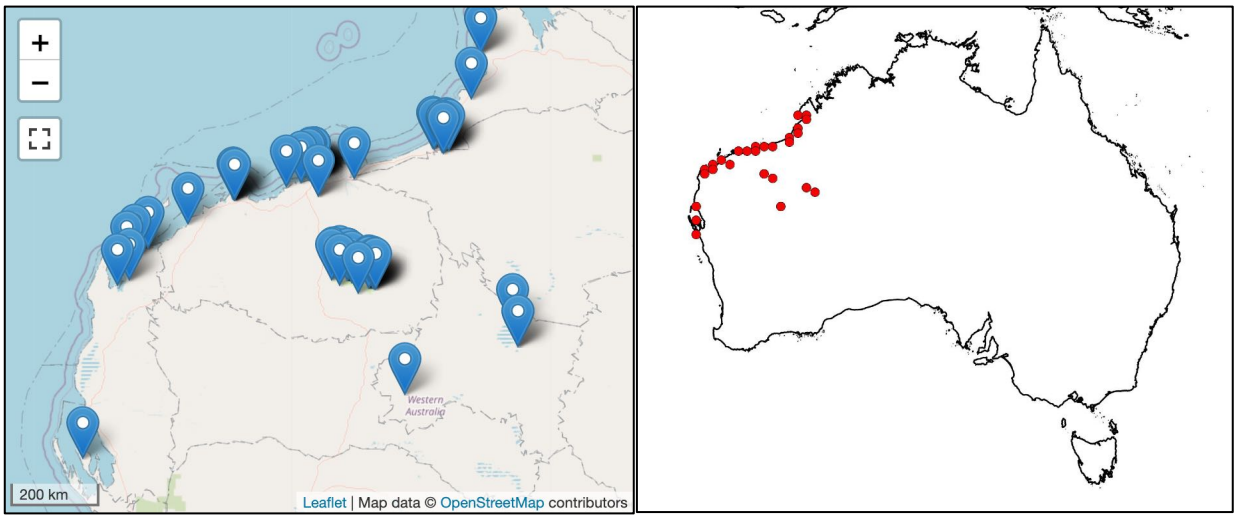


Figure 28. Current Tecticornia auriculata distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Abutilon cunninghamii

Abutilon cunninghamii is a member of the Malvaceae family. It is described as an upright perennial herb or shrub with yellow-orange flowers, growing to 0.5-0.9m tall. It occurs on red sand or clay, mostly towards the northwest of Western Australia, with disjunct records scattered as far east as Queensland.

Abutilon cunninghamii is currently known from 50 vouchered records in Western Australia, occurring in the Carnarvon, Gascoyne, Little Sandy Desert, Pilbara and Yalgoo IBRA regions (WA Herbarium 1998-2021). It was observed growing beside a claypan in the north-eastern Study Area. *Abutilon cunninghamii* has not yet been recorded within the Great Sandy Desert IBRA region, so its presence represents an extension to its current known distribution.

Plate 14. *Abutilon cunninghamii* flower and plant (WA Herbarium 1998-2021)

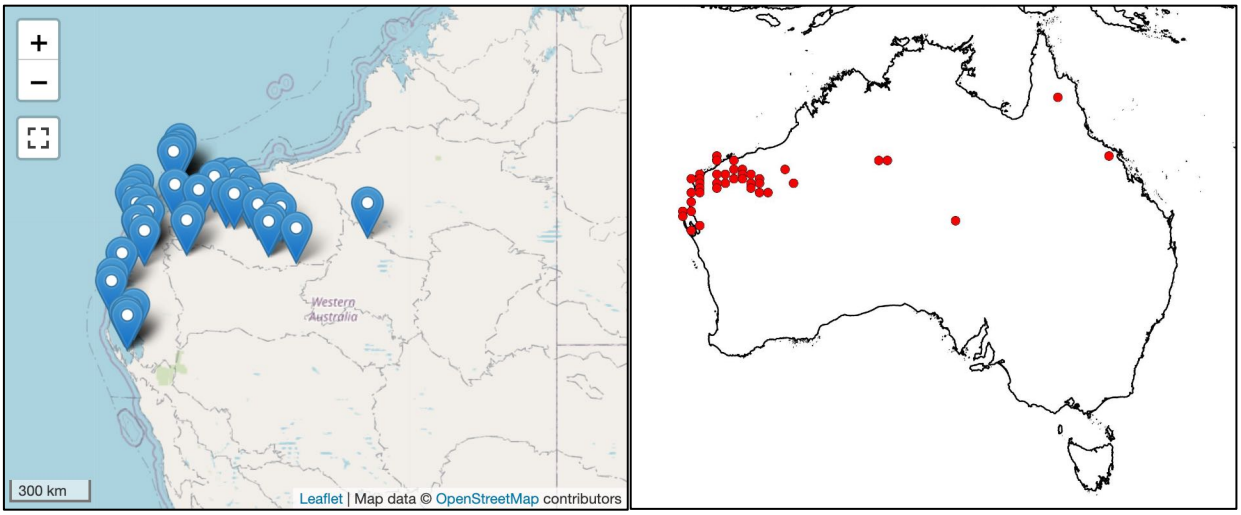


Figure 29. Current Abutilon cunninghamii distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Acacia coriacea subsp. *pendens*

Acacia coriacea subsp. *pendens* is a member of the Fabaceae family. It is described as a weeping shrub or tree to 8 m tall. It occurs on sandy soils, along rivers and creeks and on stable sand dunes. It is largely confined to the Pilbara region of Western Australia.

Acacia coriacea subsp. *pendens* is currently known from 103 vouchered records in Western Australia, occurring in the Carnarvon, Gascoyne and Pilbara IBRA regions (WA Herbarium 1998-2021). One AVH record appears to occur in Canberra, however this represents a cultivated specimen within the Botanical Gardens. One *Acacia coriacea* subsp. *pendens* was recorded during the field survey, located outside the Study Area. *Acacia coriacea* subsp. *pendens* has not yet been recorded in the Great Sandy Desert Bioregion – its presence within the Study Area thereby representing an extension to its currently known distribution.

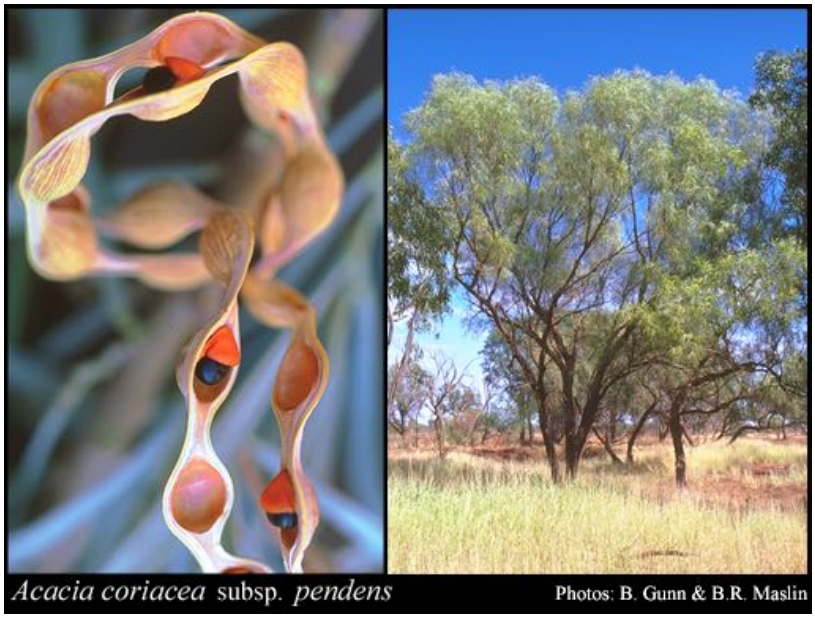


Plate 15. *Acacia coriacea* subsp. *pendens* seed pod and plant (WA Herbarium 1998-2021).

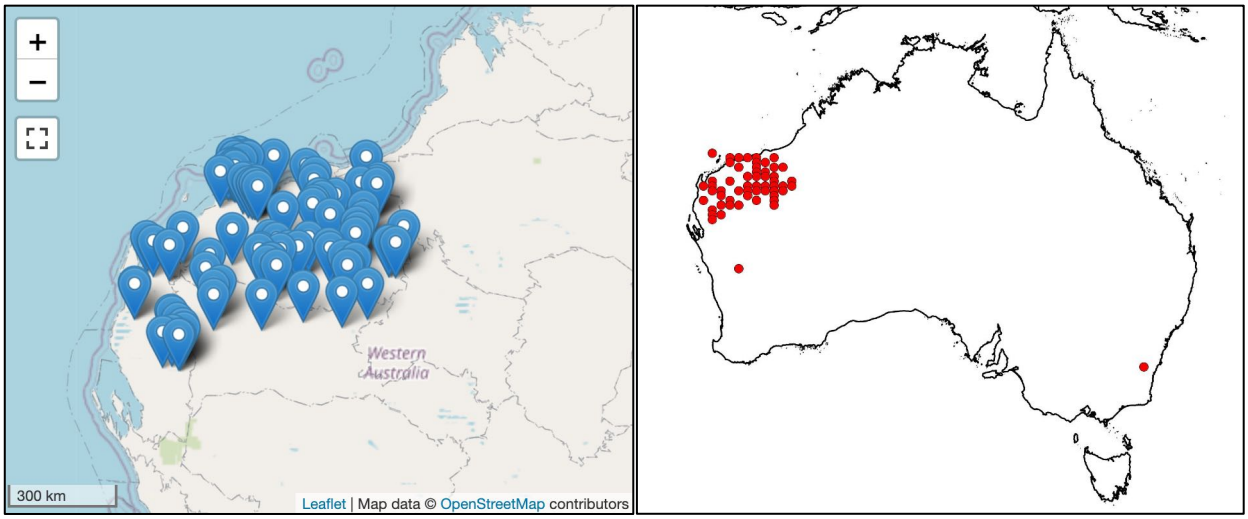


Figure 30. Current *Acacia coriacea* subsp. *pendens* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Goodenia cusackiana

Goodenia cusackiana is a member of the Goodeniaceae family. It is described as an erect to spreading, semi-woody perennial herb with yellow flowers and hairy leaves, growing to 0.6m tall. It occurs in a variety of habitats, including sand and stony loam soils, on rocky hillsides, gorges and undulating plains.

Goodenia cusackiana is currently known from 41 vouchered records in Western Australia, occurring to the west of the Nifty Copper Mine, within in the Carnarvon and Pilbara IBRA regions (WA Herbarium 1998-2021). One collection of *Goodenia cusackiana* was made during the field assessment, within the *Melaleuca glomerata* Shrubland Vegetation Association at Q26. This taxon has not yet been recorded within the Great Sandy Desert IBRA region, thus its presence within the Study Area represents an extension to its currently known distribution.

Plate 16. *Goodenia cusackiana* (WA Herbarium 1998-2021).

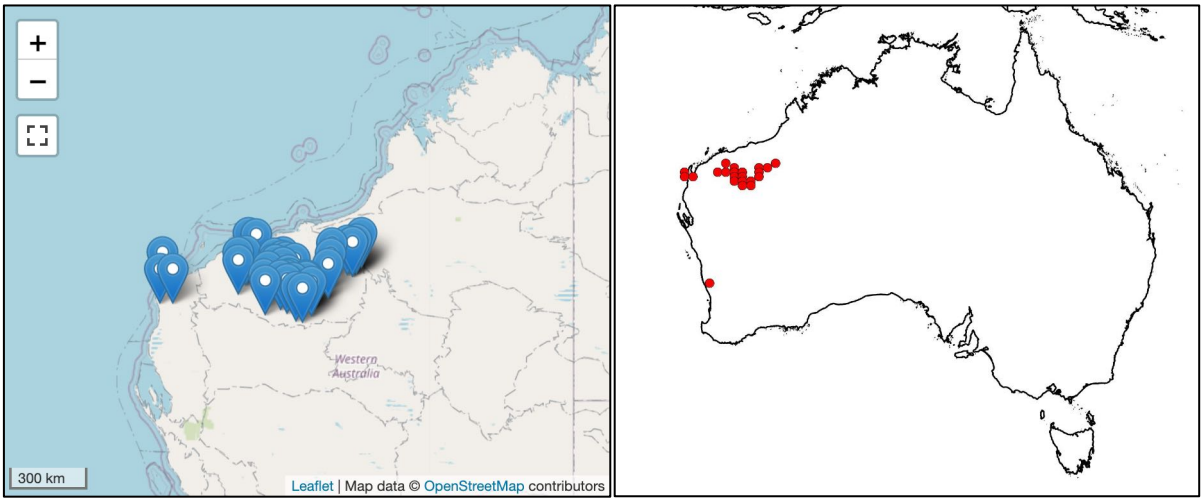


Figure 31. Current Goodenia cusackiana (distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Cassytha filiformis

Cassytha filiformis is a member of the Lauraceae family. It is a parasitic perennial, herb and climber, described as being found on *Melaleuca* and *Acacia*. It typically occurs on sandstone outcrops and plateaus, mangrove swamps, and coastal dunes; widely distributed throughout northern Australia.

Cassytha filiformis is currently known from 130 vouchered records in Western Australia, occurring, within the Carnarvon, Central Kimberley, Dampierland, Gascoyne, Great Sandy Desert, Little Sandy Desert, Northern Kimberley, Ord Victoria Plain, Pilbara, Victoria Bonaparte IBRA regions (WA Herbarium 1998-2021). This taxon was common throughout the Study Area, occurring in large masses in sand dune swales – particularly in unburnt areas within the northern polygon. Only few records of *Cassytha filiformis* appear to occur within the Great Sandy Desert Bioregion – its presence within the Study Area representing a 200 km infill to its current range.

Plate 17. *Cassytha filiformis* (WA Herbarium 1998-2021).

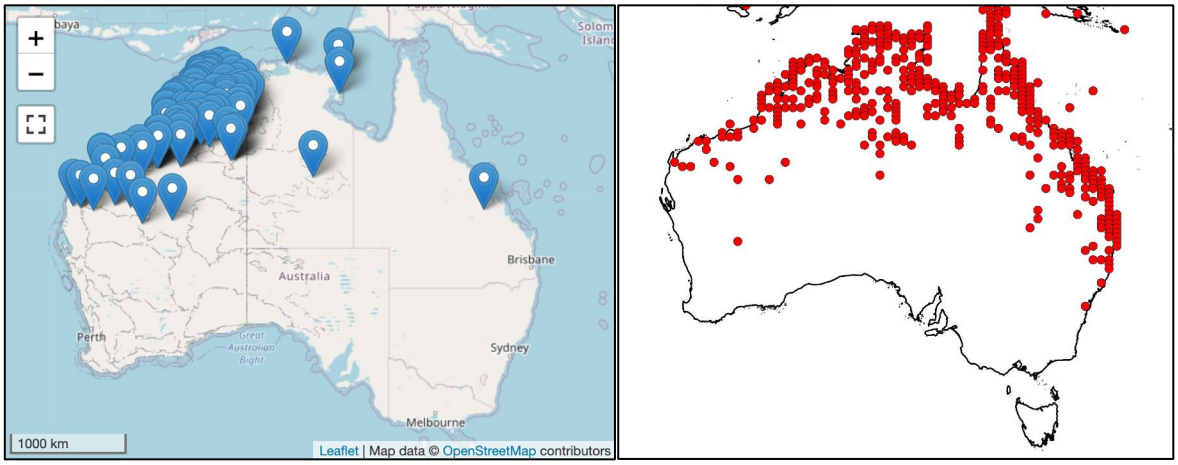


Figure 32. Current *Cassytha filiformis* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Amphipogon caricinus var. *caricinus*

Amphipogon caricinus var. *caricinus,* a member of the Poaceae family, is a tufted perennial grass growing to 0.6m. It is widespread throughout Australia, and commonly occurs on yellow to white sand and clay, red/brown gravelly soils, laterite and granite.

Amphipogon caricinus var. *caricinus* is currently known from 231 vouchered records in Western Australia (WA Herbarium 1998-2021), and 871 across Australia (Australasian Virtual Herbarium 2021). It was encountered in a variety of Vegetation Associations within the Study Area, including the Cc-SLT, TB-HG and ML-OS. Its presence within the Study Area represents a range extension of approximately 150 km.

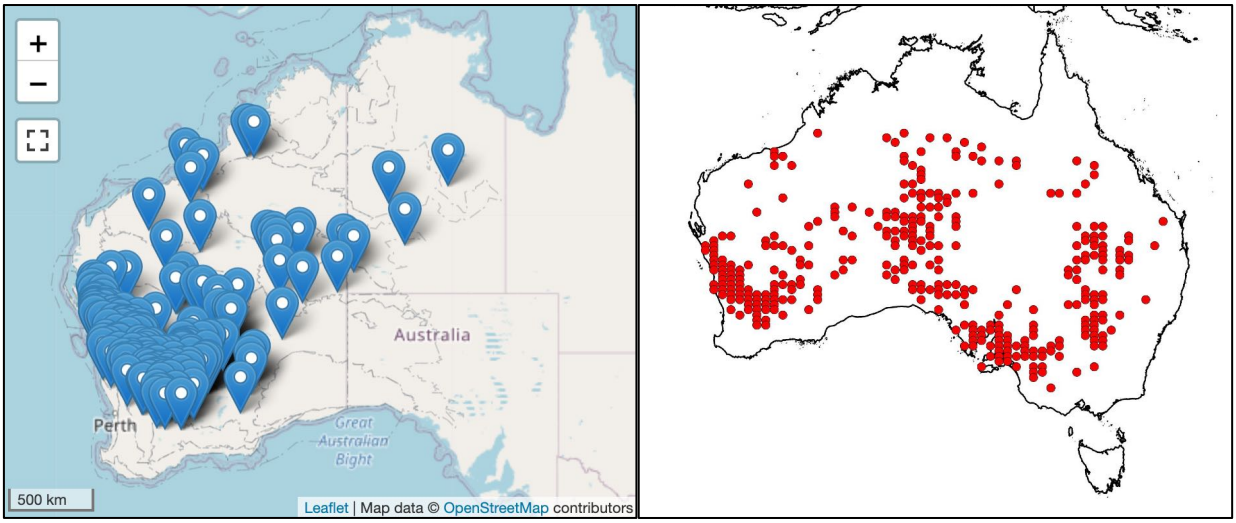


Figure 33. Current *Amphipogon caricinus* var. *caricinus* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Aristida inaequiglumis

Aristida inaequiglumis, a member of the Poaceae family, is a tufted perennial grass growing to 0.3-1.5m tall. It is widespread throughout northern Australia, and commonly occurs on red sandy loam, red earths and yellow sandy clay.

Aristida inaequiglumis is currently known from 76 vouchered records in Western Australia (WA Herbarium 1998-2021), and 690 records across Australia (Australasian Virtual Herbarium 2021). The collection of *Aristida inaequiglumis* represents an 150 km infill to its current distribution.

Plate 18. *Aristida inaequiglumis* (WA Herbarium 1998-2021)

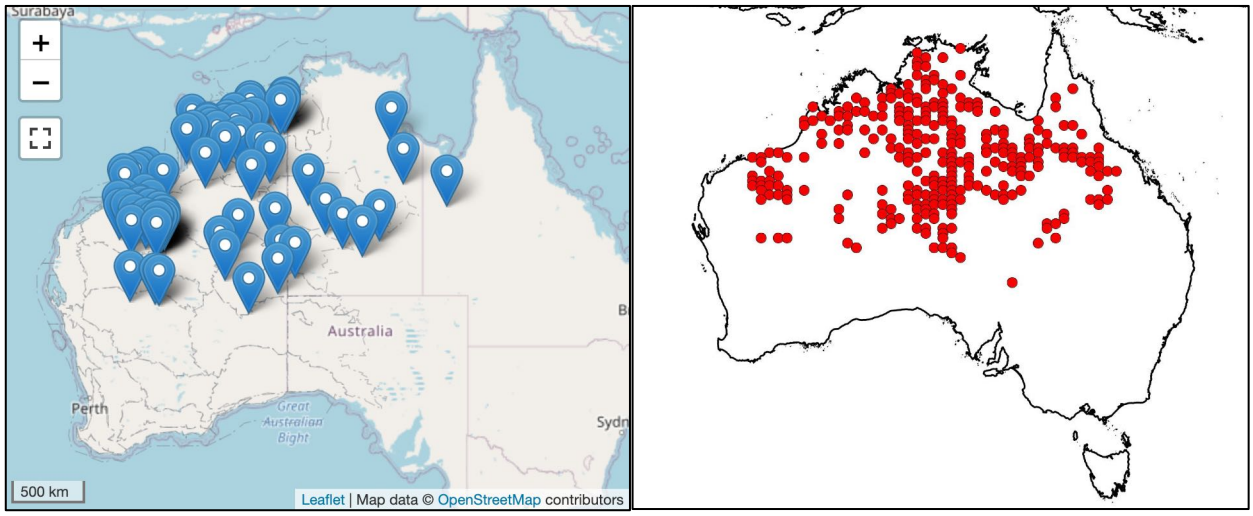


Figure 34. Current *Aristida inaequiglumis* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Pluchea ferdinandi-muelleri

Pluchea ferdinandi-muelleri, a member of the Asteraceae family, is a densely tomentose shrub with purple flowers. It occurs on sand to clay, alluvium, gravel, limestone, ironstone; on a variety of low relief sites including stony creeks, sandplains, pindan flats, swampy areas, salt marshes and flood plains. It is widespread through northern Australia.

Pluchea ferdinandi-muelleri, is currently known from 64 vouchered records in Western Australia (WA Herbarium 1998-2021), and 272 records across Australia (Australasian Virtual Herbarium 2021). It was encountered within the *Grevillea stenobotrya* Shrubland (Gs-S) Vegetation Association. The collection of *Pluchea ferdinandi-muelleri* within the Study Area, represents a 150 km infill to its current distribution.

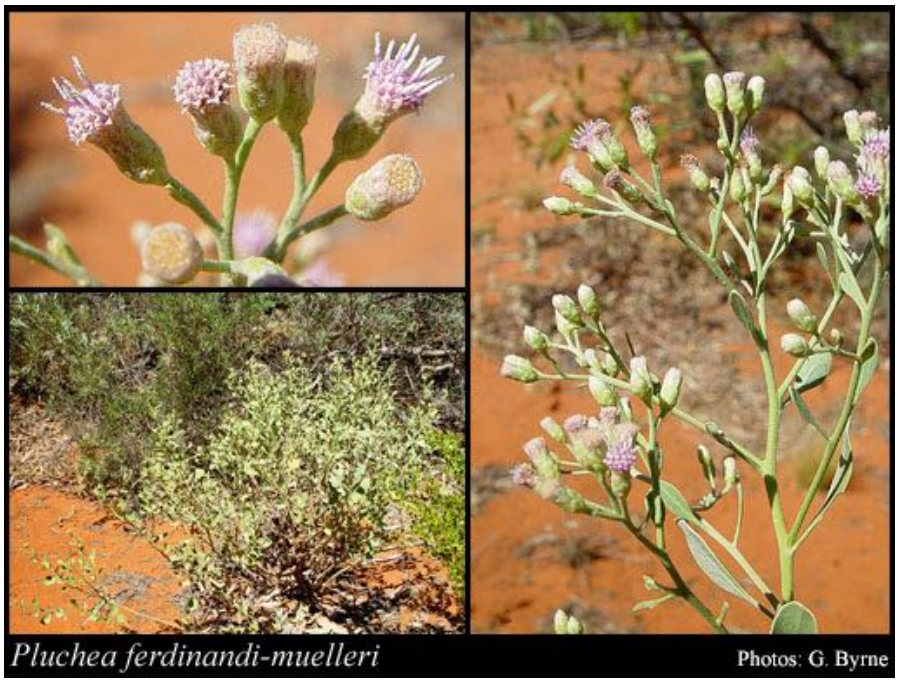


Plate 19. *Pluchea ferdinandi-muelleri* (WA Herbarium 1998-2021)

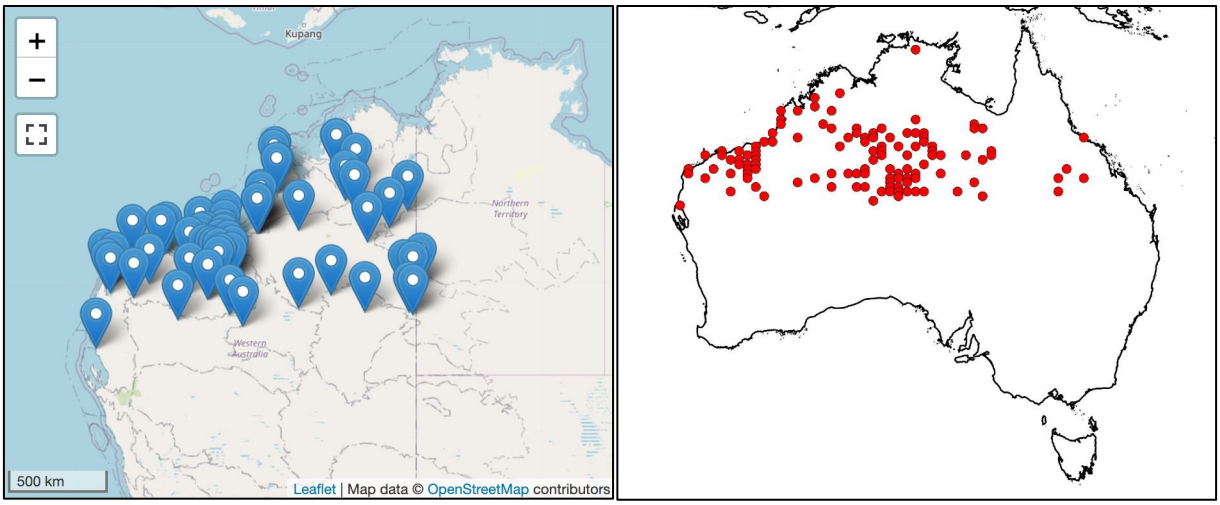


Figure 35. Current *Pluchea ferdinandi-muelleri* distribution recognised by a) Western Australian Herbarium (1998-2021) and b) Australasian Virtual Herbarium (2021).

Appendix 8. Descriptions of Vegetation Associations of the Nifty Study Area

Sand Dune Landform

***Corymbia chippendalei* Scattered Low Trees Cc-SLT**

The Sand Dune *Corymbia Chippendalei* Scattered Low Trees over *Grevillea* and *Acacia* species is characterised by an upper stratum dominated by *Corymbia chippendalei* from 4-10 m with a PFC of 1-2% over *Acacia melleodora* 1-2 m, *Acacia colei* var. *colei* 1-2 m, *Acacia jensenii* 1-4 m, *Grevillea stenobotrya* 1-3 m, *Acacia tumida* var. *kulparn* 2-3 m and *Gyrostemon tepperi* to 2 m with a PFC 1-2% over *Triodia schinzii* 0.4 m (vegetative) to 1.2 m (flowering spikes), *Crotalaria cunninghamii* var. *sturtii* 1.5 m, *Sida* sp. Western sand dunes (P.K. Latz 11980) 1.6 m, *Thinicola incana* 1.2 m, *Petalostylis cassioides* 0.8 m, and *Cyanostegia cyanocalyx* 0.6 m with a PFC 5-15% over low herbs and grasses dominated by *Gompholobium simplicifolium* 0.5 m, *Dicrastylis cinerea* 0.5 m, *Solanum gilesii* 0.25 m, *Dicrastylis doranii* 0.3 m, *Eriachne helmsii* 0.5 m, *Eriachne aristidea* 0.3 m, *Aristida holathera* var. *holathera* 0.4 m, *Stackhousia megaloptera* 0.4 m, *Paractaenum refractum* 0.3 m, and *Eragrostis eriopoda* 0.4 m with a PFC 12-20%, Plate 20

Other associated species include *Cullen martinii* 1.5 m, *Swainsona microphylla* 1.5 m, *Aluta maisonneuvei* subsp. *maisonneuvei* 1.2 m, *Newcastelia spodiotricha* 1 m, *Corynotheca asperata* (P3), *Ptilotus arthrolasius* 0.2 m, Indigofera ammobia (P3) 0.2 m, *Paranotis pterospora* 0.25 m and *Euphorbia wheeleri* 0.2 m.

Plate 20. *Corymbia chippendalei* Scattered Low Trees Cc-SLT

***Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland Am-LS**

The Sand Dune *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland is characterised by an upper stratum dominated by *Grevillea stenobotrya* from 2-2.5 m, and *Grevillea eriostachya* to 1.8m with a PFC of 1-2% over *Aluta maisonneuvei* subsp. *maisonneuvei* from 1-2 m with a PFC of 10-30% over *Triodia* aff. *lanigera* 0.4 m (vegetative) to 0.9 m (flowering), *Triodia schinzii* 0.4 m (vegetative) to 1.2 m (flowering), *Dicrastylis doranii* 0.3 m, *Gyrostemon tepperi* 0.3 m, and *Scaevola parvifolia* subsp. *pilbarae* 0.15 m with a PFC 5-10%, Plate 21.

Other associated species include *Eriachne helmsii* 0.4 m, *Gompholobium simplicifolium* 0.5 m, *Dicrastylis cordifolia* 0.3 m, *Thinicola incana* 0.5 m, *Ptilotus arthrolasius* 0.2 m, *Eragrostis eriopoda* 0.4 m and *Solanum gilesii* 0.25 m.

Plate 21. *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland

Sandplain swales Landform

***Acacia ancistrocarpa* Shrubland Aa-S**

The Sand Plain swale *Acacia ancistrocarpa* Shrubland is characterised by an upper stratum dominated by *Acacia ancistrocarpa* 2-3 m *Grevillea eriostachya* 3 m, *Grevillea stenobotrya* 2 m, *Grevillea wickhamii* subsp. *aprica* 2-5 m, *Eucalyptus kingsmillii* 2-3 m with occasional *Corymbia opaca* from 4-8 m with a PFC of 15-25% over a hummock grassland dominated by *Triodia basedowii* 0.4 m (vegetative) to 0.7m (flowering) with a PFC of 40-45% and *Dicrastylis cordifolia* to 0.3m *Scaevola parvifolia* subsp. *pilbarae* to 0.15 m, and *Goodenia triodiophila* to 0.3m with a PFC 1-2%, Plate 22.

Other associated species include *Melaleuca lasiandra* 2 m, *Hakea lorea* subsp. *lorea* 2 m, *Exocarpos sparteus* 2.5 m, *Jacksonia aculeata* 0.4 m, *Ptilotus schwartzii* 0.3 m, *Thysanotus* sp. Desert East of Newman (R.P. Hart 964) (P2) 0.25 m, *Calytrix carinata* 0.3 m, *Goodenia azurea* subsp. *hesperia* 0.5 m, *Amphipogon sericeus* 0.4 m, *Halgania solanacea* var. *solanacea* 0.4 m and *Bonamia alatisemina* 0.4 m.

Plate 22. *Acacia ancistrocarpa* Shrubland

Acacia stellaticeps Low Shrubland As-LS

The Sandplain Swale *Acacia stellaticeps* Low Shrubland is characterised by an upper stratum dominated by *Eucalyptus gamophylla – odontocarpa* to 2 m, *Acacia ancistrocarpa* to 1.8 m, and *Hakea lorea* subsp. *lorea* 1.7 m with a PFC of 1-2% over *Acacia stellaticeps* from 0.5-0.7 m with a PFC of 20-25%. The lower stratum is dominated by a hummock grassland of *Triodia basedowii* 0.3 m (vegetative) to 0.5 m (flowering) with a PFC 25-40% Plate 23.

Other associated species include *Grevillea eriostachya* 1.2 m, *Stylobasium spathulatum* 0.7m, *Amphipogon sericeus* 0.4 m, *Scaevola parvifolia* subsp. *pilbarae* to 0.15 m, *Halgania solanacea* var. *solanacea* 0.4 m, *Jacksonia aculeata* 0.4 m and *Solanum centrale* 0.3 m.

Plate 23. *Acacia stellaticeps* Low Shrubland

Grevillea stenobotrya Shrubland Gs-S

The Sandplain Swale *Grevillea stenobotrya* Shrubland is characterised by an upper stratum dominated by *Grevillea stenobotrya* from 2-3.5m, *Grevillea wickhamii* subsp. *aprica* to 2 m, *Acacia melleodora* to 1 m with a PFC of 15-50%, over a hummock grassland dominated by *Triodia* aff. *lanigera* to 0.7m with a PFC of 20-45% with *Acacia stellaticeps* 0.7m, *Jacksonia aculeata* to 0.4 m, *Aluta maisonneuvei* subsp. *maisonneuvei* to 0.6 m, *Dicrastylis doranii* to 0.3 m, and *Petalostylis cassioides* to 0.6m with a PFC of 5-8%, Plate 24.

Other associated species include *Hakea lorea* subsp. *lorea* 1.7 m, *Aristida holathera* var. *holathera* 0.4 m, *Pluchea ferdinandi-muelleri* 0.4 m, *Pluchea tetranthera* 0.4 m, *Tribulus hirsutus* 0.1 m and *Dodonaea coriacea* 0.5 m

Plate 24. *Grevillea stenobotrya* Shrubland

Melaleuca glomerata Shrubland Mg-S

The *Melaleuca glomerata* Shrubland is located within the lower part of the Sandplain Swale, it is characterised by an upper stratum dominated by *Melaleuca glomerata* from 1.5-2.5 m with a PFC from 25-35% with the occasional *Melaleuca lasiandra* to 3m, *Eucalyptus victrix* to 5 m and *Hakea lorea* subsp. *lorea* to 2.5 m. The lower stratum is dominated by a hummock grassland of *Triodia basedowii* with a PFC of 15-20%. Other associated herbs and grasses in the lower stratum include *Eragrostis eriopoda* to 0.4 m, *Ptilotus calostachyus* to 0.6 m, *Scaevola parvifolia* subsp. *pilbarae* to 0.15 m, *Goodenia azurea* subsp. *hesperia* to 0.5 m, *Goodenia armitiana* to 0.3 m, *Acacia stellaticeps* to 0.6 m, and *Newcastelia cladotricha* to 0.5 m, Plate 25.

Other associated species include *Goodenia hartiana* (P2).

Plate 25. *Melaleuca glomerata* Shrubland

Melaleuca lasiandra Open Shrubland Ml-OS

The Sandplain Swale *Melaleuca lasiandra* Open Shrubland is also found in the lower parts of the landform, situated slightly higher in the landscape compared to the *Melaleuca glomerata* Shrubland. The *Melaleuca lasiandra* Open Shrubland is characterised by an upper stratum dominated by *Melaleuca lasiandra* from 1.5 m to 4 m, *Acacia ancistrocarpa* to 1 m and *Grevillea eriostachya* to 1.2 m with a PFC of 2-10 over *Triodia basedowii* to 0.8 m, *Dampiera candicans* to 0.3 m, *Dicrastylis cordifolia* to 0.3 m, *Goodenia azurea* subsp. *hesperia* 0.3 m, *Eragrostis eriopoda* to 0.3 m and *Gompholobium polyzygum* to 0.6 m, Plate 26.

Other associated species include *Sida arenicola* 2 m, *Mirbelia viminalis* 1.2 m, *Triodia* aff. *lanigera* 0.6 m, *Amphipogon sericeus* 0.4 m and *Jacksonia aculeata* to 0.4 m.

Plate 26. *Melaleuca lasiandra* Open Shrubland

Triodia basedowii Hummock Grassland Tb-HG

The *Triodia basedowii* Hummock Grassland is recorded within the swales between Sand dunes, associated with the slightly shallower sands than those associated with the *Triodia* aff. *lanigera* Vegetation Association.

The *Triodia basedowii* Hummock Grassland in its unburnt state is characterised by an open grassland dominated by *Triodia basedowii* 0.3 m (vegetative) to 0.5 m (flowering) with a PFC of 35-50%. This grassland has occasional *Eucalyptus kingsmillii* from 2-3 m, *Hakea lorea* subsp. *lorea* to 1.8 m, *Grevillea wickhamii* subsp. *aprica* to 2 m, and *Grevillea stenobotrya* with a PFC of up to 1% Plate 27.

After fire, regeneration of this association can look markedly different with an emergence of a suite of species that lay dormant or are in very low numbers within the unburnt state. The *Triodia basedowii* Hummock Grassland in its burnt regenerating state is characterised by a similar upper stratum of regenerating *Eucalyptus kingsmillii* to 1.2 m, *Hakea lorea* subsp. *lorea* to 1.8 m, *Grevillea wickhamii* subsp. *aprica* 2 m with a PFC of less than 1%. The mid to lower stratums are characterised by *Gompholobium polyzygum* 1.2 m with a PFC of 2-5% over *Halgania solanacea* var. *solanacea* 0.4 m, *Triodia basedowii* 0.2 m, *Amphipogon setaceus* 0.5 m, *Amphipogon caricinus* 0.4 m, *Ptilotus calostachyus* 0.5 m, *Ptilotus exaltatus* 0.4 m, *Eragrostis eriopoda* 0.3 *m Grevillea wickhamii* subsp. *aprica* 0.5 m *Ptilotus schwartzii* var. *schwartzii* 0.3 m, *Dampiera candicans* 0.3 m, *Jacksonia aculeata* 0.3 m, and *Dicrastylis cordifolia* 0.2 m with a PFC of 25-40-% Plate 28.

Plate 27. *Triodia basedowii* Hummock Grassland (unburnt)

Plate 28. *Triodia basedowii* Hummock Grassland (burnt recently)

Triodia aff. *lanigera* Hummock Grassland Tl-HG

The *Triodia* aff. *lanigera* Hummock Grassland is recorded along the foot slopes of the sand dunes, associated with the deeper sands arising from the sand dunes. The *Triodia* aff. *lanigera* Hummock Grassland is characterised by an upper stratum dominated by occasional *Corymbia chippendalei* to 5 m, *Grevillea eriostachya* 1.5 m, *Grevillea stenobotrya* from 1-3 m, and *Acacia melleodora* to 2 m with a PFC 2%. The mid stratum is dominated by *Triodia* aff. *lanigera* 0.4 m (vegetative) to 0.7 m (flowering) with a PFC of 40-55%. The lower stratum of *Calytrix carinata* to 0.5 m, *Dicrastylis cordifolia* 0.3 m, *Gompholobium simplicifolium* to 0.5 m, *Scaevola parvifolia* subsp. *pilbarae* to 0.2 m, *Dicrastylis doranii* to 0.2 m and *Jacksonia aculeata* to 0.3 m, with a PFC of 2-5%, Plate 29.

Other associated species include *Ptilotus exaltatus* 0.7 m, *Eragrostis eriopoda* 0.4 m, *Salsola australis* 0.4 m, *Eriachne aristidea* 0.3 m and *Amphipogon sericeus* 0.4 m

Plate 29. *Triodia* aff. *lanigera* Hummock Grassland

Stoney Plain & Low Hill

***Acacia hilliana* Low Shrubland Ah-LS**

The *Acacia hilliana* Low Shrubland is associated with the low outcropping stony rises. The *Acacia hilliana* Low Shrubland is characterised by an upper stratum dominated by occasional *Corymbia opaca* to 5 m, with *Senna glaucifolia* to 1.6 m and *Senna sericea* 1.5 m with a PFC 1-2% over *Acacia hilliana* to 0.6 m, *Triodia basedowii* to 0.4 m, *Ptilotus calostachyus* to 0.7 m PFC 40-45%, Plate 30.

Other associated species include *Calytrix carinata* to 0.5 m, *Cyanostegia cyanocalyx* 0.6 m, *Ptilotus axillaris* 0.1m, *Indigofera boviperda* subsp. *eremaea* to 0.2m, *Jacksonia aculeata* 0.4m, *Tephrosia arenicola* 0.4m, *Goodenia stobbsiana* 0.4m, with *Goodenia hartiana* (P2) 0.4m along the edges of this association.

Plate 30. *Acacia hilliana* Low Shrubland

Clay Pan Playa

***Eragrostis falcata* Grassland Ef-G**

The *Eragrostis falcata* Grassland was recorded at a single location within an internally draining clay pan location within the study area, and formed a unique vegetation assemblage not seen elsewhere within or outside of the Study Area during the survey.

The Eragrostis falcata Grassland is characterised by an open grassland dominated by a near monoculture of *Eragrostis falcata* to 0.3 m with a PFC of 55%. This grassland has occasional *Melaleuca lasiandra* from 0.5-3 m and *Melaleuca glomerata* to 3 m with a PFC of less than 1%, as an upper stratum. Also, within this association are small mounds of deeper sand that supports the occasional clump of *Aristida holathera* var. *holathera* to 0.4 m and *Ptilotus exaltatus* 0.7 m, Plate 31.

Plate 31. *Eragrostis falcata* Grassland

Tecticornia auriculata Low Shrubland Ta-S

The *Tecticornia auriculata* Low Shrubland was recorded within an internally draining clay pan location. The *Tecticornia auriculata* Low Shrubland is characterised by a monoculture of *Tecticornia auriculata* to 0.5m, with a PFC of 65-70%. Other associated species that occur occasionally within this association include *Eragrostis falcata* 0.1 m, *Stemodia grossa* 0.4 m and *Ptilotus exaltatus* 0.6 m with a PFC of less than 1% Plate 32 .

Plate 32. *Tecticornia auriculata* Low Shrubland

Appendix 9. Quadrat Site Descriptions and Data

Cyprium - Nifty Copper Mine **Site** Q01
Date 01/06/2020 **Type** Q 50 x 50
MGA Zone 51K 350664**mE** 7603254**mN** 121.556688°**E** -21.667742°**S**
Habitat Cc-SLT
- *Corymbia chippendalei* Scattered Low Trees on sand dune.

Soil
Deep soft red sand with no outcropping cover or coarse fragments.

Veg Condition
Excellent – Evidence of fire within the last 3 years.

Comments
25-30° angle with15-20 m relief

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	1	6
Acacia tumida var. kulparn	2	1-1.5
Acacia jensenii	+	1-3.8
Thinicola incana	0.5	1.5
Grevillea stenobotrya	+	1.3
Gompholobium simplicifolium	2	0.8
Aluta maisonneuvei subsp. maisonneuvei	+	1.2
Dicrastylis doranii	0.5	0.5
Eragrostis eriopoda	1	0.5
Eriachne aristidea	15	0.6
Petalostylis cassioides	+	1
Triodia schinzii	3	0.7-1.7
Aristida holathera var. holathera	4	0.6
Paractaenum refractum	0.5	0.5
Gyrostemon tepperi	+	0.6
Ptilotus arthrolasius	+	0.4
Cyanostegia cyanocalyx	+	1
Dampiera cinerea (red flower form)	2	0.4
Paranotis pterospora	+	0.1
Heliotropium transforme	+	0.3
Solanum gilesii	+	0.4
Euphorbia wheeleri	+	0.1
Newcastelia cladotricha	+	0.4
Sida sp. Western sand dunes (P.K. Latz11980)	+	0.6
Indigofera ammobia	+	0.3
Stackhousia megaloptera	+	0.5
Senna notabilis	out	0.1
Halgania solanacea var. solanacea	out	0.3
Cullen martinii	out	0.2
Calytrix carinata	out	0.6
Polygala isingii	out	0.1

Cyprium - Nifty Copper Mine **Site** Q02
Date 01/06/2020 **Type** Q 50 x 50
MGA Zone 51K 350827**mE** 7602979**mN** 121.558238°**E** -21.670240°**S**
Habitat Tl-HG -
Triodia aff. *lanigera* mid-dense hummock grassland on dune swale.
Soil
Deep red sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – evidence of fire within the last 3 years.
Comments
Burnt in NW corner only.

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	+	1.5
Gompholobium simplicifolium	2-3	0.5
Calytrix carinata	5	0.6
Dampiera cinerea (red flower form)	0.5	0.5
Triodia aff. lanigera	35-40	0.2
Cyanostegia cyanocalyx	+	0.8
Jacksonia aculeata	1	0.6
Grevillea eriostachya	+	1.3
Grevillea stenobotrya	+	1
Gyrostemon tepperi	+	1.2
Acacia melleodora	+	0.5
Scaevola parvifolia subsp. pilbarae	+	0.2
Dicrastylis cordifolia	+	0.2
Dicrastylis doranii	+	0.4
Triodia schinzii	+	0.9
Newcastelia cladotricha	+	0.1
Polygala isingii	+	0.1
Ptilotus arthrolasius	+	0.1
Eragrostis eriopoda	+	0.3
Aristida holathera var. holathera	+	0.2
Halgania solanacea var. solanacea	+	0.2

Cyprium - Nifty Copper Mine **Site** Q03
Date 01/06/2020 **Type** Q 50 x 50
MGA Zone 51K 351003**mE** 7602693**mN** 121.559913°**E** -21.672838°**S**
Habitat Ml-OS -
Melaleuca lasiandra Open Low Shrubland on Sandplain.
Soil
Deep sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – evidence of fire within the last 3 years.
Comments

SPECIES LIST:

Name	Cover	Height
Melaleuca lasiandra	2	1.6-1.8
Gompholobium polyzygum	9	0.7
Acacia ancistrocarpa	9	1
Ptilotus calostachyus	9	0.9
Triodia basedowii	10-12	0.4
Dampiera candicans	10-12	0.4
Halgania solanacea var. solanacea	+	0.4
Dicrastylis cordifolia	0.5	0.3
Newcastelia cladotricha	+	0.4
Goodenia armitiana	2	0.3
Eragrostis eriopoda	2-3	
Goodenia azurea subsp. hesperia	+	0.4
Acacia ancistrocarpa	1.5	0.4
Goodenia triodiophila	+	0.3
Scaevola parvifolia subsp. pilbarae	+	0.2
Ptilotus exaltatus	+	0.5
Ptilotus schwartzii var. schwartzii	+	0.4
Ptilotus axillaris	+	0.2
Ptilotus arthrolasius	+	0.3
Eriachne aristidea	+	0.5
Jacksonia aculeata	+	0.5
Sida sp. Pilbara (A.A Mitchell PRP 1543)	+	0.5
Amphipogon sericeus	+	0.4
Paranotis pterospora	+	0.1
Aristida holathera var. holathera	+	0.3
Goodenia connata	+	0.1
Brunonia australis var. A Kimberley Flora (K.F. Kenneally 5452)	+	0.05
Polygala isingii	+	0.1
Senna notabilis	+	0.1
Ptilotus astrolasius	+	0.2
Abildgaardia oxystachya	+	0.15
Gyrostemon tepperi	out	0.6
Hibiscus leptocladus	out	0.6
Sida arenicola	out	2

Cyprium - Nifty Copper Mine **Site** Q04
Date 02/06/2020 **Type** Q 50 x 50
MGA Zone 51K 351645**mE** 7603200**mN** 121.566172°**E** -21.668303°**S**
Habitat Ah-LS - *Acacia hilliana* Low Shrubland on stony rise.
Soil
Silty dark red loam with abundant (50-90%) platelike basaltic lag gravel (20-100mm) over outcropping (2-10%) weathered basalt.
Veg Condition
Excellent – evidence of fire with last 3 years.
Comments

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	1	2
Acacia hilliana	20	0.6
Triodia basedowii	20	0.6
Ptilotus calostachyus	+	0.7
Goodenia stobbsiana	+	0.3
Afrohybanthus aurantiacus	+	0.1
Indigofera boviperda subsp. eremaea	1	0.4
Ptilotus axillaris	+	0.2
Halgania solanacea var. solanacea	+	0.2
Paraneurachne muelleri	+	0.3
Hakea lorea subsp. lorea	+	0.2
Tephrosia arenicola	+	0.4
Senna artemisioides subsp. oligophylla	out	1
Calytrix carinata	out	0.6

Cyprium - Nifty Copper Mine **Site** Q05
Date 02/06/2020 **Type** Q 50 x 50
MGA Zone 51K 352143**mE** 7602789**mN** 121.570928°**E** -21.672066°**S**
Habitat Ah-LS - *Acacia hilliana* Low Shrubland on stony flat
Soil
Silty sand with discontinuous (20-50%) platy lag gravel (20-100mm) and no outcropping cover.
Veg Condition
Good to Excellent – Evidence of fire within the last 3 years
Comments
Limited clearing from historical gravel exploration test scrapes (one within and one outside quadrat).

SPECIES LIST:

Name	Cover	Height
Acacia hilliana	12	0.6
Triodia basedowii	18	0.5
Ptilotus calostachyus	1	0.7
Calytrix carinata	+	0.4
Afrohybanthus aurantiacus	1	0.4
Jacksonia aculeata	++	0.5
Goodenia azurea subsp. hesperia	+	0.3
Halgania solanacea var. solanacea	+	0.3
Polygala glaucifolia	+	0.05
Eriachne helmsii	+	0.3
Gompholobium polyzygum	+	0.6
Grevillea wickhamii subsp. aprica	+	0.8
Acacia ancistrocarpa	+	0.6
Ptilotus astrolasius	+	0.4
Tephrosia arenicola	+	0.3
Dampiera candicans	+	0.3
Indigofera boviperda subsp. eremaea	out	0.2
Polygala isingii	out	0.05
Heliotropium glabellum	out	0.1

Cyprium - Nifty Copper Mine **Site** Q06
Date 02/06/2020 **Type** Q 50 x 50
MGA Zone 51K 352567**mE** 7602427**mN** 121.575002°**E** -21.675371°**S**
Habitat Tb-HG - *Triodia basedowii* (Burnt) Open Hummock Grassland on sand.
Soil
Deep red sand with no coarse fragments or outcropping cover.
Veg Condition
Very Good – Evidence of fire within the last 3 years
Comments
Triodia basedowii PFC lower than other SASP sites, other species with higher representation.

SPECIES LIST:

Name	Cover	Height
Gompholobium polyzygum	1	0.8
Gyrostemon tepperi	+	0.6
Jacksonia aculeata	10	0.6
Triodia basedowii	6	0.6
Amphipogon sericeus	4	0.5
Grevillea wickhamii subsp. aprica	+	0.5
Tephrosia arenicola	+	0.7
Eragrostis eriopoda	2	0.4
Dicrastylis cordifolia	4	0.2
Halgania solanacea var. solanacea	+	0.3
Dampiera candicans	+	0.3
Goodenia triodiophila	+	0.2
Calytrix carinata	+	0.1
Polygala isingii	+	0.1
Scaevola parvifolia subsp. pilbarae	+	0.1
Gompholobium simplicifolium	+	0.3
Newcastelia cladotricha	+	0.3
Dampiera cinerea (red flower form)	+	0.5
Ptilotus schwartzii var. schwartzii	+	0.4
Eriachne aristidea	+	0.2
Ptilotus calostachyus	+	0.3
Brunonia australis var. A Kimberley Flora (K.F. Kenneally 5452)	+	0.1
Trianthema triquetrum	+	0.1
Goodenia azurea subsp. hesperia	+	0.1
Acacia ancistrocarpa	+	0.1
Abildgaardia oxystachya	+	0.1
Leptosema chambersii	out	0.2
Dampiera cinerea (purple flower form)	+	0.1
Grevillea eriostachya	out	0.8
Ptilotus arthrolasius	out	0.4
Stackhousia sp. swollen gynophore (W.R. Barker 2041)	out	0.2

Cyprium - Nifty Copper Mine **Site** Q07
Date 02/06/2020 **Type** Q 50 x 50
MGA Zone 51K 351577**mE** 7692526**mN** 121.565435°**E** -21.674394°**S**
Habitat Cc-SLT
- *Corymbia chippendalei* Scattered Low Trees on sand dune.

Soil
Deep soft red sand with no coarse fragments or outcropping cover.

Veg Condition
Very Good to Excellent – Fire age approx. 10 years.

Comments
25°
angle with 12-15 m relief.

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	1	6-8
Acacia jensenii	+	1.2
Acacia tumida var. kulparn	2	1.2
Thinicola incana	+	1.5
Crotalaria cunninghamii subsp. sturtii	1	1.4
Sida sp. Western sand dunes (P.K. Latz11980)	+	1.6
Gyrostemon tepperi	+	1.2
Triodia schinzii	6	1.5
Newcastelia spodiotricha	+	1.2
Aristida holathera var. holathera	4	0.7
Eragrostis eriopoda	1	0.3
Eriachne aristidea	1	0.4
Paractaenum refractum	2	0.4
Eriachne helmsii	2	0.6
Dicrastylis doranii	4	0.5
Solanum gilesii	1	0.4
Dampiera cinerea (red flower form)	1	0.5
Jacksonia aculeata	+	0.5
Stackhousia megaloptera	+	0.4
Paranotis pterospora	+	0.2
Euphorbia wheeleri	+	0.01
Sida sp. Western sand dunes (P.K. Latz11980)	+	0.3
Scaevola parvifolia subsp. pilbarae	2	0.2
Halgania solanacea var. solanacea	+	0.3
Ptilotus arthrolasius	+	0.4
Gompholobium simplicifolium	+	0.4
Triodia basedowii	+	0.4
Acacia jensenii	+	0.4
Acacia ancistrocarpa	+	1.5
Cucumis variabilis	+	2
Aenictophyton reconditum subsp. reconditum	+	0.5
Androcalva loxophylla	1	0.5
Newcastelia cladotricha	+	0.4
Dicrastylis cordifolia	+	0.3
Yakirra australiensis var. australiensis	+	0.1
Polygala isingii	out	0.1
Grevillea eriostachya	out	1.3
Grevillea stenobotrya	out	0.4


SC7
SD

Cyprium - Nifty Copper Mine **Site** Q08
Date 02/06/2020 **Type** Q 50 x 50
MGA Zone 51K 350441**mE** 7603644**mN** 121.554568°**E** -21.664201°**S**
Habitat Mg-S - *Melaleuca glomerata* Shrubland on clay
Soil
Silty clay loam with sand and isolated (<2%) rounded lateritic lag gravel; no outcropping cover.
Veg Condition
Excellent – Limited clearing from access track surround quadrat.
Comments

SPECIES LIST:

Name	Cover	Height
Eucalyptus victrix	+	2-4
Melaleuca glomerata	30	2-2.5
Sida arenicola	+	0.6
Triodia basedowii	15	0.4-0.6
Dysphania kalpari	out	0.1
Senna artemisioides subsp. oligophylla	out	2.5
Ptilotus calostachyus	out	0.7

Cyprium - Nifty Copper Mine **Site** Q09
Date 22/06/2020 **Type** Q 50 x 50
MGA Zone 51K 354518**mE** 7604515**mN** 121.594038°**E** -21.656672°**S**
Habitat Ef-LG - *Eragrostis falcata* Low Grassland on flat claypan.
Soil
Sandy soil with light clay surface wash; no coarse fragment or outcropping cover.
Veg Condition
Very Good – evidence of some clearing and runoff from tailing damn.
Comments
Long unburnt

SPECIES LIST:

Name	Cover	Height
Melaleuca lasiandra	+	3.5
Melaleuca glomerata	1	3-4
Eragrostis falcata	50	0.3-0.4
Cassytha filiformis	1	0.158
Pluchea rubelliflora	+	0.5
Aristida holathera var. holathera	1	0.5
Ptilotus exaltatus	+	0.3
Streptoglossa macrocephala	+	0.4
Triodia basedowii	+	0.6
Polygala isingii	+	0.1
Cucumis variabilis	+	0.1
Melaleuca lasiandra	+	0.3
Sida sp. Pindan (B.G.Thomson 3398)	out	0.4
Sida arenicola	out	0.8

Cyprium - Nifty Copper Mine **Site** Q10
Date 22/06/2020 **Type** Q 20 x 70
MGA Zone 51K 352614**mE** 7605508**mN** 121.575730°**E** -21.647547°**S**
Habitat Tl-HG - *Triodia* aff. *lanigera* mid-dense Hummock Grassland on lower dune slope
Soil
Deep red sand, with slight surface crust/ colluvium from waste dump; no coarse fragments or outcropping cover.
Veg Condition
Excellent
Comments

Evidence of fire within the last 15-20 years.

SPECIES LIST:

Name	Cover	Height
Grevillea eriostachya	1	1-1.8
Grevillea stenobotrya	+	1.6
Acacia melleodora	1	1-1.4
Triodia schinzii	+	0.4-1.2
Scaevola parvifolia subsp. pilbarae	+	0.2
Triodia aff. lanigera	40-45	0.4-1
Triodia basedowii	+	0.4
Calytrix carinata	+	0.4
Jacksonia aculeata	+	0.4
Gompholobium simplicifolium	+	0.4
Dicrastylis doranii	+	0.4
Amphipogon sericeus	+	0.3
Cassytha filiformis	+	0.1
Eragrostis eriopoda	+	0.3
Acacia stellaticeps	out	1

Cyprium - Nifty Copper Mine **Site** Q11
Date 22/06/2020 **Type** Q 30 x 70
MGA Zone 51K 352575**mE** 7605625**mN** 121.575363°**E** -21.646487°**S**
Habitat Aa-S -
Acacia ancistrocarpa Low Shrubland on deep sand
Soil
Medium-deep red sand, with isolated (<1%) lateritic lag gravel; no outcropping cover.
Veg Condition
Very Good to Excellent
Comments
Clearing
/access tracks on the northern and southern sides of quadrat

SPECIES LIST:

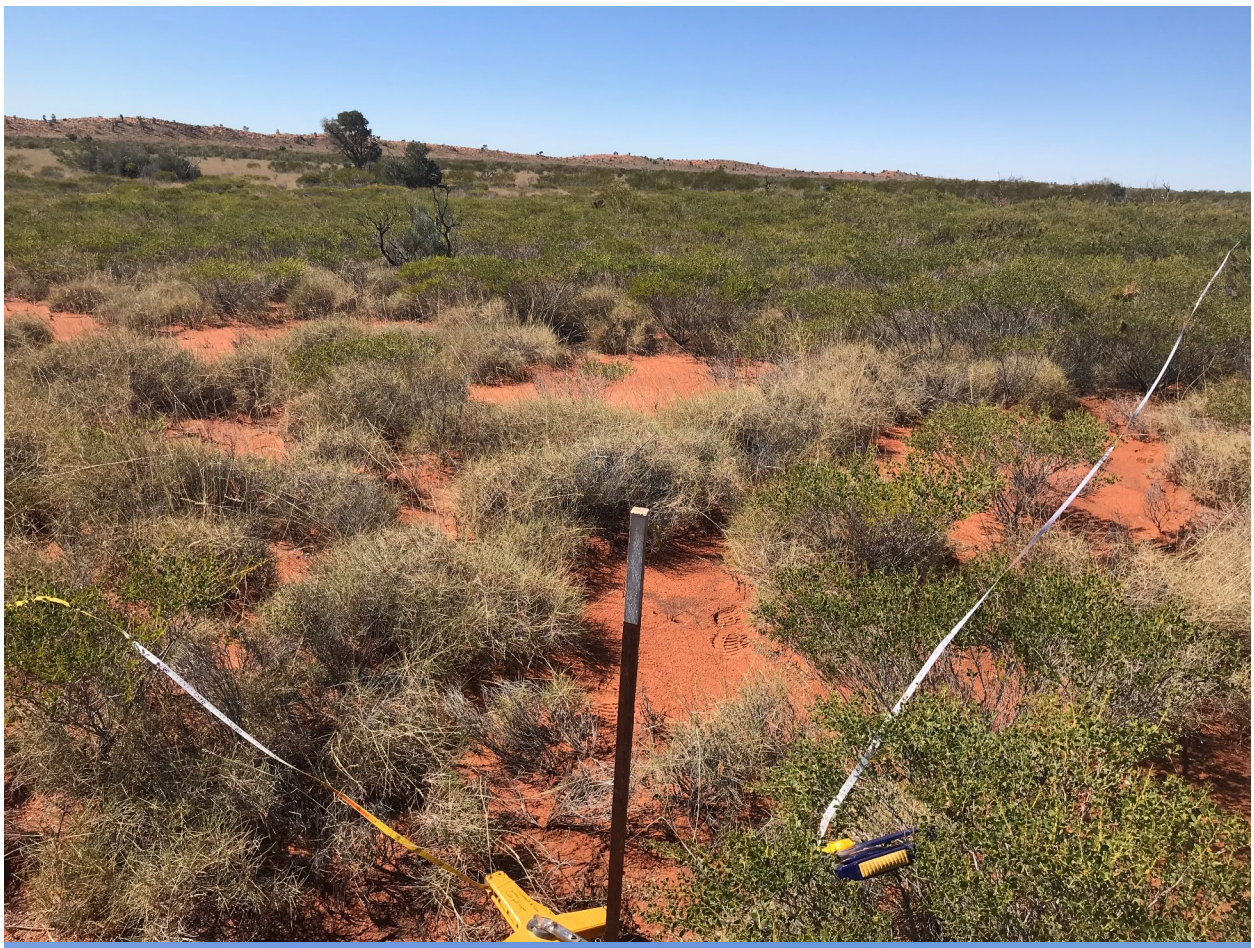
Name	Cover	Height
Acacia ancistrocarpa	20-25	1.5-2
Melaleuca lasiandra	+	2
Grevillea stenobotrya	+	1.5
Hakea lorea subsp. lorea	+	1.6
Exocarpos sparteus	out	2.4
Jacksonia aculeata	+	1.4
Scaevola parvifolia subsp. pilbarae	+	0.2
Indigofera boviperda subsp. eremaea	+	0.15
Eragrostis eriopoda	+	0.3
Ptilotus schwartzii var. schwartzii	+	0.4
Triodia basedowii	40	0.4-0.8
Goodenia triodiophila	+	0.2
Halgania solanacea var. solanacea	+	0.4
Ptilotus calostachyus	out	0.4
Eriachne aristidea	out	0.1
Tribulus hirsutus	out	0.1
Euphorbia myrtoides	out	0.05
Grevillea wickhamii subsp. aprica	out	1.5
Bonamia alatisemina	+	0.3
Ptilotus fusiformis	out	0.2

Cyprium - Nifty Copper Mine **Site** Q12
Date 22/06/2020 **Type** Q 30 x 70
MGA Zone 51K 352749**mE** 7605610**mN** 121.577033°**E** -21.646636°**S**
Habitat As-LS - *Acacia stellaticeps* Low Shrubland on mid-deep sand
Soil
Medium to deep red-brown sand with no coarse fragments or outcropping cover.
Veg Condition
Very Good to Excellent – Limited clearing on western boundary.
Comments

Evidence of fire within the last 15-20 years.

SPECIES LIST:

Name	Cover	Height
Grevillea wickhamii subsp. aprica	+	1.4
Melaleuca lasiandra	+	1
Hakea lorea subsp. lorea	+	1
Acacia sphaerostachya	+	1.2
Acacia stellaticeps	50	0.5
Scaevola parvifolia subsp. pilbarae	+	0.3
Triodia schinzii	+	0.5
Triodia basedowii	40	0.4-0.6
Indigofera boviperda subsp. eremaea	+	0.3
Cassytha filiformis	+	0.1
Goodenia azurea subsp. hesperia	out	0.2
Dicrastylis cordifolia	out	0.2



Cyprium - Nifty Copper Mine **Site** Q13
Date 23/06/2020 **Type** Q 35 x 65
MGA Zone 51K 352801**mE** 7605408**mN** 121.577528°**E** -21.648465**S**
Habitat Cc-SLT
- *Corymbia chippendalei* Scattered Low Trees on Sand dune

Soil
Deep soft red sand with no coarse fragments or outcropping cover.

Veg Condition
Excellent – Some weeds present within quadrat.

Comments

Evidence of fire within the last 15-20 years.

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	1-2	8-11
Clerodendrum floribundum var. ovatum	+	1.2
Acacia anaticeps	+	0.9
Sida sp. Western sand dunes (P.K. Latz11980)	+	0.5
Triodia schinzii	0	0.8-1.4
Triodia aff. lanigera	+	
Salsola australis	+	0.5
Eragrostis eriopoda	10	0.5
Dampiera cinerea (red flower form)	+	0.4
Dicrastylis doranii	1-2	0.5
Indigofera ammobia	+	0.35
Paranotis pterospora	+	0.1
Euphorbia wheeleri	+	0.01
Ptilotus arthrolasius	+	0.2
Grevillea stenobotrya	2	1.5-2
Eriachne aristidea	2-4	0.3
Aristida holathera var. holathera	2-4	0.4
Acacia melleodora	1	2
Crotalaria cunninghamii subsp. sturtii	+	0.8
Cucumis variabilis	+	3.5
Gyrostemon tepperi	+	1.6
Aerva javanica	+	0.7
Gompholobium simplicifolium	1	0.5
Aluta maisonneuvei subsp. maisonneuvei	1	1.2
Cullen martinii	+	0.4
Petalostylis cassioides	+	1.2
Yakirra australiensis var. australiensis	+	0.2
Cyanostegia cyanocalyx	+	0.6
Grevillea eriostachya	+	1
Cassytha filiformis	+	0.2
Corynotheca asperata	+	5

Cyprium - Nifty Copper Mine **Site** Q14
Date 22/06/2020 **Type** Q 80 x 20
MGA Zone 51K 3535117**mE** 7605498**mN** 121.580598°**E** -21.647679°**S**
Habitat Gs-S - *Grevillea stenobotrya* Shrubland on sand dune swale.
Soil
Deep sand, orange/red surface chocolate brown below; no outcropping cover or coarse fragments.
Veg Condition
Excellent
Comments

Evidence of fire within the last 15-20 years.

SPECIES LIST:

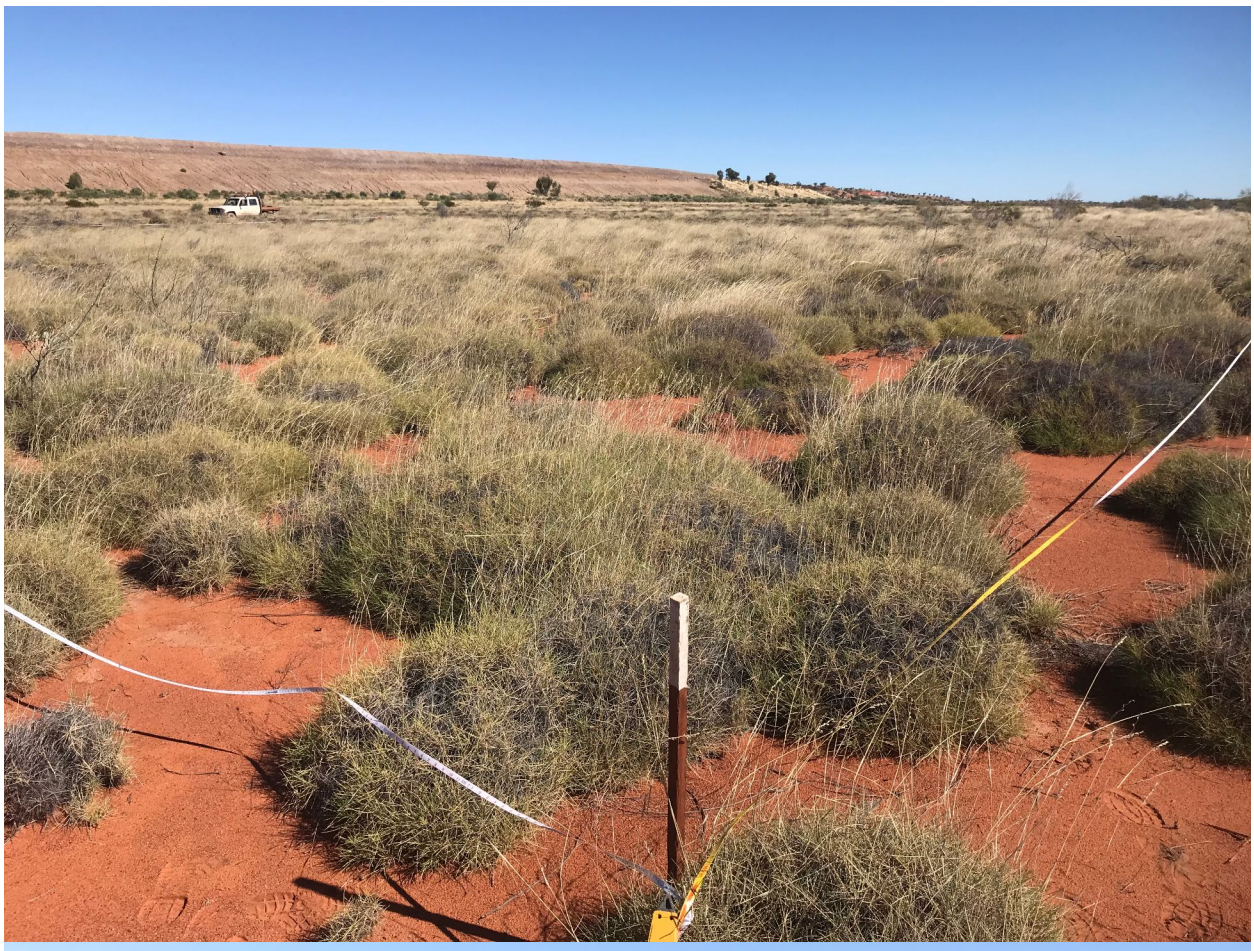
Name	Cover	Height
Corymbia chippendalei	+	2.5
Grevillea stenobotrya	50	1.5-2.4
Jacksonia aculeata	25	0.5-0.7
Triodia basedowii	5	0.5-0.7
Triodia aff. lanigera	25-30	0.5-1.5
Cassytha filiformis	10	0.5
Exocarpos sparteus	+	1.3
Pluchea ferdinandi-muelleri	+	0.5
Eriachne aristidea	+	0.2
Aristida holathera var. holathera	+	0.4
Salsola australis	+	0.7
Pluchea tetranthera	+	0.7
Dicrastylis cordifolia	+	0.4
Acacia melleodora	+	1-1.5
Dodonaea coriacea	+	1
Eragrostis eriopoda	+	0.4
Triodia schinzii	+	0.5-1.4
Aerva javanica	+	0.8
Tribulus hirsutus	+	0.1
Calytrix carinata	+	0.2
Grevillea wickhamii subsp. aprica	+	0.5
Scaevola parvifolia subsp. pilbarae	+	0.1
Acacia ancistrocarpa	out	3

Cyprium - Nifty Copper Mine **Site** Q15
Date 23/06/2020 **Type** Q 50 x 50
MGA Zone 51K 350866**mE** 7605371**mN** 121.587823°**E** -21.648887°**S**
Habitat Tb-HG - *Triodia basedowii* Mid-Dense Hummock Grassland on deep sand
Soil
Deep red sand with white clay transported from tailings; minor areas of lateritic lag gravel; no outcropping cover.
Veg Condition
Excellent
Comments

Evidence of fire within the last 15-20 years.

SPECIES LIST:

Name	Cover	Height
Hakea chordophylla	+	0.5
Grevillea wickhamii subsp. aprica	+	1
Grevillea stenobotrya	+	0.6
Triodia basedowii	50	0.4
Ptilotus exaltatus	+	0.5
Ptilotus calostachyus	+	0.6
Ptilotus axillaris	+	0.1
Eragrostis eriopoda	+	0.4
Aristida holathera var. holathera	+	0.5
Polygala isingii	+	0.05
Polycarpaea holtzei	+	0.05
Eriachne aristidea	+	0.35
Cassytha filiformis	3-4	0.5
Amphipogon caricinus var. caricinus	+	0.5
Cyperus sp.	+	0.4
Triodia schinzii	+	0.3-0.9
Salsola australis	+	0.4
Jacksonia aculeata	+	0.5
Tribulus macrocarpus	+	0.4



Cyprium - Nifty Copper Mine **Site** Q16
Date 23/06/2020 **Type** Q 50 x 50
MGA Zone 51K 353929**mE** 7605167**mN** 121.588404°**E** -21.650735°**S**
Habitat Tp-HG - *Triodia* aff. *lanigera* Mid-Dense Hummock Grassland on deep sand
Soil
Deep red sand with white clay washed over; no coarse fragments or outcropping
Veg Condition
Excellent
Comments
Clay transported from tailings dam washed across site.

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	+	2
Ptilotus exaltatus	+	0.7
Triodia aff. lanigera	45-50	0.6-1
Jacksonia aculeata	3-5	0.4-0.6
Eragrostis eriopoda	+	0.4
Eriachne aristidea	+	0.2
Triodia basedowii	+	0.5
Triodia schinzii	+	0.4-1
Cassytha filiformis	3-4	0.4
Aristida holathera var. holathera	+	0.3
Amphipogon sericeus	+	0.25
Grevillea wickhamii subsp. aprica	+	0.5
Cyperus sp.	+	0.6
Calytrix carinata	+	0.25
Salsola australis	+	0.3
Sida sp. Pindan (B.G.Thomson 3398)	+	0.6
Grevillea stenobotrya	1	1.2
Gompholobium simplicifolium	+	0.4
Ptilotus calostachyus	+	0.4

Cyprium - Nifty Copper Mine **Site** Q17
Date 14/06/2020 **Type** Q 50 x 50
MGA Zone 51K 354465**mE** 7605007**mN** 121.593569°**E** -21.652224°**S**
Habitat Aa-S - *Acacia ancistrocarpa* Open Shrubland on deep sand.
Soil
Deep red/brown sand; occasional surface crust of material transported from tailings damn; small lateritic lag gravel in patches and no outcropping cover.
Veg Condition
Very Good
Comments
Long unburnt

SPECIES LIST:

Name	Cover	Height
Hakea lorea subsp. lorea	+	1
Acacia ancistrocarpa	45	2.5-3.5
Grevillea stenobotrya	1	2.2-3.5
Triodia basedowii	55	0.4-0.8
Goodenia azurea subsp. hesperia	+	0.5
Cassytha filiformis	+	0.3
Bonamia alatisemina	+	0.2
Stackhousia sp. swollen gynophore (W.R. Barker 2041)	+	0.25
Aristida holathera var. holathera	1	0.5
Calytrix carinata	+	0.3
Halgania solanacea var. solanacea	+	0.35
Jacksonia aculeata	+	0
Grevillea eriostachya	+	1.5
Thysanotus sp. Desert East of Newman (R.P. Hart 964)	+	0.1
Acacia melleodora	+	1.3
Salsola australis	+	0.4
Grevillea wickhamii subsp. aprica	out	3

Cyprium - Nifty Copper Mine **Site** Q18
Date 23/06/2020 **Type** Q 30 x 70
MGA Zone 51K 354691**mE** 7604665**mN** 121.595732°**E** -21.655332°**S**
Habitat Tl-HG - *Triodia* aff. *lanigera* Mid-Dense Hummock Grassland on deep sand
Soil
Deep red brown sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 15-20 years.
Comments
Access tracks just outside of quadrat.

SPECIES LIST:

Name	Cover	Height
Acacia melleodora	+	1
Triodia aff. lanigera	35	0.4-0.8
Jacksonia aculeata	2-10	0.5-0.7
Dicrastylis cordifolia	+	0.4
Scaevola parvifolia subsp. pilbarae	+	0.2
Triodia basedowii	1-2	0.4-0.7
Calytrix carinata	1	0.5

Cyprium - Nifty Copper Mine **Site** Q19
Date 24/06/2020 **Type** Q 60 x 40
MGA Zone 51K 354289**mE** 7604185**mN** 121.591796°**E** -21.659634°**S**
Habitat Cc-SLT
- *Corymbia chippendalei* on Scattered Low Trees on sand dune.

Soil
Deep, soft red sand with no coarse fragments or outcropping cover.

Veg Condition
Excellent – Waste dump 50-100m to the west.

Comments
Long
unburnt

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	2	8-10
Grevillea stenobotrya	2	1.5-3
Gompholobium simplicifolium	2	0.5
Acacia tumida var. kulparn	+	0.6-1.2
Acacia anaticeps	1	0.5
Dampiera cinerea (red flower form)	+	0.5
Corynotheca asperata	3-5	0.3
Triodia schinzii	+	0.4-1.4
Aristida holathera var. holathera	1	0.5-0.6
Paractaenum refractum	+	0.5
Paranotis pterospora	+	0.1
Euphorbia wheeleri	+	0.15
Eriachne aristidea	1	0.4
Sida sp. Western sand dunes (P.K. Latz11980)	+	0.5
Cassytha filiformis	+	0.4
Stackhousia megaloptera	+	0.4
Newcastelia spodiotricha	+	0.6
Petalostylis cassioides	1	0.8
Cucumis variabilis	+	2
Grevillea eriostachya	+	0.5
Dicrastylis doranii	1	0.4-0.6
Calytrix carinata	+	0.3-1.2
Eragrostis eriopoda	+	0.4
Cyanostegia cyanocalyx	+	0.4-0.8
Triodia aff. lanigera	+	0.5
Ptilotus arthrolasius	+	0.2
Polygala isingii	+	0.1

Cyprium - Nifty Copper Mine **Site** Q20
Date 24/06/2020 **Type** Q 50 x 50
MGA Zone 51K 353535**mE** 7602333**mN** 121.584348°**E** -21.676300°**S**
Habitat Ml-OS
Melaleuca lasiandra Open Shrubland on deep sand.
Soil
Deep sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 3 years.
Comments

SPECIES LIST:

Name	Cover	Height
Melaleuca lasiandra	3	1.2-2.4
Grevillea eriostachya	1	1.8
Gompholobium polyzygum	1	1.1
Jacksonia aculeata	3	0.3-0.7
Amphipogon sericeus	3	0.3-0.5
Triodia basedowii	4	0.1-0.6
Dicrastylis cordifolia	2	0.15-0.3
Melaleuca lasiandra	1	0.4
Tephrosia arenicola	1	0.5-1
Eragrostis eriopoda	+	0.25
Scaevola parvifolia subsp. pilbarae	+	0.15-0.55
Dampiera candicans	+	0.3
Acacia ancistrocarpa	+	0.8
Ptilotus calostachyus	+	0.9
Polygala isingii	+	0.15
Halgania solanacea var. solanacea	+	0.4
Aristida holathera var. holathera	+	0.7
Bonamia alatisemina	+	0.05
Senna curvistyla	+	0.15
Goodenia armitiana	+	0.3
Cyperus sp.	+	0.4
Sida sp. Pindan (B.G.Thomson 3398)	+	0.2
Newcastelia cladotricha	+	0.3
Dampiera cinerea (purple flower form)	+	0.3
Gompholobium simplicifolium	+	0.15
Corymbia chippendalei	out	8
Melaleuca glomerata	out	0.6
Senna notabilis	out	0.5

Cyprium - Nifty Copper Mine **Site** Q21
Date 24/06/2020 **Type** Q 50 x 50
MGA Zone 51K 353034**mE** 7602376**mN** 121.579511°**E** -21.675870**S**
Habitat Tb-HG - *Triodia basedowii* (burnt) Open Hummock Grassland on sandplain
Soil
Medium-deep sand with occasional (<2%) lateritic gravel (2-60mm); no outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 3 years.
Comments

SPECIES LIST:

Name	Cover	Height
Hakea lorea subsp. lorea	+	1.5
Grevillea wickhamii subsp. aprica	+	1.4
Ptilotus calostachyus	+	0.7
Tephrosia arenicola	1	0.7
Dicrastylis cordifolia	2	0.4
Halgania solanacea var. solanacea	+	0.4
Bonamia alatisemina	+	0.05
Dampiera candicans	4	0.4
Amphipogon caricinus var. caricinus	4	0.5
Triodia basedowii	8	
Goodenia azurea subsp. hesperia	1	0.3
Tribulus macrocarpus	+	0.05
Senna curvistyla	+	0.35
Cassytha filiformis	+	0.3
Indigofera boviperda subsp. eremaea	+	0.4
Eragrostis eriopoda	+	0.4
Sida sp. Pindan (B.G.Thomson 3398)	+	0.3
Jacksonia aculeata	+	0.5
Leptosema chambersii	+	0.5
Stackhousia sp. swollen gynophore (W.R. Barker 2041)	+	0.4
Polygala isingii	+	0.1
Ptilotus schwartzii var. schwartzii	+	0.5
Abildgaardia oxystachya	+	0.3
Goodenia armitiana	+	0.1
Newcastelia cladotricha	+	
Waltheria virgata	+	0.4

Cyprium - Nifty Copper Mine **Site** Q22
Date 24/06/2020 **Type** Q 60 x 40
MGA Zone 51K 352997**mE** 7602731**mN** 121.579175°**E** -21.672660°**S**
Habitat Tl-HG - *Triodia* aff. *lanigera* Mid-Dense Hummock Grassland on deep sand
Soil
Deep soft red sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 20 years.
Comments
Camel tracks observed within quadrat.

SPECIES LIST:

Name	Cover	Height
Grevillea eriostachya	+	1.2
Triodia aff. lanigera	45-50	
Triodia schinzii	+	0.4-1.2
Dicrastylis doranii	+	0.25
Calytrix carinata	1	0.5
Jacksonia aculeata	+	0.6
Dicrastylis cordifolia	1	0.4
Triodia basedowii	+	0.5-0.6
Gompholobium simplicifolium	+	0.4
Petalostylis cassioides	+	0.6
Polygala isingii	+	0.1
Amphipogon sericeus	+	0.4
Halgania solanacea var. solanacea	+	
Goodenia triodiophila	+	0.3
Gyrostemon tepperi	+	0.4
Tephrosia arenicola	+	0.4
Acacia melleodora	+	0.6

Cyprium - Nifty Copper Mine **Site** Q23
Date 25/06/2020 **Type** Q 40 x 60
MGA Zone 51K 353025**mE** 760295**mN** 121.579399°**E** -21.678407°**S**
Habitat Cc-SLT
- *Corymbia chippendalei* on Scattered Low Trees on sand dune.

Soil
Deep soft red sand with no coarse fragments or outcropping cover.

Veg Condition
Excellent – Evidence of fire within the last 3 years.

Comments
Camel tracks present within quadrat.

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	2	8-11
Acacia tumida var. kulparn	+	2-3
Gyrostemon tepperi	1	2
Acacia jensenii	+	1.6
Gompholobium simplicifolium	+	0.4
Ptilotus arthrolasius	+	0.4
Euphorbia wheeleri	+	0.3
Aristida holathera var. holathera	+	0.5
Paractaenum refractum	+	0.6
Eriachne aristidea	+	0.4
Sida sp. Western sand dunes (P.K. Latz11980)	+	1.2
Newcastelia spodiotricha	5	1
Swainsona microphylla	+	0.5-1.2
Paranotis pterospora	+	0.3
Eriachne helmsii	+	0.5
Dampiera cinerea (red flower form)	1	0.5
Eragrostis eriopoda	8-10	0.4
Grevillea stenobotrya	+	0.5
Stackhousia megaloptera	+	0.5
Dicrastylis doranii	1-2	0.3
Triodia schinzii	2	0.1-1
Yakirra australiensis var. australiensis	+	0.15
Cyanostegia cyanocalyx	out	0.4

Cyprium - Nifty Copper Mine **Site** Q24
Date 26/06/2020 **Type** Q 20 x 80
MGA Zone 51K 351358**mE** 7603494**mN** 121.563425°**E** -21.665633°**S**
Habitat Aa-S -
Acacia ancistrocarpa Shrubland on dune swale.
Soil
Deep red brown sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent
Comments
Long
unburnt – very large *Triodia* ring growth

SPECIES LIST:

Name	Cover	Height
Corymbia opaca	out	5-6
Acacia ancistrocarpa	15-20	1.7-3.5
Eucalyptus kingsmillii	1	3-4
Triodia basedowii	15-50	0.4-0.6
Jacksonia aculeata	+	0.4
Dicrastylis cordifolia	+	0.25-0.5
Dodonaea coriacea	+	0.7
Gompholobium polyzygum	+	0.5
Halgania solanacea var. solanacea	+	0.3
Bonamia alatisemina	+	0.2
Goodenia hartiana	+	0.4
Triodia schinzii	+	0.5
Scaevola parvifolia subsp. pilbarae	1	0.2
Eragrostis eriopoda	+	0.3
Euphorbia myrtoides	+	
Cucumis variabilis	out	
Eriachne aristidea	+	0.2
Calytrix carinata	+	0.4
Yakirra australiensis var. australiensis	+	0.4
Ptilotus calostachyus	out	0.6
Corchorus sidoides subsp. sidoides	+	0.3
Sida sp. Pindan (B.G.Thomson 3398)	+	0.25
Hibiscus brachychlaenus	out	0.3
Cassytha filiformis	+	0.3
Grevillea eriostachya	out	3
Goodenia triodiophila	+	0.2

Cyprium - Nifty Copper Mine **Site** Q25
Date 26/06/2020 **Type** Q 30 x 70
MGA Zone 51K 351669**mE** 7603356**mN** 121.566417°**E** -21.666905°**S**
Habitat As-LS - *Acacia stellaticeps* Open Low Shrubland on deep sand.
Soil
Deep red brown sand with no coarse fragments or outcropping cover.
Veg Condition
Very Good – Clearing for powerline adjacent to quadrat.
Comments
Long unburnt. Many dead Acacia stellaticeps within quadrat with many juvenile plants.

SPECIES LIST:

Name	Cover	Height
Acacia ancistrocarpa	+	3.8
Acacia stellaticeps	3-4	1-1.2
Triodia aff. lanigera	1-2	0.6
Triodia basedowii	43	0.4-0.7
Dicrastylis cordifolia	+	0.4
Goodenia triodiophila	+	0.3
Scaevola parvifolia subsp. pilbarae	+	0.4
Jacksonia aculeata	+	0.4
Hakea chordophylla	+	1.7
Halgania solanacea var. solanacea	+	0.25
Grevillea eriostachya	+	
Hakea lorea subsp. lorea	+	1.7
Amphipogon sericeus	+	0.3
Bonamia alatisemina	+	0.05
Calytrix carinata	+	0.65
Cassytha filiformis	+	0.3
Androcalva loxophylla	out	0.5
Polygala isingii	+	0.1
Acacia stellaticeps	+	0.1
Aristida holathera var. holathera	+	0.5
Triodia schinzii	+	0.2
Eriachne aristidea	+	0.1
Eragrostis eriopoda	out	0.4
Gyrostemon tepperi	out	0.6

Cyprium - Nifty Copper Mine **Site** Q26
Date 27/06/2020 **Type** Q 50 x 50
MGA Zone 51K 349573**mE** 7603964**mN** 121.546210°**E** -21.661237°**S**
Habitat Mg-S - *Melaleuca glomerata* Open Low Shrubland on sand.
Soil
Red brown sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Some clearing from track to north of quadrat.
Comments

Evidence of fire within the last 3-5 years.

SPECIES LIST:

Name	Cover	Height
Melaleuca lasiandra	1	1.8
Melaleuca glomerata	9-10	1.5
Triodia basedowii	12-14	0.4-0.6
Acacia stellaticeps	2-3	0.2
Scaevola parvifolia subsp. pilbarae	1	0.2
Eragrostis eriopoda	+	0.3
Jacksonia aculeata	+	0.3
Goodenia azurea subsp. hesperia	+	0.5
Senna notabilis	+	0.4
Ptilotus schwartzii var. schwartzii	+	0.5
Grevillea wickhamii subsp. aprica	+	0.5
Ptilotus axillaris	+	0.05
Ptilotus calostachyus	+	0.7
Goodenia armitiana	+	0.3
Stylobasium spathulatum	1	1.2
Eriachne aristidea	+	0.2
Yakirra australiensis var. australiensis	+	0.15
Newcastelia cladotricha	+	0.3
Grevillea stenobotrya	+	0.4
Dampiera candicans	+	0.3
Ptilotus polystachyus	+	0.4
Tribulus hirsutus	+	0.1
Calytrix carinata	+	0.4
Goodenia cusackiana	+	0.3
Goodenia triodiophila	+	0.4
Eriachne helmsii	+	0.6
Sida sp. Rabbit Flat (B.J. Carter 626)	+	0.3
Aristida holathera var. holathera	+	0.6
Sida sp. Rabbit Flat (B.J. Carter 626)	+	0.4
Ptilotus arthrolasius	+	0.3
Acacia melleodora	+	0.2
Euphorbia wheeleri	+	0.15
Dampiera cinerea (purple flower form)	+	0.15
Dicrastylis cordifolia	+	0.1
Polygala isingii	+	0.15

Cyprium - Nifty Copper Mine **Site** Q27
Date 29/06/2020 **Type** Q 30 x 70
MGA Zone 51K 350851**mE** 7603764**mN** 121.558550°**E** -21.663152°**S**
Habitat Am-LS
- *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland on deep sand
Soil
Deep soft red sand with no coarse fragments or outcropping cover
Veg Condition
Excellent - Quadrat in close proximity to sand dune and disturbance from powerline track.
Comments
Long unburnt.

SPECIES LIST:

Name	Cover	Height
Corymbia chippendalei	out	5
Grevillea stenobotrya	+	1.8
Grevillea eriostachya	+	1.8
Acacia melleodora	1	1.7
Thinicola incana	+	1.7
Aluta maisonneuvei subsp. maisonneuvei	16	1-1.5
Gompholobium simplicifolium	+	0.5
Calytrix carinata	1	0.5
Eriachne helmsii	1	0.5
Triodia aff. lanigera	40	1.4-1.1
Triodia schinzii	+	0.5-1
Triodia basedowii	+	0.4-0.6
Scaevola parvifolia subsp. pilbarae	+	0.2
Dicrastylis cordifolia	+	0.2
Polygala isingii	+	0.1
Gyrostemon tepperi	+	0.98
Dicrastylis doranii	+	0.3
Dampiera cinerea (red flower form)	+	0.4
Halgania solanacea var. solanacea	+	0.3
Afrohybanthus aurantiacus	+	0.2
Goodenia triodiophila	+	0.3
Jacksonia aculeata	out	0.3
Acacia stellaticeps	out	0.3
Grevillea wickhamii subsp. aprica	out	0.5

Cyprium - Nifty Copper Mine **Site** Q28
Date 29/06/2020 **Type** Q 15 x 85
MGA Zone 51K 355425**mE** 7602154**mN** 121.602596°**E** -21.678071°**S**
Habitat Ah-LS - *Acacia hilliana* Low Shrubland on stony flat.
Soil
Silty loam with discontinuous (20-50%) quarzitic / basaltic platy lag gravel (40-50mm) over outcropping platy weathered basalt.
Veg Condition
Excellent – clearing for access tracks both within and surround the quadrat.
Comments
Long unburnt

SPECIES LIST:

Name	Cover	Height
Corymbia opaca	+	2
Senna sericea	+	1
Triodia basedowii	40	0.4-1.2
Acacia hilliana	50-60	0.6
Sida sp. Pilbara (A.A Mitchell PRP 1543)	+	
Goodenia azurea subsp. hesperia	+	0.3
Eriachne aristidea	+	
Dodonaea coriacea	+	0.65
Euphorbia myrtoides	+	0.1
Indigofera boviperda subsp. eremaea	+	0.3
Ptilotus calostachyus	+	0.7
Calytrix carinata	+	0.6
Acacia ancistrocarpa	+	1
Aristida holathera var. holathera	+	0.3
Senna notabilis	out	0.2
Sida arenicola	out	0.4
Grevillea wickhamii subsp. aprica	out	1.8
Hakea lorea subsp. lorea	+	1

Cyprium - Nifty Copper Mine **Site** Q29
Date 29/06/2020 **Type** Q 50 x 50
MGA Zone 51K 353127**mE** 7601819**mN** 121.580350°**E** -21.680908°**S**
Habitat Ml-OS – *Melaleuca lasiandra* Open Shrubland on sandplain
Soil
Deep firm red brown sand, with occasional patches of quartz/granite lag gravel (50mm); no outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 3-5 years.
Comments

SPECIES LIST:

Name	Cover	Height
Melaleuca lasiandra	8-10	1.4
Acacia ancistrocarpa	+	1.8
Sida arenicola	+	2
Melaleuca lasiandra	1-2	0.4-0.6
Jacksonia aculeata	1	0.7
Dampiera candicans	8	0.4
Triodia basedowii	3-4	0.5
Triodia aff. lanigera	+	0.6
Jacksonia aculeata	+	0.4-1.3
Amphipogon caricinus var. caricinus	+	0.3
Eriachne aristidea	+	0.4
Goodenia armitiana	2	0.4
Goodenia azurea subsp. hesperia	1	0.4
Newcastelia cladotricha	+	0.4
Grevillea stenobotrya	+	
Aristida holathera var. holathera	+	
Cyperus sp.	+	0.6
Abildgaardia oxystachya	+	0.3
Senna notabilis	+	
Halgania solanacea var. solanacea	+	0.4
Paranotis pterospora	+	0.1
Eragrostis eriopoda	1	0.4
Ptilotus fusiformis	+	0.4
Dicrastylis cordifolia	1	0.3
Hakea lorea subsp. lorea	+	1
Senna notabilis	+	0.5
Ptilotus calostachyus	+	0.4
Polygala isingii	+	0.1
Indigofera boviperda subsp. eremaea	+	0.2
Gyrostemon tepperi	+	0.6
Sida sp. Pindan (B.G.Thomson 3398)	+	0.3
Acacia ancistrocarpa	+	0.2
Amphipogon sericeus	+	0.5
Goodenia stobbsiana	+	

Cyprium - Nifty Copper Mine **Site** Q30
Date 29/06/2020 **Type** Q 30 x 70
MGA Zone 51K 352279**mE** 7602120**mN** 121.572182°**E** -21.678119°**S**
Habitat Gs-S -
Grevillea stenobotrya Open Shrubland on sand dune base.
Soil
Deep creamy red sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 10-15 years.

SPECIES LIST:

Name	Cover	Height
Corymbia opaca	+	2
Grevillea wickhamii subsp. aprica	1	2
Grevillea stenobotrya	5	1-2
Gyrostemon tepperi	+	2
Triodia aff. lanigera	40	0.4-0.7
Triodia schinzii	+	0.4-1
Dicrastylis doranii	+	0.3
Aluta maisonneuvei subsp. maisonneuvei	1	0.3
Acacia melleodora	+	0.5-1.2
Jacksonia aculeata	+	0.5
Gompholobium simplicifolium	+	0.5
Dampiera cinerea (red flower form)	+	0.5
Grevillea eriostachya	+	0.4
Ptilotus arthrolasius	+	0.3
Eragrostis eriopoda	+	0.4
Acacia melleodora	+	0.5
Cyanostegia cyanocalyx	+	0.5
Dicrastylis cordifolia	+	0.3
Calytrix carinata	+	

Cyprium - Nifty Copper Mine **Site** Q31
Date 30/06/2020 **Type** Q 50 x 50
MGA Zone 51K 346385**mE** 7607327**mN** 121.516685°**E** -21.630599°**S**
Habitat Mg-S - *Melaleuca glomerata* Low Shrubland on sand plain
Soil
Sand with isolated patches of rounded lateritic lag gravel. No outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 5 years.
Comments

SPECIES LIST:

Name	Cover	Height
Melaleuca glomerata	25-30	1.5-1.8
Pluchea ferdinandi-muelleri	+	0.6
Pluchea tetranthera	out	0.5
Polygala isingii	+	0.03
Grevillea eriostachya	+	1
Tribulus hirsutus	+	0.1
Newcastelia cladotricha	+	0.2
Heliotropium diversifolium	+	0.2
Ptilotus polystachyus	+	0.6
Grevillea wickhamii subsp. aprica	+	0.6
Acacia melleodora	+	0.1
Paranotis pterospora	+	0.25
Ptilotus axillaris	+	0.5
Senna notabilis	+	0.5
Sida arenicola	1	0.4
Acacia stellaticeps	+	0.2
Eriachne aristidea	+	0.2
Goodenia armitiana	+	0.25
Scaevola parvifolia subsp. pilbarae	+	0.15
Ptilotus calostachyus	+	0.6
Corchorus sidoides subsp. sidoides	+	0.2
Dampiera candicans	+	0.15
Eragrostis eriopoda	10-15	
Triodia basedowii	5	0.2
Dodonaea coriacea	+	0.6
Aristida holathera var. holathera	+	0.2
Goodenia triodiophila	+	0.15

Cyprium - Nifty Copper Mine **Site** Q32
Date 30/06/2020 **Type** Q 30 x 70
MGA Zone 51K 347353**mE** 7607560**mN** 121.525091°**E** -21.628569°**S**
Habitat Am-LS
- *Aluta maisonneuvei* subsp. *maisonneuvei* Low Shrubland on dune swale.

Soil
Deep red sand with no coarse fragments or outcropping cover.

Veg Condition
Excellent – No evidence of fire.

Comments

SPECIES LIST:

Name	Cover	Height
Grevillea stenobotrya	1	1.8-3.5
Aluta maisonneuvei subsp. maisonneuvei	+	2.2
Aluta maisonneuvei subsp. maisonneuvei	25	1-1.8
Triodia aff. lanigera	15-20	0.4-1
Triodia schinzii	+	0.4-1.2
Dicrastylis doranii	+	0.3
Gyrostemon tepperi	+	0.6
Scaevola parvifolia subsp. pilbarae	1	0.2
Newcastelia cladotricha	+	0.15
Gompholobium simplicifolium	+	0.35
Acacia melleodora	+	0.7
Eragrostis eriopoda	1	0.4
Calytrix carinata	+	0.5
Ptilotus arthrolasius	+	0.3
Heliotropium transforme	+	0.25
Grevillea eriostachya	+	1.5
Polygala isingii	+	0.1
Petalostylis cassioides	+	0.6
Cassytha filiformis	+	0.3
Solanum gilesii	+	0.5
Cyanostegia cyanocalyx	out	0.5

Cyprium - Nifty Copper Mine **Site** Q33
Date 30/06/2020 **Type** Q 50 x 50
MGA Zone 51K 350200**mE** 7607505**mN** 121.552587°**E** -21.629308°**S**
Habitat As-LS -
Acacia stellaticeps Low Shrubland on sand.
Soil
Fine silty red sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 15 years.
Comments

SPECIES LIST:

Name	Cover	Height
Eucalyptus odontocarpa	+	2
Hakea lorea subsp. lorea	+	1.8
Stylobasium spathulatum	+	0.7
Exocarpos sparteus	+	1.7
Acacia ancistrocarpa	+	1.7
Acacia stellaticeps	25-30	0.6
Triodia basedowii	30-40	0.4-0.6
Acacia sericophylla	+	0.5
Solanum centrale	+	
Ptilotus schwartzii var. schwartzii	+	0.6
Acacia sphaerostachya	+	0.5
Scaevola parvifolia subsp. pilbarae	+	0.15
Amphipogon sericeus	+	0.2
Jacksonia aculeata	+	0.5
Grevillea eriostachya	out	2
Halgania solanacea var. solanacea	+	0.3

Cyprium - Nifty Copper Mine **Site** Q34
Date 30/06/2020 **Type** Q 50 x 50
MGA Zone 51K 354287**mE** 7604391**mN** 121.591795°**E** -21.657773°**S**
Habitat Ta-LS -
Tecticornia auriculata Low Shrubland on claypan
Soil
Fine silty light clay with patches of white material. No coarse fragment or outcropping cover
Veg Condition
Excellent
Comments

SPECIES LIST:

Name	Cover	Height
Tecticornia auriculata	65-70	0.3-0.5
Ptilotus exaltatus	+	0.5
Stemodia grossa	+	0.6
Gomphrena affinis subsp. pilbarensis	+	0.2
Eragrostis falcata	+	0.1
Trianthema triquetrum	+	0.01

Cyprium - Nifty Copper Mine **Site** Q35
Date 1/07/2020 **Type** Q 30 x 70
MGA Zone 51K 347357**mE** 7605515**mN** 121.524942°**E** -21.647040°**S**
Habitat Gs-S -
Grevillea stenobotrya Shrubland on deep sand.
Soil
Deep red sand with no coarse fragments or outcropping cover.
Veg Condition
Excellent – Evidence of fire within the last 10-15 years.
Comments

SPECIES LIST:

Name	Cover	Height
Grevillea stenobotrya	12-15	2-3.5
Hakea lorea subsp. lorea	+	3
Acacia eriopoda	1	1.8
Acacia stellaticeps	2	
Acacia melleodora	2-3	
Dicrastylis doranii	44228	
Triodia aff. lanigera	50	0.4-0.6
Aluta maisonneuvei subsp. maisonneuvei	+	0.3
Jacksonia aculeata	+	0.5
Scaevola parvifolia subsp. pilbarae	+	0.2
Petalostylis cassioides	+	0.7
Calytrix carinata	1	0.4
Gyrostemon tepperi	+	1
Stylobasium spathulatum	+	0.7
Cassytha filiformis	+	0.2

Appendix 10. GPS Tracklogs

344000 346000 348000 350000 352000 354000 356000

7608000 7606000 7604000 7602000 7600000

Image Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area
- Survey Tracklog

N

0 400 800m

Scale: 1:40,000
MGA94 (Zone 51)

CAD Ref: a2819_F011

Date: Jul 2021 | Rev: A | A3

Western Botanical

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