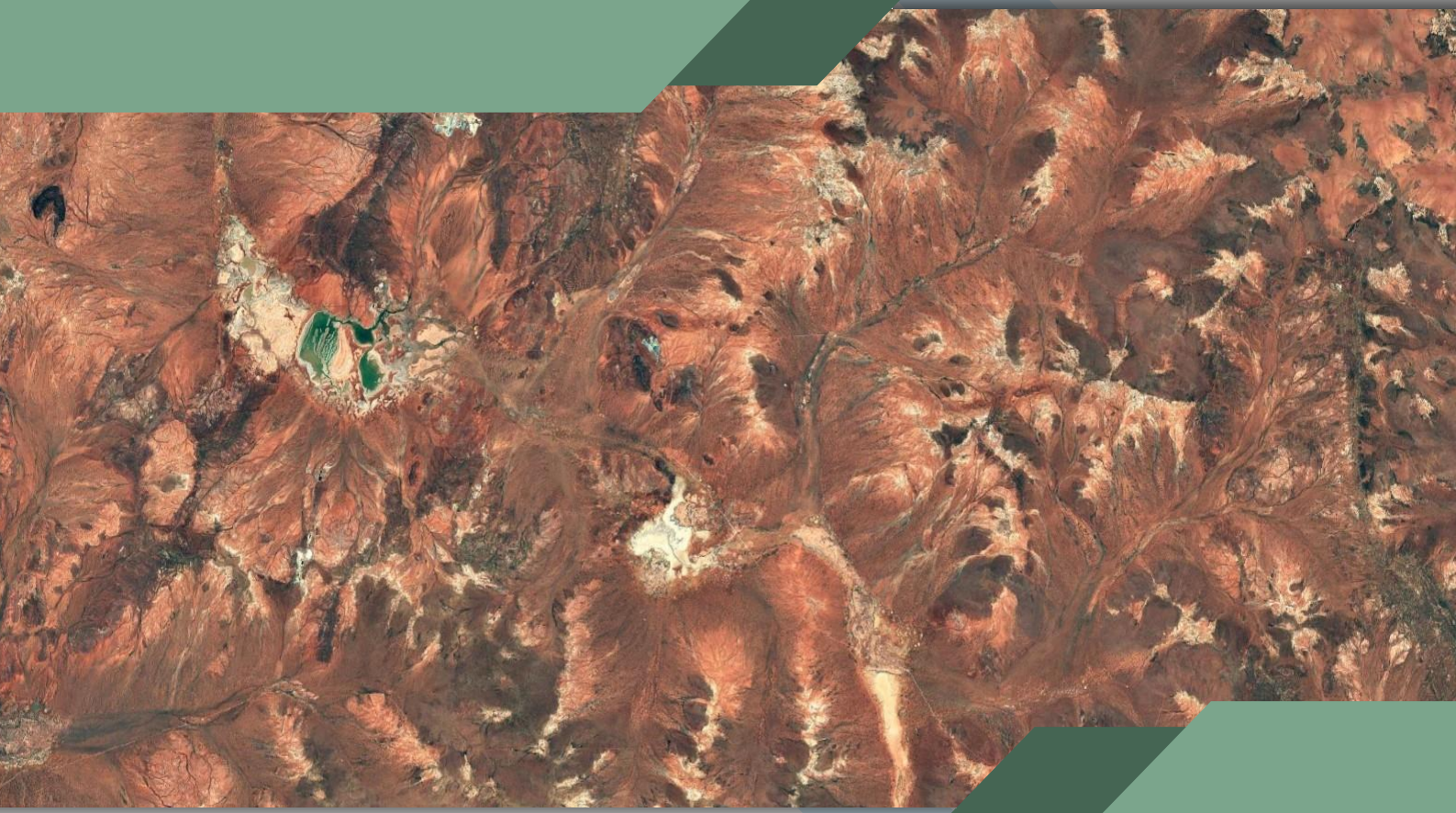
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NATIVE VEGETATION CLEARING PERMIT – SUPPORTING DOCUMENT

TUMBLEGUM SOUTH PROJECT

11 JULY 2025

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DOCUMENT CONTROL

Document Title	Tumblegum South Project – Native Vegetation Clearing Permit Supporting Document		
Document Number	RWA-TMG-VCP-01		
Revision Number	0		11/07/2025
Status	FINAL		
Author	Penjor Wangdi / Aimee Smithers Environmental Consultant Preston Consulting Pty Ltd		11/07/2025
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Authorised	Ashley Jones Managing Director Star Minerals Ltd		11/07/2025

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1 INTRODUCTION

Star Minerals Limited (Star Minerals) is seeking to develop the Tumblegum South Project (Project), an open pit gold mine located approximately 40 kilometres (km) south-southeast of Meekatharra in the Murchison bioregion of Western Australia (WA) (Figure 1). The Project is proposed to occur within two tenements (M 51/888 and L 51/112) held by White Star Minerals Pty Ltd, a wholly-owned subsidiary of Star Minerals.

1.1 PROJECT BACKGROUND

M 51/888 is situated directly along strike from the Tumblegum Pit, previously mined by Dominion during the 1987–1992 Gabanintha Gold Mine Joint Venture. Star Minerals' current focus is on gold, but there is also significant copper potential on the lease (Star Minerals, 2023).

The Project will include construction of haul roads and two open pits targeting the Tumblegum South gold deposit with an inferred resource of 600 kilotonnes at a grade of 2.2 grams of gold per tonne.

On behalf of Star Minerals, ResourcesWA Ltd commissioned Preston Consulting Pty Ltd (Preston Consulting) to prepare a Native Vegetation Clearing Permit (NVCP) application to allow the clearing of native vegetation required to develop the Project. The NVCP application and supporting document have been prepared in accordance with relevant Western Australian legislation and guidance, including:

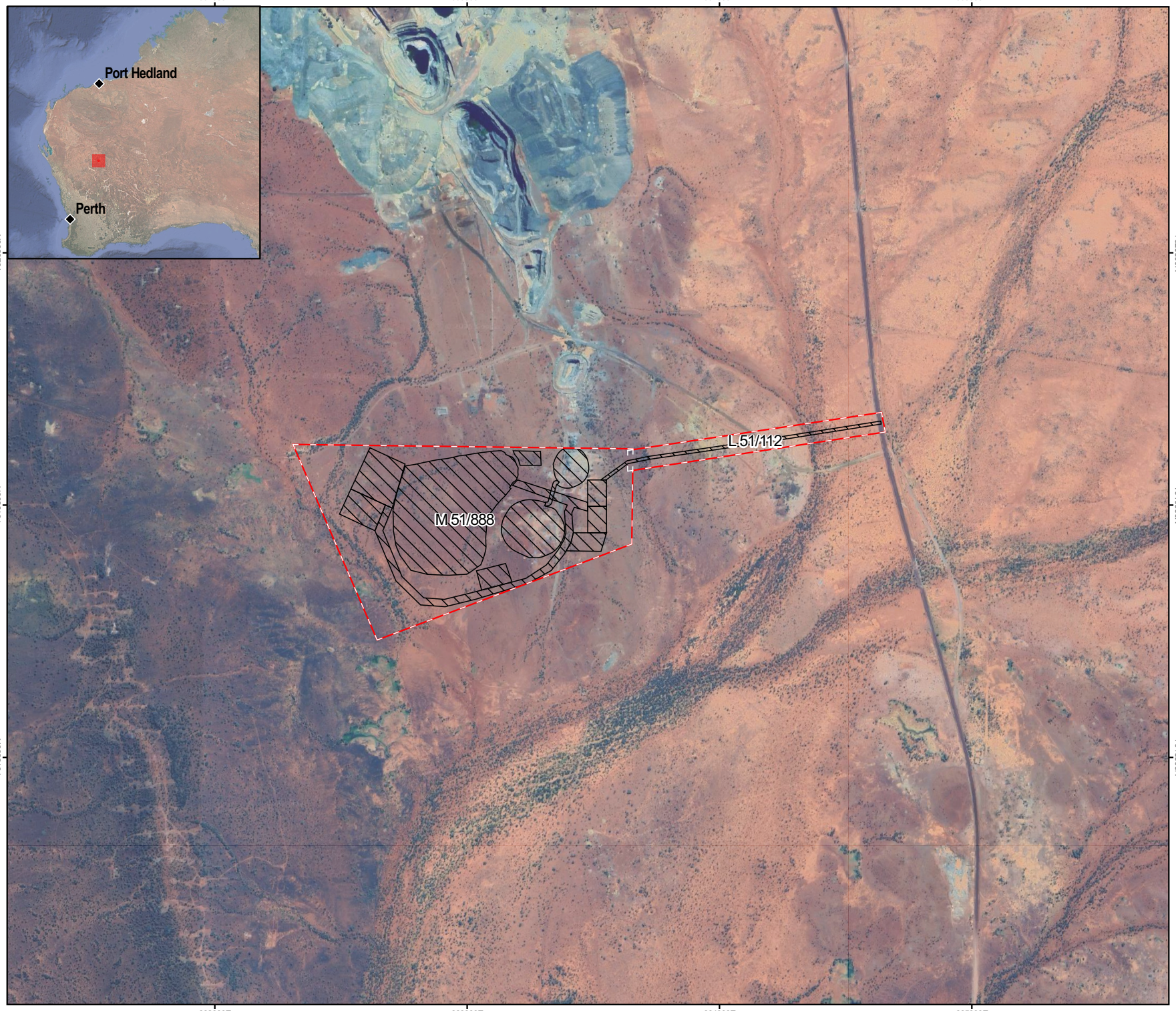
- *Environmental Protection Act 1986* (WA) (EP Act); and
- Native Vegetation Clearing Permit Procedure (2021, updated November 2024).

The Project will require up to 45 hectares (ha) of disturbance within a 79 ha Permit Area as outlined in Figure 1. The proposed Permit Area is the outer boundary of two *Mining Act 1978* tenements; M 51/888 and L 51/112.

1.2 PURPOSE

The purpose of this NVCP application is to seek approval under the EP Act (Part V Division 2) to clear up to 45 ha of native vegetation within the Permit Area shown in Figure 1 to enable the development of the Project. The clearing is necessary to develop an open pit gold mine, Waste Rock Landform, Run of Mine pad and topsoil stockpile, internal haul road, temporary construction compound including site office and amenities, vehicle and plant parking and laydown area.

The clearing is planned to commence in Q1 2026 and be completed in mid-2026.



Legend

- Permit Area
- Indicative Site Layout
- Mining Tenements (DMIRS-003)

Imagery: Google Satellite

N

0 0.3 0.6 km

GDA2020 / MGA zone 50

1:20,000

Project: RWA_TMG_001
Date: 04/07/2025
Size: A4
Author: ASmithers (Preston Consulting Pty Ltd)

Figure 1: Permit Area

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2 PERMIT AREA AND PROPOSED ACTIVITIES

A Purpose Permit is requested for the Permit Area to provide flexibility of area to be cleared for mining activities and associated infrastructure during construction and operation. Ecological surveys have been undertaken over the Permit Area as part of the suite of surveys undertaken for the environmental impact assessment of the Gabanintha Vanadium Project, and as summarised and reviewed in a desktop review conducted by Preston Consulting (2025), of which relevant information has been provided in Section 3.

2.1 BOUNDARY

Clearing is to be conducted within the boundaries of the Permit Area as shown in Figure 1. Key environmental values were identified in the baseline studies as outlined in Section 4.

2.2 TENURE AND LAND ACCESS

The Permit Area lies within M 51/888 and L 51/112 held by White Star Minerals Pty Ltd. The majority of the Permit Area falls in a "C" Class common reserve (R 10597), with the southwestern edge falling within a "C" Class Racecourse Reserve area (R 5847). Access to the Permit Area will be via the Meekatharra Sandstone Road.

2.3 NATIVE TITLE

All vegetation disturbance associated with the Project will occur within the Yugunga-Nya People Part A Native Title Determination Area (WAD 29/2019).

2.4 PROPOSED ACTIVITIES

Clearing of 45 ha of native vegetation is required to facilitate the construction of the Project. Vegetation will be cleared mechanically, and topsoil will be stockpiled for later rehabilitation. The main indicative infrastructure includes:

- Two open mine pits;
- Waste rock landform;
- Topsoil stockpiles;
- Run-of-mine stockpile pad;
- Internal haul roads; and
- Workstation and offices, vehicle parking and laydown area.

3 ENVIRONMENTAL CHARACTERISTICS

Environmental characteristics of the Permit Area relevant to this NVCP are detailed in the following sections. The Permit Area and Study Area are identical and outlined in Figure 1.

3.1 SURVEY DETAILS

Preston Consulting conducted a desktop study of flora, vegetation, and terrestrial fauna (Preston Consulting, 2025a) within the Study Area. Desktop searches of several biological databases were undertaken to identify and prepare lists of significant flora, vegetation, terrestrial fauna, and subterranean fauna that may occur within the Study Area. Desktop searches were conducted within a 50 km radius of the Study Area to provide a regional context for flora, fauna, and subterranean fauna.

In preparation for this Assessment, data from suitable databases were sourced in order to examine and identify the potential ecological values present within the Study Area (Preston Consulting, 2025a, b). Databases used include:

- Atlas of Living Australia (ALA; 2025);
- Birdlife Bird Search (Birdlife Australia, 2025);
- BOM Climate Statistics (BOM, 2025);
- Department of Biodiversity, Conservation and Attractions (DBCA) Threatened species and communities database searches;
- Department of Primary Industries and Resource Development Natural Resource Information (WA) (2021);
- EPBC Act Protected Matters Search Tool (PMST; Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2025a);
- Feral Scan (Invasive Animals Ltd, 2025);
- Florabase (DBCA, 2025); and
- Species Profile and Threats Database (DCCEEW, 2025b).

A significant portion of data was sourced from historical surveys that took place over the Permit Area, specifically for the Gabanintha Vanadium and Australian Vanadium Project tenements. This includes flora and vegetation surveys conducted by Biologic Environmental Survey Pty Ltd (Biologic, 2015a) and Onshore Environmental Consultants Pty Ltd (Onshore, 2019) and terrestrial fauna surveys by Biologic (2015b, 2020). These surveys, although not focused solely on the Study Area, provide relevant information about the Study Area and the surrounding landscape.

3.2 BIOGEOGRAPHIC REGIONS

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies Australia's landscapes into large 'bioregions' and 'subregions' based on climate, geology, landform, native vegetation, and species information (Department of the Environment and Energy, 2016).

The Project is located entirely within the Eastern Murchison subregion (MUR01) of the Murchison bioregion. This bioregion is characterised by extensive elevated red-brown desert sandplains that contain breakaway complexes and have undergone minimal dune development. Hydrology is

comprised of internal occluded paleo drainage that presents as extensive Salt Lake systems, which are replenished with rainfall (200 mm) that occurs mainly in winter due to the arid climate (Cowan, 2001). Vegetation within the Eastern Murchison subregion is predominantly Mulga woodlands with low lying ephemerals; hummock grasslands, saltbush shrublands and Halosarcia shrublands (Cowan, 2001). The subregional area for the Eastern Murchison subregion is 7,847,996 ha.

3.3 LAND SYSTEMS

DPIRD undertakes land system mapping for WA using a nested soil-landscape mapping hierarchy (Schoknecht & Payne, 2011). While the primary purpose of the mapping is to inform pastoral and agricultural land capability, it is also useful for informing biological assessments. Under this hierarchy, land systems are defined as areas with recurring patterns of landforms, soils, vegetation, and drainage (Payne & Leighton, 2004). The Study Area intersects three land systems (Table 1).

Table 1: Land Systems and Extent in the Study Area

Land system	Description	Total System Area (ha)	System in Study Area (ha)
Gabanintha System	Greenstone ridges, hills and foot slopes supporting sparse acacia and other mainly non-halophytic shrublands	251,488.0	55.6 (70.5%)
Koonmarra System	Quartz-strewn stony plains and low rises with outcropping granite, gneiss, and schist, supporting scattered mulga shrublands and other mainly non-saline shrubs.	563,292.3	1.7 (2.1%)
Wiluna System	Low greenstone hills with occasional lateritic breakaways and broad stony slopes, lower saline stony plains, and broad drainage tracts; supporting sparse mulga and other acacia shrublands with patches of halophytic shrubs.	260,091.6	21.6 (27.1%)

3.4 SOIL TYPES

In the absence of on-site sampling of soils within the Permit Area, Soil-landscape mapping at the best available scale (Version February 2019) attributed with the proportional allocation of WA Soil Groups to each map unit was utilised. This data was collected by the Department of Agriculture and Food through field observations and sampling and interpretation of aerial photography and satellite imagery at a variety of scales. The majority of the Permit Area comprises stony soils which consist of rocks or gravel throughout the soil profile (Table 2)

Table 2: Soil types of the Permit Area

Soil Type	Amount in Permit Area	Characteristics (Schoknecht & Pathan, 2013)	Soil attributes (Schoknecht & Pathan, 2013)				
			Inherent fertility	Water storage	Surface organic carbon	pH at 0-10 cm	pH at 50-80 cm
Stony Soil	56 ha (71%)	• Rocks and stones or coarse gravels dominant throughout the profile • Usually very shallow • Sandy, loamy, clayey or gravelly soil matrix • Neutral to acid pH	Low	Low	High	Slightly acidic	Slightly acidic

Soil Type	Amount in Permit Area	Characteristics (Schoknecht & Pathan, 2013)	Soil attributes (Schoknecht & Pathan, 2013)				
			Inherent fertility	Water storage	Surface organic carbon	pH at 0-10 cm	pH at 50-80 cm
Red Shallow Loam	23 ha (29%)	• Red loam over rock, hardpan or other cemented layer by 80 cm, and often <30 cm • A surface mantle of stones may be common • Gravel may be present • Usually neutral to acid pH	Moderate	Moderately low	Low	Slightly acidic	Neutral

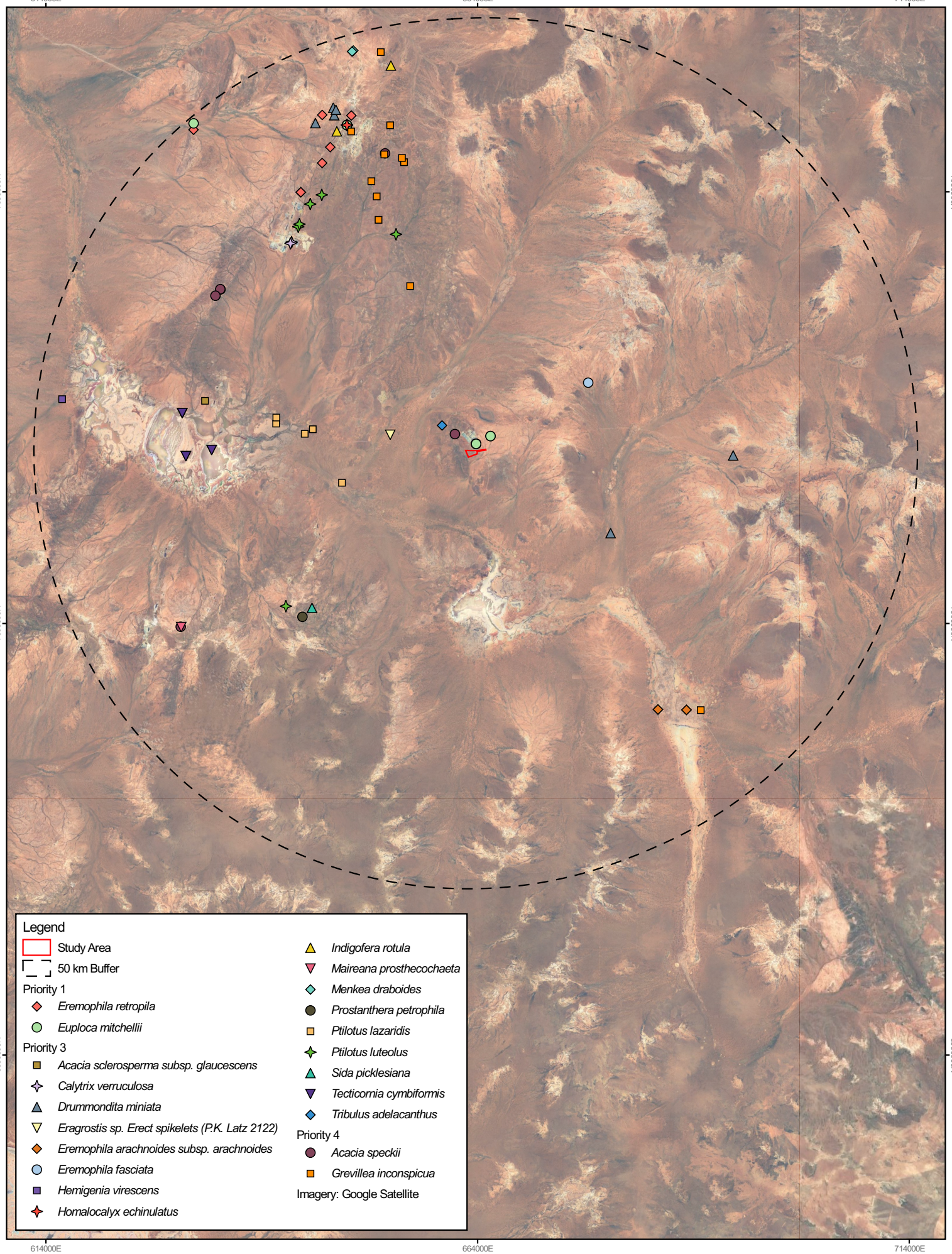
3.5 SIGNIFICANT FLORA

No EPBC Act-listed Threatened flora were recorded from the PMST. A search of the DBCA Threatened Flora database resulted in records of 20 flora species listed as Priority flora by the DBCA within 50 km of the Study Area (Table 3 and Figure 2).

None of the Priority flora records within the DBCA database were located within the Study Area.

Table 3: Flora species from the DBCA search within 50 km of the Study Area

Species	Closest record to Study Area (km)	Threatened Category
Eremophila retropila	~35.5	Priority 1
Euploca mitchellii	~0.8	Priority 1
Acacia sclerosperma subsp. *glaucescens*	~30.7	Priority 3
Calytrix verruculosa	~31.4	Priority 3
Drummondita miniata	~17.4	Priority 3
Eragrostis sp. Erect spikelets (P.K. Latz 2122)	~8.9	Priority 3
Eremophila arachnoides subsp. *arachnoides*	~36.1	Priority 3
Eremophila fasciata	~0.8	Priority 3
Hemigenia virescens	~47.1	Priority 3
Homalocalyx echinulatus	~40.1	Priority 3
Indigofera rotula	~39.9	Priority 3
Maireana prosthecochaeta	~38.7	Priority 3
Menkea draboides	~48.1	Priority 3
Prostanthera petrophila	~26.7	Priority 3
Ptilotus lazaridis	~14.8	Priority 3
Ptilotus luteolus	~26.3	Priority 3
Sida picklesiana	~25.2	Priority 3
Tecticornia cymbiformis	~29.4	Priority 3
Tribulus adelacanthus	~4.0	Priority 3
Acacia speckii	~2.3	Priority 4



0 9 18 km

GDA2020 / MGA zone 50

1:550,000

N

Project: RWA_TMG_007
Date: 05/06/2025
Size: A4
Author: ASmithers (Preston Consulting Pty Ltd)

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Figure 2: Significant flora within the Study Area from DBCA database

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Australian Vanadium Limited engaged Onshore Environmental Consultants Pty Ltd (Onshore, 2019) to undertake a two-season detailed flora and vegetation survey covering the nearby Gabanintha tenements. Seven Priority Flora and six species considered to represent range extension flora were recorded within the Onshore (2019) survey area. Of these, three Priority species and three range extension species were recorded within the Tumblegum Study Area (Table 4, Figure 3). The conservation status of these species was checked in July 2025 to ensure current information was used in this assessment.

Table 4: Flora species recorded within the Study Area (Onshore, 2019)

Species	Threatened Category	Individuals within the Permit Area	Individuals within the Indicative Site Layout
Abutilon malvifolium	Range extension	1	0
Acacia speckii	P4	130	73
Dodonaea amplisemina	P4	527	288
Hibiscus verdcourtii	Range extension	1	0
Ptilotus luteolus	P3	842	381
Sida trichopoda	Range extension	1	0

Due to the presence of significant flora individuals within the indicative site layout, investigations into the distribution and abundance of these species were conducted. This was achieved by using publicly available ALA data, the Index of Biodiversity Surveys for Assessments (IBSA) datasets and historical flora survey reports.

A review of the ALA revealed:

- 71 *Acacia speckii* (P4) records ranging north-south from below Peak Hill to the Gullewa Mine and east-west from just east of the Study Area to Yuin Station (distribution of approximately 46,558 km^2);
- 60 *Dodonaea ampilsemina* (P4) records ranging from north-south from the DeGrussa Copper Mine to the Mount Gibson Sanctuary and east-west from DeGrussa Copper Mine to the Deflector Gold Mine (distribution of approximately 58,533 km^2); and
- 24 *Ptilotus luteolus* (P3) records ranging north-south from Kennedy Range National Park to Mount Magnet and east-west from Wiluna to Kennedy Range National Park (distribution of approximately 107,560 km^2) (Figure 4).

Although the ALA is recommended to gain a broad understanding of species distributions and prevalence, the accuracy of the data can be warped, and the number of individuals is not provided, specifically regarding significant flora, to protect the location and abundance of individuals from the public.

A review of other flora surveys in the region also identified records of these Priority Flora species that are not included in ALA. In contrast to the ALA data, these reports provided individual counts at each location. Therefore, cumulative impacts to significant flora were calculated using this available spatial data and reports from IBSA Datasets (Table 5).



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Legend

- Permit Area

Significant Flora (Onshore, 2019)

- *Abutilon malvifolium* (Range Extension)
- *Acacia speckii* (P4)
- *Dodonaea amplisemina* (P4)
- *Hibiscus verdcourtii* (Range Extension)
- *Marsilea costulifera* (Range Extension)
- *Ptilotus luteolus* (P3)
- *Sida trichopoda* (Range Extension)

Imagery: Google Satellite

N

0 0.2 0.4 km

GDA2020 / MGA zone 50

1:12,500

Project: RWA_TMG_004
Date: 04/07/2025
Size: A4
Author: ASmithers (Preston Consulting Pty Ltd)

Figure 3: Significant flora (Onshore, 2019)

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Table 5: Cumulative impacts to significant flora

Project	*Acacia speckii* (P4)	*Dodonaea amplisemina* (P4)	*Ptilotus luteolus* (P3)
Gabanintha Vanadium Project	335 (Removal of 67 individuals)	574 (Removal of 187 individuals)	2,512 (Removal of 270 individuals)
Yogi Magnetite Project	2,990 (Removal of 415 individuals)	10,639	0
Accelerator and Indicator Mining Areas	7 (Removal of 6 individuals)	52 (Removal of 4 individuals)	0
Australian Vanadium Project	8 (others likely to be already counted for Gabanintha Vanadium Project)	1 (others likely to be already counted for Gabanintha Vanadium Project)	141 (others likely to be already counted for Gabanintha Vanadium Project)
Iron Ridge Project	559 (Removal of 21 individuals)	430 (Removal of 10 individuals)	0
Weld Range Iron Ore Project	935 (Removal of 267 individuals)	618 (Removal of 191 individuals)	68
Harmony Gold Operations	0	0	204 (listed as previously accepted name '*Ptilotus astrolasius* var. *luteolus*')
Total individuals recorded in these surveys	**4,854**	**12,314**	**2,925**
Maximum disturbed by the Project	73 (1.5%)	288 (2.3%)	381 (13.0%)
Total cumulative individuals disturbed	849 (17.5%)	680 (5.5%)	651 (22.2%)
Total individuals remaining	**3,985 (82.5%)**	**11,634 (94.5%)**	**3,182 (77.8%)**

Table 5 identifies that the Project is unlikely to result in significant impacts to *Acacia speckii* (P4) or *Dodonaea amplisemina* (P4), with less than 2.3% of records from published reports (i.e., not including other regional records listed on ALA) being disturbed by the Project.

A higher proportion of *Ptilotus luteolus* (P3) individuals will be disturbed by the Project (13.0%). This species was recorded in relatively high numbers during the Gabanintha Vanadium Project survey (Biologic, 2021), with 2,512 individuals recorded (note the Biologic (2021) report states 2,503 individuals however this does not appear to match the submitted data). *Ptilotus luteolus* occurs across three bioregions, from Carnarvon in the west, through the Gascoyne and into the Murchison in the east (Figure 4).

The proportion of *Ptilotus luteolus* (P3) individuals impacted presented in Table 5 is likely to be conservative for a number of reasons:

1. Not all ALA record locations and number of individuals are included in the data set;

2. Only a small proportion of the range of *Ptilotus luteolus* (P3) has been surveyed;
3. The Tumblegum Study Area was surveyed intensively by Onshore (2019) in comparison to the surrounding areas, which increases the proportional impacts. A screenshot is provided in Figure 5, refer to Figure 8 of Onshore (2019) for the full figure (link provided in the references of this document);
4. *Ptilotus luteolus* (P3) was predominantly recorded within vegetation association 'UH EmCd', which is likely to extend outside the boundary of the Onshore (2019) survey area as it is located on the north-eastern boundary (Figure 8). This assumption means that suitable unsurveyed habitat occurs outside the survey areas, which is likely to contain additional individuals. This position is also noted by Biologic (2021) who stated: "The total known extent of *Ptilotus luteolus* is 2,503 individuals from two populations within and adjacent to the Study Area…It is likely that the two populations would connect following further targeted work. The two populations are located along the same basalt range, approximately 1 km apart."; and
5. Only a small proportion of the species' range and habitat will be disturbed by the Project.

Based on the above, it is considered likely that the Project would not result in significant impacts to the viability of *Ptilotus luteolus*, both locally and regionally.

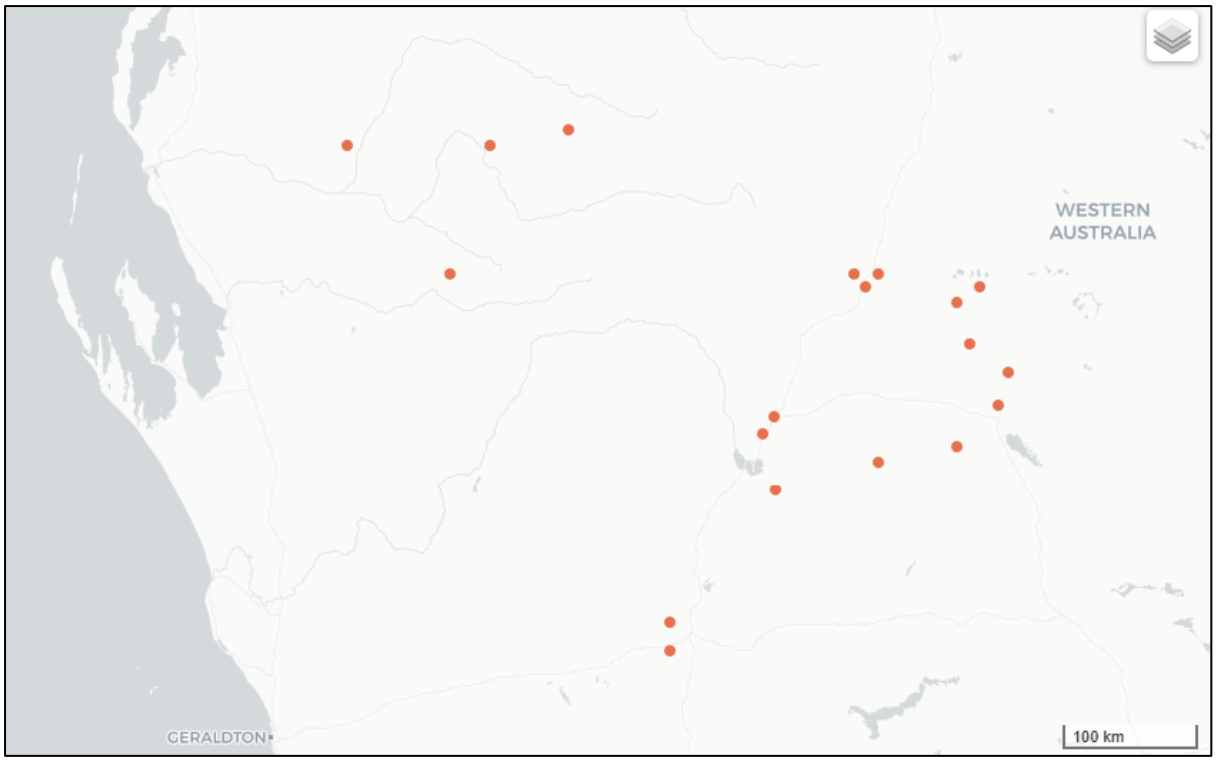


Figure 4: ALA records of *Ptilotus luteolus* (P3), accessed June 2025

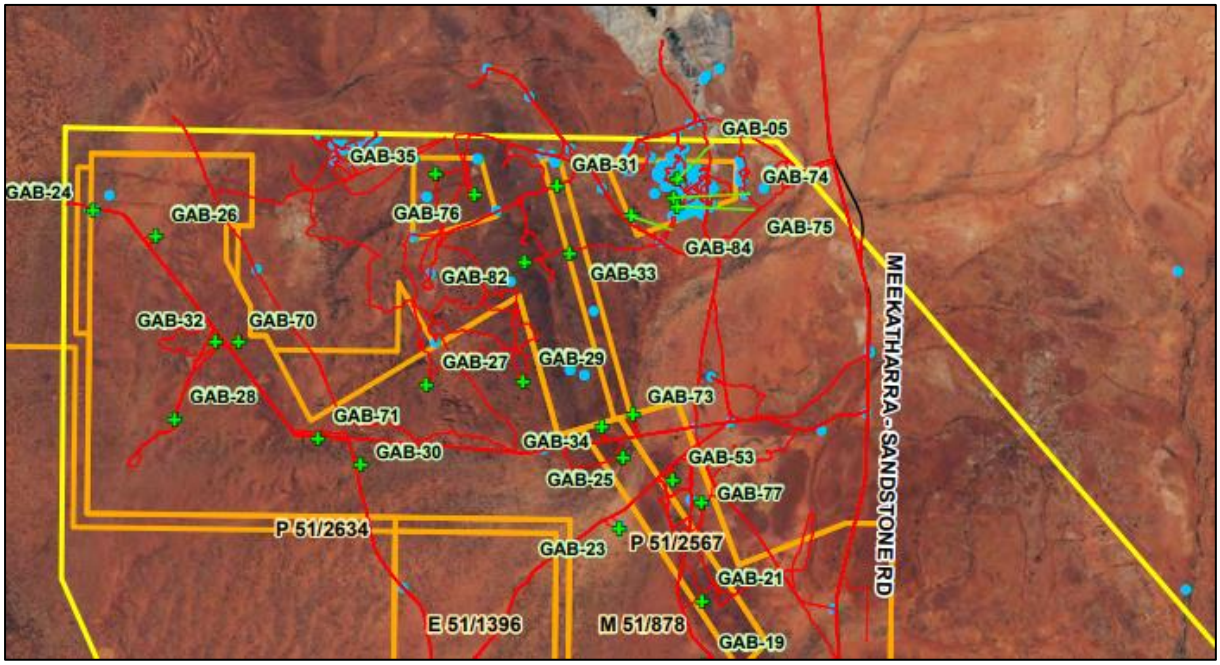


Figure 5: Screenshot of Figure 8 in Onshore (2019) showing increased survey intensity within Tumblegum Study Area (orange area surrounding GAB-74)

3.6 INTRODUCED FLORA

One species of introduced flora, the Bitter Apple (*Citrullus colocynthis*) was recorded within the Study Area during the Onshore (2019) survey (Figure 6). The Bitter Apple is a yellow flowering, trailing perennial herb or climber that flowers from January to October (Hussey et al., 1997). It occurs in rocky, stony loam or clay soils typically in wet disturbed sites such as floodplains. This taxon is widely distributed throughout WA occurring in the Eremaean, Northern and South-Western Provinces. This species is not listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007.*



Legend

- Study Area
- Indicative Site Layout

Introduced Species (Onshore, 2019)

- *Bidens bipinnata*
- *Citrullus colocynthis*
- *Lysimachia arvensis*

Imagery: Google Satellite

N

0 0.3 0.6 km

GDA2020 / MGA zone 50

1:18,000

Project: RWA_TMG_005
Date: 04/07/2025
Size: A4
Author: ASmithers (Preston Consulting Pty Ltd)

Figure 6: Introduced flora records within the Study Area (Onshore, 2019)

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3.7 VEGETATION

3.7.1 PRE-EUROPEAN VEGETATION

Pre-European vegetation mapping indicates that the Study Area is dominated by the Wiluna vegetation system (Figure 7). The Wiluna vegetation system is comprised of multiple vegetation associations, however, only two (18 and 39) intersect the Study Area which is described below:

- Vegetation Association 18: Low woodland, open low woodland, or sparse woodland consisting of Mulga *Acacia aneura* and associated species; and
- Vegetation Association 39: Scrub, open scrub, or sparse scrub consisting of Wattle, tea tree and other species such as Acacia and Melaleuca.

The state-wide pre-European extent of Vegetation Association 18 and 39 is approximately 19,843,148 ha and 6,602,578 ha, respectively. Both vegetation associations have over 99% of their extent remaining in comparison to their pre-European extent (Government of WA, 2019).

3.7.2 VEGETATION TYPES

Onshore (2019) recorded 28 vegetation types within their survey area, four of which occur within the Study Area (Table 6 and Figure 8). The Undulating hills (UH EmCd) vegetation type makes up the majority of the Study Area and was considered to be in very good condition (Onshore, 2019). None of the vegetation types recorded within the Study Area are known to support threatened flora or aligned with any state-listed Threatened or Priority Ecological Communities (TEC; PEC). However, all the vegetation types recorded within the Study Area are known to support Priority flora listed by the DBCA and may therefore be considered to be of state conservation significance (Onshore, 2019).

Additionally, vegetation types HP Mp and SP At Eg PoSl both support flora that were considered to represent significant range extensions from known distribution at the time of Onshore's (2019) survey.

Table 6: Vegetation types within the Study Area as described and mapped by Onshore (2019)

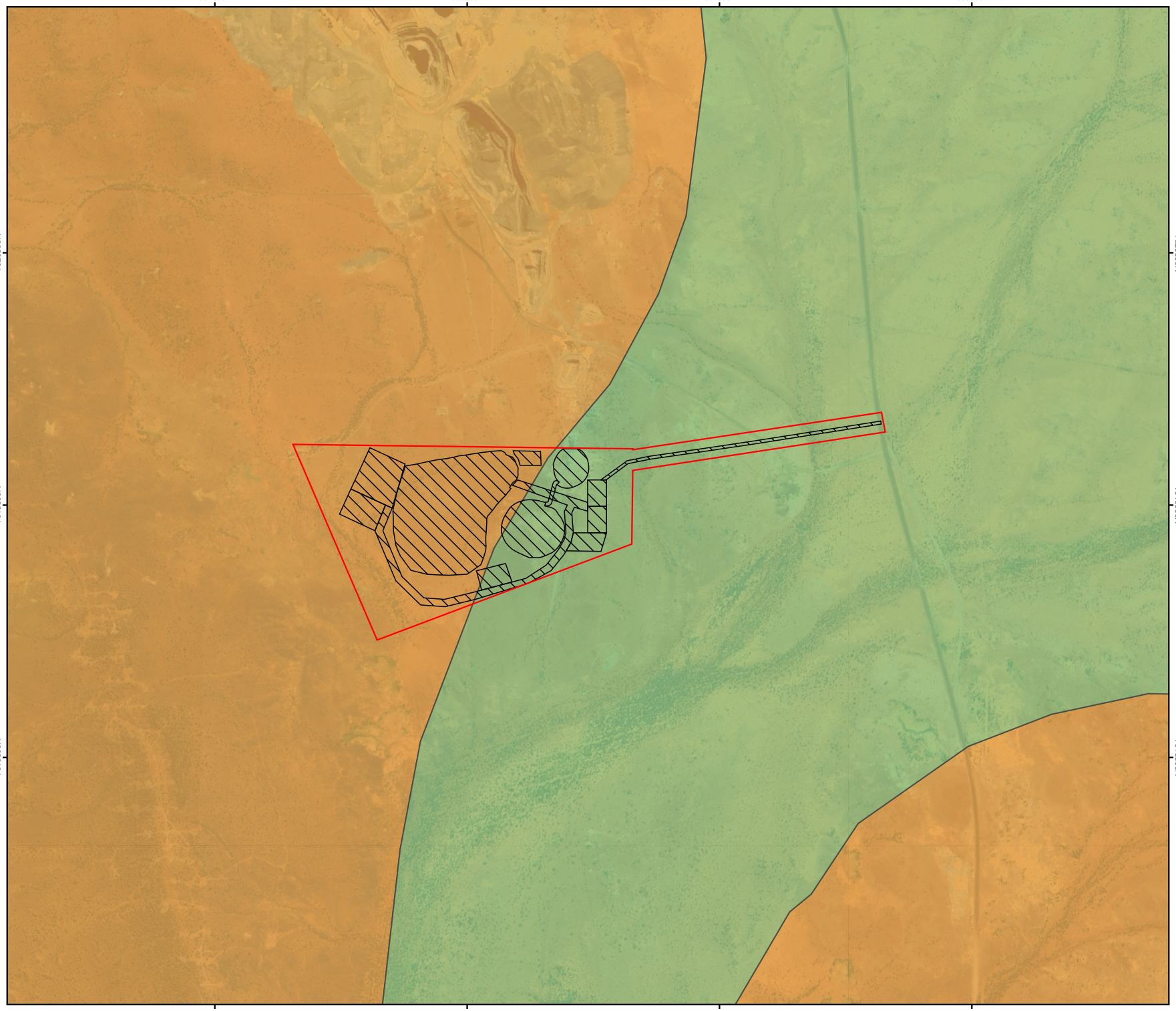
Vegetation Code	Description	Condition
HP Mp	Low Shrubland (to Low Open Shrubland) of *Maireana pyramidata*, *Cratystylis subspinescens* and *Ptilotus obovatus* over Open Tussock Grassland of *Aristida contorta, Eriachne pulchella* subsp. *pulchella* and *Tripogon loliiformis* with Scattered Tall Shrubs of *Hakea preissii, Acacia pteraneura* and Acacia *tetragonophylla* on orange sandy loam on hardpan plain	Very Good
ME AiAaAf	Low Open Forest of *Acacia incurvaneura*, *Acacia aptaneura, Acacia fuscaneura* and *Acacia craspedocarpa* (hybrid) over Open Shrubland of *Eremophila galeata, Eremophila forrestii* subsp. *forrestii* and *Acacia tetragonophylla* over Very Open Tussock Grassland of I*seilema membranaceum, Dactyloctenium radulans* and *Aristida contorta* on brown loamy sand on medium drainage lines	Very Good
SP At Eg PoSl	Low Woodland of *Acacia aptaneura, Acacia aneura*, *Acacia fuscaneura, Acacia caesaneura* and *Acacia caesaneura* (narrow phyllode variant) over High Shrubland of *Acacia craspedocarpa, Acacia craspedocarpa* (hybrid), and *Acacia tetragonophylla* over Open Shrubland of *Eremophila galeata, Sida ectogama* and *Rhagodia drummondii* over Low Open Shrubland of *Ptilotus obovatus*, *Solanum lasiophyllum* and *Eremophila forrestii* subsp. *forrestii* over Open Tussock (to Tussock) Grassland of *Aristida contorta, Eriachne pulchella* subsp. *pulchella* and *Paspalidium clementii* on brown clay loam on stony plains	Good

Vegetation Code	Description	Condition
UH EmCd	Scattered Low Trees of *Acacia fuscaneura* and *Acacia aptaneura* over Open Shrubland of *Eremophila macmillaniana* over Low Open Shrubland of *Calytrix desolata, Ptilotus obovatus* and *Senna artemisioides* subsp. *helmsii* over Very Open Tussock Grassland of *Aristida contorta* on orange, brown sandy loam on undulating low hills	Very Good

3.7.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

No TECs or PECs have been recorded within the Study Area. This is supported by Onshore's (2019) assessment of TECs and PECs which recorded ten known PECs within a 50 km radius of the Onshore (2019) survey area, none of which intersect the Study Area. The closest PEC, the Yagahong Land System, is located approximately 2.9 km northeast of the Study Area and is listed as a Priority 3 ecological community at a state level by DBCA (Figure 9). Several smaller patches of the Yagahong Land System are present in the area to the east-northeast.

The Yagahong Land System PEC is characterised by rough greenstone ridges, hills and cobble-strewn foot slopes supporting mulga shrublands. Currently, the largest threat to this PEC is overgrazing by agricultural animals (DBCA, 2023).



Legend

- Study Area
- Indicative Site Layout

Vegetation Associations (DPIRD-006)

- 18
- 39

Imagery: Google Satellite

N

0 0.3 0.6 km

GDA2020 / MGA zone 50

1:20,000

Project: RWA_TMG_004
Date: 08/07/2025
Size: A4
Author: ASmithers (Preston Consulting Pty Ltd)

Figure 7: Vegetation associations of the Study Area

ResourcesWA Preston Consulting

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7020000 7015000 7010000 7005000

GABANINTHA - NANNINE RD

YOUNO DOWNS RD

MEEKATHARRA - SANDSTONE RD

SP AcAt Eg
SP At Eg PoSl
SP Es
Old Mine
ME AlAaAf
HP Mp
UH EmCd
GP Ep
SP Aq
HC AqAl
UH Ar
HS AlAq
HP Eg
HP EgEff
SA Eff Ee
UH Ps
Borrow Pit
HP El
HP AcAt Po
DZ PaMsEy
SA Po
SP Eyy
DZ Ms Df
CP Df
Water
HP GsGn
HP Mp
CP Mh
SF Th
CP Ea



AUSTRALIAN VANADIUM LIMITED

GABANINTHA

Figure 8: Vegetation types of the Study Area

Legend

- Onshore Survey Area
- Study Area

N

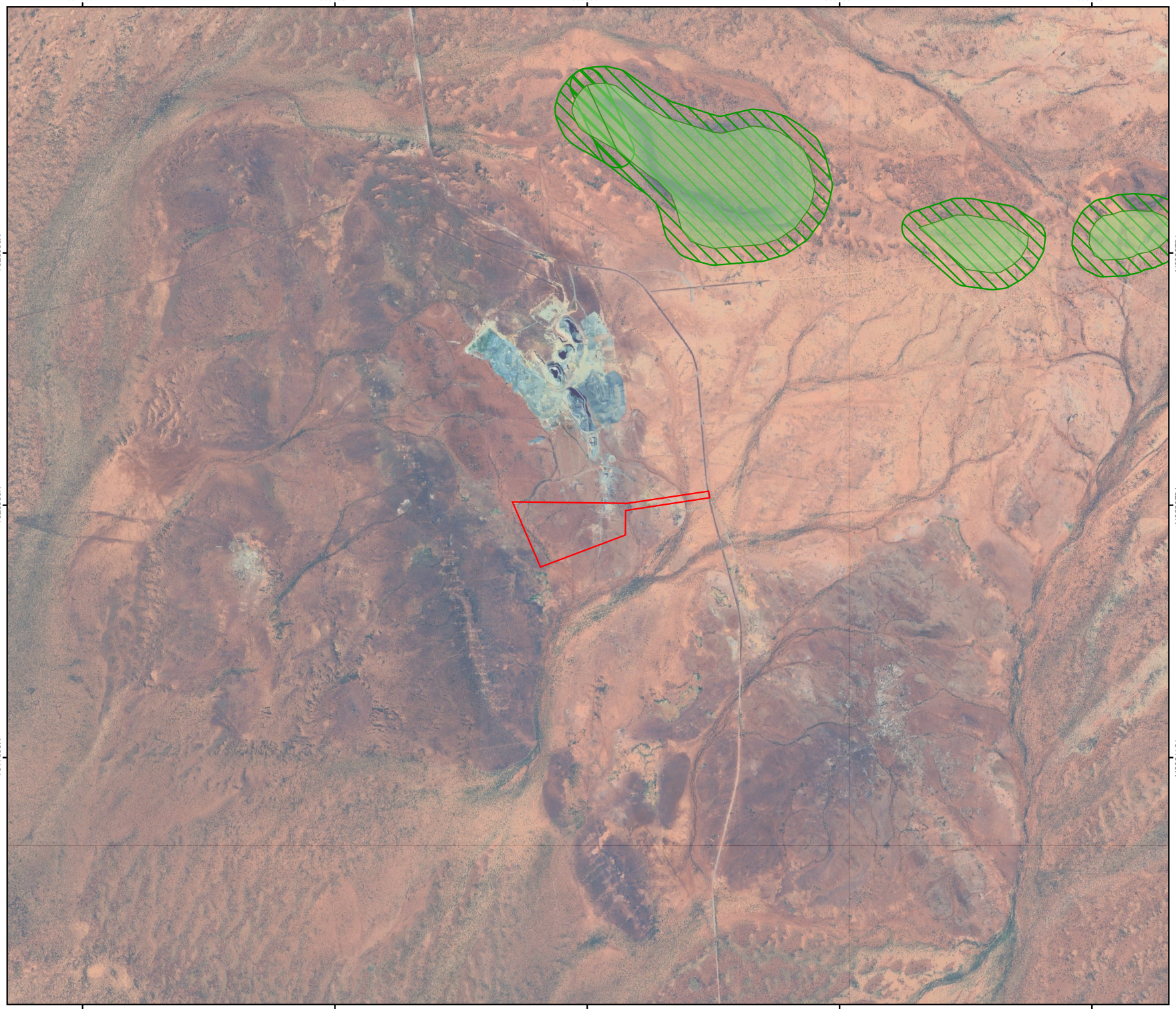
0 1 2

Kilometers
1:75,000
Datum: GDA94
Projection: MGA Zone 50

Date:	03/11/2017
Status:	Final
Figure:	10
Sheet Size:	A3
Internal Reference:	GAB_Veg
Drawn by:	GSM
Requested by:	DB

GRIFFIN SPATIAL & MAPPING


Legend
Study Area
Vegetation Types
Hill Crest
HC AqAi High Open Shrubland of Acacia quadrimarginea, Acacia incurvaneura and Acacia pruinocarpa over Low Scattered Shrubs of Eremophila latrobei subsp. latrobei, Ptilotus obovatus and Maireana georgei on orange sandy loam on laterised range crests
Hill Slopes
HS AiAq Low Woodland of Acacia incurvaneura, Acacia pruinocarpa and Acacia caesaneura (narrow phyllode variant) over High Open Shrubland of Acacia tetragonophylla and Acacia quadrimarginea over Open Shrubland of Sida ectogama and Eremophila spathulata over Low Open Shrubland of Ptilotus obovatus and Maireana villosa on brown sandy loam on BIF range
Undulating Hills
UH EmCd Scattered Low Trees of Acacia fuscaneura and Acacia aptaneura over Open Shrubland of Eremophila macmillaniana over Low Open Shrubland of Calytrix desolata, Ptilotus obovatus and Senna artemisioides subsp. helmsii over Very Open Tussock Grassland of Aristida contorta on orange brown sandy loam on undulating low hills
UH Ps High Shrubland of Acacia fuscaneura, Acacia incurvaneura and Acacia pruinocarpa over Open Shrubland of Eremophila glutinosa and Senna glaucifolia over Low Scattered Shrubs of Ptilotus obovatus, Eremophila latrobei subsp. latrobei, Tribulus suberosus and Ptilotus schwartzii on orange silty loam on dark ironstone hills
UH Ar High Shrubland (to High Open Shrubland) of Acacia incurvaneura, Acacia pruinocarpa and Acacia rhodophloia over Open Shrubland of Acacia rhodophloia and Acacia tetragonophylla over Scattered Low Shrubs of Eremophila spathulata, Senna artemisioides subsp. helmsii x sturtii and Senna sp. Meekatharra (E. Bailey 1-26) on orange sandy loam on undulating low hills and stony plains
UH EmAt High Open Shrubland of Acacia fuscaneura and Acacia synchronicia over Open Shrubland of Eremophila macmillaniana and Acacia tetragonophylla over Low Open Shrubland of Ptilotus obovatus and Solanum lasiophyllum over Very Open Tussock Grassland of Enneapogon caerulescens and Aristida contorta on brown sandy loam on undulating low dolerite hills
Stony Plains
SP Eyy Shrubland (to Open Shrubland) of Eremophila youngii subsp. youngii and Hakea preissii over Very Open Herbs of Sclerolaena cuneata, Atriplex codonocarpa and Tribulus astrocarpus and Scattered Tall Shrubs of Hakea preissii, Acacia tetragonophylla and Acacia fuscaneura on orange brown silty clay loam on stony plains
SP Aq High Shrubland (to High Open Shrubland) of Acacia incurvaneura, Acacia fuscanerua and Acacia quadrimarginea over Open Shrubland of Eremophila latrobei subsp. latrobei, Eremophila forrestii subsp. forrestii and Eremophila galeata over Low Scattered Shrubs of Ptilotus schwartzii and Solanum lasiophyllum on brown sandy loam on stony plains and undulating low hills
SP Es Low Open Woodland of Acacia incurvaneura, Acacia pruinocarpa and Acacia pteraneura over Open Shrubland of Eremophila spathulata over Low Open Shrubland of Ptilotus schwartzii, Solanum lasiophyllum and Ptilotus obovatus on red sandy loam on stony plains
SP At Eg PoSl High Open Shrubland of Acacia tetragonophylla, Hakea preissii, Acacia pteraneura and Acacia synchronicia over Open Shrubland of Eremophila galeata over Low Open Shrubland of Ptilotus obovatus and Solanum lasiophyllum on orange sandy clay loam on stony plains
SP AcAt Eg Low Woodland of Acacia aptaneura, Acacia aneura, Acacia fuscaneura, Acacia caesaneura and Acacia caesaneura (narrow phyllode variant) over High Shrubland of Acacia craspedocarpa, Acacia craspedocarpa (hybrid), and Acacia tetragonophylla over Open Shrubland of Eremophila galeata, Sida ectogama and Rhagodia drummondii over Low Open Shrubland of Ptilotus obovatus, Solanum lasiophyllum and Eremophila forrestii subsp. forrestii over Open Tussock (to Tussock) Grassland of Aristida contorta, Eriachne pulchella subsp. pulchella and Paspalidium clementii on brown clay loam on stony plains
Hardpan Plains
HP AcAt Po Low Open Forest of Acacia aptaneura, Acacia caesaneura and Acacia pruinocarpa over High Open Shrubland of Acacia craspedocarpa and Acacia tetragonophylla over Low Open Shrubland of Ptilotus obovatus on brown clay loam on hardpan
HP Eg Low Open Woodland of Acacia incurvaneura, Acacia pteraneura and Acacia craspedocarpa (hybrid) over Open Shrubland of Eremophila galeata, Acacia tetragonophylla and Eremophila forrestii subsp. forrestii over Very Open Tussock Grassland of Erichne pulchella subsp. pulchella, Aristida contorta and Tripogon loliiformis with Low Scattered Shrubs of Ptilotus obovatus and Solanum lasiophyllum on orange sandy clay loam on hardpan plains
HP GsGn Low Open Woodland (to Low Open Woodland) of Grevillea striata, Acacia aptaneura and Grevillea nematophylla subsp. supraplana over High Open Shrubland of Acacia grasbyi, Acacia tetragonophylla, Grevillea nematophylla subsp. supraplana and Hakea preissii over Open Shrubland of Eremophila platycalyx subsp. platycalyx, Hakea preissii and Acacia grasbyi over Very Open Tussock Grassland of Eragrostis pergracilis, Eragrostis falcata and Eriachne pulchella subsp. pulchella on yellow brown silty clay loam on hardpan plains bordering claypans
HP EgEff High Shrubland of Acacia incurvaneura, Acacia craspedocarpa, Acacia craspedocarpa (hybrid) and Acacia tetragonophylla with Low Open Woodland of Acacia pteraneura, Acacia caesaneura and Acacia caesaneura (narrow phyllode variant) over Open Shrubland of Eremophila galeata and Eremophila forrestii subsp. forrestii over Low Open Shrubland of Ptilotus obovatus, Solanum lasiophyllum on orange sandy clay loam on hardpan plains
HP Mp Low Shrubland (to Low Open Shrubland) of Maireana pyramidata, Cratystylis subspinescens and Ptilotus obovatus over Open Tussock Grassland of Aristida contorta, Eriachne pulchella subsp. pulchella and Tripogon loliiformis with Scattered Tall Shrubs of Hakea preissii, Acacia pteraneura and Acacia tetragonophylla on orange sandy loam on hardpan plain
HP El High Open Shrubland of Eremophila linearis and Acacia synchronicia over Open Shrubland of Eremophila linearis over Low Open Shrubland of Eremophila linearis, Ptilotus obovatus and Dissocarpus paradoxus on orange sandy clay loam on hardpan plains
Sandy Plains
SA Ms High Shrubland of Melaleuca stereophloia over Shrubland of Melaleuca stereophloia and Eremophila glabra subsp. glabra over Low Open Shrubland of Maireana pyramidata and Tecticornia spp. on brown orange sand on sandy plains fringing claypans
SA Eff Ee Low Woodland of Acacia caesaneura, Acacia incurvaneura, Acacia pteraneura and Acacia caesaneura (narrow phyllode variant) over Shrubland (to Open Shrubland) of Eremophila forrestii subsp. forrestii over Very Open Tussock Grassland of Eragrostis eriopoda on brown loamy sand on sandy banks and plains
SA Po Low Open Woodland of Acacia pteraneura, Acacia caesaneura and Acacia caesaneura (narrow phyllode variant) over High Open Shrubland of Acacia tetragonophylla over Low Open Shrubland of Ptilotus obovatus, Solanum lasiophyllum and Eremophila forrestii subsp. forrestii over Open Tussock Grassland of Eriachne pulchella subsp. pulchella, Tripogon loliiformis and Aristida contorta on brown sandy clay loam on sandy plains
Gilgai Plain
GP Ep Sedges of Eleocharis pallens and Cyperus iria with Open Tussock Grassland of Eriachne flaccida and Eragrostis leptocarpa, Open Herbs of Marsilea hirsuta, Ptilotus gomphrenoides and Centipeda crateriformis (plus Open Shrubland of Pimelea holroydii) on light brown cracking clay on gilgai depressions
Saline Flats
SF Th Low Open Heath of Tecticornia halocnemoides over Very Open Tussock Grassland of Enneapogon caerulescens and Eragrostis dielsii
Clay Plan
CP Ea Closed Tussock Grassland of Eragrostis australasica with Open Shrubland of Duma florulenta and Atriplex amnicola on cream light clay on claypans
CP Mh Herbs of Marsilea hirsuta, Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158) and Goodenia berringbinensis with Open Tussock Grassland of Eriachne flaccida and Very Open Sedges of Cyperus iria on brown medium clay on
CP Df Open Shrubland of Duma florulenta, Atriplex amnicola and Hakea preissii over Very Open Tussock Grassland of Eriachne falcata and Eragrostis pergracilis over Very Open Herbs of Marsilea hirsuta, Alternanthera nodiflora and Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158) with Scattered Tall Shrubs of Hakea preissii, Acacia tetragonophylla and Acacia fuscaneura on brown light clay on claypans
Drainage Zone
DZ Ms Df Open Heath of Eremophila glabra subsp. glabra, Duma florulenta and Atriplex bunburyana with High Open Shrubland of Melaleuca stereophloia, Exocarpos aphyllus and Acacia tetragonophylla over Scattered Tussock Grassland of Aristida contorta and Enneapogon polyphyllus on yellow sandy clay loam on drainage zone
DZ PaMsEy High Shrubland of Acacia tetragonophylla, Hakea preissii, Eremophila youngii subsp. youngii and Melaleuca stereophloia with Low Open Woodland of Pittosporum angustifolium, Acacia fuscaneura and Hakea lorea subsp. lorea, Open Shrubland of Eremophila platycalyx subsp. platycalyx, Eremophila youngii subsp. youngii and Rhagodia drummondii and Very Open Tussock Grassland of Eriachne flaccida and Eragrostis leptocarpa on brown silty clay loam on drainage zones and claypans
Medium Drainage Line
ME AiAaAf Low Open Forest of Acacia incurvaneura, Acacia aptaneura, Acacia fuscaneura and Acacia craspedocarpa (hybrid) over Open Shrubland of Eremophila galeata, Eremophila forrestii subsp. forrestii and Acacia tetragonophylla over Very Open Tussock Grassland of Iseilema membranaceum, Dactyloctenium radulans and Aristida contorta on brown loamy sand on medium drainage lines
Other
Water
Borrow Pit
Old Mine
ONSHORE
AUSTRALIAN VANADIUM LIMITED
GABANINTHA
Date: 03/11/2017
Status: Final
Figure: 10
Sheet Size: A3
Internal Reference: GAB_Veg
Drawn by: GSM
Requested by: DB
GRIFFIN SPATIAL & MAPPING



Legend

- Study Area
- Yagahong Land System (P3)
- 200 m Buffer

Imagery: Google Satellite

N

0 1 2 km

GDA2020 / MGA zone 50

1:60,000

Project: RWA_TMG_010
Date: 21/05/2025
Size: A4
Author: ASmithers (Preston Consulting Pty Ltd)

Figure 9: PECs in proximity to the Study area

ResourcesWA Preston Consulting

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3.8 FAUNA

3.8.1 FAUNA HABITAT

Australian Vanadium Limited engaged Biologic Environmental Survey Pty Ltd (Biologic, 2020) to undertake a two-season Level 2 baseline vertebrate and short-range endemic (SRE) invertebrate survey for the nearby Gabanintha Vanadium Project.

Eleven broad fauna habitats were described and recorded during the Biologic (2020) survey (Figure 10). Two of which overlap the Study Area; Minor Drainage Line and Stony Plain. The fauna habitat descriptions provided by Biologic (2020) have been listed in Table 7. The Biologic (2020) survey area covers a substantial portion of the Study Area; however, the eastern-most portion was not surveyed. Biologic (2020) extrapolated the surrounding fauna habitat, and it is assumed that the eastern portion of the Study Area similarly comprises Stony Plain and Minor Drainage Line.

Table 7: Fauna habitats within the Study Area as described and mapped by Biologic (2020)

Habitat Type	Significance	Description	Extent in Study Area
Stony Plain	Vertebrate Fauna Significance: Low SRE Suitability: Low	Stony Plains comprise low-lying open plains. The habitat is defined by the stony substrate that extends through its distribution, and the lack of continuous vegetation. The vegetation varied throughout the extent but was dominated by scattered Mulga and Gidgee (*Acacia pruinocarpa*) over-storey, with a mid-storey comprising *Eremophila* and *Ptilotus* species	The Stony Plain habitat covers the majority of the Study Area. It represents a transition from the Rocky Outcrops occurring outside the Study Area, to the alluvial plains and drainage areas. The Stony Plain is a common habitat both within the Study Area and in the wider regions throughout the region.
Minor Drainage Line	Vertebrate Fauna Significance: Low SRE Suitability: Low/Moderate	Minor Drainage Lines comprise drainage systems that are dominated by dense stands of Mulga and other *Acacia* species over sandy creek beds. The vegetation adjacent to the main channel or channels is denser, taller, and more diverse than adjacent terrain. The microhabitats within are similar to surrounding Mulga Woodlands but with a high density of vegetation, leaf litter, woody debris, and often sandier alluvial soils.	The Minor Drainage Lines comprises all drainage channels within the Study Area and region. The habitat is common throughout the region but comprises small percentage of the landscape. The habitat is common through the arid zone occurring wherever Mulga is dominant.

Two fauna habitats were recorded within the Study Area; Stony Plain and Minor Drainage Line (Figure 10). Both habitats were considered by Biologic (2020) to have low vertebrate fauna significance and low to moderate SRE suitability. The fauna habitats present within the Study Area have been shown to be commensurate with the surrounding area. Due to the location and relatively small extent of proposed clearing, the Project is unlikely to prevent habitat connectivity or clear any locally significant habitat.

655000 660000 665000 670000 675000

7020000 7015000 7010000

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

Legend

- Survey Area (Biologic)
- Tenement Boundaries
- Study area

Method

- Motion Camera
- Targeted Search - Day Time
- Targeted Search - Night Time
- Trapping/Avifauna Site
- Ultrasonic Bat Recorder
- Habitat Assessments

Fauna Habitats

- Chenopod Shrubland
- Claypan
- Drainage Area
- Hardpan
- Minor Drainage Line
- Mulga Woodland
- Rocky Outcrop
- Salt Lake
- Sandy Mulga
- Stony Plain
- Wetland

biologic Environmental Survey

N

1:60,000

0 0.475 0.95 1.9 2.85 3.8 km

Figure 10: Fauna Habitats of the Study area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A3. Created 04/09/2018

3.8.2 SIGNIFICANT FAUNA

A search of DBCA's Threatened and Priority Fauna database showed that 24 species were recorded within 50 km of the Study Area. Of these species, 11 were listed as Threatened at a state level under the *Biodiversity Conservation Act 2016* (BC Act; including 10 at Commonwealth level) and three were listed as Priority (Table 3). Three species were located within 10 km of the Study Area, the Long-tailed Dunnart (*Antechinomys longicaudata*), Peregrine Falcon *(Falco peregrinus*) and the West Coast Mulga Slider (*Lerista eupoda*). No significant fauna records were identified within the Study Area.

A query of the PMST identified that 12 Threatened Fauna species listed under the Commonwealth EPBC Act have the potential to occur within 10 km of the Study Area, these species are documented in Table 4. Blue rows represent species that were present in both the PMST and DBCA data searches.

Table 8: Fauna species from the DBCA search within 50 km of the Study Area

Species	Closest record to Study Area	Threatened Category	
		EPBC Act	BC Act
Bird			
Common Greenshank (*Tringa nebularia*)	~38.4 km	Migratory	Migratory
Curlew Sandpiper (*Calidris ferruginea*)	~38.4 km	Critically Endangered/Migratory	Critically Endangered
Fork-tailed Swift (*Apus pacificus*)	~21.9 km	Migratory	Migratory
Grey Falcon (*Falco hypoleucos*)	~43.1 km	Vulnerable	Vulnerable
Gull-billed Tern (*Gelochelidon nilotica*)	~28.3 km	Migratory	Migratory
Malleefowl (*Leipoa ocellata*)	~35.5 km	Vulnerable	Vulnerable
Pectoral Sandpiper (*Calidris melanotos*)	~38.5 km	Migratory	Migratory
Peregrine Falcon (*Falco peregrinus*)	~1.0 km	N/A	Other Specially Protected
Sharp-tailed Sandpiper (*Calidris acuminata*)	~38.4 km	Migratory	Migratory
Wood Sandpiper (*Tringa glareola*)	~40.9 km	Migratory	Migratory
Invertebrate			
Fairy Shrimp (inland WA) (*Branchinella simplex*)	~33.5 km	N/A	Priority 1
Mammal			
Desert Bettong (*Bettongia anhydra*)	~28.0 km	Presumed Extinct	Presumed Extinct
Long-tailed Dunnart (*Antechinomys longicaudata*)	~1.0 km	N/A	Priority 4
Reptile			

Species	Closest record to Study Area	Threatened Category	
		EPBC Act	BC Act
West Coast Mulga Slider (*Lerista eupoda*)	~8.8 km	N/A	Priority 1

Note: Blue rows indicate species present in both the PMST and DBCA database searches

Table 9: Fauna species from the PMST search with the potential to occur within 10 km of the Study Area

Species	Likelihood	Threatened Category	
		EPBC Act	BC Act
Bird			
Common Sandpiper (*Actitis hypoleucos*)	Species or species habitat may occur within area	Migratory	Migratory
Curlew Sandpiper (*Calidris ferruginea*)	Species or species habitat may occur within area	Critically Endangered/Migratory	Critically Endangered
Fork-tailed Swift (*Apus pacificus*)	Species or species habitat likely to occur within area	Migratory	Migratory
Grey Falcon (*Falco hypoleucos*)	Species or species habitat may occur within area	Vulnerable	Vulnerable
Grey Wagtail (*Motacilla cinerea*)	Species or species habitat may occur within area	Migratory	Migratory
Malleefowl (*Leipoa ocellata*)	Species or species habitat likely to occur within area	Vulnerable	Vulnerable
Night Parrot (*Pezoporus occidentalis*)	Species or species habitat may occur within area	Endangered	Critically Endangered
Pectoral Sandpiper (*Calidris melanotos*)	Species or species habitat may occur within area	Migratory	Migratory
Sharp-tailed Sandpiper (*Calidris acuminata*)	Species or species habitat may occur within area	Vulnerable/Migratory	Migratory
Southern Whiteface (*Aphelocephala leucopsis*)	Species or species habitat known to occur within area	Vulnerable	Priority 4
Yellow Wagtail (*Motacilla flava*)	Species or species habitat may occur within area	Migratory	Migratory
Spider			
Shield-backed Trapdoor Spider (*Idiosoma nigrum*)	Species or species habitat likely to occur within area	Vulnerable	Priority 3

Note: Blue rows indicate species present in both the PMST and DBCA database searches

Biologic (2020) recorded no listed fauna within the Study Area during their two season survey. The closest listed fauna record was of a Long-tailed Dunnart (*Sminthopsis longicaudata*, P4) and Peregrine Falcon (*Falco peregrinus*, other specially protected), located on a patch of rocky outcrop habitat approximately 1 km southeast.

3.9 WATER AND DRAINAGE

Pentium Water (2025) has completed a hydrological data review for regional and local hydrology of the Study Area and its surrounds to assess the impact of the Project on nearby hydrology. All information within this section has been sourced from this report unless otherwise stated.

3.9.1 Local Hydrology

Near the Project, there are three small catchments flowing from the north (B & C) and north-east of the site (Figure 11). The small northern catchment 'C' flows along the sites western boundary whilst catchments B and C intersect with the sites northern and eastern boundaries, respectively. These catchments flow across the access road and then along the southern portion of the site (Figure 11). All catchments consist of variably defined small, eroded streams and overland flow. Stream channels tend to form in response to flow accumulation or local changes, and land grade then dissipate. In larger floods, the floodwaters tend to merge across the three catchments. This pattern of drainage continues downstream of the site. Runoff from the catchment ultimately discharges into the drainage line that flows towards Lake Annean.

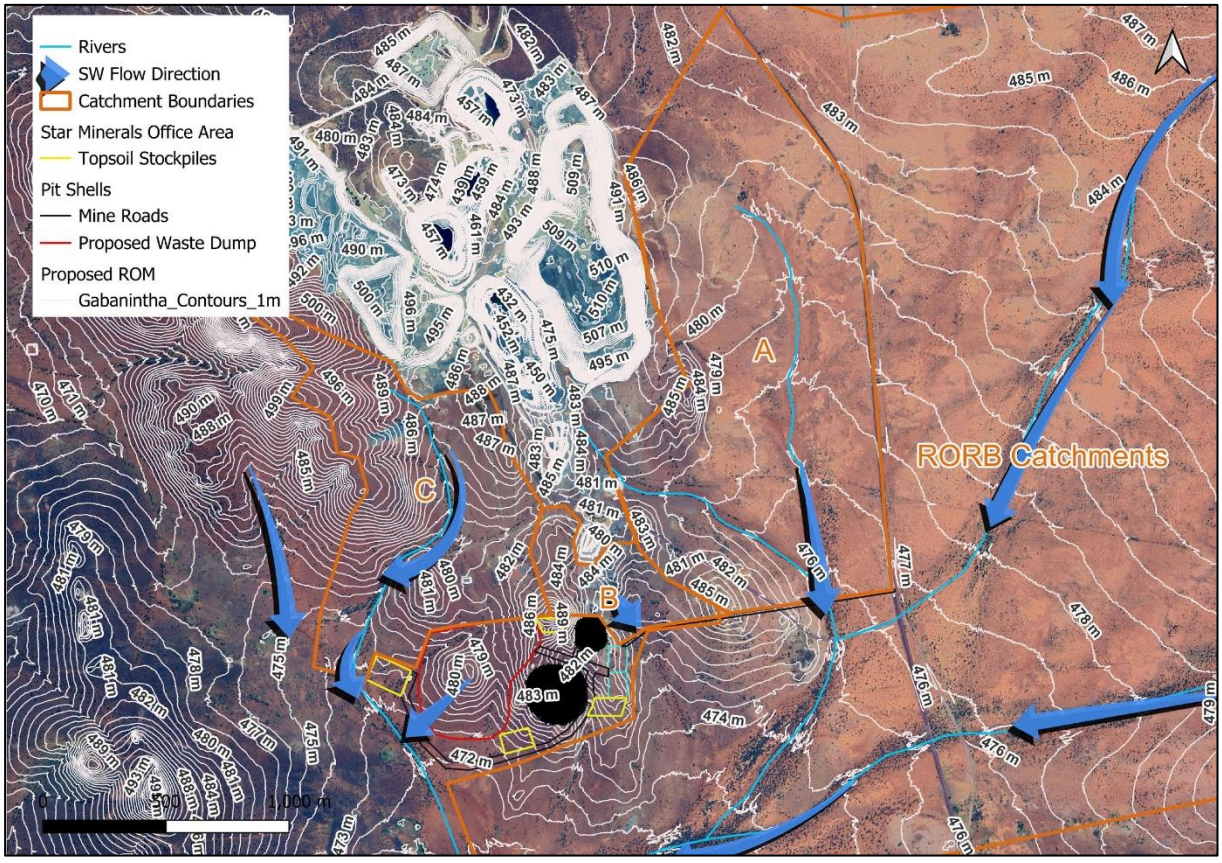


Figure 11: Local contributing catchments

3.9.2 Catchment Details

Surface water drainage systems and associated sub-catchments surrounding and upstream of the waste dumps, pits and access roads have been delineated using the Digital Elevation Model generated from supplied 1 metre LIDAR topographic data. The derived drainage paths have been validated against aerial photography, where possible, to ensure they closely match with visible drainage morphology.

Topographically, the area comprises a series of minor valleys, hills and ridge lines. The Project area itself is located at the crest of a rounded hill which forces runoff in all directions within streamlines that drain into narrow valleys and the regional drainage line to the south that ultimately drains into Lake Annean. The available high resolution LIDAR information provided

the basis for catchment subdivision for all watersheds draining towards the key infrastructure (pits, waste dumps and laydown areas).

Based on the supplied layout, the study area extends over three impacted catchments (A-C) and one non-impacted catchment (Regional catchment to the east/ Runoff Routing and Overland Routing Model (RORB) catchments; Figure 11). Derived catchment characteristics for all impacted catchments discussed above are presented in Table 10.

Table 10: Catchment details

Catchment ID	Area (km²)	Main stream length (km)
A	1.86	1.90
B	0.20	0.30
C	0.90	1.80

3.9.3 PEAK FLOW ASSESSMENT

Regional Rational Method Approach

Two regional methods were applied to estimate peak flow rates in accordance with procedures set out in the Australian Rainfall and Runoff (Ball et al., 2019). The Regional Rational Method (Rational Method) for the North-West Pilbara region (with loamy soils) were used as the basis for peak flow estimation. Parameters for the Murchison region are not available and therefore peak estimates from this region are considered highly conservative. For comparison purposes peak flow estimates were also performed using the Index Flood Method (IFM). In this region the regional IFM data tends to over-estimate peak flows and is therefore considered to be a more conservative estimate.

Given the importance of protecting road infrastructure, the IFM method is considered a more appropriate estimate to ensure overtopping of culverts does not occur in future events. This method was adopted for catchment B which intersects with the main access road into the site. All other catchments were assessed using the flood routing approach, RORB, discussed in the following section.

The catchment characteristics used in estimating peak flow using the Rational Method are presented in Table 11.

Table 11: Peak flow estimates

Catchment ID	Catchment area (km²)	Stream length (km)	Equal area slope	Time of concentration (hours)	Discharge (m3/s)			
					1% AEP Rational	1% AEP IFM	10% AEP Rational	10% AEP IFM
A	1.86	1.90	3.68	0.70	40.6	41.8	12.5	10.0
B	0.20	0.30	13.33	0.30	6.6	8.4	3.0	2.0
C	0.90	1.80	7.78	0.54	23.1	24.8	7.2	5.9

AEP: Annual Exceedance Probability

RORB Hydrology Modelling

A hydrological model of all contributing catchments was developed for the purpose of generating design flows for the mines access road crossing and for the detailed surface water management assessment of the active mine area. The rainfall-runoff program, RORB (Version 6.52), was used for this study.

RORB is a non-linear rainfall runoff and streamflow routing model that is used for the calculation of flow hydrographs in drainage and stream networks. The model requires catchments to be divided into subareas, connected by a series of conceptual reach storages. Design storm rainfall is input to the centroid of each subarea. Specified rainfall losses are then deducted, and the excess runoff is routed through the reach network.

The Tumblegum RORB model was run for the design events, adjusting the losses so that the peak flows correlated to the expected regional estimates and flood patterns (using aerial imagery) at the Meekatharra/Sandstone Road Crossing.

The peak flows and critical durations from the RORB model design simulations at significant locations circled in green (Figure 12) and are tabulated in Table 12.

Table 12: Peak flows and critical durations

AEP/ Average Recurrence Interval (ARI)	Topsoil stockpiles (Location 1)		Major access road crossing (Location 2)	
	Peak Discharge (m^3/s)	Critical Duration (hours)	Peak Discharge (m^3/s)	Critical Duration (hours)
1%/100 Year	5.3	12	26.1	12
10%/10 Year	2.4	12	14.0	12
20%/5 Year	1.7	12	9.9	12
63.2%/1 Year	0.3	18	1.9	18

3.9.4 HYDRAULIC MODELLING

Hydrologic Engineering Centre River Analysis System (US Army Corps of Engineers, 2008) modelling results at the two significant locations for the 1% AEP (100-Year ARI) are shown in Figure 13. The plot shows flood depth and velocities, highlighting flooding zones to aid in the protection of topsoil stockpiles and access roads. Results from the modelling were used to develop surface water management actions around the site, see Table 13 for additional detail.

3.10 LAND USE

The Permit Area is not located within any nearby Local Planning Schemes (such as the Shire of Meekatharra Town Planning Scheme); however, it can be assumed that the historical land use is commensurate with the surrounding landscape, which includes native pastures, reserves, and crown land. Dominant land uses are cattle farming on pastoral stations (such as the nearby Polelle and Hillview Pastoral Stations) and Mining Leases associated with the nearby Australian Vanadium Project and Gabanintha Vanadium Project.

Aerial imagery of the Study Area shows previous ground disturbance which is assumed to be from the structural review of the Tumblegum South gold resource completed in April 2024 (Star Minerals, 2024).

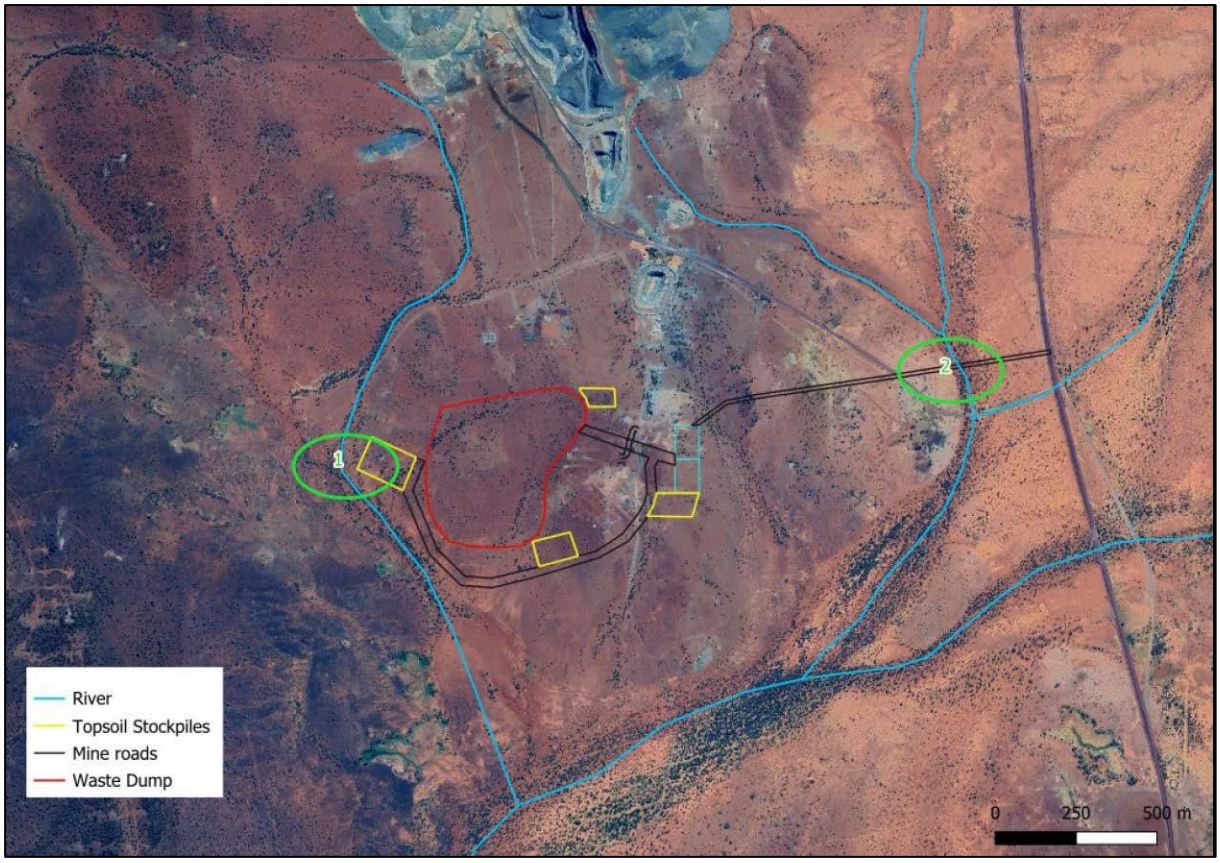


Figure 12: Significant peak flow locations

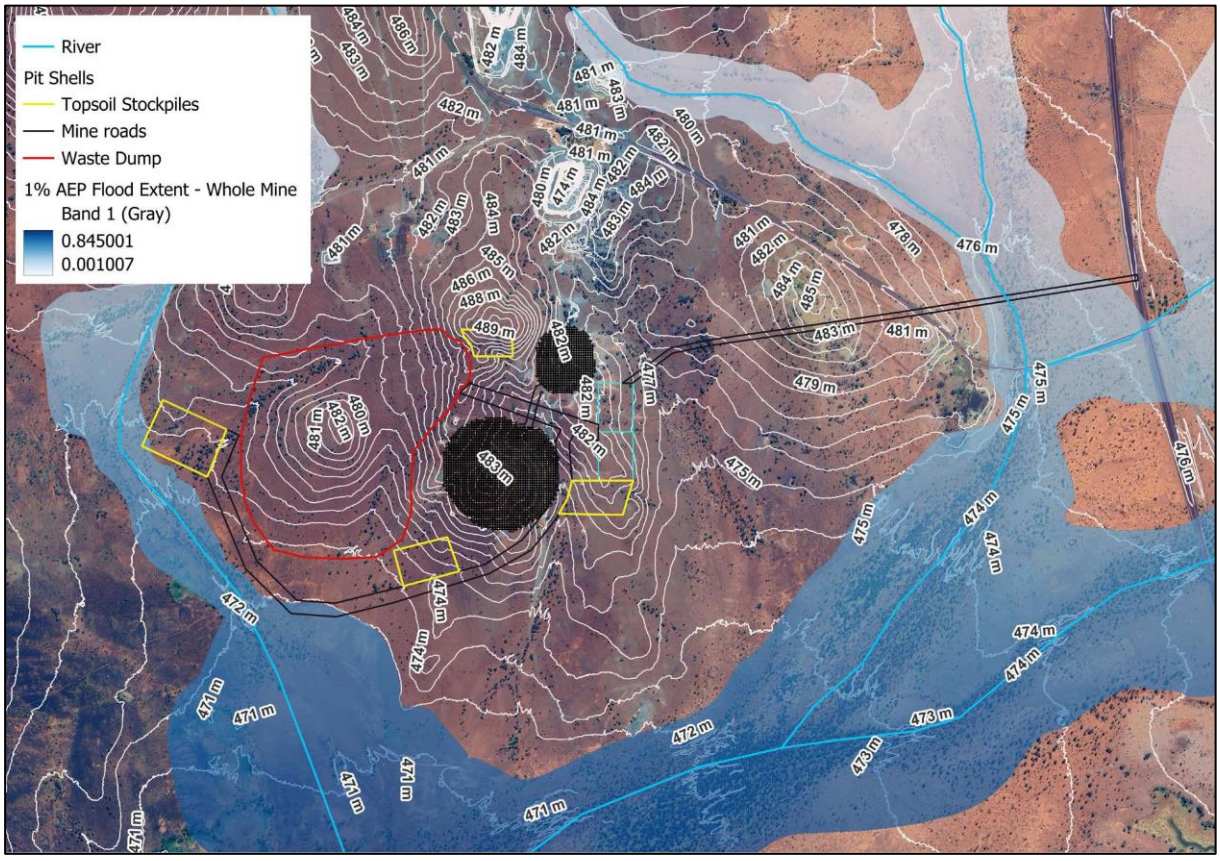


Figure 13: 1% AEP flood extent across entire site

4 STAKEHOLDER CONSULTATION

Star Minerals has consulted with the following key stakeholders regarding the Project:

- Polelle Pastoral Station - The Project is located near Polelle Pastoral Station, and primary road crosses the station land holding;
- Hillview Pastoral Station – The Project is located near Hillview Pastoral Station;
- Shire of Cue and Meekatharra - Consulted regarding use of public roads for transport of ore from the mine site to the various processing facilities within the region using the public road network;
- Yugunga-Nya - Native Title Claimants have been informed of the intention to mine; and
- Department of Mines, Petroleum and Exploration - Star Minerals held an initial meeting in Q3 2025 to discuss the broader details of the Project.

Star Minerals will continue to consult with key stakeholders throughout the life of the Project.

5 ASSESSMENT OF THE CLEARING AGAINST THE TEN CLEARING PRINCIPLES

The proposed vegetation disturbance has been assessed against the ten clearing principles described within *A Guide to the Assessment of Applications to Clear Native Vegetation* (Department of Environmental Regulation, 2014; Table 13).

Table 13: Assessment of proposed vegetation disturbance against the ten clearing principles

Relevant Information	Assessment of potential impacts	Proposed control measures	Outcome – Assessment of variance with clearing principle
1. Native Vegetation should not be cleared if it comprises a high level of biological diversity			
A desktop search of the DBCA Threatened Flora database was conducted by Preston Consulting (2025a). No EPBC Act-listed Threatened flora were recorded from the PMST search. A total of 20 Priority species listed by the DBCA have been recorded within 50 km of the Study area. No Threatened or Priority flora recorded within the DBCA or PMST database are within the Study Area. Onshore (2019) identified three Priority species and three range extension species during the two season detailed field survey within the Study Area. The Permit Area intersects vegetation association 18 and 39. Both vegetation associations have over 99% of their extent remaining in comparison to their pre-European extent (Government of WA, 2019). 14 significant fauna species were recorded within 50 km of the Study Area. No significant fauna records were identified within the Study Area. The closest fauna record was of a Long-tailed Dunnart *(Sminthopsis longicaudata*), Peregrine Falcon (*Falco peregrinus*), Pygmy Python (*Antaresia perthensis*) and a Desert Mouse (*Pseudomys desertor*), located on a patch of rocky outcrop habitat approximately 1 km southeast (Biologic, 2020).	Areas of high biological diversity were not noted to be within the Permit Area, with habitats typical of the region. Three recorded significant flora species will be disturbed by the proposed clearing, although only small percentages of local individuals will be lost. The proposed clearing will result in the removal of up to 45 ha of native vegetation which consists of low shrubland (to low open shrubland), low open forest, low woodland and scattered low trees. Regionally, this vegetation is widespread, and the clearing represents less than 0.1% of the remaining extent of Vegetation Association 18 and 39. All fauna habitat types identified in the Study Area are typical of the Eastern Murchison subregion and Gabanintha, Koonmarra and Wiluna land system.	To minimise the impact of clearing on the environment, Star Minerals proposes the following control measures: • The total extent of vegetation clearing is limited to 45 ha; • All clearing will be managed under a clearing contractor's Ground Disturbance Permit (or similar); • Locate clearing areas such that they can be utilised for other purposes if applicable (i.e., access roads, laydown); • The clearing areas will be identified using GPS coordinates; • All clearing kept to a minimum within the proposed Permit Area and completed only when required; • All vehicles, equipment and personnel will be inspected to ensure no weed-affected soil, mulch, fill, or other material is brought into the area to be cleared; and • Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.	The proposed clearing is not likely to be at variance with this principle.
2. Native vegetation should not be cleared if it comprises the whole, or part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to WA			
Two fauna habitats described by Biologic (2020) are within the Study Area. Neither	The fauna habitats present within the Study Area have been shown to be	Implement control measures described above.	The proposed clearing is not likely to be at variance with this principle.

Relevant Information	Assessment of potential impacts	Proposed control measures	Outcome – Assessment of variance with clearing principle
habitat was identified as being restricted or important to any significant fauna species. These habitats are described as: 1. Stony Plain The habitat significance to vertebrate fauna and its suitability to SREs is Low. The habitat comprises of low-lying open plains with stony substrate and lack of continuous vegetation. The vegetation varied throughout the extent but was dominated by scattered Mulga and Gidgee (*Acacia pruinocarpa*) over-storey, with a mid-storey comprising *Eremophila* and *Ptilotus species.* The Stony Plain is a common habitat both within the Study Area and in the wider regions throughout the region. 2. Minor Drainage Line With Low/Moderate SRE suitability its significance to vertebrate fauna is also Low. This habitat is characterised by drainage system that are dominated by dense stand of Mulga and other *Acacia* species over Sandy creek beds. The habitat is common throughout the region but comprises small percentage of the landscape.	commensurate with the surrounding area. Due to the location and relatively small clearing extent, the Project will not prevent habitat connectivity or clear any locally significant habitat. Regionally, clearing of 45 ha represents less than 0.1% of the remaining extent of Vegetation Association 18 and 39. No fauna of conservation significance has been identified within the Study Area (using historical surveys and DBCA databases). The Minor Drainage Line habitat within the area may only rarely be utilised by threatened species and does not represent critical habitat. No threatened species have been recorded during on site surveys and as mentioned previously, there is an abundance of equal value habitat in the surrounding area.		
3. Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora			
No Threatened Flora species have been recorded within the Permit Area. Six significant flora species have however been recorded within the Study Area by Onshore (2019). Only three of these species will be directly impacted by the clearing for the Project: 1. *Acacia speckii* (P4) 2. *Dodonaea amplisemina* (P4) 3. *Ptilotus luteolus* (P3)	Publicly available data was reviewed to determine the current extent of significant flora recorded within the Study Area. Using this information, the clearing for the Project may result in the loss of known records of approximately 73 *Acacia speckii*, 288 *Dodonaea amplisemina* and 381 *Ptilotus luteolus* individuals. These species have all been recorded throughout the region, and proportional impacts remain relatively low, with more	Implement control measures described above. Impacts to significant flora will be restricted to *73 Acacia speckii*, 288 *Dodonaea amplisemina* and 381 *Ptilotus luteolus* individuals (based on Onshore (2019) data).	The proposed clearing may be at variance with this principle.

Relevant Information	Assessment of potential impacts	Proposed control measures	Outcome – Assessment of variance with clearing principle
	than 77% of known individuals remaining after the disturbance of all mining operations in the area is taken into account.		
4. Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a Threatened Ecological Community			
No PECs or TECs have been recorded within the Study Area. The closest PEC is located approximately 2.9 km to the northeast and will not be impacted by the Project.	Not applicable.	Not applicable.	The proposed clearing is not at variance with this principle.
5. 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 Permit Area lies entirely within the Eastern Murchison IBRA Subregion. The Eastern Murchison subregion covers 7,847,996 ha. The Study Area intersects vegetation association 18 and 39. Both vegetation associations have over 99% of their extent remaining in comparison to their pre-European extent (Government of WA, 2019).	The Permit Area does not represent a significant remnant of native vegetation in an extensively cleared area. The proposed clearing will result in the removal of up to 45 ha of native vegetation. This clearing represents less than 0.1% of the remaining extent of Vegetation Association 18 and 39. Both vegetation associations have over 99% of their extent remaining and are therefore considered least concern (Government of WA, 2019).	Implement control measures described above.	The proposed clearing is not at variance with this principle.
6. Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland			
Flood modelling by Pentium Water (2025) suggests that given the position of the mine at the top of the catchment, runoff within the mining area is relatively insignificant and only minimal surface water management is required to control overland flows.	No significant watercourses or permanent wetlands are present within the Permit Area.	Not applicable.	The proposed clearing is not at variance with this principle.
7. Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation			
The area within and surrounding the Permit Area remains mostly uncleared with disturbance limited to that caused by Meekatharra and Sandstone Road and	The clearing will occur in an area that is of low erosion risk but with historic disturbance and introduced weeds. The small size of the Project and its associated	Implement control measures described above. Stockpiles and other potential erosion-susceptible landforms have been	The proposed clearing is unlikely to be at variance with this principle.

Relevant Information	Assessment of potential impacts	Proposed control measures	Outcome – Assessment of variance with clearing principle
smaller access tracks and mine clearing. No declared pests or Weeds of National Significance were recorded within the Permit Area (Biologic, 2021). Previous flood modelling by Hydrologia (2023), suggests only a portion of the project infrastructure resides within the flood fringes of the 1% AEP, which means erosion risks are low.	clearing is however unlikely to result in any appreciable land degradation.	positioned outside of areas that may be within flood extents or watercourses.	
8. 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 proposed clearing area does not occur within or adjacent to any conservation areas. The Study Area is not located in close proximity to any legislated lands, with the closest including the Kaluwiri National Park, Lakeside Conservation Park, and Lake Annean. They are located approximately 88 km southeast, 108 km southwest and 23 km West of the Study Area, respectively.	Not applicable.	Not applicable.	The proposed clearing is not at variance with this principle.
9. Native vegetation should not be cleared if the clearing is likely to cause deterioration in the quality of surface or underground water			
Flood modelling by Pentium Water (2025) suggests that given the position of the mine at the top of the catchment, runoff within the mining area is relatively insignificant and only minimal surface water management is required to control overland flows. As such only minor bunding for the south-eastern topsoil stockpile and floodways/culverts for the access road to the site are recommended to mitigate flooding and prevent downstream impacts.	No major watercourses or wetlands are present within the Permit Area. Groundwater recharge is expected to be by direct rainfall or by stream flow during episodic rainfall events, with no wetland or dampland areas in the Permit Area. Recharge is predominantly from surface water runoff and flooding events associated with local tributaries feeding Lake Annean Recharge occurs mainly on or adjacent to the groundwater divide and along drainage lines. The Project clearing is relatively small and short-term in nature and the risks of contamination (i.e.,	Implement the control measures described above. A combination of floodways and culverts at both crossing locations. Floodways are generally the preferred method for managing surface water flow across the access roads. If culverts are used they will be adequately sized to convey adopted design flows beneath the access roads while avoiding adverse impacts on local watercourses.	The proposed clearing is not likely to be at variance with this principle.

Relevant Information	Assessment of potential impacts	Proposed control measures	Outcome – Assessment of variance with clearing principle
	from hydrocarbons) of surface or groundwater is considered to be low,	One flood protection bund is required around the south-eastern topsoil stockpile.	
10. Native vegetation should not be cleared if the clearing is likely to cause, or exacerbate, the incidence or intensity of flooding			
The region has a subtropical desert climate, with mild, dry winters and very hot summers. The Study Area only represents less than approximately 0.01% of the Yalgar River Sub-Catchment. The proposed clearing area will not alter any significant banks or directional flow.	Not applicable	Not applicable	The proposed clearing is not at variance with this principle.

6 SUMMARY AND CONCLUSIONS

The purpose of this NVCP Application is to allow the clearing of up to 45 ha of native vegetation within a 79 ha Permit Area for development of the Project as described in Section 3.

The following key points are noted:

- The area has been extensively studied based on the available reports, databases, and relevant documents of Gabanintha Vanadium Project and historical Gabanintha Gold mine and the findings have been used to assess the impacts of clearing;
- Clearing of 45 ha within the Permit Area represents less than 0.1 % of the remaining extent of Vegetation Association 18 and 39;
- Fauna habitats within the Permit Area are widespread, consisting of Minor Drainage Line and Stony Plain habitat;
- No regionally or locally restricted habitat types are present;
- The proposed clearing will not result any significant impacts to the following:
    - TECs or PECs;
    - Wetlands / watercourses; or
    - Conservation areas; and
- Impacts to three Priority Flora species will occur, however these species are relatively widespread, with significant proportion of known records to remain, even after the clearing of all surrounding mining operations are taken into account.

Star Minerals has also identified a number of control measures to minimise the impacts to native vegetation. These measures include the following:

- All clearing to be managed under a clearing contractor's Ground Disturbance Permit (or similar);
- The clearing areas will be identified using GPS coordinates;
- All clearing kept to a minimum within the Permit Area and completed only when required;
- All vehicles, equipment and personnel will be inspected and cleaned as required to prevent the incidental spread of weeds;
- Clearing limits for Priority Flora; and
- Surface water management measures.

This NVCP application assessed the proposed vegetation clearing against the ten clearing principles described in *A Guide to the Assessment of Applications to Clear Native Vegetation* (Department of Environment Regulation, 2014). The assessment determined that the proposed clearing may be at variance with one clearing principle; "Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora". The clearing will not result in the clearing of Threatened Flora, however three Priority Flora species will be impacted. The scale of impacts to these species is considered unlikely to be significant, based on the information provided in Section 3.5.

7 GLOSSARY

Term	Meaning
AEP	Annual Exceedance Probability
ALA	Atlas of Living Australia
ARI	Average Recurrence Interval
BC Act	*Biodiversity Conservation Act 2016*
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DMPE	Department of Mines, Petroleum and Exploration
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ha	Hectares
IBRA	Interim Biographical Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
IFM	Index Flood Method
ILUA	Indigenous Land Use Agreement
km	Kilometres
NVCP	Native Vegetation Clearing Permit
P	Priority
PEC	Priority Ecological Communities
Permit Area	Boundary for clearing proposed in this NVCP (Figure 1)
PMST	Protected Matters Search Tool
Preston Consulting	Preston Consulting Pty Ltd
RORB	Runoff Routing and Overland Routing Model
SRE	Short Range Endemic
Star Minerals	Star Minerals Limited
TEC	Threatened Ecological Communities
The Project	Tumblegum South Project
WA	Western Australia

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