NATIVE VEGETATION CLEARING PERMIT
GARDEN GULLY PROJECT

PREPARED FOR:

NEW MURCHISON GOLD LIMITED

NMG
New Murchison
Gold Limited

DECEMBER 2024

PREPARED BY:

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MBS
ENVIRONMENTAL

GARDEN GULLY PROJECT
NATIVE VEGETATION CLEARING PERMIT

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TABLE OF CONTENTS

1. SUMMARY 1
2. INTRODUCTION 2
3. BACKGROUND 3
3.1 LOCATION 3
3.2 TENURE 3
3.3 ENVIRONMENTAL SETTING 7
3.3.1 Climate 7
3.3.2 Soils and Landscape 7
3.3.3 Flora and Vegetation 12
3.3.4 Terrestrial Fauna and Habitats 20
3.3.5 Surface Water and Groundwater 25
4. PROPOSED LAND CLEARING 29
5. ASSESSMENT OF CLEARING PRINCIPLES 30
5.1 NATIVE VEGETATION CLEARING PRINCIPLES 30
5.2 BIODIVERSITY 31
5.2.1 Potential Impacts 31
5.2.2 Management and Mitigation 31
5.3 SIGNIFICANT FAUNA HABITAT 34
5.3.1 Potential Impacts 34
5.3.2 Management and Mitigation 35
5.4 THREATENED FLORA 37
5.4.1 Potential Impacts 37
5.4.2 Management and Mitigation 37
5.5 THREATENED ECOLOGICAL COMMUNITIES 37
5.6 REMNANT VEGETATION 37
5.7 WATERCOURSE OR WETLAND ENVIRONMENTS 38
5.8 LAND DEGRADATION 38
5.8.1 Potential Impacts 38
5.8.2 Management and Mitigation 39
5.9 CONSERVATION ESTATE 40
5.10 SURFACE AND GROUNDWATER QUALITY 40
5.10.1 Potential Impacts 40
5.10.2 Management and Mitigation 41
5.11 FLOODING POTENTIAL 42
5.11.1 Potential Impacts 42
5.11.2 Management and Mitigation 42
6. ROLES AND RESPONSIBILITIES 44
6.1 CHIEF EXECUTIVE OFFICER AND GENERAL MANAGER 44
6.2 OHSE OFFICER 44
6.3 PRODUCTION ENGINEER 44
6.4 EMPLOYEES AND CONTRACTORS 45
7. REPORTING AND AUDITING 46
8. CONCLUSION 47
9. REFERENCES 48

TABLES

Table 1: Project Tenements 3
Table 2: Soil and Landform Units 9
Table 3: Pre-European Vegetation Associations within the Purpose Permit Area........ 12
Table 4: Mapped Vegetation Communities........ 14
Table 5: Potential Significant Flora within 40 km 16
Table 6: Mapped Fauna Habitats 20
Table 7: Potential Significant Fauna within 40 km of Project........ 21
Table 8: Potential Direct and Indirect Impacts to Subterranean Fauna 22
Table 9: Summary of Clearing Assessment Against Clearing Principles........ 30
Table 10: Potential Impacts to Vegetation Communities 33
Table 11: Potential Impacts to Fauna Habitat........ 34
Table 12: Pre-European Vegetation Association Representation 38

FIGURES

Figure 1: Project Location........ 5
Figure 2: Tenement Plan 6
Figure 3: Climate Data for Meekatharra Airport (1950–2024) (BoM, 2024)........ 7
Figure 4: Land Systems........ 10
Figure 5: Dominant Soil Groups 11
Figure 6: Mapped Vegetation Communities and Priority Flora (Mining Area)........ 18
Figure 7: Hydrological Cross-Section 19
Figure 8: Habitat Types 24
Figure 9: Larger Catchments and Water Reserve 27
Figure 10: Local Catchments with Key Infrastructure 28

APPENDICES

Appendix 1: Proof of Occupier Status
Appendix 2: Westgold Agreement
Appendix 3: Soil and Landform Assessment
Appendix 4: Reconnaissance Flora and Basic Fauna Assessment
Appendix 5: Hydrological and Hydrogeological Assessment
Appendix 6: Subterranean Fauna Assessment

1. SUMMARY

New Murchison Gold Limited (NMG, previously Ora Gold Limited) proposes to clear 93.96 ha of native vegetation within a 204.53 ha Purpose Permit Area for development of the Garden Gully Project (the Project).

The Project is located 670 km northeast of Perth and approximately 20 km north of Meekatharra in the Northern Goldfields region of Western Australia. NMG is proposing to develop the Crown Prince deposit as an open pit mining, crushing, and trucking operation, with stockpiled ore transported off site for processing. The Project will consist of two open pits and associated infrastructure including waste rock landform, low-grade ore stockpiles, ROM, workshop, dewatering infrastructure, offices and internal roads.

An assessment against the ten clearing principles was undertaken based on information collected from site specific flora and fauna surveys and hydrological studies conducted for the Project. NMG have also engaged with Traditional Owners as part of the stakeholder consultation process including the Wajarri Yamaji Aboriginal Corporation, Ngoonooru Wadjari Peoples Trust and the Wajarri Yamaji Group. The indicative clearing footprint and mine site layout has been developed to ensure impacts to sensitive environmental and cultural values are avoided or minimised.

The assessment of the proposed clearing against the ten clearing principles determined that the proposed clearing of 93.96 ha for the Project will not be or is unlikely to be at variance with the ten clearing principles. Appropriate environmental management procedures will be implemented to ensure potential direct and indirect impacts associated with the clearing are avoided or minimised where practicable.

2. INTRODUCTION

NMG is proposing to develop the Project as an open pit mining, crushing, and trucking operation, with stockpiled ore transported off site for processing. It is proposed the Project will include:

- Development of two open pit mines, extending below the water table.
- Run-of-mine (ROM) pad and ore storage area.
- A permanent waste rock landform (WRL).
- Low grade ore (LGO) stockpile.
- Water storage in a shallow dam (turkey's nest).
- Mobile crushing, screening and sampling plant.
- Other associated mining infrastructure:
  - Topsoil stockpiles.
  - Mine haul roads, access roads and tracks.
  - Fuel storage and dispensing facilities.
  - Surface water management infrastructure.
  - Laydown areas.
  - Exploration core storage yard.
  - Hardstand areas.
  - Mine equipment maintenance workshop.
  - Temporary administration / office / gatehouse buildings.
  - Explosive storage (Magazine).
  - Diesel generators.
  - Communication (satellite or microwave tower).

Clearing will be undertaken in a staged manner over M 51/886 and M 51/889 as the Project is developed. Future clearing is proposed over pending miscellaneous tenements (L 51/138 and L 51/139) for dewatering infrastructure (including pipelines to Sabbath and Five Mile Well pits and evaporators) and to connect M 51/886 and M 51/889. This will be subject to a future clearing permit application once these tenements are granted.

3. BACKGROUND

3.1 LOCATION

The Project is situated approximately 670 km northeast of Perth and 20 km north of Meekatharra (Figure 1). It comprises the Crown Prince deposit of the Abbots Greenstone Belt.

The Project is accessed by Meekatharra-Mount Clere Road (unsealed), approximately 13 km from the Great Northern Highway. Ore products will be transported from the Project via site access roads and the Great Northern Highway to Bluebird Gold Mine (Bluebird), located approximately 15 km south southwest of Meekatharra.

3.2 TENURE

The Project is situated within Mining Leases M 51/886 and M 51/889 and two pending Miscellaneous Lease applications (L 51/138 and L 51/139). Mining operations and the majority of infrastructure are located on M 51/886 with some supporting infrastructure located on M 51/889. Both M 51/886 and M 51/889 are held by Zeus Mining Pty Ltd, a wholly owned subsidiary of Red Dragon Mines Pty Ltd. Red Dragon Mines Ltd is a wholly owned subsidiary of NMG (previously Ora Gold Limited). Evidence of tenure is provided in Appendix 1.

The first Miscellaneous Lease application (L 51/138) (which is proposed for dewatering infrastructure to Sabbath Pit) overlays L 51/98, and portions of E 51/1791 and M 51/322 as well as the road easement of a portion of Meekatharra Mount Clere Road. The second Miscellaneous Lease application (L 51/139) (which is proposed for dewatering infrastructure to Five Mile Well Pit) overlays part of road easement of the southern portion of Meekatharra Mount Clere Road as well as portions of E 51/1791, M 51/199, M 51/670, M 51/671, E 51/2263 and Crown Land. L 51/98, M 51/322, M 51/199, M 51/670 and M 51/671 are held by Big Bell Gold Mines Pty Ltd, a wholly owned subsidiary of Westgold Resources Ltd (Westgold). Pending lease E 51/2263 was submitted by Redstone Metals Pty Ltd. E 51/1791 is held by Zeus Mining Pty Ltd.

NMG has an operational and access agreement with Westgold over L 51/98, M 51/322, M 51/199, M 51/670 and M 51/671 for dewatering infrastructure as well as haulage of ore offsite for processing. The agreement with Westgold also includes ore purchase and processing arrangements at Westgold's Bluebird Mill at Meekatharra (Appendix 2). Future arrangements may include access to Westgold's camp and associated facilities.

This clearing permit application is being submitted for proposed clearing on M 51/886 and M 51/889. Future clearing proposed over pending tenements L 51/138 and L 51/139 for dewatering infrastructure and to connect M 51/886 and M 51/889 will be subject to a future clearing permit application once these tenements are granted.

A summary of the tenements applicable to this Native Vegetation Clearing Permit (NVCP) are provided in Table 1 with a tenement plan presented in Figure 2.

Table 1: Project Tenements

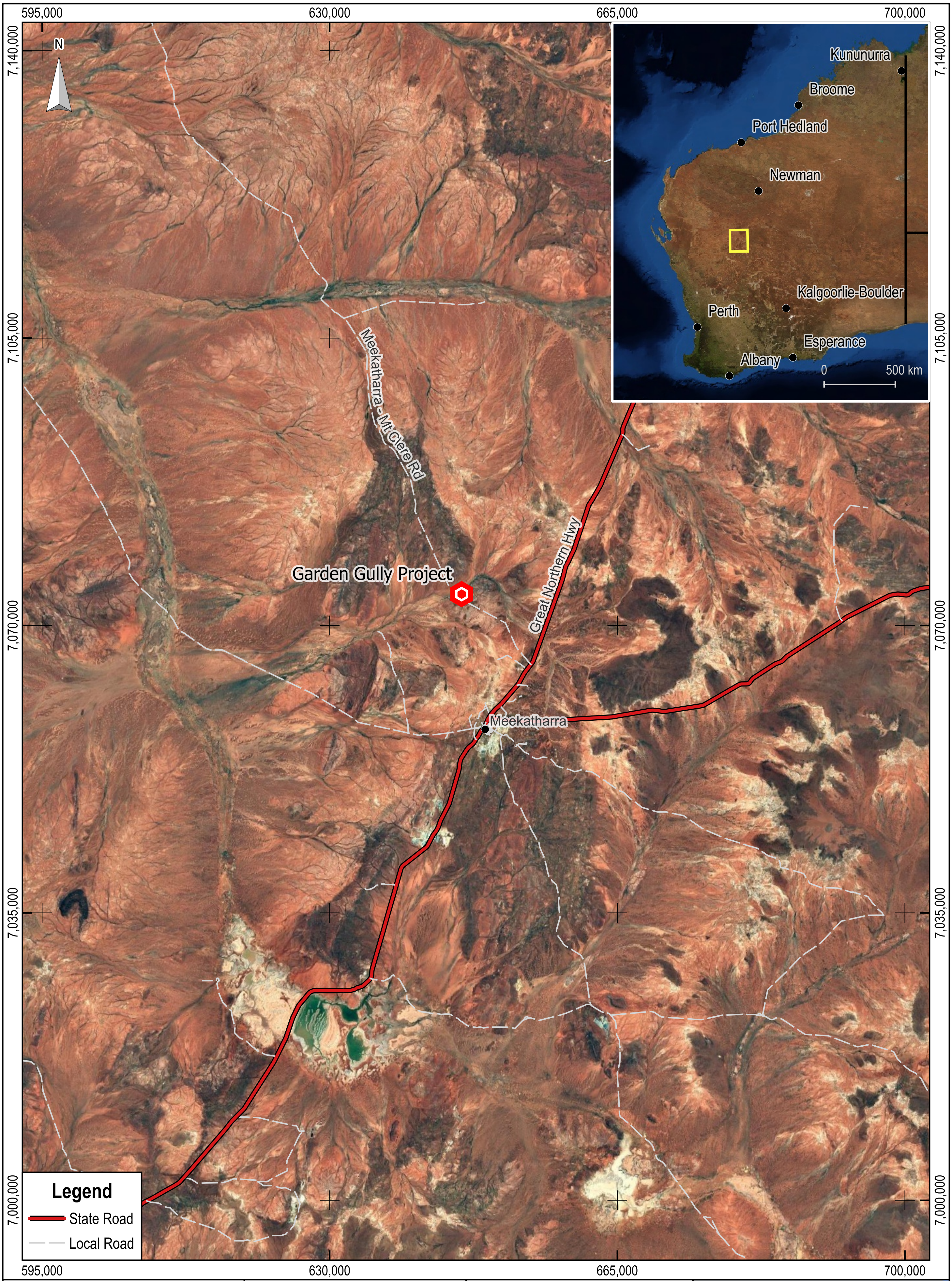
Tenement	Area (Ha)	Holder	Granted	Expiry
M 51/886	204.297	Zeus Mining Pty Ltd	21/02/2022	20/02/2043
M 51/889	189.438	Zeus Mining Pty Ltd	21/02/2022	20/02/2043

The Project is located within the Shire of Meekatharra and is situated across Yoothapina Pastoral Station and Sherwood Pastoral Station. A portion of the Project (M 51/889 and portions of M 51/886) is located over an old local recreation reserve No. 10633 associated with historic cultural events, mining, settlement and water supply. NMG consulted with the Meekatharra Shire regarding the Project, including Site 25188. The Shire confirmed the Garden Gully site was largely absent and raised no objections to the Project. In addition, no mining is proposed within the

Meekatharra Town site and the reserve is highly unlikely to be needed for future public water supply. Similarly, the Shire had no objections during consultations in 2020 for mining lease applications M 51/886 and M 51/889 over the reserve. The Meekatharra Water Reserve which includes the Sherwood borefield that supplies water for the town is approximately 2 km northeast and upstream of the Project at its closest point, but about 9 km from the nearest production bore.

On 19 October 2017 (Part A WCD2017/007) and 23 April 2018 (Part B WCD2018/002), the Federal Court of Australia determined the Wajarri Yamatji (claimant) as holders of Native Title of a determination area which covers Yoothapina pastoral station and the Project. On 12 November 2021, NMG (previously Ora Gold Limited) executed a Native Title and Heritage Agreement (ID 2021-NWA-GG-886-36) between Zeus Mining Pty Ltd and the Wajarri Yamaji Aboriginal Corporation (WYAC) in relation to mining leases M 51/886 and M 51/889. The agreement commits to actions relating to payments, community sponsorship, employment, training, contracting, environmental protection, protection of cultural heritage protocols, compensation, access.

NMG has continued to engage with relevant Native Title Groups including the WYAC, Ngoonooru Wadjari Peoples Trust and the Wajarri Yamaji Group including proposed applications for additional tenements as well as required heritage surveys.



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Aerial Imagery: Google Satellite
Grid: GDA2020 / MGA zone 50
0 7.5 15 km

New Murchison Gold Limited
Garden Gully Project

Figure 1

Location Plan

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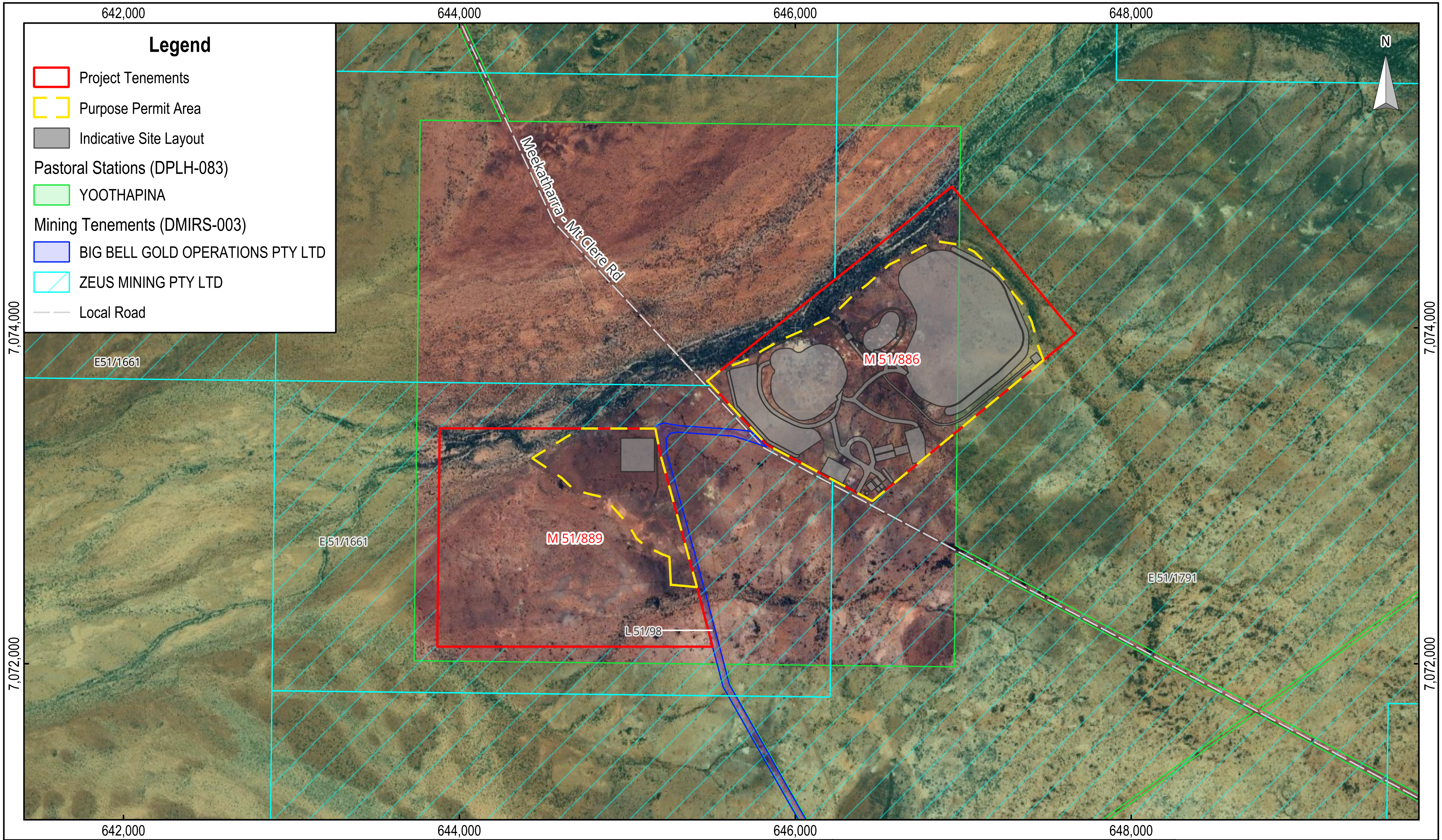

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Aerial Imagery: Google Satellite
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New Murchison Gold Limited
Garden Gully Project

Figure 2

Tenement Plan

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W:\Ora Gold\Approvals\NVCP\GIS\Ora Gold_NVCP_2024.qgz 18/12/2024 F02 Tenement Plan A4L

3.3 ENVIRONMENTAL SETTING

3.3.1 Climate

The Project is located in the Northern Goldfields region which experiences a non-seasonal arid climate with hot and dry summers and cool winters. No month in a given year can be considered reliably wet, and zero rainfall can be recorded in any month.

Meekatharra Airport (ID: 007045) is the closest representative Bureau of Meteorology (BoM) weather station (20 km to the southeast). The mean maximum temperatures range from 19.3 to 38.4°C, with mean minimum temperatures ranging from 7.5 to 24.5°C (Figure 3).

Rainfall averages 232.5 mm/year with totals influenced by the remnants of tropical cyclones and local atmospheric depressions. The yearly rainfall statistics from Meekatharra Airport weather station are shown in Figure 3. The lowest recorded annual rainfall was 66.2 mm; the highest recorded at 573.2 mm. The rainfall for January 2024 and April 2024 was above average. Rainfall for June 2024 was significantly higher than the average (BoM 2024).

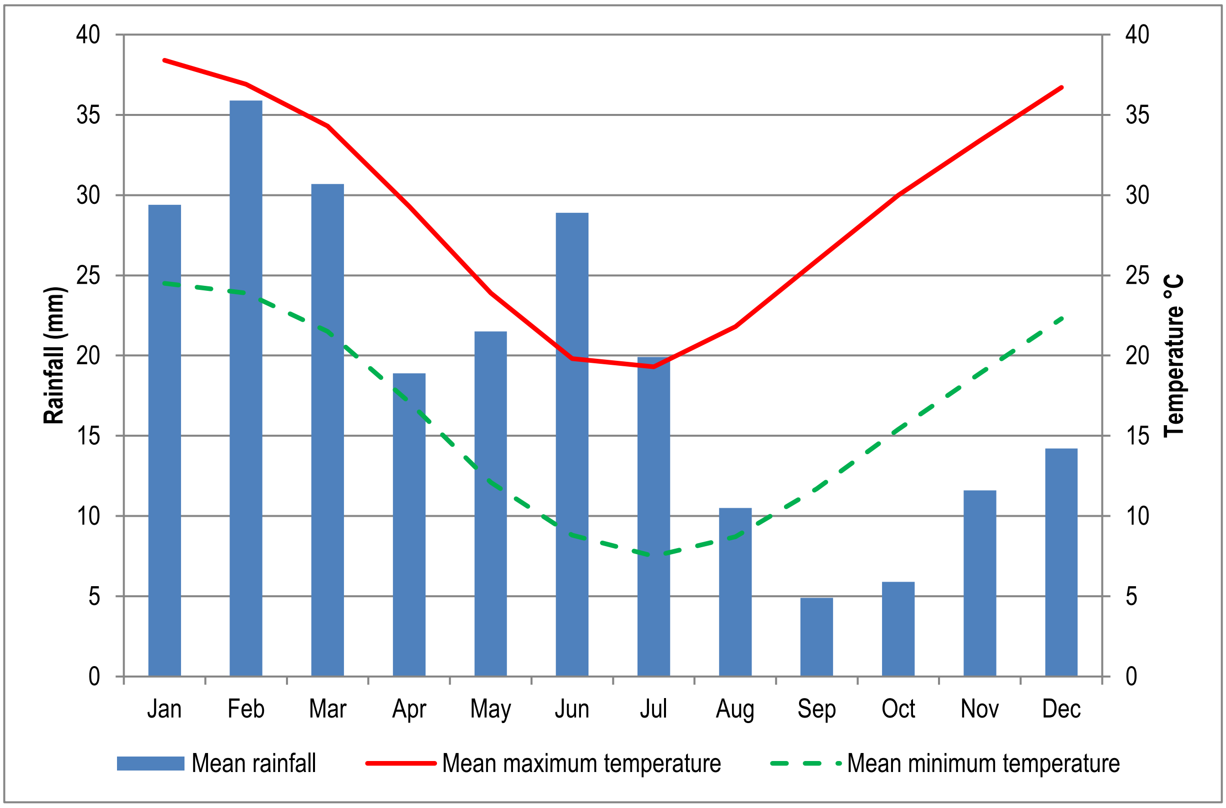


Figure 3: Climate Data for Meekatharra Airport (1950–2024) (BoM, 2024)

3.3.2 Soils and Landscape

A desktop review of land systems and soil types was performed using available data from the Department of Primary Industries and Regional Development (DPIRD 2018).

- Wiluna is the main land system unit and covers all of the proposed disturbance on M 51/886 and M 51/889.
- Mapped soil types include red shallow loams and sandy duplexes, red-brown hardpans and stony soils.

Characteristics of the land systems and soil types mapped across the Project are described in Table 2 and shown in Figure 4 (Van Vreeswyk et al, 2004; Pringle et al, 1994).

MBS (2024) was engaged to complete a soil and landform assessment for the main tenements of the Project (M 51/889 and M 51/886) (Appendix 3). Soil and subsoil profiles from eight (8) locations were sampled in this assessment, with dominant soil groups determined, as shown in Figure 5.

Key findings from the soil assessment include:

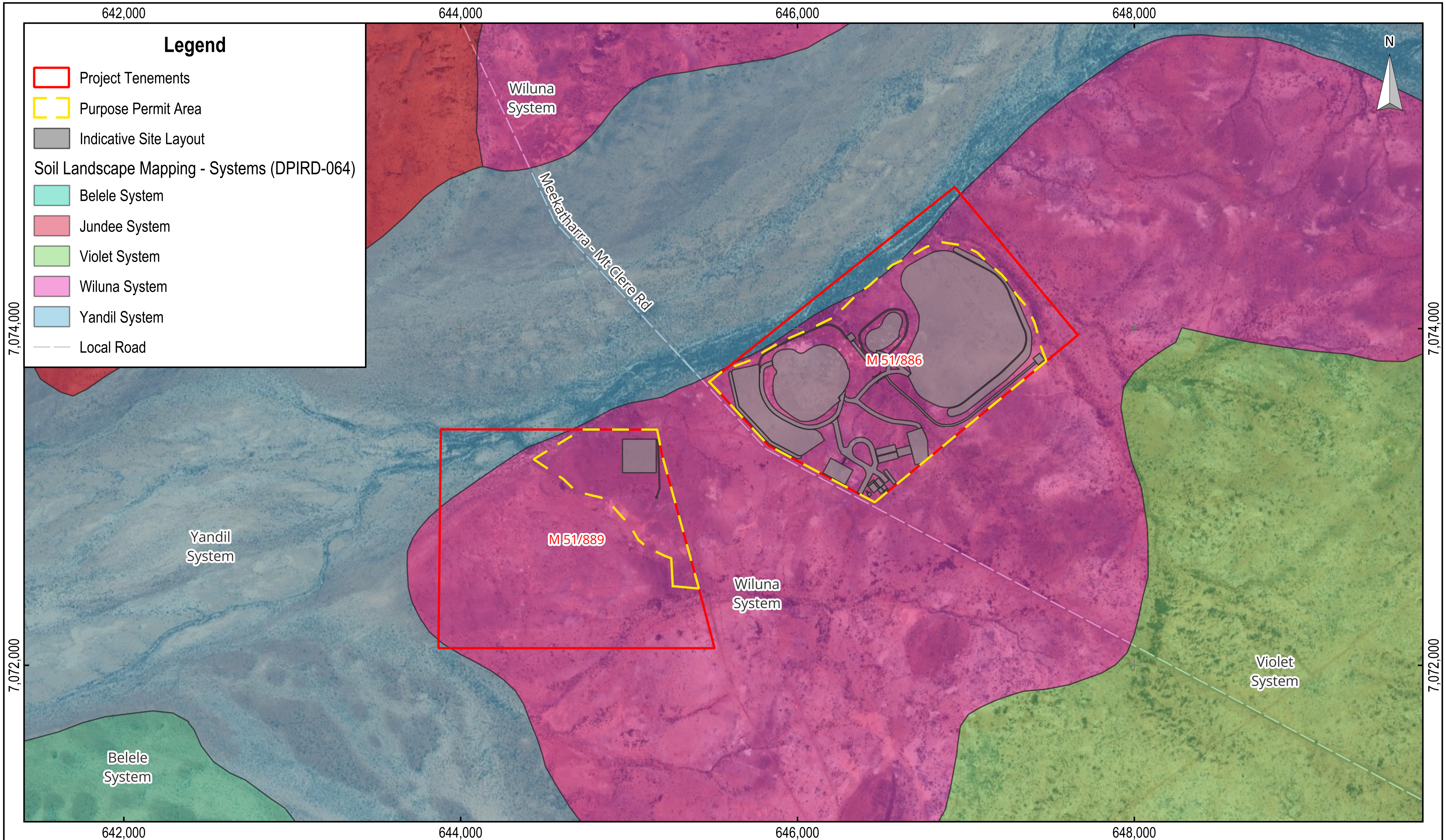
- Two landform types were identified:
  - Stony plains.
  - Broad stony slopes/plains.
- Both identified landforms are not considered significant with respect to EPA (2018) criteria for the following reasons:
  - Landforms are widely represented locally and regionally.
  - Landforms have been subjected to geological exploration and pastoral land use and are thus not considered pristine.
  - Landforms are not of any known ecological, geological or cultural significance.
  - The proposed disturbance area is <400 ha, which represents a very minor area with respect to the distribution of these landforms regionally.
- Three soil groups were identified:
  - Red shallow loams (DAFWA Group 522).
  - Red-brown hardpan shallow loams (DAFWA Group 523).
  - Shallow gravels (DAFWA Group 304).
- Gravel contents were variable across soils and subsoils ranging from 2% to 40% in surface soils and 2% to 65% in subsoils.
- Texturally, surface soils were typically sandy loams, whilst subsoils generally contained more clay and were classified as sandy loams, sandy clay loams or clays.
- Subsoils from two locations (OGCP01 and OGCP05, Figure 5) are likely to be dispersive given they had an Emerson Class rating of 1 and clay contents of around 27% to 28%. Soils from other areas are unlikely to be dispersive given they contained Emerson Class ratings of ≥3.
- Samples contained low exchangeable sodium percentages (ESP%) of <4.4%. This indicates that Project soils are non-sodic and thus unlikely to be erosion prone.
- Soils and subsoils had highly variable pH values ranging from 4.6 to 8.5.
- There was general trend in which soil pH increased with soil depth. A total of six (6) samples contained pH values of ≤5.2 which are consistent with moderate to highly acidic soils.
- Most soils were of low salinity, with the notable exception of one location (OGCP03, Figure 5) which contained higher clay contents and very high EC values of 240 mS/m in surface soils; and 460 to 480 mS/m in subsoils. Soils from this location were thus classified as extremely saline.
- Exchangeable cation concentrations were generally low across all tested soils and subsoils. Whilst most soils contained typical/moderate exchangeable aluminium concentrations, aluminium toxicity was not considered likely. All soils also contained low exchangeable sodium percentage (ESP) values and are thus non-sodic.
- Soils typically contained low organic carbon, total nitrogen concentrations plus plant available cobalt, molybdenum, nickel and sulphur concentrations. Potential metal(loid) contaminants such as arsenic, cadmium, lead and selenium were present in low plant-available concentrations across all samples.

- On an average basis soils were unlikely to contain total metal(loid) concentrations that exceed the NEPM default environmental criteria used as a reference throughout this assessment.

The study concluded that the majority of soils and subsoils can be stripped, harvested, stockpiled and re-used as required. There are some localised impediments to re-use such as dispersivity, acidity (Pit and WRL footprints) and salinity (primarily within the WRL footprints) which has the potential to impact both landform stability and revegetation activities. Clay-rich but potentially saline-to-extremely saline subsoils (especially in the WRL footprint) may be harvested if required for use as an impermeable clay layer. Subsoil clays are, however, otherwise unlikely to be suitable to rehabilitation, especially if saline and/or exposed on slopes.

Table 2: Soil and Landform Units

Land System	Geology	Landforms	Major Soil Types (DAFWA Soil Group)	Infrastructure Within Land System
Wiluna (272Wi)	Archaean amphibolite, basalt and schistose rocks with Tertiary laterite capping. Quaternary colluvium on slopes and Quaternary alluvium on lowlands.	Low greenstone hills with occasional lateritic breakaways and broad stony slopes. Lower saline stony plains and broad drainage tracts. Sparse mulga and other acacia shrublands with patches of halophytic shrubs.	Red shallow loam. Red shallow sandy duplex. Red shallow sand. Red-brown hardpan shallow loam. Stony soil.	Main disturbance area including pit and WRL and some dewatering infrastructure.



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Aerial Imagery: Google Satellite
Grid: GDA2020 / MGA zone 50 (EPSG:7850)
0 750 1,500 m

New Murchison Gold Limited
Garden Gully Project

Figure 4

Land Systems and Soils

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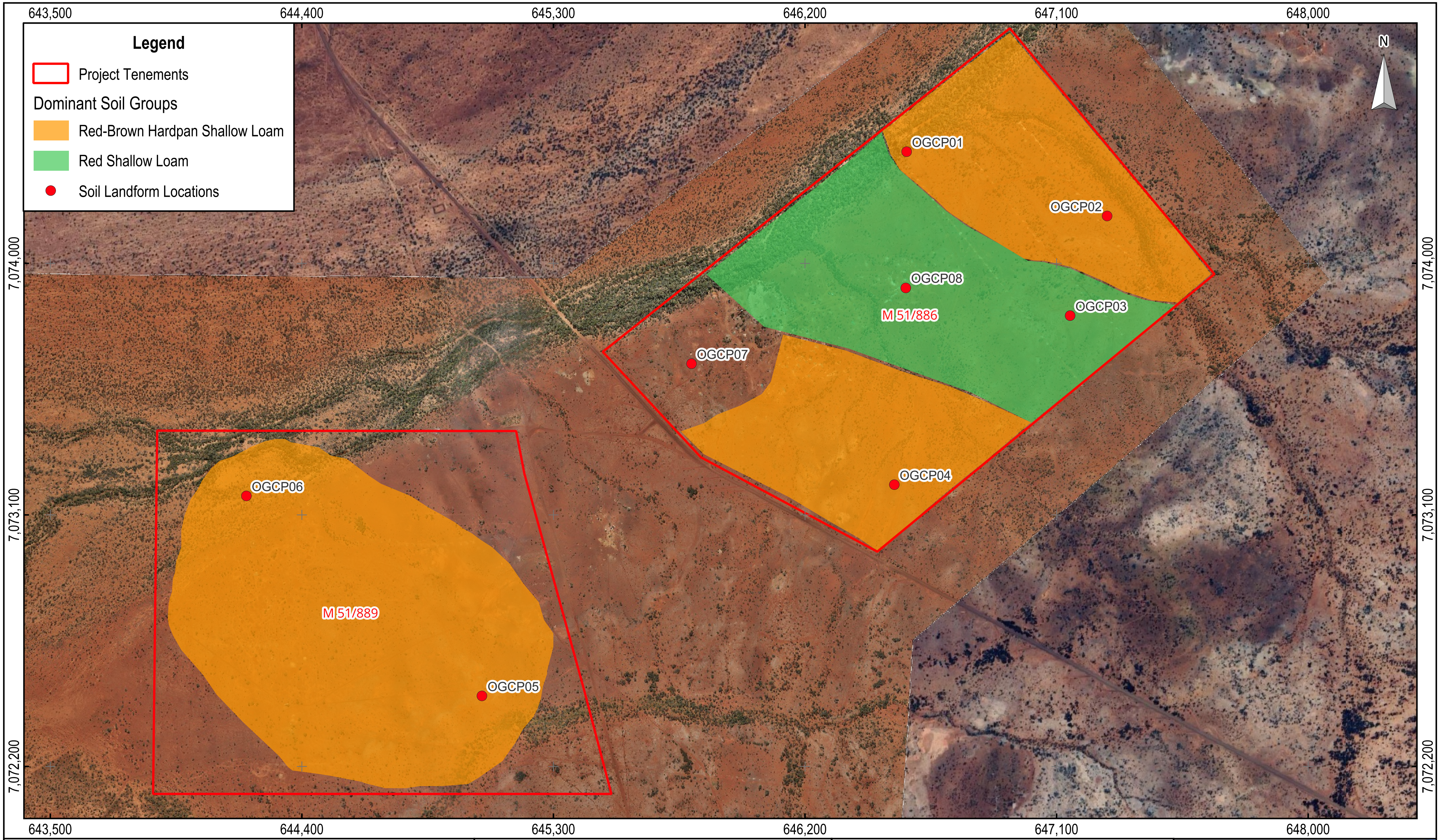

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Figure 5

Dominant Soil Groups

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W:\Ora Gold\Approvals\NVCP\GIS\Ora Gold_NVCP_2024.qgz 18/12/2024 F05 Dominant Soil Groups

3.3.3 Flora and Vegetation

The Project lies within the Western Murchison (MUR2) sub-region of the Interim Biogeographical Regionalisation of Australia (IBRA) Murchison Bioregion (Botanica 2024). The subregion can be characterised by mulga low woodlands, often rich in ephemerals (usually with bunch grasses), on outcrop and fine textured Quaternary alluvial and eluvial surfaces (extensive hardpan washplains that dominate and characterise the subregion) mantling granitic and greenstone strata of the northern part of the Yilgarn Craton. Surfaces associated with the occluded drainage occur throughout with hummock grasslands on Quaternary sandplains, saltbush shrublands on calcareous soils and Tecticornia low shrublands on saline alluvia. The MUR2 sub-regional area is 6,985,514 ha.

There are no Department of Biodiversity Conservation and Attractions (DBCA) managed lands or other conservation areas within proximity to the Purpose Permit Area with the nearest being the being the Lakeside Conservation Park (R54420), approximately 130 km southwest of the Project (Botanica, 2024).

Botanica (2024) undertook a reconnaissance level flora and vegetation survey of tenements M 51/886 and M 51/889 including a total area of 393.84 ha during June 2024 (Appendix 4). As part of the study, Botanica (2024) undertook a desktop assessment for a 40 km buffer area including a literature review of previous botanical assessments, database search requests for significant flora records, ecological communities as well as numerous publicly available database searches relevant to other biodiversity matters of conservation significance. The flora and vegetation survey was undertaken in accordance with the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

3.3.3.1 Vegetation Communities

The pre-European vegetation spatial mapping dataset (DPIRD 2023) identified two vegetation associations as occurring within the Purpose Permit Area. Proposed infrastructure for mining is located within an area mapped as the Upper Murchison 18 association.

The association description and remaining extent, as specified in the 2018 Statewide Vegetation Statistics (DBCA 2019) are provided in Table 3. Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered "endangered" (Botanica 2024). Upper Murchison 18 association retains greater than 99.73% of its pre-European extent, and development of the Project will not significantly reduce the current this vegetation community.

Table 3: Pre-European Vegetation Associations within the Purpose Permit Area

Vegetation Association	Description	Pre-European extent remaining (%)
Upper Murchison 18	Low woodland, open low woodland or sparse woodland of Mulga (*Acacia aneura*) and associated species.	99.73

The Botanica (2024) survey of M 51/886 and M 51/889 identified 80 vascular flora taxa, representing 44 genera across 26 families. The most diverse families were Fabaceae (17 species), Chenopodiaceae (ten species) and Scrophulariaceae (nine species), with Acacia (12 species) and Eremophila (nine species) as the most dominant genera. Twenty annual species were observed during the survey. Six introduced flora (weeds) species were observed. These were located in disturbed areas and along tracks. None of these species are listed as a Declared Pest on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) or as a Weed of National Significance.

As part of Botanica (2024) four broad-scale vegetation communities were identified and these largely aligned with the vegetation associations described in Table 4. Vegetation types were identified within two landform types (plains and drainage depressions) and comprised of three major vegetation groups, dominated by Acacia and Eremophila species. These vegetation communities are considered to be of low biological diversity and are well represented outside the survey area (Botanica 2024). Vegetation condition was categorised as 'Good' for 369 ha, with cleared areas (25 ha) considered "Completely Degraded".

Vegetation communities that intersect the Purpose Permit Area and their surveyed/mapped extents are described in Table 4 and shown in Figure 6.

Table 4: Mapped Vegetation Communities

Vegetation Group	Vegetation Community/Code	Description	Surveyed/Mapped Extent (ha)	Source
Acacia open woodlands (MVG 13)	RP-AOW1	Mid woodland of *Acacia pruinocarpa* and *Acacia incurvaneura* over mid open shrubland of *Acacia grasbyi*, *Eremophila galeata* and *Senna* sp. Meekatharra over low sparse shrubland of *Maireana triptera* and *Enchylaena tomentosa* on rocky plain.	175.45	Botanica (2024)
	CLP-AOW1	Mid woodland of *Acacia incurvaneura* over mid shrubland of *Eremophila compacta* over low sparse shrubland of *Solanum lasiophyllum* and *Aristida contorta* on clay loam plain.	114.68	
Acacia forests and woodlands (MVG 6)	DD-AFW1	Mid open forest of *Acacia incurvaneura* over mid open shrubland of *Acacia tetragonophylla, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* in drainage depression.	63.28	
Eucalypt woodlands (MVG 5)	DD-EFW1	Mid open forest of *Eucalyptus camaldulensis* over mid open shrubland of *Acacia tetragonophylla, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* in drainage depression.	15.97	
Cleared	Cleared	Land cleared of native vegetation	24.46	
		Total	**393.84**	

3.3.3.2 Threatened and Priority Ecological Communities

No Threatened, Priority or otherwise significant ecological communities were identified in the survey by Botanica (2024). In addition, the desktop assessment determined that the nearest potential Priority Ecological Community (PEC) is over 7.5 km to the west of the Purpose Permit Area (Botanica 2024).

No Environmentally Sensitive Areas occur in the Purpose Permit Area with the nearest over 45 km to the south and associated with Lake Annean. There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within or in proximity to the Purpose Permit Area.

3.3.3.3 Significant Flora Species

The Botanica (2024) desktop assessment identified one Threatened flora species and 15 priority flora species as occurring within a 40 km radius of their survey area. These taxa were assessed for distribution and known habitat to determine their likelihood of occurrence within the survey area. The species identified in the desktop assessment are summarised in Table 5, with likelihood of occurrence provided based on surveys undertaken by Botanica (2024) and desktop analysis of species records and habitat preferences.

No Threatened flora pursuant to the *EPBC Act* or *BC Act* were identified in the field surveys conducted by Botanica (2024). In addition, based on known species records and habitat requirements described by Botanica (2024), the *Pityrodia augustensis* (Vulnerable) species is considered unlikely to occur in the Purpose Permit Area with the nearest known population over 300 km to the northwest.

One Priority flora species was observed within the Botanica (2024) survey area of M 51/886, *Grevillea inconspicua* (P4). Approximately 30 plants were seen growing in a minor dry drainage line within the proposed Purpose Permit Area. Whilst this population is not directly impacted, given the close proximity to infrastructure and likely changes to this drainage line, indirect impacts are considered likely (Figure 6). *Grevillea inconspicua* is known from more than 62 populations on Florabase and is known to occur in two IBRA subregions, the Eastern Murchison and Western Murchison. There are seven populations within approximately 100 km of the survey area (DBCA 2024b), and according to Florabase the species covers a range of more than 50,000 km². Within the 40 km desktop area there are over 10 recorded populations, the closest of which is over 9.2 km south east of M 51/886. Botanica's (2024) survey did not record other Priority flora on M 51/886, M 51/889.

Table 5: Potential Significant Flora within 40 km

Significant Species	Conservation Status		Habitat Description	Likelihood of Occurrence
	EPBC Act and BC Act	DBCA Listed		
Acacia speckii		P4	Rocky soils over granite, basalt or dolerite. Rocky hills or rises.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.
Calytrix verruculosa	-	P3	Sandy clay. Shallow hardpan plain.	**Possible** - recorded over 280 m south of M 51/889.
Drummondita miniata		P3	Laterite. Breakaways.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.
Eremophila fasciata		P3	Stony hill.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.
Eremophila retropila	-	P1	Gravelly loam. Stony flats.	Unlikely - Not recorded by Botanica (2024) and nearest record over 8.5 km south of Project area.
Euploca mitchellii		P1	Rocky hills.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.
Goodenia berringbinensis		P4	Red sandy loam. Along watercourses.	Unlikely - Not recorded by Botanica (2024) and nearest record over 35 km north of Project area.
Grevillea inconspicua	-	P4	Along drainage lines on rocky outcrops, creeklines.	**Recorded** in M 51/886 and 9.2 km southeast of M 51/886
Hemigenia virescens		P3	Yellow-red sandy clay.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.
Homalocalyx echinulatus		P3	Laterite. Breakaways, sandstone hills.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.
Indigofera rotula		P3	Red loamy banks of watercourses.	Unlikely - recorded over 11.2 km southeast of M 51/886
Lepidium xylodes	-	P1	Gravelly loam, clayey sand.	Unlikely - Not recorded by Botanica (2024) and nearest record over 97 km north of Project area.
Menkea draboides	-	P3	Red sand or clay, granite.	Unlikely - recorded over 7.3 km the southeast of M 51/886
Pityrodia augustensis	VU		Amongst rocks on slopes or in drainage lines.	Unlikely - Not recorded by Botanica (2024) and nearest record over 300 km from Project area.
Ptilotus lazaridis		P3	Clay loam. Floodplains	Unlikely - Not recorded by Botanica (2024) and nearest record over 33 km west and south of the Project area.
Ptilotus luteolus		P3	Hillslopes.	Unlikely - Not recorded by Botanica (2024) and no habitat fitting this description in Project area.

3.3.3.4 Groundwater Dependant Ecosystems

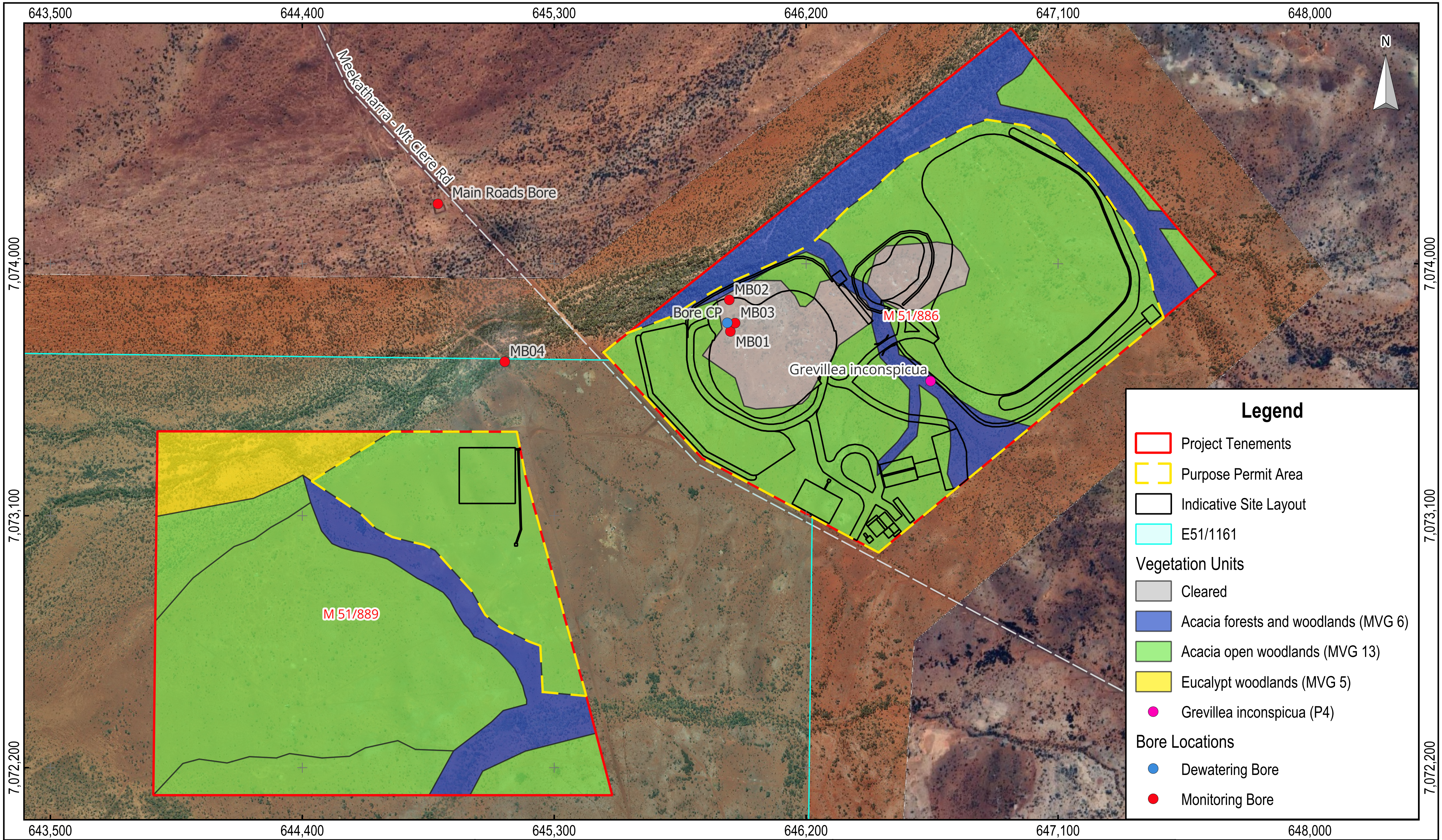
In accordance with the BoM Atlas of Groundwater Dependent Ecosystems (GDEs) database, there are no known or potential aquatic GDEs within the Project area however two potential terrestrial GDEs occur. Botanica determined that vegetation types identified mostly aligned with the ecosystem descriptions provided in be BoM Atlas and although difficult to determine how dependent these communities are on groundwater, determined they are more likely to obtain their water requirements from surface water (Botanica 2024).

Dewatering will be required during development of the open pits as the water table is located approximately 10 m below ground level (475 m AHD) within the pits. Rockwater (2024a) were engaged to undertake a hydrogeological study of the Crown Prince deposit and surrounding area to gain an understanding of the hydrogeological context, provide estimates of dewatering requirements and the potential for groundwater related impacts of mining. A cross section of the hydrological setting is shown in Figure 7. Rockwater (2024) determined that pit base would be at least 100 m from Garden Gully Creek vegetation however dewatering would result in groundwater-level drawdowns beneath the creek. Although it was noted that groundwater level drawdown has the potential to impact vegetation, Rockwater (2024a) in alignment with Botanica (2024) determined that vegetation within the creek is more likely to be supported by soil moisture rather than groundwater.

As part of the hydrogeological study, passive-seismic survey confirmed the presence of a palaeochannel of Tertiary age up to 70 m deep to the north of Garden Gully. The base of clay and alluvium that makes up the palaeochannel rises towards Crown Prince where it becomes thinner at Garden Gully Creek. There are unlikely to be any aquifers in the area of vegetated alluvium, as the alluvium is thin and very clayey. During pumping tests, monitoring of bores with Garden Gully Creek (MB04) and the palaeochannel (Main Roads bore) showed little to no water level drawdown (0.02 m and 0 m respectively) (Rockwater 2024a). This indicates poor connectivity between the fractured rock aquifer and the overlying clays and alluvium of the creek. It is likely that drawdown during dewatering would be much slower in the clays than the underlying fractured rock and the clay would remain moist. Rainfall would maintain moisture levels in the alluvium.

Given the presence of *Eucalyptus camaldulensis,* vegetation within Garden Gully Creek may use groundwater opportunistically however it is not considered likely to require groundwater to survive, with vegetation more likely to be supported by soil moisture rather than groundwater (Botanica 2024 and Rockwater 2024a). Given the above, there is expected to be sufficient water in the vadose zone from incident rainfall to support the creek vegetation. The life of mine is short at three years with predicted maximum drawdowns to occur at the end of mining of the deeper West Pit at approximately the end of year two, and therefore any potential impacts from dewatering will not be prolonged.

NMG will continue to monitor groundwater level drawdown including within Garden Gully Creek (MB04) and the palaeochannel (Main Roads bore) throughout mining operations. NMG will undertake vegetation health monitoring within Garden Gully Creek adjacent to the West Pit to monitor water stress from dewatering. If it is determined that dewatering is having an impact of vegetation health, NMG will seek permission from DWER to discharge environmental flows into the creek to support soil moisture noting the Project has a positive water balance. Water for environmental flows would reduce the excess water volume pumped offsite to nearby adjacent pits.



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Original Size: A4
Aerial Imagery: Ora Gold August 2024
Grid: GDA2020 / MGA zone 50 (EPSG:7850)
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Figure 6

Vegetation Units and Priority Flora

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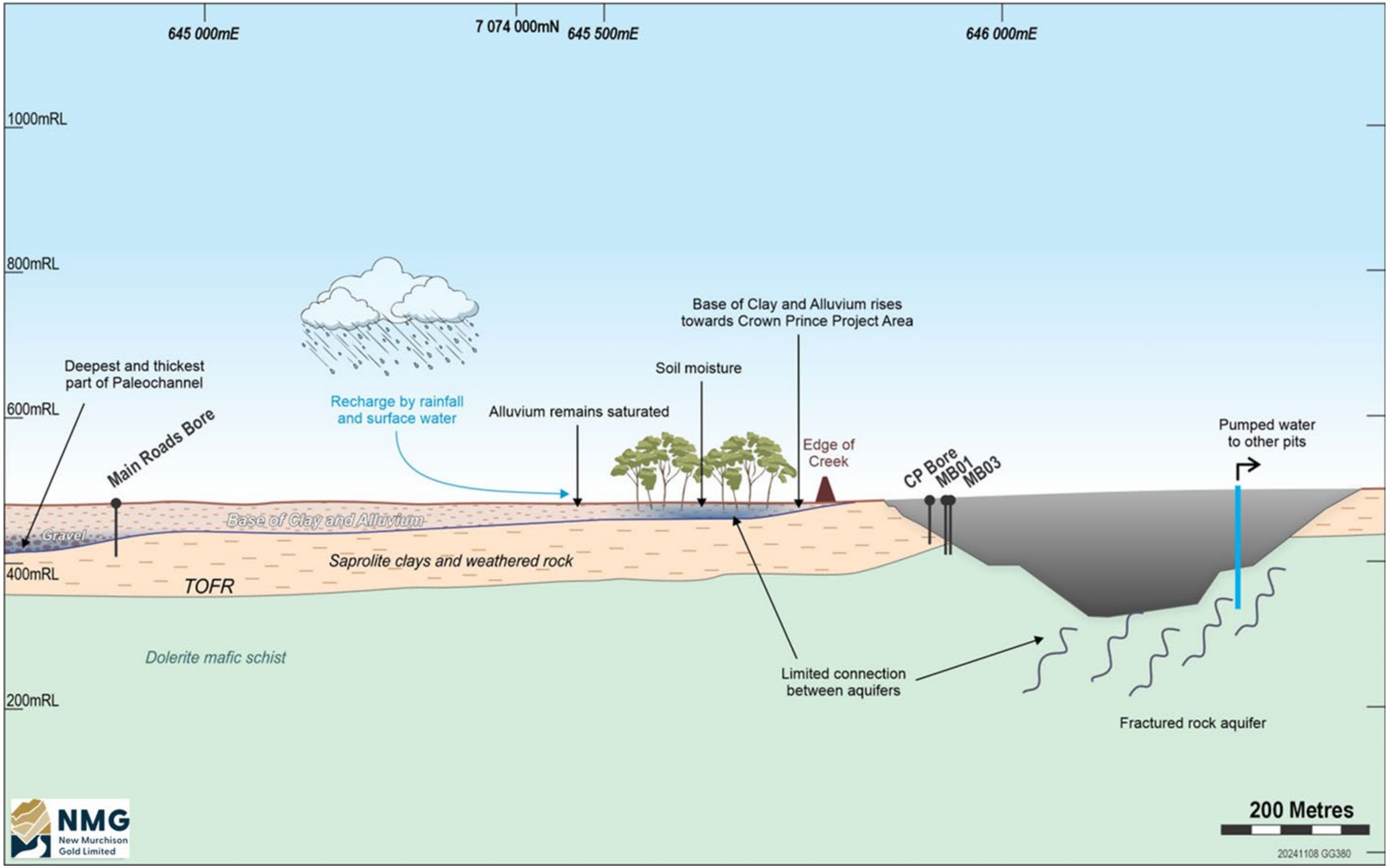


Figure 7: Hydrological Cross-Section

3.3.4 Terrestrial Fauna and Habitats

3.3.4.1 Fauna Habitat

Botanica (2024) undertook a basic fauna assessment of tenements M 51/886 and M 51/889 including a total area of 393.84 ha during June 2024 (Appendix 4). As part of the study, Botanica (2024) undertook a desktop assessment for a 40 km buffer area including a literature review of previous fauna assessments, database search requests for significant fauna records, as well as numerous publicly available database searches relevant to other biodiversity matters of conservation significance. The fauna assessment was undertaken in accordance with EPA Technical Guide - Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA 2020).

Based on vegetation and associated landforms identified, Botanica (2024) identified two broad scale terrestrial fauna habitats being acacia open woodlands, and acacia/eucalypt woodlands in drainage lines. These are summarised in Table 6 and are shown in Figure 8**.**

Table 6: Mapped Fauna Habitats

Habitat Type	Description	Surveyed/Mapped Extent (ha)
Cleared	Land cleared of native vegetation	24.46
Acacia open woodland on rocky or clay-loam plain	Open Acacia woodland over Eremophila shrubland. Ground not particularly suited to burrowing species. Low diversity vegetation strata supporting a reduced avifauna assemblage. Low vegetation density and low leaf litter supporting some small reptiles.	290.12
Acacia and/or Eucalypt woodland in drainage line	Closed Acacia and/or Eucalypt woodland over mixed Acacia and Eremophila shrubland Ground moderately suited to burrowing species in some areas. Moderate diversity vegetation strata supporting a good avifauna assemblage. Moderate vegetation density and moderate leaf litter supporting small reptiles.	79.26
	Total	**393.84**

3.3.4.2 Significant Fauna

Database searches (Dandjoo and Atlas of Living Australia) identified a total of 204 terrestrial vertebrate fauna taxa within 40 km of the survey area, consisting of 154 bird, 10 mammal, 38 reptile and two amphibian taxa. The basic fauna assessment identified twelve fauna species from opportunistic observations. No evidence of conservation significant fauna species was observed during the survey.

The desktop review (DBCA 2024b, DCCEEW 2024) identified nine terrestrial vertebrate species and one invertebrate species of conservation significance as previously being recorded in the regional area, consisting of eight threatened and one otherwise specially protected species. In addition, several migratory wading/shorebird species were assessed collectively due to their similar habitat requirements. Habitat and distribution data was used to determine the likelihood of occurrence within the survey area and based on this assessment two significant fauna species were identified as possibly occurring with all other species assessed as "unlikely" or "would not occur" (Table 7). Both species considered as possibly occurring are highly mobile avian species with large home ranges. In addition, no evidence of threatened or priority fauna species was observed by Botanica (2024) during site surveys.

Table 7: Potential Significant Fauna within 40 km of Project

Class	Significant Species	Conservation Status		Likelihood of Occurrence
		EPBC Act	DBCA Listed (BC Act)	
Reptile	Great desert skink (*Liopholis kintorei*)	VU	-	Would not Occur
Bird	Southern whiteface (*Aphelocephala leucopsis*)	VU	-	Unlikely
	Grey Falcon (*Falco hypoleucos*)	VU	VU	Possible
	Mallee fowl (*Leipoa ocellata*)	VU	VU	Unlikely
	Peregrine falcon (*Falco peregrinus*)	-	OS	Possible
	Sharp-tailed Sandpiper (*Calidris acuminata*)	VU	MI	Would not Occur
	Curlew Sandpiper (*Calidris ferruginea*)	CR	CR	Would not Occur
	Night parrot (*Pezoporus occidentalis*)	EN	CR	Would not Occur
	Migratory Shorebirds (inc Common sandpiper, Red necked stint)	MI	IA	Would not Occur
Invertebrate	Shield-backed trapdoor spider (*Idiosoma nigrum*)	VU	EN	Would not Occur

3.3.4.3 Subterranean Fauna

Rockwater (2024b) undertook a basic stygofauna survey over the Crown Prince deposit at Garden Gully, in conjunction with a desktop subterranean fauna study (Appendix 6). The report (Rockwater 2024b) considered the EPA's guidance for assessment of subterranean fauna, including *Technical Guidance – Subterranean fauna surveys for environmental impact assessment* (EPA 2021) and *Environmental Factor Guideline – Subterranean Fauna* (EPA 2016c).

Results of the desktop study indicate that no suitable habitat for troglofauna is likely, and the aquifers of the immediate Project area are unlikely to host a rich stygofauna community. Database searches undertaken for the study found that there are few records of subterranean fauna in the Murchison region of Western Australia, and no publicly available records that indicate surveys for stygofauna or troglofauna have been undertaken in the Garden

Gully area. A search of DBCA's Threatened and Priority Fauna database found no subterranean fauna species within a 100 km radius of the Project.

A database search for Threatened and Priority Ecological Community (TEC/PEC) relating to subterranean fauna confirmed that there are no TECs relating to subterranean fauna within a 100 km radius of the Project. The search returned several Priority Ecological Communities (PEC) pertaining to stygofauna communities in calcrete habitats, with all five communities listed occurring (at least partially) within a 50 km radius of the Project. The nearest of these PECs is the Priority 1 Belele calcrete groundwater assemblage, with its spatial buffer being approximately 34 km to the west of the Project and 33 km from any modelled drawdown impacts associated with pit dewatering at the Project. There are no calcrete or karstic formations in the area that was studied; however, several bores located upstream of the Project intersected significant thicknesses of porous calcrete that have historically had moderately high groundwater yields (Rockwater 2024b).

Results of 24 samples from the Project area included 12 possible stygofauna species, including copepods, ostracods, syncarids, and aquatic worms. Most of the stygofauna species from the Project area were found to occur more widely. However, one cyclopoid copepod species (Parastenocaris 'BHA433') collected from a single site within the palaeochannel (Main Roads bore) currently known only from the Garden Gully area.

Rockwater (2024b) identified potential direct, indirect and cumulative impacts associated with the Project as summarised in Table 8.

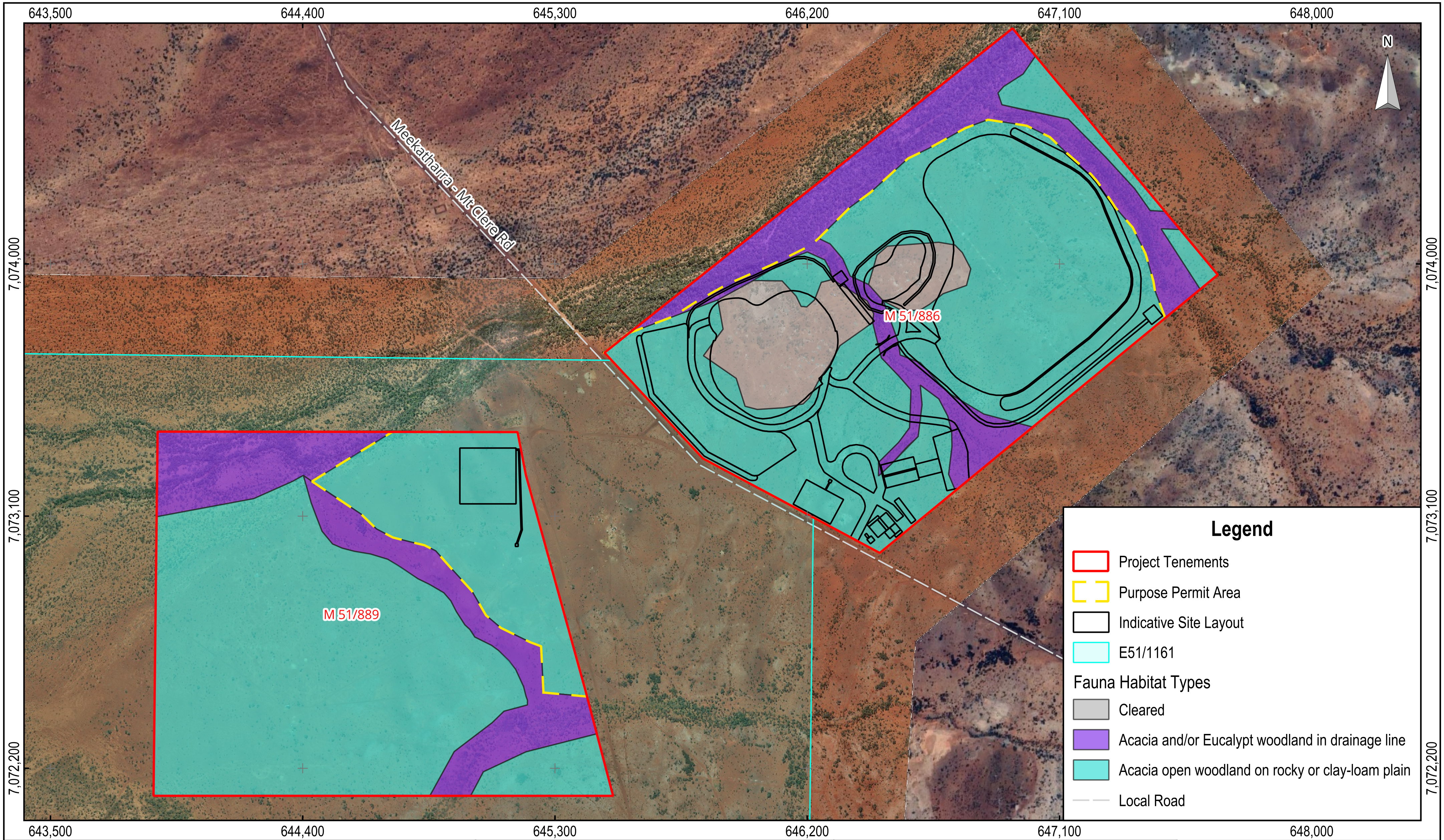
Table 8: Potential Direct and Indirect Impacts to Subterranean Fauna

Impact Type	Description
Direct Impacts (open pit and groundwater drawdown	Direct impacts to subterranean fauna habitat due to mine development, excavation of open pit (stygofauna and troglofauna) and groundwater drawdown (for stygofauna) due to pit dewatering.
Indirect Impacts (open pit and other mining infrastructure)	Impacts that may modify subterranean habitats, such as clearing and/or modifying landform, and activities associated with construction of infrastructure where such activities cause siltation, void collapse, alteration to nutrient balance and contamination.
Cumulative Impacts	Impacts of Project with consideration of other projects/users potentially impacting subterranean fauna. These include: 1. Pit Dewatering (nearby mines). 2. Other groundwater users.

During pumping tests, monitoring of the Main Roads bore showed no water level drawdown (Rockwater 2024a). This indicates poor connectivity between the fractured rock aquifer being dewatered and the palaeochannel. It is likely that drawdown during dewatering would be minimal in the palaeochannel as supported by drawdown modelling (Rockwater 2024a). The subterranean study (Rockwater 2024b) further concluded that modelled drawdown at the site the species was recorded at represents 2% of the aquifer thickness, which will not affect the conservation status of the species. Drawdown associated with the Project affects an area of approximately 1,580 ha and is unlikely to impact any stygofauna conservation values of the wider Garden Gully area (Rockwater 2024b). The nearest calcrete groundwater assemblage with significant conservation values (Belele P1 Priority Ecological Community) has its spatial buffer approximately 34 km to the west of Garden Gully Project, and 33 km from any modelled drawdown impacts associated with pit dewatering at Crown Prince deposit.

Indirect impacts from clearing and related risks to subterranean habitats such as siltation, void collapse, alteration to nutrient balance and contamination were considered unlikely by Rockwater (2024b), given the local geology and small scale of the Project. Cumulative impacts of drawdown from the other mining operations were also not considered relevant to the Project, as there will be no interactions between mine pit dewatering and drawdown associated with any current projects. There are no other significant groundwater users in the area that could impact the aquifers of the Project area. The Meekatharra Water Reserve, which includes the Sherwood Borefield that provides water for the town, is about 2 km upstream from Crown Prince deposit at its closest point. However, the nearest Sherwood Borefield production bore is about 9 km from the Crown Prince deposit.

Rockwater (2024b) concluded that there appears to be no risk from the Project to any stygofauna conservation values associated with listed threatened or priority ecological communities. The localised drawdown from pit dewatering as well as indirect impacts including clearing over the life of the Project are unlikely to impact any stygofauna values at Garden Gully, or the persistence of any stygofauna species recorded by the survey.



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Original Size: A4
Aerial Imagery: Ora Gold August 2024
Grid: GDA2020 / MGA zone 50 (EPSG:7850)
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Figure 8

Fauna Habitat Types

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3.3.5 Surface Water and Groundwater

3.3.5.1 Local Groundwater

Rockwater (2024a) were engaged to undertake a hydrogeological study of the Crown Prince deposit and surrounding area to gain an understanding of the hydrogeological context, provide estimates of dewatering requirements and the potential for groundwater related impacts of mining. The assessment included bore rehabilitation and survey, drilling and construction of new monitoring bores, passive seismic survey and the development of a groundwater model. Four monitoring bores (MB01 to MB04) were constructed as part of the assessment. Monitoring bores MB01 to MB03 are located in the northwest corner of West Pit, MB04 is approximately 800 m west of West Pit in the Garden Gully drainage and a Main Roads bore is located approximately 1.3 km north west within a Tertiary age palaeochannel. The palaeochannel which was defined by passive-seismic survey is approximately 70 m depth.

Results of the study indicate:

- The groundwater level across the area studied is at about 475 m AHD (approximately 10 mbgl). The proposed pit depth is approximately 150 m and therefore, mine dewatering will be required to facilitate mining.
- Groundwater quality at the Project is fresh to brackish, with total dissolved solids (TDS) concentrations of 1,620 mg/L to 1,800 mg/L and slightly alkaline with a pH of 7.8 to 8.2. Metal concentrations were generally low or below reference levels, although arsenic was slightly elevated (0.128 mg/L), possibly due to arsenopyrite mineralisation associated with gold mineralisation and typical for the Gascoyne region. Nutrients were low – Total nitrogen 2.1 mg/L, and total phosphorus 0.04 mg/L.
- Groundwater modelling results determined that dewatering flow rates could average up to 3,680 m^3/d (low estimate 1,870 m^3/d; high estimate 5,540 m^3/d), peaking in months five to twelve of mining at West Pit while dewatering rates for East Pit are anticipated to be much lower.
- Model-calculated groundwater-level drawdowns suggest that the largest drawdowns will occur at the end of mining of the deep West Pit at the end of year two. The Crown Prince deposit is within an old recreation reserve, No. 10633 that is very unlikely to be needed for public water supply. Drawdowns could extend to three pastoral bores and wells (if the bores/wells still exist, and are in the positions recorded), and possibly as far as the corner of the upstream Sherwood borefield Water Reserve boundary, but not as far as the nearest bore in that borefield.
- Pit dewatering would result in groundwater-level drawdowns beneath the Garden Gully creek, with the potential to impact vegetation. Rockwater (2024a) in alignment with Botanica (2024) determined that vegetation within the creek is more likely to be supported by soil moisture rather than groundwater. Results from pumping tests also indicated poor connectivity between the fractured rock aquifer and the overlying clays and alluvium of the creek as shown in Figure 7.

3.3.5.2 Surface water

The Project is located within the Upper Murchison River catchment, part of the Murchison River drainage basin which has low hills and mesas separated by flat colluvium and alluvial plains. The basin is primarily an open drainage system of lakes and rivers that drain west. Drainage systems also drain inwards to inland salt lakes.

All drainages are ephemeral. Major drainages have broad flood plains incised by narrow channels with some dissected sheets of calcrete along trunk drainages. Palaeodrainages are associated with saline drainages and salt lakes in the southeast. These are interlaid with gypsiferous mud flats and small parabolic banks of calcareous and gypsiferous sands.

The Garden Gully drainage line drains a moderately large catchment with an area of 546.5 km^2 which lies to the north, east and southeast of the Project, denotated as Catchment A in Figure 9. The Garden Gully drainage line flows to the southwest towards Hope River, a palaeodrainage (35 km from the Project), which is a zone of groundwater (and surface water) discharge. Three local catchments (B to D) as shown in Figures 9 and 10 influence local surface water flows, directing runoff northwest along minor drainage lines into Garden Gully.

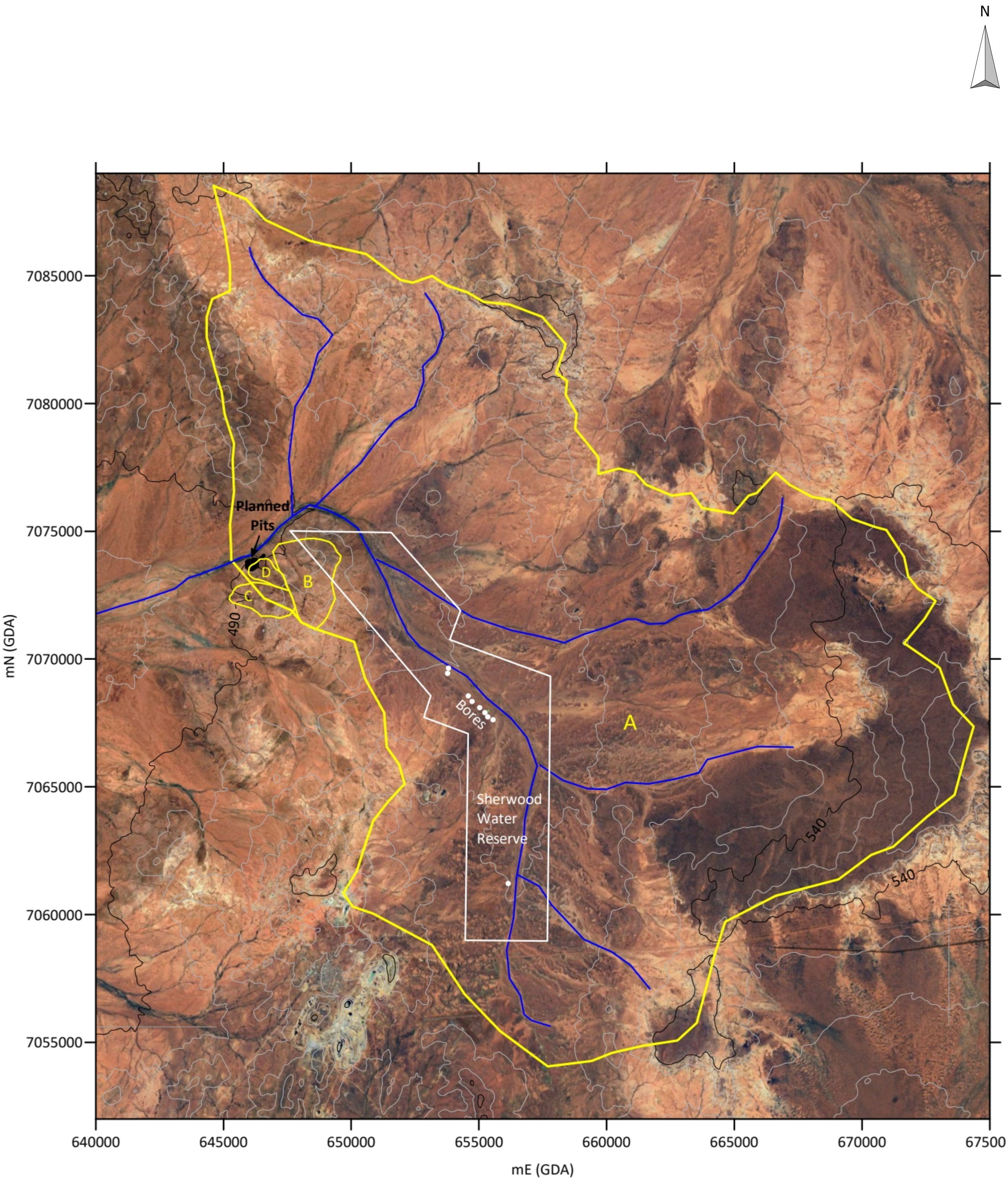
The Project is not located within a proclaimed Surface Water Area under the *Rights in Water and Irrigation Act 1991* (RIWI Act).

3.3.5.3 Flood Modelling

Rockwater were engaged to undertake a hydrological and hydrogeological assessment for the Project. This included estimation of design storm events and peak flows to predict flood flows in the main and local drainages. The report (Rockwater 2024a) is provided as Appendix 5.

The design storms for the Garden Gully catchment (Catchment A) and local catchments (Catchments B to D) were estimated using the methodologies described in Australian Rainfall and Runoff (ARR) 1987 guidelines (Pilgrim et. al., 1987). Peak flows in the catchment for 100-year Average Recurrence Interval (ARI) and Probable Maximum Flood (PMF) events were analysed to assess whether they could adversely impact the Garden Gully pits and infrastructure. The key findings are summarised as follows:

- Contours indicate the reach of the Garden Gully drainage line adjacent to the planned pits is relatively flat, resulting in high flood flows at Catchment A.
  - During a 1-in-100-year flood event, with a protective bund on the northern side of West Pit, the flood levels would peak at 482.6 m AHD with a flow width of about 480 m. The level would be about 0.2 m higher in a PMF event. The calculated maximum depth of water would be about 2.2 m and the maximum velocity in the order of 0.51 m/s.
  - Rockwater (2024a) advised that a protective bund along the northern perimeter of West Pit should be constructed to a height of 2.5 m and at maximum flow velocity there would be minimal risk of erosion.
- Catchment B has a northerly-trending drainage that flows into Garden Gully after passing near the eastern wall of the WRL footprint (Figure 9).
  - During a 1-in-100-year flood event, the flood levels would peak at 484.2 m AHD with a flow width of about 67 m. The level would be about 0.14 m higher in a PMF event. The calculated maximum depth of water would be about 0.95 m and the maximum velocity in the order of 0.76 m/s.
  - Rockwater (2024a) advised that flood flows would not extend to the WRL.
- Catchment C has a westerly-trending drainage that flows through the south of M 51/889.
  - During a 1-in-100-year flood event, the flood levels would peak at 483.7 m AHD with a flow width of about 304 m. The level would be about 0.07 m higher in a PMF event. The calculated maximum depth of water would be about 0.32 m and the maximum velocity in the order of 0.32 m/s.
  - The proposed site layout is designed to lie outside the flood extent of this catchment.
- Catchment D is small, extends southeast of the planned pits, and drains between the pits to Garden Gully (Figure 10).
  - During a 1-in-100-year flood event, the flood levels would peak at 482.8 m AHD with a flow width of about 37 m. The level would be about 0.13 m higher in a PMF event. The calculated maximum depth of water would be about 0.69 m and the maximum velocity in the order of 0.63 m/s.
  - The footprint of East Pit extends into the drainage and a diversion drain and bund were designed to divert flows as per recommendations by Rockwater (2024a).



catchment and contours.srf

Image Source: Rockwater Pty Ltd Original Size: A4	New Murchison Gold Limited Garden Gully Project	**Figure 9** **Larger Catchments and Water Reserve (Rockwater Pty Ltd)**	Martinick Bosch Sell Pty Ltd 4 Cook St West Perth WA 6005 Australia t: +61 8 9226 3166 info@mbsenvironmental.com.au www.mbsenvironmental.com.au

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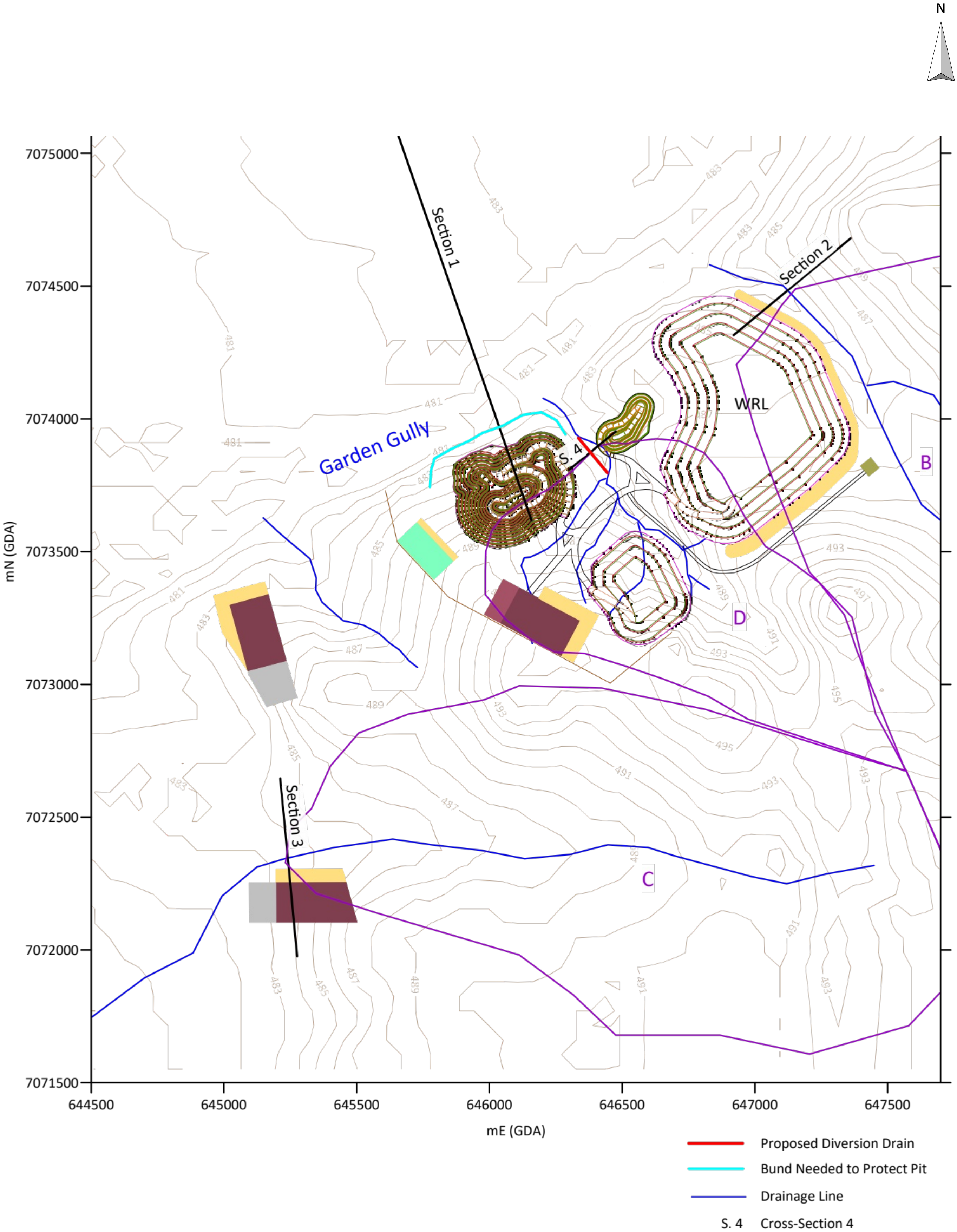

Site Layout Sept & contours.srf

Image Source: Rockwater Pty Ltd Original Size: A4	New Murchison Gold Limited Garden Gully Project	**Figure 10** **Local Catchments with Key Infrastructure (Rockwater Pty Ltd)**	Martinick Bosch Sell Pty Ltd 4 Cook St West Perth WA 6005 Australia t: +61 8 9226 3166 info@mbsenvironmental.com.au www.mbsenvironmental.com.au

4. PROPOSED LAND CLEARING

The Project will require clearing of 93.96 ha of native vegetation within the Purpose Permit Area of 204.53 ha. Clearing is anticipated to commence early in 2025 to facilitate construction.

Clearing is required for mining activities, which will include the construction of:

- Two open pits and abandonment bunds.
- Run-of-mine (ROM) pad and ore storage area.
- A permanent WRL.
- LGO stockpile.
- Water storage in a shallow dam (turkey's nest).
- Mobile crushing, screening and sampling plant.
- Other associated mining infrastructure:
  - Topsoil stockpiles.
  - Mine haul roads, access roads and tracks.
  - Fuel storage and dispensing facilities.
  - Surface water management infrastructure.
  - Laydown areas.
  - Exploration core storage yard.
  - Hardstand areas.
  - Mine equipment maintenance workshop.
  - Temporary administration / office / gatehouse buildings.
  - Explosive storage (Magazine).
  - Diesel generators.
  - Communication (satellite or microwave tower)..

A shapefile is provided for the Purpose Permit Application Area. There may be minor variations made to the precise location and area of site infrastructure within this area.

To allow for potential minor changes to areas of disturbance, NMG has applied to clear 93.96 ha within the Purpose Permit Area of 204.53 ha.

5. ASSESSMENT OF CLEARING PRINCIPLES

5.1 NATIVE VEGETATION CLEARING PRINCIPLES

Clearing applications are assessed against the 10 principles outlined in Schedule 5 of the *Environmental Protection Act 1986*. These principles aim to ensure that all potential impacts resulting from removal of native vegetation are assessed in an integrated method and consistently apply to all lands throughout Western Australia. The principles address the four environmental areas of biodiversity significance, land degradation, conservation estate and ground and surface water quality.

The following sections discuss the potential impacts associated with clearing for the Project. A summary of the outcomes of the assessment against the 10 Clearing Principles are provided in Table 9.

Table 9: Summary of Clearing Assessment Against Clearing Principles

Principle Number	Clearing Principle	Outcome
a	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Unlikely to be at variance
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.	Unlikely to be at variance
c	Native vegetation should not be cleared if it includes or is necessary for the continued existence of Threatened flora.	Unlikely to be at variance
d	Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a TEC.	Not at variance
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.	Not at variance
f	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	Unlikely to be at variance
g	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	Unlikely to be at variance
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 areas.	Not at variance
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.	Unlikely to be at variance
j	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	Not at variance

5.2 BIODIVERSITY

Clearing Principle A: Native vegetation should not be cleared if it comprises a high level of biological diversity.

5.2.1 Potential Impacts

Impacts to the biological diversity of native vegetation associated with clearing for the Project are limited to localised flora/habitat loss from clearing in the Purpose Permit Area as well as the potential spread of existing weed species and the introduction of new weed species into the area.

No Threatened flora or fauna species or TECs/PECs are known to occur within the Purpose Permit Area.

The four broad-scale vegetation communities mapped in tenements M 51/886 and M 51/889 are considered to be of low biological diversity and are well represented outside the survey area (Botanica, 2024). One vegetation association occurs within the Purpose Permit Area, Upper Murchison 18 with more than 99% of its pre-European vegetation extent remaining.

Potential impacts to vegetation communities within the Purpose Permit Area are detailed in Table 10. Based on the extent of survey undertaken for the Project some impacts to vegetation units are greater than 30% however overall they are below 30%. Botanica (2024) also determined that vegetation communities are considered to be of low biological diversity and well represented on a local and regional scale.

The reconnaissance flora survey (Botanica 2024) recorded one Priority 4 flora species, *Grevillea inconspicua*, in the Purpose Permit Area and further Priority species (*Calytrix verruculosa* P3) is considered to have potential to occur based on habitat available and nearby records (Table 5).

Approximately 30 individuals of *Grevillea inconspicua* (P4) were recorded growing in a minor dry drainage line in M 51/886 and there is potential for additional individuals to occur across the application area. Florabase has 62 known records of the species with frequency for each of these typically described as 'isolated plants'. Further, there are flora surveys in the public domain that indicate the species can also occur at higher densities (e.g. approximately 6,000 individuals noted in the CPS 10259).

The closest known record of *Calytrix verruculosa* P3 is located over 280 m south of M 51/889. The species is known from the Murchinson IBRA region with Florabase containing 14 records, with frequency varying from uncommon to frequent.

Considering suitable habitat for the priority flora species is widely available locally and regionally, the proposed clearing is not expected to impact on the conservation status of these species.

One Vulnerable (VU), Peregrine falcon (*Falco peregrinus*), and one Other Specially Protected (OS), Grey Falcon (*Falco hypoleucos*) may occur in the Purpose Permit Area, based on the presence of potentially suitable habitat. Impacts to these species from the Project are discussed further in Section 5.3.1.

The Purpose Permit Area and indicative clearing footprint were designed to minimise environmental impact to vegetation communities, and conservation significant flora and fauna species as much as practicable.

5.2.2 Management and Mitigation

Management and mitigation measures to reduce impacts on biological diversity comprise:

- Clearing of vegetation will be kept to the minimum required for the Project.
- Utilising existing disturbed areas where possible.
- *Grevillea inconspicua* to be clearly marked and GPS coordinates of their locations noted prior to nearby clearing proceeding, to avoid accidental direct disturbance.

- Managing clearing via an internal Land Clearing Procedure.
- Clearly delineating the clearing area to ensure only that required for a safe working area is cleared.
- Implement a procedure to record the amount of clearing undertaken and report the cumulative total in the Annual Environmental Report (AER) and Mine Rehabilitation Fund (MRF) reporting.
- Vehicle and equipment hygiene procedures will be implemented to minimise entry of weed and soil borne diseases.
- Site weed and dust control measures will be conducted as required.
- Stockpiling stripped topsoil and vegetation for use in future rehabilitation activities.
- Progressively rehabilitating disturbed areas on completion of Project activities.
- Implementing speed limits to minimise dust emissions and to minimise the risk of fauna injury or death due to vehicle traffic.

Given the widespread and common nature of vegetation communities in the region and absence of Threatened species or TECs/PECs in the proposed Purpose Permit Area, the Project is not considered to comprise a high level of biological diversity. Therefore, the proposed clearing is unlikely to be at variance with Clearing Principle A.

Table 10: Potential Impacts to Vegetation Communities

Vegetation Community/Code	Description	Total Mapped Area (ha)	Purpose Permit Area (ha)	Clearing Footprint Area (ha)	% Total Vegetation Impacted	Source
RP-AOW1	Mid woodland of *Acacia pruinocarpa* and *Acacia incurvaneura* over mid open shrubland of *Acacia grasbyi*, *Eremophila galeata* and *Senna* sp. Meekatharra over low sparse shrubland of *Maireana triptera* and *Enchylaena tomentosa* on rocky plain.	175.45	92.16	32.66	18.61	Botanica (2024)
CLP-AOW1	Mid woodland of *Acacia incurvaneura* over mid shrubland of *Eremophila compacta* over low sparse shrubland of *Solanum lasiophyllum* and *Aristida contorta* on clay loam plain.	114.68	75.89	57.62	50.24	
DD-AFW1	Mid open forest of *Acacia incurvaneura* over mid open shrubland of *Acacia tetragonophylla, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* in drainage depression.	63.28	11.96	3.68	5.81	
DD-EFW1	Mid open forest of *Eucalyptus camaldulensis* over mid open shrubland of *Acacia tetragonophylla, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* in drainage depression.	15.97	0.06	0.00	0.00	
Cleared	Land cleared of native vegetation	24.46	24.46	18.85	77.06	
	Total	**393.84**	**204.53**	**112.81**	**28.64**	

5.3 SIGNIFICANT FAUNA HABITAT

Clearing Principle B: 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 Western Australia.

5.3.1 Potential Impacts

The survey for tenements M 51/886 and M 51/889 identified two broad scale terrestrial fauna habitats being acacia open woodlands, and acacia/eucalypt woodlands in drainage lines (Botanica, 2024). Both of the habitats are considered locally common and widespread. The mapped extent of potential impacts to fauna habitats are detailed in Table 11.

Table 11: Potential Impacts to Fauna Habitat

Habitat Type	Total Mapped (ha)	Purpose Permit Area (ha)	Clearing Footprint Area (ha)	(%) Total Habitat Impacted
Cleared	24.46	24.46	18.85	77.06
Acacia open woodland on rocky or clay-loam plain	290.12	168.06	90.28	31.12
Acacia and/or Eucalypt woodland in drainage line	79.26	12.01	3.68	4.64
Total	**393.84**	**204.53**	**112.81**	**28.64**

No evidence of significant fauna species was observed during the Botanica (2024) survey and based on preferred habitat and distribution data, seven of the nine conservation significance identified in the desktop assessment were assessed as 'unlikely to occur' or 'would not occur'. Two species of conservation significance are regarded as possibly utilising the survey area:

- Grey Falcon (*Falco hypoleucos*) – VU (EPBC Act and BC Act)
  - This species is sparsely recorded throughout inland Australia. Suitable habitat may be present but is unlikely to represent critical habitat.
- Peregrine Falcon (*Falco peregrinus*) – OS (DBCA)
  - This species is sparsely recorded throughout inland Australia. Suitable habitat may be present but is unlikely to represent critical habitat.

While the habitats for these species are considered possibly suitable, some or all may be marginal in extent/quality and therefore the fauna species considered as possibly occurring may in fact only visit the area for short periods as infrequent vagrants. In addition, both species considered as possibly occurring are highly mobile avian species with large home ranges and therefore Project activities are not expected to impact individuals or populations of these species.

Database searches undertaken for subterranean fauna found few records of subterranean fauna in the Murchison region of Western Australia, and no stygofauna or troglofauna surveys undertaken in the Garden Gully area. No subterranean fauna species or TECs relating to subterranean fauna are known within a 100 km radius of the Project. The nearest PEC pertaining to stygofauna communities in calcrete habitats, is the Priority 1 Belele calcrete groundwater assemblage, with its spatial buffer being approximately 34 km to the west of the Project.

Results of 24 samples from the Project area included 12 possible stygofauna species, including copepods, ostracods, syncarids, and aquatic worms. Most of the stygofauna species from the Project area were found to occur more widely. However, one cyclopoid copepod species (Parastenocaris 'BHA433') collected from a single site within the palaeochannel (Main Roads bore)currently known only from the Garden Gully area.

Rockwater (2024b) identified potential direct, indirect and cumulative impacts associated with the Project as summarised in Table 8 of Section 3.3.4.3. During pumping tests, monitoring of the Main Roads bore showed no water level drawdown (Rockwater 2024a). This indicates poor connectivity between the fractured rock aquifer being dewatered and the palaeochannel. It is likely that drawdown during dewatering would be minimal in the palaeochannel as supported by drawdown modelling (Rockwater 2024a). The subterranean study (Rockwater 2024b) further concluded that modelled drawdown at the site the species (Parastenocaris 'BHA433') was recorded at represents 2% of the aquifer thickness, which will not affect the conservation status of the species. Drawdown associated with the Project affects an area of approximately 1,580 ha and is unlikely to impact any stygofauna conservation values of the wider Garden Gully area (Rockwater 2024b). The nearest calcrete groundwater assemblage with significant conservation values (Belele P1 Priority Ecological Community) has its spatial buffer approximately 34 km to the west of Garden Gully Project, and 33 km from any modelled drawdown impacts associated with pit dewatering at Crown Prince deposit.

Indirect impacts from clearing and related risks to subterranean habitats such as siltation, void collapse, alteration to nutrient balance and contamination are considered unlikely, given the local geology and small scale of the Project (Rockwater 2024b). Cumulative impacts of drawdown from the other mining operations are not considered relevant to the Project, as there will be no interactions between mine pit dewatering and drawdown associated with any current projects. There are no other significant groundwater users in the area that could impact the aquifers of the Project area. The Meekatharra Water Reserve, which includes the upstream Sherwood Borefield that provides water for the town, is about 2 km from Crown Prince deposit at its closest point. However, the nearest Sherwood Borefield production bore is about 9 km from the Crown Prince deposit.

Rockwater (2024b) concluded that there appears to be no risk from the Project to any stygofauna conservation values associated with listed threatened or priority ecological communities. The localised drawdown from pit dewatering as well as indirect impacts including clearing over the life of the Project are unlikely to impact any stygofauna values at Garden Gully, or the persistence of any stygofauna species recorded by the survey.

5.3.2 Management and Mitigation

The main risk to fauna and habitat is loss or fragmentation of habitat through clearing activities.

Management measures to reduce impacts on fauna and habitat comprise:

- Clearing of vegetation will be kept to the minimum required for the Project.
- Utilising existing disturbed areas and locating roads and infrastructure to avoid fauna habitat where possible.
- Managing clearing via an internal Land Clearing Procedure.
- Clearly delineating the clearing area with to ensure only that required for a safe working area is cleared.
- Implement a procedure to record the amount of clearing undertaken and report the cumulative total in the Annual Environmental Report (AER) and Mine Rehabilitation Fund (MRF) reporting.
- Progressively rehabilitating disturbed areas on completion of Project activities.
- Implementing speed limits to minimise dust emissions and to minimise the risk of fauna injury or death due to vehicle traffic.
- All personnel will undertake a site induction which will include detail on the importance of flora and fauna management.

Based on the assessment of potential impacts to fauna habitat, the two habitats that occur in the Purpose Permit Area are not considered to contain significant fauna habitat. This conclusion was drawn from:

- The widespread and common nature of habitat in the region.
- Absence of conservation significant fauna and suitable habitat (excluding Peregrine Falcon and Grey Falcon).
- Habitat for the Grey Falcon and Peregrine Falcon assessed as 'unlikely to represent critical habitat', with these species possibly visiting the area only for short periods as infrequent vagrants.
- The localised drawdown from pit dewatering as well as indirect impacts including clearing over the life of the Project are unlikely to impact any stygofauna values at Garden Gully, or the persistence of any stygofauna species recorded by the survey.

Based on these findings, the proposed clearing is unlikely to be at variance to Clearing Principle B.

5.4 THREATENED FLORA

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

5.4.1 Potential Impacts

Existing impacts to vegetation within the Purpose Permit Area include roads, access tracks, heavy grazing, historical mining, and exploration disturbances. One species of Threatened flora *Pityrodia augustensis* listed as Vulnerable was identified in the desktop study however based on a lack of suitable habitat in the Purpose Permit Area as well as the nearest known population being greater than 300 km from the Project, the species is considered unlikely to occur. No Threatened Flora as listed under the *BC Act 2016* or Commonwealth EPBC Act were recorded within surveys undertaken by Botanica (2024).

5.4.2 Management and Mitigation

Management measures to reduce impacts to during clearing:

- Utilising existing disturbed areas where possible.
- Managing clearing via an internal Land Clearing Procedure.
- Clearly delineating the clearing area with survey pegs and flagging tape to ensure only that required for a safe working area is cleared.
- Implement a procedure to record the amount of clearing undertaken and report the cumulative total in the AER and Mine Rehabilitation Fund (MRF) reporting.
- Weed hygiene practices will be implemented and site weed control will be conducted as required.
- All personnel will undertake a site induction which will include detail on the importance of flora and fauna management.

As the areas to be impacted do not include Threatened flora and based on the above, the proposed clearing is unlikely to be at variance with Clearing Principle C.

5.5 THREATENED ECOLOGICAL COMMUNITIES

Clearing 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.

No TECs or PECs as listed under either the *EPBC Act* or *BC Act* have been identified within the Purpose Permit Area (Botanica, 2024). There are six PECs that occur within a 40 km radius of the survey area, two of which occur approximately 7 km from the survey area. The remaining four PECs occur more than 27 km from the survey area. No TECs are known within a 40 km radius of the survey area.

Based on the above, clearing for the Project is not at variance with Principle D.

5.6 REMNANT VEGETATION

Clearing 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 Project and Purpose Permit Area intersects one pre-European vegetation association, Upper Murchison 18 as detailed in Table 12.

The EPA uses a standard level of native vegetation retention of at least 30% of the pre-clearing extent of an ecological community as a benchmark. The levels of native vegetation retention have most recently been recognised in the National Objectives and Targets for Biodiversity Conservation 2001-2005, which recognised that the retention of 30%, or more, of the pre-clearing extent of an ecological community is necessary if Australia's biological diversity is to be protected (Department of the Environment and Heritage, 2001). The pre-European vegetation type occurring in the Project Purpose Permit Area, Upper Murchison 18 has greater than 99% of its pre-European extent remaining at a State level and within the Shire of Meekatharra (Table 12).

Table 12: Pre-European Vegetation Association Representation

Vegetation Association	Vegetation Description	Pre-European Extent	Current Extent in the State	% Remaining After Clearing
Upper Murchison 18	Low woodland, open low woodland or sparse woodland of Mulga (*Acacia aneura*) and associated species.	1,823,263.25	1,822,786.34	99.73

Based on the above the proposed clearing is not at variance with Clearing Principle E.

5.7 WATERCOURSE OR WETLAND ENVIRONMENTS

Clearing 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.

There are no Ramsar wetlands or wetlands of national importance (ANCA Wetlands) within the Purpose Permit Area or within a 40 km radius. Lake Annean (Lake Nannine) is a wetland of national importance but is located 50 km south of the Project.

There are no permanent water features within the Purpose Permit Area. The proposed Purpose Permit Area has been designed to avoid disturbance to the vegetation of Garden Gully Creek. Minor ephemeral drainage lines which are not regionally or locally significant are partially present within the Purpose Permit Area.

As the clearing will not impact wetlands or Garden Gully Creek and only a minor drainage line are present, the Project is considered unlikely to be at variance with Clearing Principle F.

5.8 LAND DEGRADATION

Clearing Principle G: Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Vegetation communities within the Purpose Permit Area were assessed to range from 'Good' to 'Completely Degraded' condition (Botanica 2024). Existing land degradation is mostly attributed to clearing for access tracks, historical mining and exploration activities, and grazing by large feral herbivores (Botanica, 2024). The presence of weeds in disturbed areas and along tracks also contributes to existing land degradation.

Soil samples from the Project were described as having low exchangeable sodium percentages, indicating soils across the Project are unlikely to be erosion prone (MBS 2024). Subsoils from sample locations OGCP01 and OGCP05 were described as likely to be dispersive, which can cause issues like erosion or poor soil stability. Both of these samples were taken outside of the proposed Purpose Permit Area with one located near Garden Gully Creek (OGCP01) and the other located west of the Purpose Permit Area on M 51/889 (OGCP05).

5.8.1 Potential Impacts

Potential sources of land degradation from clearing activities include:

- Wind and mechanical erosion during vegetation and topsoil stripping activities.
- Wind and water erosion of topsoil stockpiles and cleared areas.
- Water erosion due to changes in surface water flow.
- Soil compaction.
- Soil contamination i.e. spills or machinery failure.
- Introduction and/or spread of weeds.

5.8.2 Management and Mitigation

Minimisation of land degradation will be achieved by applying recognised clearing and rehabilitation methods. Management and mitigation strategies to achieve this include:

- Minimising the area requiring vegetation clearing.
- Confining vehicle movements to defined roads and tracks.
- Conducting topsoil-stripping activities during periods of low winds.
- Stockpiling topsoil and vegetation for use in rehabilitation.
- Storing hydrocarbons and reagents in bunded areas and applying spill response procedures.
- Progressive rehabilitation of completed areas to minimise active areas exposed where possible.
- Scarifying or deep ripping (as appropriate) compacted tracks and roads prior to rehabilitation.
- Establishment of surface water management infrastructure to direct surface water flow to natural drainage channels.
- Monitoring of high-risk erosion events, such as extreme weather, to mitigate impacts as far as reasonably practicable.
- Dust suppression via water cart where practicable.

In the context of the local land systems, intact vegetation on a regional scale and existing level of localised land degradation, the scale of disturbance from the proposed clearing is not anticipated to increase land degradation. As such, proposed clearing is unlikely to be at variance with Clearing Principle G.

5.9 CONSERVATION ESTATE

Clearing 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 Purpose Permit Area is not associated with any conservation lands and not located within a DBCA managed Conservation Reserve. The nearest Legislated Reserve is the Lakeside Conservation Park (R54420), approximately 130 km southwest of the Project (Botanica, 2024).

There are no Environmentally Sensitive Areas (ESA) as listed under the EP Act intersecting or within a 40 km radius of the Project (Botanica, 2024).

Based on the above, clearing for the Project is not at variance with Clearing Principle H.

5.10 SURFACE AND GROUNDWATER QUALITY

Clearing 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.

The Purpose Permit Area intersects an old local recreation reserve, No. 10633 associated with historic cultural events, mining, settlement and water supply. NMG consulted with the Meekatharra Shire regarding the Project, including Site 25188. The Shire confirmed the Garden Gully site was largely absent and raised no objections to the Project. In addition, no mining is proposed within the Meekatharra Town site and the reserve is highly unlikely to be needed for future public water supply. Similarly, the Shire had no objections during consultations in 2020 for mining lease applications M 51/886 and M 51/889 over the reserve. The Meekatharra Water Reserve which includes the Sherwood borefield that supplies water for the town is approximately 2 km northeast and upstream of the Project at its closest point, but about 9 km from the nearest production bore.

There are no permanent water bodies or wetlands within the Purpose Permit Area with all drainage lines being ephemeral. The Garden Gully drainage line, located north of the Purpose Permit Area boundary, drains a moderately-large catchment with an area of 546.5 km^2 which lies to the north and east of the Project and flows to the southwest towards Hope River, a palaeodrainage (35 km from the project site), which is a zone of groundwater (and surface water) discharge. Groundwater quality at the Project was described as fresh to brackish (Rockwater 2024a). Smaller drainage lines are present across the Project area, only flowing briefly immediately following significant rainfall events.

In accordance with the BoM Atlas of GDEs database, there are no known or potential aquatic GDEs within the Project area however two potential terrestrial GDEs occur. Botanica determined that vegetation types identified mostly aligned with the ecosystem descriptions provided in be BoM Atlas and although difficult to determine how dependent these communities are on groundwater, Botanica (2024) and Rockwater (2024a) determined they are more likely to obtain their water requirements from surface water. Dewatering will be required during development of the open pits as the water table is located approximately 10 m below ground level (475 m AHD) within the pits. Rockwater (2024a) were engaged to undertake a hydrogeological study of the Crown Prince deposit and surrounding area to gain an understanding of the hydrogeological context, provide estimates of dewatering requirements and the potential for groundwater related impacts of mining.

5.10.1 Potential Impacts

Surface water quality has the potential to be affected by increased sedimentation caused through clearing and soil disturbance and removal of vegetation that acts to bind soil, including riparian vegetation. This may result in a localised decrease in surface water quality. Garden Gully Creek passes just to the north of the proposed mine site. The proposed Purpose Permit Area has been designed to avoid disturbance to Garden Gully Creek. Construction and clearing will be scheduled outside of peak rainfall events to avoid times of high surface flows and reduce the risk of erosion and elevated turbidity to drainage lines from disturbed areas.

Land clearing is considered unlikely to adversely impact on groundwater quality. Hydrocarbon spills may occur from earth moving machinery used for land clearing activities. Uncontained spills may affect surface and/or groundwater quality.

Rockwater (2024) noted that groundwater level drawdown has the potential to impact vegetation, however in alignment with Botanica (2024) determined that vegetation within the creek is more likely to be supported by soil moisture rather than groundwater. Furthermore, pumping tests indicated poor connectivity between the fractured rock aquifer and the overlying clays and alluvium of the creek and therefore it is likely that drawdown during dewatering would be much slower in the clays than the underlying fractured rock and the clay would remain moist. Rainfall would further maintain moisture levels in the alluvium (Figure 7 in Section 3.3.3.4).

Given the above, there is expected to be sufficient water in the vadose zone from incident rainfall to support the creek vegetation. In addition, the life of mine is short at three years with predicted maximum drawdowns to occur at the end of mining of the deeper West Pit at approximately the end of year two, and therefore any potential impacts from dewatering will not be prolonged.

5.10.2 Management and Mitigation

Management measures to prevent impacts to surface and groundwater quality include:

- Proposed Purpose Permit Area has been designed to avoid Garden Gully Creek.
- Existing disturbed areas will be used where possible.
- Clearing and construction will be scheduled outside of peak rainfall events to avoid times of high surface flows and reduce the risk of erosion and elevated turbidity to drainage lines from disturbed areas.
- Hydrocarbons will be stored in bunded areas.
- Where necessary, suitable floodways, drains and culverts will be installed to transfer flow past infrastructure and return it to its natural flow path.
- Spill kits will be maintained on site to allow containment and treatment of spillages of hydrocarbons.
- Progressive rehabilitation of completed areas to minimise active areas exposed where possible.
- With regard to Garden Gully Creek vegetation, NMG will:
    - Continue to monitor groundwater level drawdown including within Garden Gully Creek (MB04) and the palaeochannel (Main Roads bore) throughout mining operations (Figure 6).
    - Undertake vegetation health monitoring within Garden Gully Creek adjacent to the West Pit to monitor water stress from dewatering. The health of vegetation within Garden Gully drainage adjacent to mining will be compared to upstream analogue sites using aerial imagery and NDVI data set interrogation to monitor changes over time for vegetation cover (%), vegetation health and vegetation density.
    - If it is determined that dewatering is having an impact of vegetation health then NMG will seek permission from DWER to discharge environmental flows into the creek to support soil moisture noting the project has a positive water balance. Water for environmental flows would reduce the excess water volume pumped off site to nearby adjacent pits.

In addition to the above management measures, groundwater abstraction at the Project will be in accordance with a s5C Licence to Take Water under the RIWI Act. An application for an s5C Licence has been submitted to DWER, with a proposed annual water entitlement of 1,400,000 kL per year. Under the GWL, the taking of water within M 51/886 is proposed to be for dewatering, dust suppression, construction and general mining purposes. The GWL will be conditioned to manage groundwater by setting specific requirements for monitoring water levels, water quality and tracking extraction volumes. This will include monitoring bores MB01 to MB03 located in the northwest corner of West Pit, MB04 within Garden Gully drainage, Main Roads bore within the palaeochannel to the north, as well as pastoral bores for Yoothapina Station.

Impacts to surface water and groundwater quality from the proposed clearing are not anticipated to be significant. Localised, short term impacts on surface water quality can be managed using standard erosion and sediment control mitigation measures.

Based on the above the proposed clearing is unlikely to be at variance with Clearing Principle I.

5.11 FLOODING POTENTIAL

Clearing Principle J: Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

The proposed clearing is within a non-seasonal arid region that experiences a mean total rainfall of 232.5 mm/year (BOM 2024). Precipitation is often associated with sporadic summer cyclonic rainfall and thunderstorms. No month in a given year can be considered reliably wet, and zero rainfall can be recorded in any month.

The Project falls within the Garden Gully Catchment, with the ephemeral Garden Gully Creek running just north of the Purpose Permit Area. Smaller drainage lines are present within the Purpose Permit Area which are also ephemeral in nature, only flowing briefly immediately following significant rainfall events. Four catchments occur nearby or within the Purpose Permit Area that have flooding potential; Catchment A - Garden Gully catchment, Catchment B – eastern side of planned waste rock landform, Catchment C - south of planned mining area, and Catchment D – drainage between the two planned pits (Figures 9 and Figure 10).

5.11.1 Potential Impacts

Removal of vegetation generally increases flooding whereby uptake, infiltration, moisture retention and physical barriers to reduce flow velocities provided by vegetation are also removed. As most of the vegetation cover within the Purpose Permit Area occurs at relatively high elevations on rocky or stony plains, the overall vegetation density is low. Therefore, it is not expected that the removal of vegetation would significantly increase the risk of flooding above natural levels.

Rockwater (2024a) were engaged to undertake a hydrological assessment for the Project including estimation of design storm events and peak flows to predict flood flows in the main and local drainages. The Rockwater (2024a) assessment confirmed that flooding impacts will be localised in extent and recommended surface water infrastructure in order to prevent adverse impacts on surface water drainages and Project infrastructure.

5.11.2 Management and Mitigation

Management strategies to prevent flooding include:

- Clearing will not significantly alter the natural landscape, contours, or drains that could otherwise impact flooding potential.
- Project design has considered location of drainage lines and flood levels with the aim of minimising disturbance of these areas. Recommended surface water infrastructure to be installed in the event of a 1:100-year flood event will include:
  - A protective bund along the northern perimeter of West Pit to be constructed to a height of 2.5 m.
  - A diversion drain and bund around East Pit to divert flows.
- Diversions will be installed where necessary to direct surface flow away from cleared areas, and return flows to natural paths.
- Culverts or floodways will be installed where the roads cross ephemeral drainages.
- Vegetation will be removed in stages with disturbance kept to a minimum to reduce runoff.

Overall, the proposed clearing of 93.96 ha in the Purpose Permit Area, particularly given local vegetation density is low, will have no detectable increased impact on flooding potential for the Project. In addition, management and mitigation measures will be implemented to prevent adverse impacts on surface water drainages and Project infrastructure from flooding.

Based on the above, the proposed clearing is not at variance with Clearing Principle J.

6. ROLES AND RESPONSIBILITIES

The roles and responsibilities of the Project personnel associated with clearing vegetation are described below.

6.1 CHIEF EXECUTIVE OFFICER AND GENERAL MANAGER

- Ensure appropriate resources and systems are provided to implement the management and mitigation measures outlined in this document.
- Coordinate preparation and finalisation of the NVCP, in consultation with relevant government agencies, and ensure adequate systems and procedures are in place to facilitate compliance with NVCP requirements through the exploration program.
- Manage all pre-construction environmental surveys and post-implementation monitoring.
- Coordinate engagement with key stakeholders including relevant recreational user groups.
- Overall responsibility for ensuring that all supervisory, management employees and contractor personnel are aware of, and understand, their responsibilities under this NVCP.
- Oversee the implementation of any corrective and remedial actions arising from audits and incident investigations.

6.2 OHSE OFFICER

- Ensure all land clearing for the Project is conducted in compliance with this document and other regulatory requirements.
- Ensure all employees and contractors on site are aware of and adhere to obligations regarding clearing requirements.
- Ensure adequate processes are maintained to communicate relevant information with internal stakeholders.
- Ensure that all the required information is provided in the Vegetation Clearing Application and that data is accurate.
- Conduct visits and inspections to ensure all work complies with commitments and management measures outlined in this NVCP.
- Record and report environmental incidents to the General Manager and Regulator.
- Undertake incident cause analysis method investigations where required and manage the implementation of corrective and remedial actions arising from audits and incident investigations.
- Review and approve all Vegetation Clearing Applications.
- Maintain the Internal Clearing Permit Register.
- Compile and collate vegetation clearing data for annual reporting in the Annual Environmental Report.

6.3 PRODUCTION ENGINEER

- Ensure management measures contained in this application and associated plans and procedures are implemented.
- Ensure that land clearing is undertaken only as authorised by the Vegetation Clearing Application.
- Conduct site walkovers of areas with clearing machinery operators prior to clearing.
- Ensure that post-clearing surveys are conducted, and that data is provided to the OHSE Officer.
- Report environmental incidents.

6.4 EMPLOYEES AND CONTRACTORS

- Prevent contamination of vegetation, topsoil and subsoil stockpiles.
- Adhere to all obligations in relation to vegetation clearing procedures.
- Report environmental incidents.
- Keep to existing tracks unless following advice from their Supervisor.
- Adhere to standard soil hygiene practices and spill response when operating machinery.
- Aid in implementing and maintaining environmental impact minimisation programs when requested by the OHSE Officer.

7. REPORTING AND AUDITING

Clearing will be reported in the NMG internal monthly operation reports.

Disturbance as a result of the proposed vegetation clearing will be reported yearly under the Project AER and MRF reporting.

Upon approval of this Clearing Permit, subsequent environmental approvals will be sought to construct and develop the Project. These approvals will include additional conditions and commitments relating to environmental monitoring and reporting.

8. CONCLUSION

The vegetation and habitats present within the proposed Purpose Permit Area are generally well represented on a local and regional scale. It is considered unlikely that there will be significant impact on the conservation status of relevant flora and fauna species or vegetation communities. There are likely to be only minor local impacts from loss and fragmentation of vegetation and fauna habitat.

The proposed clearing will not impact significantly upon the ten clearing principles and a range of environmental management measures and procedures are in place to ensure that clearing will be managed to minimise any potential adverse impacts. Rehabilitation will minimise exposed areas and the long-term loss of vegetation cover.

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APPENDICES

APPENDIX 1: PROOF OF OCCUPIER STATUS

Attachment 1A: Proof of Occupier Status

Department of Energy, Mines, Industry Regulation and Safety

eMiTS MINERAL TITLES ONLINE

Home | Tenement Register | Online Transactions | Enquiry | Admin | Help

Tenement Register

Register for Tenement M 51/886

Identifier: M 51/886 | New Search | Previous | Next | Application Tracking

Status:	Live
Area:	204.29650 HA
Markout:	09/08/2019 15:57:00
Received:	12/08/2019 15:40:00
Term Granted:	21 Years
Commence:	21/02/2022
Expiry:	20/02/2043
Death:	

Rent Status

Due for Year End 20/02/2025:	PAID IN FULL
Rental for Year End 20/02/2026:	$5,863.00

Expenditure Status

Expended Year End 20/02/2024:	EXPENDED IN FULL
Current Year Commitment:	$20,500.00

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings | Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation ZEUS MINING PTY LTD 100/100

ACN 113 854 596 **ABN** 83 113 854 596

Principal Place of Business Details

Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892

Email xxxx@mmts.net.au

Telephone xxxxxxxxxxx997

Designated Tenement Contact (Correspondence Details)

Name MCMAHON MINING TITLE SERVICES PTY LTD

Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892

Email xxxx@mmts.net.au

Telephone xxxxxxxxxxx997

Department of Energy, Mines, Industry Regulation and Safety

eMITS MINERAL TITLES ONLINE

Home | Tenement Register | Online Transactions | Enquiry | Admin | Help

Tenement Register

Register for Tenement M 51/889

Identifier: M 51/889 | New Search | Previous | Next | Application Tracking

Status: Live
Area: 189.43813 HA
Markout: 25/06/2020 13:52:00
Received: 26/06/2020 10:01:23
Term Granted: 21 Years
Commence: 21/02/2022
Expiry: 20/02/2043
Death:

Rent Status

Due for Year End 20/02/2025: PAID IN FULL
Rental for Year End 20/02/2026: $5,434.00

Expenditure Status

Expended Year End 20/02/2024: EXPENDED IN FULL
Current Year Commitment: $19,000.00

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings | Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation ZEUS MINING PTY LTD 100/100
ACN 113 854 596 **ABN** 83 113 854 596

Principal Place of Business Details
Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892
Email xxxx@mmts.net.au
Telephone xxxxxxx997

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Email xxxx@mmts.net.au
Telephone xxxxxxx997

Department of Energy, Mines, Industry Regulation and Safety

eMiTS MINERAL TITLES ONLINE

Home | Tenement Register | Online Transactions | Enquiry | Admin | Help

Tenement Register

Register for Tenement L 51/138

Identifier: L 51/138 | New Search | Previous | Next | Application Tracking

Status:	Pending
Area:	69.00000 HA
Markout:	
Received:	15/11/2024 13:42:50
Term Granted:	
Commence:	
Expiry:	
Death:	

Rent Status

Due for Year End 14/11/2025: N/A
Rental Next Year End: N/A

Expenditure Status

Expended Year End : NO EXPENDITURE REQUIRED
Current Year Commitment: NO EXPENDITURE REQUIRED

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings | Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation ZEUS MINING PTY LTD 100/100
ACN 113 854 596 **ABN** 83 113 854 596

Principal Place of Business Details
Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892
Email xxxx@mmts.net.au
Telephone xxxxxxxxxxx997

Designated Tenement Contact (Correspondence Details)
Name MCMAHON MINING TITLE SERVICES PTY LTD
Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892
Email xxxx@mmts.net.au
Telephone xxxxxxxxxxx997

Department of Energy, Mines, Industry Regulation and Safety

eMiTS MINERAL TITLES ONLINE

Home Tenement Register Online Transactions Enquiry Admin Help

Tenement Register

Register for Tenement L 51/139

Identifier: L 51/139 New Search Previous Next

Application Tracking

Status: Pending
Area: 114.00000 HA
Markout:
Received: 15/11/2024 13:42:50
Term Granted:
Commence:
Expiry:
Death:

Rent Status

Due for Year End 14/11/2025: N/A
Rental Next Year End: N/A

Expenditure Status

Expended Year End : NO EXPENDITURE REQUIRED
Current Year Commitment: NO EXPENDITURE REQUIRED

Holders | Description | Relationships | Survey | General | Shire | Grant | Conditions | Dealings | Payments | Expenditure | Combined Reporting | Bond | Map | Native Title | Warden's Court | Documents

Current Holders | Holder Changes | Applicants On Receival

Organisation ZEUS MINING PTY LTD 100/100
ACN 113 854 596 **ABN** 83 113 854 596
Principal Place of Business Details
Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892
Email xxxx@mmts.net.au
Telephone xxxxxxxxxxx997

Designated Tenement Contact (Correspondence Details)
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Address C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892
Email xxxx@mmts.net.au
Telephone xxxxxxxxxxx997

Form 21

WESTERN AUSTRALIA

Mining Act 1978

(Secs. 41, 58, 70C, 74, 86, 91, Reg. 64)

APPLICATION FOR MINING TENEMENT

(a) Type of tenement (b) Time & Date marked out (where applicable) (c) Mineral Field	(a) Miscellaneous Licence	No. L 51/138
	(b) a.m./p.m. / /	(c) MURCHISON
For each applicant: (d) Full Name and ACN/ABN (e) Address (f) No. of shares (g) Total No. of shares	(d) and (e) ZEUS MINING PTY LTD (ACN: 113 854 596) C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892	(f) Shares 100
		(g) Total 100

DESCRIPTION OF GROUND APPLIED FOR:
(For Exploration Licences see Note 1. For other Licences see Note 2. For all Licences see Note 3.)

(h) Locality
(i) Datum Peg
(j) Boundaries

(h) KYARRA

(i) All coordinates situated in GDA 94 Zone 50
7073653.566 mN 645501.423 mE

(j) From datum situated in GDA 94 Zone 50
Thence 7073305.87 mN 645827.394 mE
Thence 7073095.213 mN 646221.289 mE
Thence 7072968.749 mN 646458.786 mE
Thence 7072687.526 mN 646988.862 mE
Thence 7072261.943 mN 647783.934 mE
Thence 7072128.94 mN 648032.415 mE
Thence 7072063.393 mN 647989.619 mE
Thence 7072187.888 mN 647757.234 mE
Thence 7072614.981 mN 646958.748 mE
Thence 7072827.248 mN 646557.365 mE
Thence 7072907.211 mN 646409.072 mE
Thence 7073252.731 mN 645768.32 mE
Thence 7073355.09 mN 645630.004 mE
Thence 7073378.355 mN 645297.788 mE
Thence 7073371.097 mN 645254.225 mE
Thence 7073340.773 mN 645231.244 mE
Thence 7073255.21 mN 645234.963 mE
Thence 7072486.707 mN 645447.227 mE
Thence 7071875.561 mN 645607.609 mE
Thence 7071076.054 mN 646060.858 mE
Thence 7070558.379 mN 646368.717 mE
Thence 7070115.559 mN 646630.052 mE
Thence 7069815.111 mN 646803.372 mE
Thence 7069578.899 mN 646901.555 mE
Thence 7069389.437 mN 646989.307 mE
Thence 7069324.291 mN 646960.546 mE
Thence 7069257.894 mN 646943.93 mE
Thence 7069206.865 mN 646960.092 mE
Thence 7068863.864 mN 647152.245 mE
Thence 7068691.699 mN 647152.253 mE
Thence 7068571.084 mN 647140.305 mE
Thence 7068404.088 mN 646844.213 mE
Thence 7068292.291 mN 646681.135 mE
Thence 7068175.574 mN 646570.451 mE
Thence 7068161.497 mN 646554.009 mE
Thence 7068101.889 mN 646484.373 mE
Thence 7068001.95 mN 646391.665 mE
Thence 7067906.309 mN 646246.876 mE
Thence 7067792.072 mN 646147.258 mE
Thence 7067667.218 mN 646116.707 mE
Thence 7067575.567 mN 646262.815 mE
Thence 7067465.319 mN 646246.876 mE
Thence 7067153.162 mN 646074.2 mE
Thence 7067101.033 mN 646007.681 mE
Thence 7067095.814 mN 645946.249 mE
Thence 7067138.126 mN 645853.516 mE
Thence 7067157.252 mN 645836.703 mE
Thence 7067249.293 mN 645796.389 mE
Thence 7067587.524 mN 645958.634 mE
Thence 7067669.877 mN 646063.571 mE
Thence 7067811.998 mN 646098.105 mE
Thence 7067931.544 mN 646208.36 mE
Thence 7068032.494 mN 646361.114 mE
Thence 7068132.093 mN 646458.308 mE
Thence 7068176.394 mN 646510.034 mE
Thence 7068205.128 mN 646543.57 mE
Thence 7068321.305 mN 646653.561 mE

Thence 7068439.101 mN 646825.174 mE
Thence 7068563.715 mN 647077.315 mE
Thence 7068590 mN 647103.636 mE
Thence 7068692.499 mN 647112.195 mE
Thence 7068858.565 mN 647112.104 mE
Thence 7069188.988 mN 646924.198 mE
Thence 7069257.254 mN 646903.146 mE
Thence 7069335.918 mN 646922.194 mE
Thence 7069389.477 mN 646947.138 mE
Thence 7069562.252 mN 646865.075 mE
Thence 7069798.694 mN 646766.793 mE
Thence 7070095.574 mN 646595.428 mE
Thence 7070538.053 mN 646334.191 mE
Thence 7071056.178 mN 646026.135 mE
Thence 7071862.924 mN 645569.48 mE
Thence 7072476.289 mN 645408.521 mE
Thence 7073246.902 mN 645195.778 mE
Thence 7073399.901 mN 645166.102 mE
Thence 7073413.608 mN 645168.353 mE
Thence 7073422.886 mN 645180.524 mE
Thence 7073433.094 mN 645218.232 mE
Thence 7073417.717 mN 645304.516 mE
Thence 7073394.562 mN 645636.634 mE
Thence 7073646.291 mN 645399.22 mE
Thence 7073654.349 mN 645418.785 mE
Back to datum

Purposes: a pipeline , a power line , a pump station , a road , a water management facility and taking water.

(k) Area (ha or km^2) — (k) 69.00000 HA

(l) Signature of applicant or agent(if agent state full name and address) — (l)*Amy Probert*
PO BOX 6301, EAST PERTH, WA, 6892

Date: 15/11/2024

OFFICIAL USE

A NOTICE OF OBJECTION may be lodged at any mining registrar's office on or before the 20th day of December 2024 (See Note 4).

Where an objection to this application is lodged the hearing will take place on a date to be set.

Received at 13:42:50 on 15 November 2024 with fees of

Application	$669.00
Rent	$1,821.60
TOTAL	$2,490.60
Receipt No:	48619421421

Mining Registrar

NOTES

Note 1: EXPLORATION LICENCE

(i) Attachments 1 and 2 form part of every application for an exploration licence and must be lodged with this form in lieu of (h), (i), (j) and (k) above.

(ii) An application for an Exploration Licence shall be accompanied by a statement specifying method of exploration, details of the proposed work programme, estimated cost of exploration and technical and financial ability of the applicant(s).

Note 2: PROSPECTING/MISCELLANEOUS LICENCE AND MINING/GENERAL PURPOSE LEASE

(i) This application form shall be accompanied by a map on which are clearly delineated the boundaries of the area applied for.

Note 3: GROUND AVAILABILITY

(i) The onus is on the applicant to ensure that ground is available to be marked out and/or applied for.

(ii) The following action should be taken to ascertain ground availability:
(a) public plan search; (b) register search; (c) ground inspection.

Note 4: ALL APPLICATIONS OVER PRIVATE LAND

The period for lodgement of an objection is within 21 days of service of this notice, or the date noted above for lodging objections, whichever is the longer period.

Form 21

WESTERN AUSTRALIA

Mining Act 1978

(Secs. 41, 58, 70C, 74, 86, 91, Reg. 64)

APPLICATION FOR MINING TENEMENT

(a) Type of tenement (b) Time & Date marked out (where applicable) (c) Mineral Field	(a) Miscellaneous Licence	No. L 51/139
	(b) a.m./p.m. / /	(c) MURCHISON

For each applicant: (d) Full Name and ACN/ABN (e) Address (f) No. of shares (g) Total No. of shares	(d) and (e) ZEUS MINING PTY LTD (ACN: 113 854 596) C/- MCMAHON MINING TITLE SERVICES PTY LTD, PO BOX 6301, EAST PERTH, WA, 6892	(f) Shares 100
		(g) Total 100

DESCRIPTION OF GROUND APPLIED FOR:
(For Exploration Licences see Note 1. For other Licences see Note 2. For all Licences see Note 3.)

(h) Locality
(i) Datum Peg
(j) Boundaries

(h) KYARRA
(i) All coordinates situated in GDA 94 Zone 50
7072968.419 mN 646458.382 mE
(j) From datum situated in GDA 94 Zone 50
Thence 7072904.612 mN 646579.076 mE
Thence 7072687.526 mN 646988.862 mE
Thence 7072484.537 mN 647368.039 mE
Thence 7072261.943 mN 647783.935 mE
Thence 7072128.94 mN 648032.415 mE
Thence 7072049.156 mN 648181.475 mE
Thence 7071836.359 mN 648579.015 mE
Thence 7071623.563 mN 648976.556 mE
Thence 7071612.715 mN 648996.832 mE
Thence 7071396.299 mN 649396.401 mE
Thence 7071179.883 mN 649795.978 mE
Thence 7070963.457 mN 650195.547 mE
Thence 7070747.041 mN 650595.116 mE
Thence 7070530.615 mN 650994.693 mE
Thence 7070314.199 mN 651394.27 mE
Thence 7069945.764 mN 651559.723 mE
Thence 7069577.339 mN 651725.184 mE
Thence 7069208.904 mN 651890.645 mE
Thence 7068838.539 mN 652056.972 mE
Thence 7068468.175 mN 652223.307 mE
Thence 7068097.81 mN 652389.626 mE
Thence 7067727.446 mN 652555.953 mE
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Thence 7067021.079 mN 653004.123 mE
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Thence 7066013.055 mN 653849.635 mE
Thence 7065677.053 mN 654131.47 mE
Thence 7065636.131 mN 654165.797 mE
Thence 7065067.057 mN 653667.864 mE
Thence 7065024.956 mN 653705.251 mE
Thence 7064958.929 mN 653768.669 mE
Thence 7064917.688 mN 653790.661 mE
Thence 7064835.214 mN 653792.492 mE
Thence 7064793.973 mN 653789.746 mE
Thence 7064741.743 mN 653779.661 mE
Thence 7064666.599 mN 653732.008 mE
Thence 7064556.431 mN 653642.475 mE
Thence 7064503.402 mN 653541.628 mE
Thence 7064486.345 mN 653487.461 mE
Thence 7064487.575 mN 653311.074 mE
Thence 7064513.54 mN 653267.487 mE
Thence 7064587.735 mN 653217.064 mE
Thence 7064634.385 mN 653210.69 mE
Thence 7064660.47 mN 653214.458 mE
Thence 7064686.255 mN 653223.726 mE
Thence 7064702.201 mN 653229.234 mE
Thence 7064729.146 mN 653233.869 mE
Thence 7064780.585 mN 653238.363 mE
Thence 7064745.813 mN 653290.526 mE
Thence 7065019.807 mN 653544.712 mE
Thence 7065622.214 mN 654073.081 mE
Thence 7065960.125 mN 653789.63 mE
Thence 7066298.027 mN 653506.179 mE
Thence 7066635.928 mN 653222.728 mE
Thence 7066973.839 mN 652939.278 mE
Thence 7067311.74 mN 652655.827 mE

Thence 7067686.524 mN 652487.521 mE
Thence 7068061.308 mN 652319.207 mE
Thence 7068436.101 mN 652150.892 mE
Thence 7068810.885 mN 651982.578 mE
Thence 7069185.669 mN 651814.264 mE
Thence 7069544.296 mN 651653.214 mE
Thence 7069902.913 mN 651492.157 mE
Thence 7070261.54 mN 651331.099 mE
Thence 7070476.876 mN 650933.534 mE
Thence 7070692.202 mN 650535.969 mE
Thence 7070907.538 mN 650138.403 mE
Thence 7071122.864 mN 649740.838 mE
Thence 7071338.201 mN 649343.281 mE
Thence 7071553.527 mN 648945.716 mE
Thence 7071564.385 mN 648925.44 mE
Thence 7071774.542 mN 648531.659 mE
Thence 7071984.709 mN 648137.879 mE
Thence 7072063.393 mN 647989.619 mE
Thence 7072614.981 mN 646958.748 mE
Thence 7072827.248 mN 646557.365 mE
Thence 7072907.211 mN 646409.072 mE
Back to datum

Purposes: a pipeline , a power line , a pump station , a road , a water management facility and taking water.

(k)	Area (ha or km^2)	(k) 114.00000 HA
(l)	Signature of applicant or agent(if agent state full name and address)	(l)*Amy Probert* PO BOX 6301, EAST PERTH, WA, 6892 — Date: 15/11/2024

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TOTAL	$3,678.60
Receipt No:	48619421421

Mining Registrar

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(a) public plan search; (b) register search; (c) ground inspection.

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The period for lodgement of an objection is within 21 days of service of this notice, or the date noted above for lodging objections, whichever is the longer period.

APPENDIX 2: WESTGOLD AGREEMENT

Licence and Access Water Discharge Deed

Zeus Mining Pty Ltd ACN 113 854 596 (**Zeus**)

Big Bell Gold Operations Pty Ltd ACN 090 642 809 (**BBGO**)

Table of Contents

1. Definitions and interpretation ... 1
   1.1 Definitions ... 1
   1.2 Interpretation ... 4
2. Consent ... 5
3. Grant of Licence ... 6
   3.1 Grant of Licence ... 6
   3.2 Licence Term ... 6
4. Access ... 6
   4.1 Restrictions ... 6
   4.2 Acknowledgements ... 6
5. BBGO Obligations ... 7
   5.1 Limit of BBGO obligations ... 7
   5.2 BBGO not to grant water rights to Third Party ... 7
6. Works ... 7
   6.1 Conduct of Works ... 7
   6.2 MRF ... 7
7. Parties' covenants ... 8
8. Indemnity ... 9
9. Relocation of Zeus Infrastructure ... 9
   9.1 Notice for relocation ... 9
   9.2 Zeus Response to Relocation Notice ... 10
   9.3 Alternative location investigation ... 11
   9.4 Zeus Alternative Notice ... 11
   9.5 Discussion for Further Alternative Location ... 11
   9.6 Dispute Resolution ... 11
   9.7 Expert determination ... 12
   9.8 Relocation of Zeus Affected Infrastructure ... 13
   9.9 Limits on relocation ... 13
10. Confidentiality ... 13
    10.1 Non-disclosure of Confidential Information ... 13
    10.2 Disclosure by recipient of Confidential Information ... 14
    10.3 Return of Confidential Information ... 14
    10.4 Survival on termination ... 14
11. Assignment and Encumbrances ... 14
    11.1 Assignment ... 14
    11.2 Encumbrances ... 14
12. Dispute Resolution ... 15
    12.1 Limitation on proceedings ... 15
    12.2 Dispute Resolution Process ... 15
    12.3 Dispute Resolution Process not to interrupt activities ... 15
    12.4 Clause does not apply to matters where consent required ... 16
13. Term & Termination ... 16
    13.1 Term ... 16
    13.2 Termination ... 16
    13.3 Effect of Termination ... 17
    13.4 Survival ... 17
14. Notices ... 17
15. Ancillary provisions ... 18
    15.1 Entire agreement ... 18
    15.2 GST ... 18
    15.3 Enurement ... 19
    15.4 No reliance or inducement ... 19
    15.5 Amendment ... 19
    15.6 Merger ... 19
    15.7 Moratorium legislation ... 19
    15.8 Remedies cumulative ... 19
    15.9 Severability ... 19

Table of Contents

15.10 Waiver ... 19
15.11 Fees and charges ... 19
15.12 Effect as a Deed ... 20
15.13 Counterparts ... 20
15.14 Applicable law and Jurisdiction ... 20
Schedule 1 - Details 20
Schedule 2 - Plan of Access Area 21

Date 11 December 2024

Parties

Zeus Mining Pty Ltd ACN 113 854 596 (**Zeus**)

Big Bell Gold Operations Pty Ltd ACN 090 642 809 (**BBGO**)

Background

A. Zeus and BBGO are parties to the Crown Prince Ore Purchase Agreement which, amongst other things, is conditional upon Zeus and BBGO entering into this Deed.

B. BBGO is the registered holder of the BBGO Existing Tenure which host the BBGO Mining Pits.

C. Zeus is the owner and operator of the Project.

D. Zeus intends to conduct the Works and construct the Zeus Infrastructure.

E. Zeus will apply for the Miscellaneous Licences to connect the Project to the BBGO Mining Pits.

F. BBGO agrees to grant the Licence and not to lodge any Objection to the grant of the Miscellaneous Licences in consideration for Zeus entering into this Deed and being bound by its terms and conditions.

G. BBGO consents to Zeus conducting the Works in accordance with this Deed.

It is agreed

1. Definitions and interpretation

1.1 Definitions

In this Deed:

Access Area means the area shown on the plan attached to this Deed as Schedule 2 that is at the Execution Date the subject of miscellaneous licences L51/138 and L51/139 and is outlined in red and orange outline.

Affected Area means the area of the Access Area which encroaches on the BBGO Existing Tenure.

Alternative Location has the meaning set out in clause 9.1(b)(4).

Approval means any approval, authorisation, permit, licence, certificate, consent, direction or notice (including any renewal or extension) from any government or other competent Authority (whether Commonwealth, State or local).

Authority is any government department, local government council, Warden, government or statutory authority or any other party under a Law has a right to impose a requirement or whose consent is required with respect to mining operations.

BBGO Activities means:

(a) exploration for minerals on the BBGO Existing Tenure;

(b) productive extraction and mining of minerals on or from the BBGO Existing Tenure; and

(c) infrastructure to treat minerals or support exploration for minerals or productive extraction and mining of minerals on or from the BBGO Existing Tenure.

BBGO Existing Tenure means the tenements described in item 1 of Schedule 1 (and includes any extension, renewal, conversion, replacement, or substitution of those tenements).

BBGO Infrastructure means any infrastructure on the Affected Area which is owned or used by BBGO as part of the BBGO Activities.

BBGO Mining Pits means the Five Mile Well Pit and Sabbath Pit.

Business Day means any day which is not a Saturday, Sunday or a public holiday in Perth, Western Australia.

Confidential Information means all confidential, non-public or proprietary information of a Party regardless of how the information is stored or delivered, which is exchanged between the Parties before, on or after the date of this Deed in connection with this Deed, other than information:

(a) which is in or becomes part of the public domain other than through breach of this Deed or an obligation of confidence owed to the disclosing Party; or

(b) which the recipient can prove by contemporaneous written documentation was already known by it at the time of disclosure to it (unless such knowledge arose from disclosure of information in breach of an obligation of confidentiality).

Consent Notice has the meaning set out in clause 9.2(c)(1).

Consequential Loss means pure economic loss, incidental, special or other consequential or indirect loss or damage and exemplary or punitive damages including loss or damage in relation to loss of use, loss of production, loss of revenue, loss of profits or anticipated profits, loss of business, loss of business opportunity, loss of contract, loss of reputation or opportunity, business interruptions of any nature.

Corporations Act means the *Corporations Act 2001* (Cth).

Crown Prince Ore Purchase Agreement means the agreement executed between Big Bell Gold Operations Pty Ltd and Zeus Mining Pty Ltd for the sale and purchase of ore mined by Zeus from its Project.

Deed means the agreement between the Parties constituted by this document.

Department means the department of the government of Western Australia responsible for the administration of the Mining Act.

Dewatering Points means the evaporators and standpipes as shown on the plan attached to this Deed as Schedule 2 and the point at which the Pipeline will discharge water into the BBGO Mining Pits.

Dispute has the meaning set out in clause 12.1.

Dispute Notice has the meaning set out in clause 12.2(a).

Dispute Resolution Process has the meaning set out in clause 12.1.

Encumbrance means any mortgage, pledge, lien, charge, title retention arrangement, trust or power, or other form of security or interest having effect as a security for the payment of any monetary obligation or the observance of any other obligation whether existing or agreed to be granted or created.

Encumbrancee means a person who is entitled to the benefit of an Encumbrance over the BBGO Existing Tenure or a Miscellaneous Licence as applicable or over a Party's rights under this Deed.

Execution Date means the date this Deed is executed by all parties.

Expert has the meaning given in clause 9.7(a).

Five Mile Well Pit means the mining pit known as the Five Mile Well pit that is located on M51/670 shaded in grey with the pit at the area indicated on the plan attached to this Deed as Schedule 2.

Further Alternative Location has the meaning set out in clause 9.4.

Further Alternative Location Notice has the meaning set out in clause 9.2(c)(3).

Good Industry Practice is currently recognised mining methods and practice which could reasonably be expected from experienced and competent mining companies operating in Australia under conditions compared to those applicable to the relevant activity.

Infrastructure Dispute Resolution Notice has the meaning set out in clause 9.6(a).

Insurances means each of the insurances described in item 2 of Schedule 1.

Investigation Period has the meaning set out in clause 9.3.

Law is Commonwealth and State legislation including regulations, by laws, and other subordinate legislation, the requirements and guidelines of any Authority, with which a Party is legally required to comply, and common law and equity.

Licence has the meaning as defined in clause 3.

Licence Term means the period commencing on the Execution Date and ending on the earlier of the grant of both Miscellaneous Licences or Term of this Deed coming to an end.

Loss means any loss, diminution in value or deficiency of any kind but excludes Consequential Loss.

Mining Act means the *Mining Act 1978* (WA).

Miscellaneous Licence means miscellaneous licences L51/138 and L51/139 and any extension, renewal, replacement or substitution of such miscellaneous licences. .

Objection means an objection to the grant of a Miscellaneous Licence to any Authority including the Warden.

Parties means Zeus and BBGO and Party means either of them as relevant.

Pipeline means a water pipeline to be installed by Zeus over the Access Area for the purpose of transporting water from the Project to the BBGO Mining Pits and in accordance with clause 5

Personnel mean all officers, employees, invitees, agents, contractors and subcontractors.

Permitted Purpose means:

(a) conducting the Works on the Affected Area;

(b) discharging water from the Pipeline into the BBGO Mining Pits;

(c) gaining access to and from the Access Area from public roads to carry out the activities described in (a) and (b) above; and

(d) doing all other things which may be reasonably necessary for any of the activities described in (a) to (c) above.

Project means the Garden Gully Project owned and operated by Zeus located on various tenements including M51/886 and M51/889.

Refusal Notice has the meaning set out in clause 9.2(c)(4).

Relevant Activities has the meaning set out in clause 9.1(b)(1).

Related Body Corporate means a related body corporate as defined in the Corporations Act.

Relocation Notice has the meaning set out in clause 9.1.

Sabbath Pit means the mining pit known as the Sabbath mining pit that is located on M51/322 shaded in grey with the pit at the area indicated on the plan attached to this Deed as Schedule 2.

Term has the meaning as that term is defined in clause 13.1.

Third Party means a person that is not a Party, or a Related Body Corporate of a Party, to this Deed.

Warden means a Warden of Mines appointed under the Mining Act.

WHS Act means the Work Health and Safety Act 2020 (WA) and the Work Health and Safety (Mines) Regulations 2022 (WA).

Works mean all activities relating to preparation, construction, installation, operation and maintenance of the Zeus Infrastructure and the discharging of water from the Pipeline into the BBGO Mining Pits conducted by Zeus or its Personnel.

Zeus Affected Infrastructure has the meaning as defined in clause 9.1(b)(2).

Zeus Infrastructure means the Pipeline and any powerlines, pumping stations, water storage, access road, sumps, and other associated infrastructure constructed or proposed to be constructed by Zeus on the Access Area required to carry out the transport of water from the Project to the BBGO Mining Pits and the discharge of water from the Pipeline into the BBGO Mining Pits.

1.2 **Interpretation**

In this Deed, unless the context otherwise requires:

(a) the singular includes the plural and vice-versa;

(b) headings do not affect the interpretation of this Deed;

(c) a reference to a Party means includes that Party's executors, administrators, substitutes, successors and permitted assigns and its Personnel;

(d) references to a part, clause, schedule, exhibit and annexure refers to a part, clause, schedule, exhibit or annexure of, in or to this Deed;

(e) a reference to this Deed includes all schedules, exhibits and annexures to this Deed;

(f) a reference to a deed, instrument or other document includes the same as amended, novated, supplemented, varied or replaced from time to time;

(g) a reference to a court is to an Australian court;

(h) a reference to any legislation or legislative provision includes any statutory modification or re-enactment of, or legislative provision substituted for, and any subordinated legislation (including regulations) issued under, that legislation or legislative provision;

(i) a reference to a day, month or year is relevantly to a calendar day, calendar month or calendar year;

(j) a reference to $, AUD or dollars is to the lawful currency of the Commonwealth of Australia;

(k) the expressions "including", "includes" and "include" have the meaning as if followed by "without limitation";

(l) where a word or phrase is defined, its other grammatical forms have a corresponding meaning;

(m) if a Party to this Deed is the parent company of a corporation then that party must procure that its subsidiaries take all actions to comply with that parties obligations under this Deed;

(n) a Party may exercise a right or remedy or give or refuse its consent in any way it considers appropriate (including by imposing conditions), unless this Deed expressly states otherwise; and

(o) no rule of construction is to apply to the disadvantage of a Party on the basis that that Party drafted the whole or any part of this Deed.

2. Consent

BBGO:

(a) consents to the grant of the Miscellaneous Licences over the Affected Area and agrees that it will not lodge Objections to any application for a Miscellaneous Licence made by Zeus;

(b) subject to its rights under this Deed:

(1) will not take any steps to impede or restrict the grant of a Miscellaneous Licence or any Approval for the Works;

(2) consents to the grant of any Approval for the Works to Zeus, with every such consent to be provided in writing by BBGO to Zeus (or as otherwise directed by Zeus) as soon as reasonably practicable after a request in writing by Zeus for the consent to be given; and

(3) provide reasonable assistance to Zeus to enable Zeus to obtain any required Approval for the Works, including if required during the Licence Term, making, or permitting Zeus to make, any applications for such Approval in its name;

(c) consents to Zeus conducting the Works in accordance with this Deed.

3. Grant of Licence

3.1 Grant of Licence

BBGO grants to Zeus, and Zeus takes from BBGO, a non-exclusive licence for Zeus and its Personnel to access and use the Affected Area for the Permitted Purpose during the Licence Term on the terms and conditions set out in this Deed (**Licence**).

3.2 Licence Term

The Licence will be granted for the Licence Term and will expire at the end of the Licence Term.

4. Access

4.1 Restrictions

Zeus must not, and must procure that its Personnel do not, use the Licence or this Deed:

(a) for any purpose or in any manner not permitted by Law (or a purpose permitted by Law with an Approval where that Approval has not been obtained); or

(b) for any purpose other than the Permitted Purpose or in any manner inconsistent with the Permitted Purpose without first seeking and obtaining the prior written consent of BBGO.

4.2 Acknowledgements

(a) Zeus acknowledges during the Term:

(1) its Personnel must undertake any site induction requirements implemented by BBGO relating to this Deed or access to the Affected Area;

(2) it must promptly reimburse BBGO to the extent Zeus's access to and use of the Affected Area results in a payment obligation being imposed on, or increases a payment obligation imposed on, BBGO including in respect of any levies or other payments due under the WHS Act, including any mines safety inspection levy; and

(3) the rights granted to Zeus under the Licence are contractual only and do not give Zeus a proprietary interest in the Affected Area.

(b) Zeus and BBGO acknowledge that the Miscellaneous Licences may cover additional area which do not overlap BBGO Existing Tenure and that the Licence is only granted over the Affected Area.

5. BBGO Obligations

5.1 **Limit of BBGO obligations**

Subject to clause 5.2, nothing in this Deed requires BBGO to pay any money or provide other valuable consideration to any person, or otherwise take any action which, in BBGO's reasonable opinion would impact adversely on the BBGO Activities.

5.2 **BBGO not to grant water rights to Third Party**

During the Term, BBGO will not provide any Third Party with any right to deposit water into the BBGO Mining Pits or conduct activities similar to the Works at the BBGO Mining Pits, however BBGO shall be entitled to take water or discharge water at the BBGO Mining Pits for BBGO Activities.

6. Works

6.1 **Conduct of Works**

In respect of the Works during the Term, Zeus and its Personnel must:

(a) be responsible for the design, construction or upgrade and operation of the Zeus Infrastructure and conduct of the Works;

(b) consult with BBGO regarding the location and specifications of Zeus Infrastructure on the Affected Area before constructing the Works;

(c) not damage the stability of the Mining Pits;

(d) appoint all representatives required under the WHS Act in relation to the BBGO Existing Tenure unless notified by BBGO that BBGO intends to appoint the representatives required under the WHS Act in relation to the BBGO Existing Tenure, in which case, BBGO shall appoint all representatives required under the WHS Act;

(e) obtain and comply with any Approval relating to the Works, including but not limited to requirements under the Mining Act, *Environmental Protection Act 1986* (WA) and *Aboriginal Heritage Act 1972* (WA);

(f) take all reasonable precautions to reduce fire risk and to reduce the risk of damage to trees or property;

(g) be responsible for any pollution, Loss, damage or destruction BBGO suffers as a result of the Works or construction of the Zeus Infrastructure; and

(h) comply with all reasonable directions made by BBGO regarding the conduct of Works on the Affected Area.

6.2 **MRF**

(a) If the Works, Zeus Infrastructure or other activities undertaken by Zeus or its Personnel on the Affected Area increase the levy payable by BBGO under the *Mining Rehabilitation Fund Act 2012* (WA) on the BBGO Existing Tenure then:

(1) BBGO will provide details of how those Works, Zeus Infrastructure or other activities undertaken by Zeus or its Personnel on the Affected Area have increased the levy payable by BBGO under the *Mining Rehabilitation Fund Act 2012* (WA) on the BBGO Existing Tenure; and

(2) Zeus will reimburse BBGO for any increase in the levy payable by BBGO under the *Mining Rehabilitation Fund Act 2012* (WA) on the BBGO Existing Tenure which has occurred as result of the Works, Zeus Infrastructure or other activities undertaken by Zeus or its Personnel on the Affected Area.

7. Parties' covenants

The Parties covenant with each other that they will, and will ensure that their respective Personnel will, at all times during the Term:

(a) comply with the provisions of the Mining Act, *Environmental Protection Act 1986* (WA), *Aboriginal Heritage Act 1972* (WA), the WHS Act and any other Law which may be applicable to their activities on, or otherwise in respect of, the Affected Area;

(b) rehabilitate their respective activities so that BBGO will rehabilitate any activities conducted by BBGO and Zeus will rehabilitate any activities that conducted by Zeus on the Affected Area in accordance with any requirements of the Department;

(c) subject to clause 9, use reasonable endeavours to minimise interference with any activities conducted or proposed to be conducted by the other Party and its Personnel on the Affected Area;

(d) comply with any health and safety directions made by all representatives appointed under the WHS Act in relation to the Affected Area;

(e) subject to clause 9, allow the Other Party and its Personnel to exercise all rights legally permissible under a Miscellaneous Licence (in respect of Zeus) and BBGO Existing Tenure (in respect of BBGO);

(f) subject to clauses 6 and 9, ensure that it does not damage or otherwise interfere with the construction and use of any Zeus Infrastructure or BBGO Infrastructure or conduct any activities that would, or would be reasonably likely to, prevent, interfere or impede, in a material way, the other Parties use of the Zeus Infrastructure or BBGO Infrastructure;

(g) if requested by the other Party, consult with that Party in good faith regarding any activities currently being carried out, or to be carried out by Zeus or BBGO on the Affected Area with a view to minimising the impact of each Party's activities on the other Party;

(h) make good any damage to the BBGO Infrastructure or Zeus Infrastructure to the extent it is caused by that Party or its Personnel's use of the Affected Area;

(i) use all reasonable endeavours to ensure that all of its activities on the Affected Area are undertaken with due care and diligence in accordance with Good Industry Practice; and

(j) effect and maintain during the Term the Insurances, ensure that all of the terms and conditions of such Insurances are complied with, pay all premiums, calls and deductibles when due, and produce to the other Party certificates of currency of such Insurances prior to commencing any activities on or immediately adjacent to the Affected Area and at such subsequent times as and when reasonably requested by the other Party.

8. Indemnity

(a) Zeus indemnifies BBGO, its Related Bodies Corporate, and their respective Personnel (each, an **Indemnified Person**) from and against all claims, damage, Loss, expense or liability of any nature but excluding Consequential Loss, including any claims made by Third Parties, suffered or incurred by that Indemnified Person arising from the exercise of rights or obligations under this Deed including:

(1) physical loss of or damage to property of that Indemnified Person or any Third Party; and

(2) damage, Loss, expense or liability in respect of personal injury, disease, illness or death,

except which will be reduced proportionally to the extent the damage, loss, expense or liability is caused by BBGO's negligent act or omission on or in respect of the Access Area.

(b) Neither Party, its Related Bodies Corporate or their respective Personnel, shall be liable to the other Party for any Consequential Loss however arising under this Deed.

(c) Clause 8(a) and 8(b) of this Deed survives, and continues to bind the Parties after, the expiry, completion or termination of this Deed.

(d) Zeus indemnifies and holds BBGO harmless from and against any claims, damage, expense, Loss or liabilities of any nature arising from or in connection with any Approval or environmental damage or pollution to the BBGO Existing Tenure.

9. Relocation of Zeus Infrastructure

9.1 Notice for relocation

(a) If BBGO:

(1) has a bona fide requirement to conduct BBGO Activities on the Affected Area; and

(2) considers, acting reasonably:

(A) that such BBGO Activities may, would, or would be reasonably likely to materially prevent, interfere with or impede, Zeus's use of the Zeus Infrastructure on the Affected Area; or

(B) Zeus's use of the Zeus Infrastructure may, would, or would be reasonably likely to materially prevent, interfere with or impede, the conduct of BBGO Activities,

BBGO may give written notice to Zeus requesting that the Zeus Infrastructure on the Affected Area be relocated (**Relocation Notice**).

(b) A Relocation Notice must, with reasonable particularity:

(1) outline the BBGO Activities on the Affected Area that would, or would be reasonably likely to:

(A) prevent, interfere with or impede (and the reasons why they may do so); or

(B) be prevented, interfered with or impeded by (and the reasons why they may do so),

by Zeus's use of the Zeus Infrastructure in its current location (**Relevant Activities**);

(2) identify the part or parts of the Zeus Infrastructure that would, or would be likely to need to be relocated (**Zeus Affected Infrastructure**);

(3) outline any steps taken by BBGO to investigate ways in which to mitigate the effect of BBGO conducting the Relevant Activities on the area of the Zeus Affected Infrastructure in its current location;

(4) identify a proposed alternative location for the Zeus Affected Infrastructure (**Alternative Location**); and

(5) specify a date which must be no earlier than six (6) months for that Zeus Affected Infrastructure (**Relocation Date**) by which it proposes Zeus should relocate the Zeus Affected Infrastructure, which date must allow a reasonable period, taking into account the nature of the Zeus Affected Infrastructure, for Zeus to:

(A) obtain all necessary tenure, approvals and consents required to enable Zeus to construct, operate and maintain the replacement infrastructure for the Zeus Affected Infrastructure on the Alternative Location;

(B) construct all necessary replacement of the Zeus Affected Infrastructure on the Alternative Location; and

(C) remove any part of the Zeus Affected Infrastructure and rehabilitate areas affected by the relocation in accordance with relevant law and the requirements of any Authority or any other party under a law which has a right to impose a requirement or whose consent is required with respect to the Zeus Affected Infrastructure.

9.2 Zeus Response to Relocation Notice

(a) If BBGO has given a Relocation Notice, Zeus and BBGO must meet to discuss the Relocation Notice within 20 Business Days of the receipt of that Relocation Notice with a view to discussing any possible methods of carrying out the proposed Relevant Activities without requiring the Zeus Affected Infrastructure to be relocated.

(b) In issuing a Relocation Notice, in undertaking discussions regarding a Relocation Notice, and in presenting positions and views on matters relating to a Relocation Notice or otherwise as contemplated by this clause 9, the Parties must be reasonable and act in good faith.

(c) Within 30 Business Days of the date of the Relocation Notice, Zeus must give BBGO a notice:

(1) consenting to the proposed relocation of the Zeus Affected Infrastructure, the agreed Relocation Date and the proposed Alternative Location (**Consent Notice**), in which case clause 9.8 will apply; or

(2) consenting to the proposed relocation of the Zeus Affected Infrastructure and the proposed Alternative Location, but stating that the Relocation Date is not reasonable taking into account the matters contemplated in clause 9.1(b)(5), in which case clause 9.6 will apply; or

(3) electing to consider alternative options to the Alternative Location (**Further Alternative Location Notice**), in which case clause 9.3 will apply; or

(4) disputing that some or all of the Zeus Affected Infrastructure needs to be relocated (**Refusal Notice**), in which case clause 9.6 will apply.

9.3 Alternative location investigation

If Zeus gives a Further Alternative Location Notice, BBGO must give Zeus a notice of a period, determined by BBGO acting reasonably, of not less than three months from the date of the Further Alternative Location Notice, within which Zeus may consider alternative locations for the Zeus Affected Infrastructure (**Investigation Period**). BBGO must provide all reasonable assistance to Zeus to conduct investigations into the suitability of an alternative location for the Zeus Affected Infrastructure other than the Alternative Location, including by allowing Zeus access to BBGO's tenure in order to conduct those investigations. All costs incurred by Zeus in connection with such investigations will be borne by Zeus.

9.4 Zeus Alternative Notice

At any time before 15 Business Days after the expiry of the Investigation Period, Zeus must give BBGO:

(a) a Consent Notice; or

(b) a notice requesting that the Alternative Location be changed to a different location (**Further Alternative Location**), which notice must specify with reasonable particularity the reasons for proposing the Further Alternative Location and a proposed Relocation Date in respect of the Further Alternative Location.

9.5 Discussion for Further Alternative Location

(a) If Zeus has given the notice described in clause 9.4(b), Zeus and BBGO must meet to discuss the Further Alternative Location within 10 Business Days of the issue of that notice.

(b) In undertaking discussions regarding the Further Alternative Location, and in presenting positions and views on matters relating to a Further Alternative Location, the Parties must be reasonable and act in good faith.

9.6 Dispute Resolution

(a) If Zeus issues:

(1) a notice described in clause 9.2(c)(1) stating that the Relocation Date proposed by BBGO is not reasonable;

(2) a Refusal Notice; and/or

(3) a notice under clause 9.4(b) specifying a Further Alternative Location and the parties do not agree on the location for the Zeus Affected Infrastructure within 20 Business Days of the first meeting to discuss Further Alternative Location pursuant to clause 9.5,

either Party may:

(4) 20 Business Days after issuing any notice referred to in clause 9.6(a)(1) or clause 9.6(a)(2); or

(5) 20 Business Days after the first meeting to discuss Further Alternative Location in relation to a notice referred to in clause 9.6(a)(3),

issue a notice requiring that the matter(s) of difference between the Parties be resolved by an Expert in accordance with clause 9.7 (**Infrastructure Dispute Resolution Notice**).

(b) The Infrastructure Dispute Resolution Notice must specify which of the following matters are to be resolved by the Expert:

(1) whether the Zeus Affected Infrastructure should be moved to the Alternative Location or Further Alternative Location or moved at all; and

(2) having regard to the requirements in clause 9.1(b)(5), the Relocation Date.

9.7 Expert determination

(a) In the event the either Party issues an Infrastructure Dispute Resolution Notice, the matter(s) will be referred for determination by an independent expert agreed between the Parties or, failing agreement within 20 Business Days of the Infrastructure Dispute Resolution Notice, appointed by the Australasian Institute of Mining and Metallurgy (**Expert**).

(b) Where the Expert is so appointed in accordance with clause 9.7(a):

(1) the Parties must provide prompt access to the Expert to all information relating to the matter to be determined and each of the Parties must provide every reasonable assistance to ensure that the Expert is fully informed of the issues;

(2) the Expert may travel to and view the Affected Area or, if the proposed Alternative Location or Further Alternative Location is not within the Affected Area, that other location;

(3) each Party may (expeditiously) make written submissions to the Expert with respect to the matter, provided that the Party must promptly copy all such submissions to the other Party;

(4) all costs of the determination of the Expert will be borne by the Parties equally, unless the Expert determines that BBGO and/or Zeus did not act reasonably or in good faith as required under clause 9.2(b) and clause 9.5(b), in which case the costs of the determination of the Expert will be borne as the Expert otherwise determines;

(5) the Parties will indemnify the Expert from and against any payment, expense, Loss or damage incurred by the Parties as a result of any act or omission by the Expert in the course of performance or attempted performance of its appointment, however arising;

(6) the Expert must deliver the Expert's determination in writing to both Parties within 30 days of the date of the Expert's acceptance of appointment;

(7) the Expert will not be obliged to have regard to any particular information or evidence in reaching the Expert's determination and may, in their discretion, procure and consider such information and evidence and in such form as he or she sees fit;

(8) each of the Parties must comply promptly with any request of the Expert for information in such form as the Expert requires;

(9) the Expert may, in the Expert's complete discretion, decide upon the procedure the Expert will adopt in reaching the Expert's determination and each of the Parties must comply with any requirement of the Expert in connection with those procedures; and

(10) the Expert will be acting as an expert, not an arbitrator, and the decision of the Expert will be final and binding on the Parties.

9.8 **Relocation of Zeus Affected Infrastructure**

If an alternative location for the Zeus Affected Infrastructure has been agreed or determined:

(a) Zeus will, if necessary, at Zeus's cost, apply for a miscellaneous licence over the area of the new location and will, upon the grant of this substitute tenement, relocate the Zeus Affected Infrastructure at Zeus's cost;

(b) if the substitute tenement is located upon the BBGO Existing Tenure or any other mining tenement held by BBGO, BBGO must not, and must ensure that its Related Bodies Corporate do not, object to Zeus's application for the substitute tenement and the terms of this Deed will apply to any area of encroachment of the substitute tenement on BBGO's tenements, as if it were the Access Area; and

(c) Zeus will not be under any liability to BBGO for any losses, delays, damages or other costs which may be suffered or incurred by BBGO arising out of or in connection with the relocation of the Zeus Affected Infrastructure, including any delay in the grant of the substitute tenement or the relocation of the Zeus Affected Infrastructure.

9.9 **Limits on relocation**

Notwithstanding anything to the contrary in this Deed Zeus is not under any obligation to relocate any Dewatering Point which has already been relocated once pursuant to this clause 9.

10. Confidentiality

10.1 **Non-disclosure of Confidential Information**

A Party must not disclose Confidential Information except:

(a) if the disclosure is expressly permitted by this Deed; or

(b) to a Related Body Corporate, who requires the information for the purposes of or related to this Deed; or

(c) with the written consent of the Party who supplied the Confidential Information, which consent may be given or withheld in its absolute discretion; or

(d) if the Party, or a Related Body Corporate of the Party, holding the Confidential Information is required to do so by Law, including by a recognised securities exchange, Authority or in connection with legal proceedings relating to this Deed; or

(e) to its employees, accountants, auditors, financial advisers or legal advisers with the prior requirement that they keep the disclosed information confidential in accordance with this clause; or

(f) if disclosure is made on a confidential basis to a prospective farminee or assignee of the Party's rights and obligations under this Deed or prospective financier of the Party or its Related Bodies Corporate, or to a potential bona fide purchaser of shares in a

Party provided the farminee, assignee, financier or bona fide purchaser agrees to keep the disclosed information confidential in accordance with this clause.

10.2 Disclosure by recipient of Confidential Information

(a) To the extent permitted by section 275 of the *Personal Property Securities Act 2009* (Cth), the parties agree to keep all information of the kind mentioned in section 275(1) of that Act confidential and to not disclose that information to any other person, except as permitted by this Deed.

(b) A Party disclosing Confidential Information as permitted by this Deed must use all reasonable endeavours to ensure that persons receiving Confidential Information from it do not disclose the Confidential Information except as permitted by this Deed.

10.3 Return of Confidential Information

A Party who has disclosed Confidential Information to a prospective farminee, assignee, financier or other Third Party as provided for by this Deed must obtain from that person prior to disclosure an undertaking that, on the request of the disclosing Party, it will immediately deliver or re-deliver to that Party all Deeds or other materials containing or referring to the Confidential Information in its possession, power or control.

10.4 Survival on termination

This confidentiality clause continues to bind a person notwithstanding that that person ceases to be a Party to this Deed or this Deed is terminated for any reason, for a period of three years from the date of termination.

11. Assignment and Encumbrances

11.1 Assignment

A Party (**Assigning Party**) may not:

(a) assign, transfer or otherwise dispose of all or any part of its rights or obligations under this Deed; or

(b) transfer or create any interest in a Miscellaneous Licence or any BBGO Existing Tenure (as the case may be), whether by assignment, transfer or otherwise,

(each an **Assignment**) to or in favour of a Third Party or a Related Body Corporate (**Assignee**) unless the Assignee executes and delivers to the other Party (**Continuing Party**) a form of assumption deed approved by the Continuing Party (which approval must not be unreasonably withheld or delayed) under which the Assignee agrees to assume the obligations of the Assignor under, and be bound by the terms and conditions of, this Deed to the extent of the interest and rights the subject of the Assignment.

11.2 Encumbrances

Each Party covenants in favour of the other Party that it will not grant any Encumbrance over a Miscellaneous Licence or BBGO Existing Tenure as applicable or this Deed unless the Encumbrancee executes a deed of covenant in favour of the other Party under which the Encumbrancee agrees to be bound by the terms of this Deed in exercising the Encumbrancee’s powers or remedies under the Encumbrance, as if it was a Party to this Deed, on terms reasonably acceptable to the other Party.

12. Dispute Resolution

12.1 Limitation on proceedings

The Parties agree that it is a condition precedent to the commencement of any litigation proceedings by a Party in respect of a dispute under, or in relation to, this Deed (**Dispute**) that the Party has complied fully with the agreed process of resolving a Dispute (**Dispute Resolution Process**) under this clause (regardless of the level or levels on which the Dispute has previously been considered) except:

(a) where the Dispute is the non-payment of monies due; or

(b) if the Party seeks urgent interlocutory, injunctive or declaratory relief; or

(c) if the other Party has failed to observe the requirements of this clause and the Party seeks to enforce compliance with the Dispute Resolution Process,

in respect of the Dispute.

12.2 Dispute Resolution Process

(a) Where a Dispute arises between the Parties, a Party may give notice to the other Party initiating a Dispute Resolution Process in respect of the Dispute (**Dispute Notice**) which must:

(1) describe the nature of the Dispute; and

(2) nominate a representative of the Party who is authorised to negotiate and settle the Dispute on the Party's behalf.

(b) The other Party must within five Business Days after receipt of a Dispute Notice nominate in writing to the other Party a representative authorised to negotiate and settle the Dispute on its behalf.

(c) The Parties' representatives must negotiate in good faith with a view to resolving the Dispute within 15 Business Days after the receipt of the Dispute Notice, or such longer period as those representatives agree, failing which the Dispute must be immediately referred to the Chief Executive Officers of the Parties.

(d) The Chief Executive Officers must negotiate in good faith with a view to resolving the Dispute within ten Business Days of the Dispute being referred to them, or such longer period as the Chief Executive Officers agree, after which either Party may at any time after that date commence litigation proceedings in respect of the Dispute.

(e) if not earlier resolved, be continued for a period expiring on the date being ten Business Days after the nomination of the mediator (or such other period as the Parties may agree) after which either Party may at any time after that date commence litigation proceedings in respect of the Dispute.

12.3 Dispute Resolution Process not to interrupt activities

(a) Prior to the resolution of a Dispute, the Parties must continue to perform their respective obligations under this Deed insofar as those obligations are not the subject-matter of the Dispute.

(b) The Parties must ensure that neither the commencement nor conduct of any Dispute Resolution Process, including mediation, causes any interruption to the Parties' respective activities or to the performance by the Parties of their respective obligations under this Deed. The commencement or conduct of any Dispute Resolution Process will not affect any of the time limits fixed in this Deed unless the performance of a Party under this Deed is materially affected by the submission of the matter in dispute to litigation or by the result of the litigation.

12.4 **Clause does not apply to matters where consent required**

If this Deed refers to the Parties reaching agreement on a matter or the consent of any Party being given then, except where this Deed requires that consent or agreement is not to be unreasonably withheld or delayed, the Dispute Resolution Process cannot be used to resolve a dispute between the Parties in relation to the reaching of that agreement or the giving of that consent.

13. Term & Termination

13.1 **Term**

The term of this Deed commences from the Execution Date, and shall continue until terminated in accordance with clause 13.2 (**Term**).

13.2 **Termination**

(a) Unless otherwise agreed in writing by the Parties, this Deed will terminate with immediate effect if any of the following events occur:

(1) the Crown Prince Ore Purchase Agreement is terminated by either Party in accordance with clause 2.4 of the Crown Prince Ore Purchase Agreement;

(2) the Crown Prince Ore Purchase Agreement being terminated by BBGO in accordance with clause 17.2 and 17.1(d) of the Crown Prince Ore Purchase Agreement; and

(3) the Affected Area ceasing to exist as a result of the Miscellaneous Licences or BBGO Existing Tenure being partially surrendered or varied so that there is no longer any Licence granted under this Deed or encroachment by any Miscellaneous Licence on the BBGO Existing Tenure.

(b) Unless otherwise agreed in writing by the Parties, this Deed will terminate on the date which is 12 months from the date of occurrence of any of the following events:

(1) the Crown Prince Ore Purchase Agreement being terminated by Zeus in accordance with clauses 4.2(b) and 16.4 of the Crown Prince Ore Purchase Agreement;

(2) the Crown Prince Ore Purchase Agreement being terminated by BBGO in accordance with clause 17.1(a) of the Crown Prince Ore Purchase Agreement;

(3) the Crown Prince Ore Purchase Agreement being terminated by Zeus in accordance with clause 17.2 of the Crown Prince Ore Purchase Agreement; and

(4) the Crown Prince Ore Purchase Agreement being terminated by either Party in accordance with clause 17.1(b) of the Crown Prince Ore Purchase Agreement.

(c) Unless otherwise agreed in writing by the Parties, this Deed will terminate with immediate effect from the date of the Crown Prince Ore Purchase Agreement being terminated by Zeus in accordance with clause 17.1(a) of the Crown Prince Ore

Purchase Agreement.

(d) Unless otherwise agreed in writing by the Parties, this Deed will terminate with immediate effect if the Crown Prince Ore Purchase Agreement expires or terminates for reason not already specified in clauses 13.2(a), 13.2(b) and 13.2(c).

13.3 **Effect of Termination**

(a) Within at 10 days of termination of this Deed, Zeus must cease discharging water into the BBGO Mining Pits and further construction of any Works.

(b) If terminated under clause 13.2(a), Zeus must and is authorised to, within 6 months from the date of termination pursuant to clause 13.2:

(1) remove any Zeus Infrastructure from the Affected Area; and

(2) surrender the Miscellaneous Licences or otherwise cause the Miscellaneous Licences to be partially surrendered or varied so that there is no longer any encroachment by any Miscellaneous Licence on the BBGO Existing Tenure.

(c) If terminated under clause 13.2(b),13.2(c) or 13.2(d), Zeus must and is authorised to, within 30 days from the date of termination pursuant to clause 13.2:

(1) remove any Zeus Infrastructure from the Affected Area; and

(2) surrender the Miscellaneous Licences or otherwise cause the Miscellaneous Licences to be partially surrendered or varied so that there is no longer any encroachment by any Miscellaneous Licence on the BBGO Existing Tenure.

13.4 **Survival**

Clause 12.3 of this Deed survives, and continues to bind the Parties after, the expiry, completion or termination of this Deed.

14. Notices

(a) Any notice, certificate, consent, approval, waiver or other communication in connection with this Deed (**Notice**) must be in writing, in English and signed by (or specified as being from) a person duly authorised by the Party sending it.

(b) A Notice required or permitted to be given by a Party to the other Party under this Deed must be addressed to the other Party and:

(1) delivered at that Party's delivery address;

(2) sent by pre-paid mail to that Party's postal address; or

(3) sent by email to that Party's email address.

(c) For the purpose of this clause, the address of a Party is the address set out below (or another address of which that Party may from time to time give notice to the other Party:

Zeus

Attention: [redacted]

Delivery Address: [redacted]

Electronic Mail: [redacted]

BBGO

Attention: Chief Legal Officer

Delivery Address: Level 6, 200 St Georges Terrace, Perth WA 6000

Postal Address: Level 6, 200 St Georges Terrace, Perth WA 6000

Electronic Mail: [redacted]

(d) A Notice given to a Party is treated as having been duly given and received:

(1) (in the case of its being delivered at that Party's address) when delivered;

(2) (in each case of its being sent by pre-paid mail) on the fifth Business Day following the date of postage if posted in Australia or otherwise when it would be expected to be delivered in the ordinary course of post;

(3) (in the case of its being sent by email) at the time shown in the delivery confirmation report generated by the sender’s email system which indicates that the email was sent to the recipient’s email address; and

(4) a Notice delivered or received other than on a Business Day or after 5.00pm (recipient’s times) is regarded as served at 9.00am the following Business Day and a Notice delivered or received before 9.00am (recipient’s time) is regarded as served at 9.00am.

15. Ancillary provisions

15.1 Entire agreement

This Deed contains everything the Parties have agreed and overrides and supersedes all other earlier agreements in relation to the subject matter of this Deed.

15.2 GST

(a) If any supply made under this Deed is subject to GST, the Party to whom the supply is made (**Recipient**) must pay to the Party making the supply (**Supplier**), subject to the Supplier first issuing a Tax Invoice to the Recipient, an additional amount equal to the GST payable on that supply. The additional amount is payable at the same time and in the same manner as the consideration for the supply, unless a Tax Invoice has not been issued in which case the additional amount is payable on receipt of a Tax Invoice. This subclause does not apply to the extent that the consideration for a supply is expressed to be GST inclusive.

(b) If any Party is required to reimburse or indemnify the other Party for a cost, expense or liability (**Cost**) incurred by the other party, the amount of that Cost for the purpose of this Deed is the amount of the Cost incurred less the amount of any credit or refund of GST to which the party incurring the Cost is entitled to claim in respect of the Cost.

(c) In this clause 15.2, **GST** and **Tax Invoice** have the meaning given to those terms in *A New Tax System (Goods and Services Tax) Act 1999* (Cth).

15.3 **Enurement**

The provisions of this Deed enure for the benefit of and are binding on each Party and their respective successors and permitted assigns.

15.4 **No reliance or inducement**

Each Party warrants and agrees that when entering into this Deed it relied exclusively on the terms expressly contained in this Deed and on:

(a) its own inspections, investigations, skill and judgement; and

(b) opinions and advice obtained by it,

and did not rely on any statements, inducements, undertakings, representations or advice given or made, whether orally or in writing, by or on behalf of any other Party, including without limitation by any officer, employee or agent of any Party.

15.5 **Amendment**

No modification, variation or amendment of this Deed is of any force unless it is in writing and has been signed by each of the Parties.

15.6 **Merger**

If the liability of a party to pay money under this Deed becomes merged in any deed, judgment, order or other thing, the party liable must pay interest on the amount owing from time to time under that deed, judgment, order or other thing at the higher of the rate payable under this Deed and that fixed by or payable under that deed, judgment, order or other thing.

15.7 **Moratorium legislation**

Any law which varies prevents or prejudicially affects the exercise by a party of any right, power or remedy conferred on it under this Deed is excluded to the extent permitted by law.

15.8 **Remedies cumulative**

The rights and remedies under this Deed are cumulative and not exclusive of any rights or remedies provided by law.

15.9 **Severability**

If any provision of this Deed is void, illegal or unenforceable, it may be severed without affecting the enforceability of other provisions in this Deed.

15.10 **Waiver**

A waiver of any right, power or remedy under this Deed must be in writing signed by the Party granting it. A waiver is only effective in relation to the particular right, power or remedy in respect of which it is given. It is not to be taken as an implied waiver of any other right, power or remedy or as an implied waiver of that right, power or remedy in relation to any other occasion.

15.11 **Fees and charges**

Unless otherwise stated in the Deed, each Party must bear its own costs for the preparation, execution, delivery and performance of this Deed.

15.12 **Effect as a Deed**

The Parties intend for this Deed to take effect as a deed but if the form or manner of execution or delivery of this Deed fails to satisfy any of the formal requirements which must be satisfied in order for this Deed to take effect as a deed, then the Parties nevertheless intend that this Deed takes effect as a legally binding agreement. The covenants and promises given by each Party in this Deed are given in consideration of the covenants and promises of each other Party.

15.13 **Counterparts**

This Deed may be executed in any number of counterparts and by different parties in separate counterparts. Each counterpart when so executed is deemed an original but all of which together constitute one and the same instrument. If this Deed is executed in counterpart, this Deed will be deemed to be delivered upon the last of each signed counterpart, or a copy thereof, being provided to each other Party either by hand delivery, by post or courier, or as a PDF email attachment.

15.14 **Applicable law and Jurisdiction**

(a) This Deed is governed by and must be construed in accordance with the laws of Western Australia.

(b) The Parties submit irrevocably to the non-exclusive jurisdiction of the courts of Western Australia and all courts competent to hear appeals from those courts.

Schedule 1 - Details

1. BBGO Existing Tenure

   M51/670, M 51/199, M 51/322 and L 51/98

2. Insurances

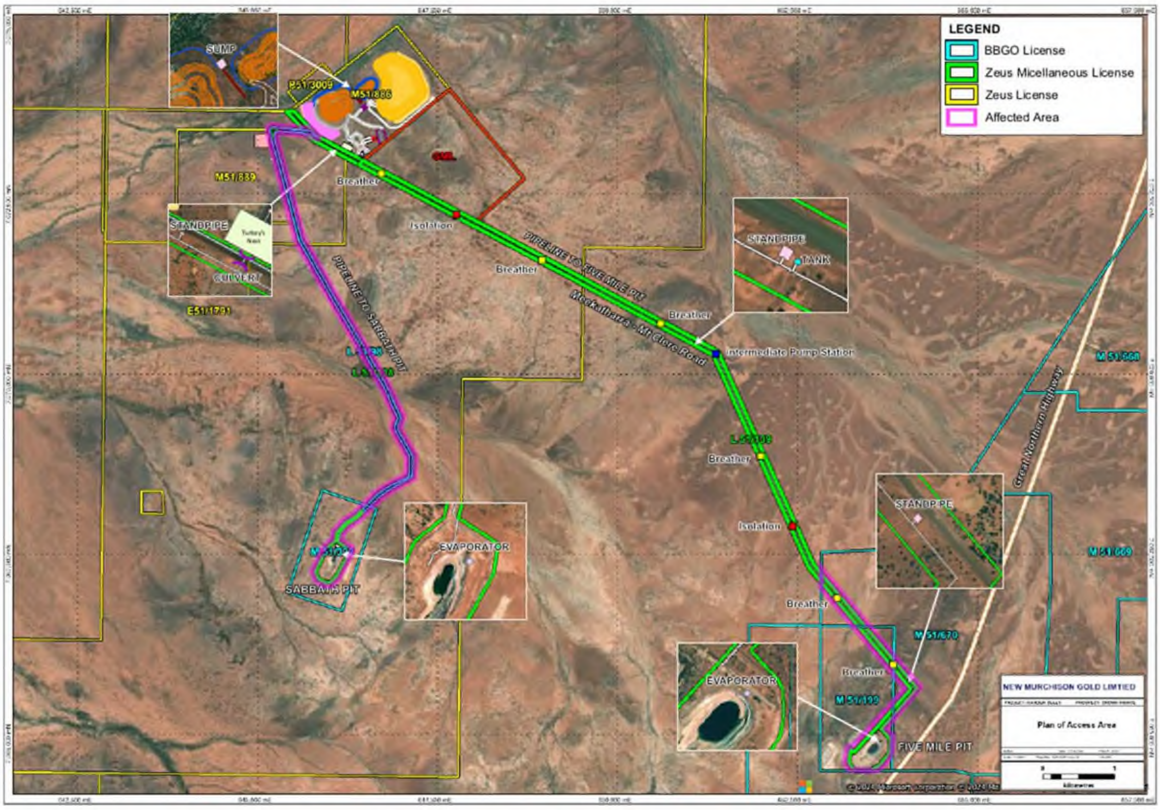
   (a) Public liability insurance with an overall limit of at least $20 million for any one occurrence and unlimited for the period of insurance.

   (b) Workers' compensation and occupational disease insurance in respect of liabilities arising from statute and the common law.

   (c) Motor vehicle insurance with a limit of liability for third party personal injury and property damage of not less than $20 million in respect of any one accident or a series of accidents arising from one event.

   (d) Any other insurance which is required by Law.

Schedule 2 - Plan of Access Area



Signing page

Executed by Zeus Mining Pty Ltd
ACN 113 854 596

[redacted]

Executed by Big Bell Gold Operations Pty Ltd
ACN 090 642 809

Director	Director/Secretary (if applicable)
Print full name of Director	Print full name of Director/Secretary

Signing page

Executed by Zeus Mining Pty Ltd
ACN 113 854 596

Director	Director/Secretary (if applicable)
Print full name of Director	Print full name of Director/Secretary

Executed by Big Bell Gold Operations Pty Ltd
ACN 090 642 809

[redacted]

APPENDIX 3: SOIL AND LANDFORM ASSESSMENT

Crown Prince Gold Project

Soil and Landform Assessment

Prepared for:

Ora Gold Ltd

ORA
GOLD LIMITED

October 2024

Prepared by:

[redacted]

MBS
ENVIRONMENTAL

Crown Prince Gold Project
Soil and Landform Assessment

Distribution List:

Company	Contact Name	Copies	Date
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Document Control for Job Number: OGLCPSLA

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Draft Report	[redacted]		26 September 2024
Final Report			28 October 2024

EXECUTIVE SUMMARY

BACKGROUND AND SCOPE OF WORK

The Crown Prince Project (Crown Prince) is located in the Murchison region of Western Australia approximately 20 km north of Meekatharra and 650 km northeast of Perth. The Crown Prince project infrastructure will primarily be located on mining tenements M51/886 and M51/889 and will consist of an open pit, waste rock dump (WRD), run of mine (ROM) pad and associated infrastructure (primarily on M51/886).

MBS Environmental (MBS) was engaged to complete a soil and landform assessment for the Crown Prince project. The assessment was done to understand soils from a physical and chemical basis and to assist with mine design, approvals and closure planning. The scope of work performed by MBS included:

- Conducting a site visit and soil sampling program to log soil profiles and collect soils and subsoils for laboratory analyses.
- Preparing a soil and landform assessment (this report) that describes the natural landforms and soil types; assesses the key physical and chemical characteristics of surface soils and subsoils; identifies soil types and associated volumes of soil materials suitable for use in rehabilitation post closure.

KEY FINDINGS

Identified Landforms and Soil Groups

- From the desktop and field assessments the following landform types were observed within the project area and in wider surrounding region:
  - Stony plains
  - Broad stony slopes/plains
- Across these landforms, three soil groups were identified which included:
  - Red shallow loams (DAFWA Group 522)
  - Red-brown hardpan shallow loams (DAFWA Group 523)
  - Shallow gravels (DAFWA Group 304)
- Based on the field and desktop assessments, both landforms listed above are not considered significant with respect to EPA (2018) criteria for the following reasons:
  - Landforms are widely represented locally and regionally.
  - Landforms within the project area have been subjected to geological exploration and pastoral land use and are thus not considered pristine.
  - Landforms within the project area are not of any known ecological, geological or cultural significance.
  - The proposed disturbance area is <400 ha which represents a very minor area with respect to the distribution of these landforms regionally.

Soil Physico-Chemical Properties

- Soils from across the project area contained highly variable amounts of gravel (2% – 65% by mass), and clay (up to 46% by mass) contents, particularly in subsoil materials.
- Texturally, surface soils were typically sandy loams, whilst subsoils generally contained more clay and were classified as sandy loams, sandy clay loams or clays.

- Subsoils from locations OGCP01 and OGCP05 are likely to be dispersive given they had an Emerson Class rating of 1 and clay contents of around 27–28%. Soils from other areas are unlikely to be dispersive given they contained Emerson Class ratings of ≥3.
- Soils and subsoils from across the project area had highly variable pH values ranging from 4.6 – 8.5. Across the project area there was general trend in which soil pH increased with soil depth. A total of six (6) samples contained pH values of ≤5.2 which are consistent with moderate to highly acidic soils.
- Most project area soils were of low salinity, with the notable exception of location OGCP03 which contained very high EC values of 240 mS/m in surface soils and 460–480 mS/m in subsoils. Soils from this location were thus classified as extremely saline.
- Exchangeable cation concentrations were generally low across all tested soils and subsoils. Whilst most soils contained typical/moderate exchangeable aluminium concentrations due to being somewhat acidic in nature (pH variably less than 5), aluminium toxicity was not considered likely across the project area. All soils also contained low ESP(%) values and are thus non-sodic.
- Project area soils typically contained low organic C, total N concentrations plus plant available cobalt, molybdenum, nickel and sulfur concentrations. Potential metal(loid) contaminants such as arsenic, cadmium, lead and selenium were present in low plant-available concentrations across all samples.
- On an average basis, project area soils were unlikely to contain total metal(loid) concentrations that exceed the NEPM (2013) default environmental criteria used as a reference throughout this assessment.

MANAGEMENT IMPLICATIONS

- Subsoils in many areas contain appreciable clay (27%--45% by mass) and gravel (up to 65% by mass) resources that could be useful during operations or for rehabilitation post closure depending on requirement. In particular, the areas around sampling locations OGCP01, OGCP03, OGCP07 and OGCP08 appear likely to contain gravel resources. Location OGCP03 and surrounds in particular could be harvested as a source of clay materials as needed for use in construction of clay liners (although not rehabilitation due to the higher salinity at this location). Surface and subsoils from OGCP03 contained EC values between 240–480 mS/m, which are classified as 'extremely saline'. Locations OGCP01 and OGCP05 contain moderate amounts of clay (27%) with lower salinity levels than OGCP03.
- Most soils present in the project disturbance areas are likely to be suitable for stripping, harvesting and stockpiling given they are of neutral/alkaline pH, low salinity and are non-dispersive. It must be noted, however, that there are some exceptions to this.
- Subsoils harvested from locations OGCP01 and OGCP05 (both classified as red-brown hardpan shallow loams) which are predicted to contain dispersive clays which have an increased chance of being prone to erosion.
- A total of six (6) soil and subsoil samples (from locations OGCP02, OGCP04 and OGCP08) contained pH values in the 4.6 – 5.2 range. These soils have the potential to inhibit the growth of non-acid-tolerant plants used in rehabilitation. It must be noted, however, that many local plant species are likely be adapted to the acidic (lateritic) conditions present in these soils).
- All soils and subsoils contained low effective cation exchange capacity (ECEC) values and are thus likely to have limited nutrient holding capacity.

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 BACKGROUND 1
1.2 SCOPE OF WORK 1

2. PROJECT DESCRIPTION 1

3. PROJECT ENVIRONMENT 4

3.1 CLIMATE 4
3.2 GEOLOGY 4
3.3 HYDROLOGY 4
3.4 VEGETATION 5

4. LAND SYSTEMS AND LANDFORMS 6

4.1 LAND SYSTEMS AND SOILS 6
4.2 LANDFORMS 6
4.2.1 Regional Landform Context 6
4.2.2 Project Area Landforms 7
4.2.3 Assessment of Landform Significance 7

5. PREVIOUS SOIL AND LANDFORM ASSESSMENTS 10

5.1 PREVIOUS SOIL AND LANDFORM ASSESSMENTS 10
5.2 DPIRD (2018) DATABASE 10

6. DETAILED FIELD INVESTIGATION 12

6.1 SAMPLING LOCATIONS 12
6.2 SOIL PROFILE CHARACTERISATION 14
6.3 LABORATORY TESTS 15
6.4 EXPLANATION OF LABORATORY ANALYSES 16
6.4.1 Particle Size Distributions 16
6.4.2 Clay Dispersion — Emerson Class 17
6.4.3 pH and EC 17
6.4.4 Exchangeable Cation Content 18
6.4.5 Major Nutrients 20
6.4.6 Mehlich 3 Extractable Nutrients (Plant Available) 21
6.4.7 Total Metals and Metalloids (Aqua Regia Digestible) 21
6.5 INTERPRETATION OF RESULTS 22

7. SOIL PROFILE DESCRIPTIONS 23

7.1 RED-BROWN HARDPAN SHALLOW LOAM (DAFWA SOIL GROUP 523) 23
7.2 RED SHALLOW LOAM (DAFWA SOIL GROUP 522) 23
7.3 SHALLOW GRAVEL (DAFWA SOIL GROUP 304) 25

8. PHYSICAL PROPERTIES 27

8.1 GRAVEL CONTENT 27
8.2 PARTICLE SIZE DISTRIBUTION 27
8.3 EMERSON CLASS 28

9. CHEMICAL PROPERTIES 29

9.1 PH AND SALINITY 29
9.2 EFFECTIVE CATION EXCHANGE CAPACITY (ECEC) 29
9.3 MAJOR NUTRIENTS 30
9.4 PLANT AVAILABLE NUTRIENTS, TRACE ELEMENTS AND CONTAMINANTS 31

9.5 METALS AND METALLOIDS 33
10. DISCUSSION AND RECOMMENDATIONS 34
10.1 LANDFORMS 34
10.2 PHYSICAL PROPERTIES OF PROJECT SOILS 34
10.3 CHEMICAL PROPERTIES OF PROJECT SOILS 34
10.4 IMPLICATIONS FOR SOIL MANAGEMENT 35
10.4.1 Soil Re-use Options and Limitations 35
10.4.2 Final Comments 36
11. REFERENCES 38

TABLES

Table 1: Land Systems and Soils of the Project Area 6
Table 2: Summarised Soil Physical Data from DPIRD (2018) Database 10
Table 3: Summarised Soil Chemical Data from DPIRD (2018) Database 11
Table 4: Details of Samples Collected in this Assessment. 12
Table 5: Emerson Aggregate Test Class Numbers 17
Table 6: Soil pH Rating Table 18
Table 7: Salinity Rating Table 18
Table 8: Ratings for Exchangeable Cations and Related Parameters 19
Table 9: Ratings Table for Organic Carbon, Total Nitrogen and C/N Ratio 20
Table 10: Ratings Table for Plant-available Elements (mg/kg), Mehlich 3 Test 21
Table 11: Gravel Content of Soils 27
Table 12: Particle Size Distribution of Selected Soil Samples 27
Table 13: Emerson Class Data for Selected Soils 28
Table 14: pH and EC (Salinity) Data for Selected Soils 29
Table 15: Average Exchangeable Cation Characteristics 30
Table 16: Average Organic Carbon and Total Nitrogen Concentrations in Selected Surface Soils 30
Table 17: Concentrations of Plant Available Nutrients and Trace Elements in Selected Surface Samples (mg/kg) 32
Table 18: Aqua Regia Digestible Metal and Metalloid Concentrations in Selected Samples (mg/kg) 33
Table 19: Summarised Physical and Chemical Characteristics of Project Area Soils 35

FIGURES

Figure 1: Project Location 2
Figure 2: Conceptual Layout of Disturbance Area and Land Systems 3
Figure 3: Identified Landforms Across the Project Area 9
Figure 4: Soil Sampling Locations 13

Figure 5: Dominant Soil Groups Across the Project Area 26
Figure 6: Harvesting and Re-use Characteristics of Project Area Soils 37

PLATES

Plate 1: Example of Soil Profile Photograph 15
Plate 2: Example of a Red-Brown Hardpan Shallow Soil (OGCP06) 23
Plate 3: Example of a Red Shallow Loam Soil (OGCP03) 24
Plate 4: Example of a Shallow Gravel Soil (OGCP07) 25

CHARTS

Chart 1: Soil Texture Triangle 16

APPENDICES

Appendix 1: Soil Profile Descriptions
Appendix 2: Collated Analytical Results
Appendix 3: Laboratory Reports

1. INTRODUCTION

1.1 BACKGROUND

The Crown Prince Prospect (Crown Prince) is a gold zone at the Garden Gully Gold Project (Garden Gully) located approximately 650 km northeast of Perth and 20 km north of Meekatharra in the Murchison region of Western Australia (Figure 1). It is owned and operated by Ora Gold Ltd (Ora).

MBS Environmental (MBS) was engaged to complete a soil and landform assessment for Crown Prince. The assessment was done to understand soils from a physical and chemical basis and to assist with mine design, approvals and closure planning.

Early characterisation of soil resources is beneficial to mine planning to avoid risk and ensure suitable use of materials for construction and closure. It also ensures soils with adverse characteristics (i.e. acidic, saline, dispersive, phytotoxic or contaminated) are identified and management measures are implemented as necessary.

1.2 SCOPE OF WORK

The scope of work included:

- Preparation of a sampling and analysis plan (SAP) to select appropriate locations and laboratory analyses required to characterise soils.
- Undertaking a site visit and soil sampling program. This included the logging of soil profiles and collection of soils and subsoils for laboratory analyses.
- Preparation a soil and landform assessment (this report) that includes:
  - Description of the natural landforms and soil types.
  - Assessment of key physical and chemical characteristics of surface soils and subsoils.
  - Identification of soil types suitable for rehabilitation.

An indication of the volume of recoverable surface soils to be stockpiled for use in closure activities.

2. PROJECT DESCRIPTION

Ora are the tenement holders for the Garden Gully Project. It comprises a 677 km^2 tenement package over the Abbotts greenstone belt. Ora owns several gold prospects along the belt with Crown Prince the most advanced. The ore body is located on mining tenement M51/886. A conceptual layout is presented in Figure 2.

The proposed development will include:

- Two open pits.
- Waste rock dump (WRD).
- Run-of-mine (ROM) pad.
- Associated infrastructure (i.e. haul / access roads, laydowns, hardstands, workshops, buildings etc.).

Scale: 1:350467
Original Size: A4
Image: Copernicus Sentinel Data 2020
Grid: GDA2020 / MGA zone 50
0 5 10 km

Ora Gold
Crown Prince Gold Project

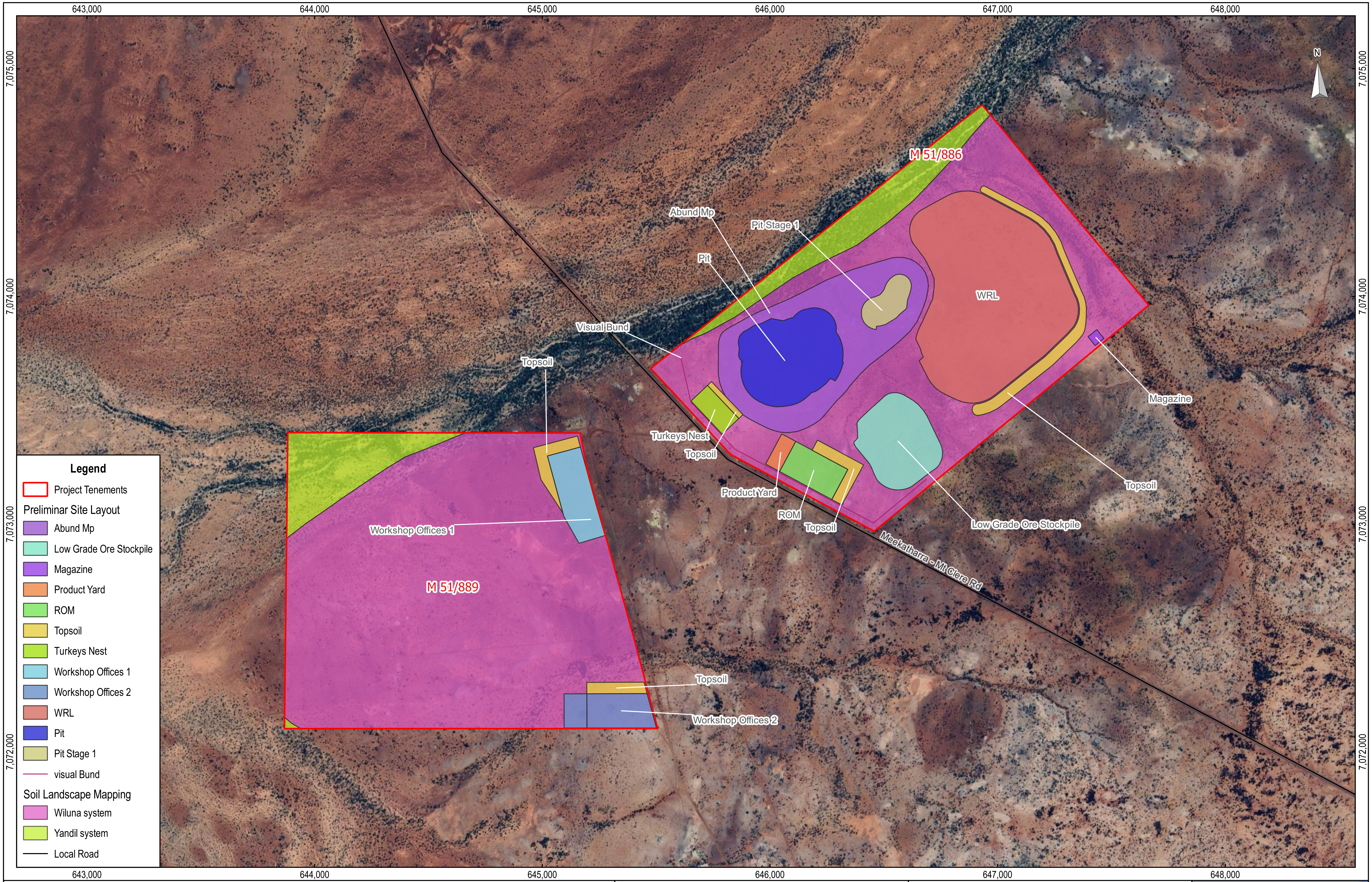
Figure 1

Project Location

Martinick Bosch Sell Pty Ltd
4 Cook St
West Perth WA 6005
Australia
t: +61 8 9226 3166
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au

MBS ENVIRONMENTAL

\\mbssvr\working\Ora Gold\Studies\SAL\GIS\Location Plan.qgz 16/09/2024



Scale: 1: 15,000
Original Size: A3

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 km

Ora Gold
Crown Prince Gold Project

Figure 2

Conceptual Layout of Disturbance Area and Land Systems

Martinick Bosch Sell Pty Ltd
4 Cook St
West Perth WA 6005
Australia
t: +61 8 9226 3166
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au
MBS ENVIRONMENTAL

W:\Ora Gold\GIS-Common\OraGold_Project.qgz 25/09/2024 F2 Conceptual Layout

3. PROJECT ENVIRONMENT

3.1 CLIMATE

The Murchison bioregion experiences an arid to semi-arid climate with variable temporal and spatial rainfall distribution. Rainfall averages ~230 mm/year with totals influenced by the remnants of tropical cyclones and local depressions. Mean number of days of rain ≥1 mm is 28.2 indicative of the arid climate (BOM 2024).

Mean minimum and maximum temperatures range from 16.0°C to 29.1°C respectively. Temperatures range between 35°C to 40°C in summer (December to March) and 19°C to 25°C in winter (June to August) (BOM 2024). Annual evaporation can vary from 3200 mm/yr to 3600 mm/yr.

Thunderstorms can bring short and intense rainfall events and flooding. These can impact rehabilitated landforms via sheet erosion, mass movement / slumping, gully formation and general rain splash impact to the soil surface. High evaporation can also reduce soil moisture, impacting seed strike and vegetation establishment.

3.2 GEOLOGY

Murchison Province occurs over the Yilgarn Craton with underlying Archaean grained granitic rocks. These rocks are intruded by quartz veins and dolerite dykes.

Crown Prince lies within the structurally deformed Archaean Abbotts greenstone belt. It consists of a succession of mafic, ultramafic (i.e. basalt) and felsic volcaniclastic rocks. The latter material in nearby regions (i.e. Goldfields) has been found to weather rapidly when mined and reworked. The material can contain metasediments that produce large amounts of fines receptive to vegetative growth, however prone to erosion on steep slopes. Whereas the basalt is generally considered suitable for rock armouring on outer batters and use in engineered structures (Westgold, 2019).

Gold mineralisation is associated with quartz veins in various rock types (i.e. sediments, volcaniclastics, mafics and ultramafics) and has a spatial association with the northeast trending Abernethy Shear Zone. This zone may represent the northern extension of a major structure which passes through the Big Bell deposit. The margins of the belt are structurally complex bounded by granites and monzogranites (Westgold, 2019)

Surface geology is associated with an extensive residual lateritised plateau below footslopes with schists or quartz outcropping and rounded hills on a granitic basement. Fine textured Quaternary alluvial and eluvial surfaces dominate the region (i.e. from sheet flows and scalding) and have influenced soil development.

Denuded areas have minimal to no topsoil with some exposed subsoils and/or hardpans remaining as the land surface. Hardpans generally occur on the wash plains and sandplains (Tille *et al.* 2006). These plains contain various soils from red shallow loams and earths to deep red and yellow sands.

Erosion resistant stony soils with bare rock are found on granitic hills, stony slopes and rocky ridges with lateritic breakaways. Low lying areas are associated with sand plains and drainages of Tertiary and Quaternary alluvium with hummock grasslands on red-brown hardpans (i.e. shallow loams, sandy duplexes). Calcrete platforms (i.e. calcareous loams) occur with saltbush shrublands and halosarcia low shrublands on saline alluvium.

Red or brown non-cracking clays and shallow clayey loams are also prominent (Tille *et al.* 2006). These can be underlain by clayey and/or clay loamy saprolitic sediments formed from weathered rock.

3.3 HYDROLOGY

The Upper Murchison River catchment is part of the Murchison River drainage basin. The basin is primarily an open drainage system of lakes and rivers that drain west. Drainage systems also drain inwards to inland salt lakes.

All drainages are ephemeral. Major drainages have broad flood plains incised by narrow channels with some dissected sheets of calcrete along trunk drainages.

Paleodrainages are associated with saline drainages and salt lakes in the southeast. These are interlaid with gypsiferous mud flats and small parabolic banks of calcareous and gypsiferous sands.

Tenements M51/886 and M51/889 gently slope to the north-west and elevated above major drainage lines. There are minor drainages that direct surface flows to north into Garden Gully. These will be diverted with channels during operation. Garden Gully drains west into Yalgar River; a tributary of the Murchison River.

3.4 VEGETATION

The Murchison bioregion has low hills and mesas with flat sandplains. Vegetation is predominately low mulga (*Acacia* spp.) shrublands and mallee woodlands (*Eucalyptus* spp.).

Grasslands occur on sandplains and comprise a range of species including acacia (i.e. *A. aneura*), eucalyptus (i.e. *E. gongylocarpa*), mallees (i.e. *E. kingsmilli*), bowgada (*A. ramulosa*), *Grevillea*, *Melaleuca* and *Hakea* spp. with cypress pine (*Callitris columellaris*) (Tille *et al.* 2006).

Low flat areas surrounding salt lakes comprise shrublands of samphire *(Haloscarcia* spp.), saltbush, sage and *Frankenia* spp. Along floodplains and drainages there are shrublands of bluebush (*Maireana* spp.) and mulga (i.e. prickly wattle and *A. distans*) (Tille *et al.* 2006).

4. LAND SYSTEMS AND LANDFORMS

4.1 LAND SYSTEMS AND SOILS

A desktop review of soil types and landform system units was done using available data from the *Department of Primary Industries and Regional Development* (DPIRD 2018). Key findings include:

- Wiluna is the dominant land system unit and covers most of the tenement (Figure 2).
- The Yandil Land System extends along a drainage feature to the north and will not be disturbed.
- Mapped soil types include red shallow loams and sandy duplexes, red-brown hardpans and stony soils.

Characteristics of the land systems and soil types mapped across the Project area are in Table 1 (Van Vreeswyk *et al.*, 2004; Pringle *et al.*, 1994).

Table 1: Land Systems and Soils of the Project Area

Land System	Geology	Landforms	Major Soil Types (DAFWA Soil Group)	Infrastructure Within Land System
Wiluna (272Wi)	Archaean amphibolite, basalt and schistose rocks with Tertiary laterite capping. Quaternary colluvium on slopes and Quaternary alluvium on lowlands	• Low greenstone hills with occasional lateritic breakaways and broad stony slopes. • Lower saline stony plains and broad drainage tracts • Sparse mulga and other acacia shrublands with patches of halophytic shrubs.	• Red shallow loam (522) • Red shallow sandy duplex (406) • Red shallow sand (423) • Red-brown hardpan shallow loam (523) • Stony soil (203)	Main disturbance area including pit and WRL, etc..
Yandil (272Yn)	Quaternary cemented alluvium derived principally from gneiss and granite with minor aeolian deposits.	• Flat hardpan wash plains with mantles of small pebbles and gravels. • Groved mulga shrublands and occasional wanderrie grasses.	• Red-brown hardpan shallow loam (523) • Red loamy earth (544) • Red shallow sand (423)	Within tenement but will not be disturbed based on current site layout.

4.2 LANDFORMS

Landforms can be described as “The distinctive, recognisable physical features of the earth’s surface having a characteristic shape produced by natural processes. A landform is defined by the combination of its geology (composition) and morphology (form)” (EPA 2018).

The following sections describe the regional landform context of the surrounding area as well as the landforms identified within the Project area and an assessment of their potential significance (refer Section 4.2.3).

4.2.1 Regional Landform Context

The Project lies on the Upper Murchison soil-landscape zone within the Murchison Province. The province is characterised by hardpan wash plains and sandplains on granitic rocks and greenstone of the Yilgarn Craton. The Upper Murchison is characterised by alluvial, stony and wash plains with acacia and mulga shrublands.

The Yalgoo Plains and Salinaland Plains lie to the south and southeast. These zones are characterised by hardpan wash plains on granitic rocks of the Yilgarn Craton (Eastern Goldfields Superterrane) and sandplains on sedimentary rocks of the Badgeradda Group (Tille *et al.* 2006).

4.2.2 Project Area Landforms

Based on the findings of the desktop assessment the following landforms are likely to occur within the Project area (Figure 3):

- Alluvial plains and fans.
- Stony plains/slopes.
- Wash plains.

Specific landmarks within the Project and surrounding areas include (DMIRS, 2021):

- Registered Aboriginal heritage site:
  - Deafy Bore One approximately 5 km southwest.
  - Burial / Ritual site approximately 11 km south
  - Camp / Water source approximately 17 km north.
  - No registered sites are located within the Project area.
- No geoheritage sites are located within 50 km.
- No National Heritage Areas are located with 50 km.

4.2.3 Assessment of Landform Significance

EPA nominates the following criteria to determine whether landforms are significant (EPA 2018):

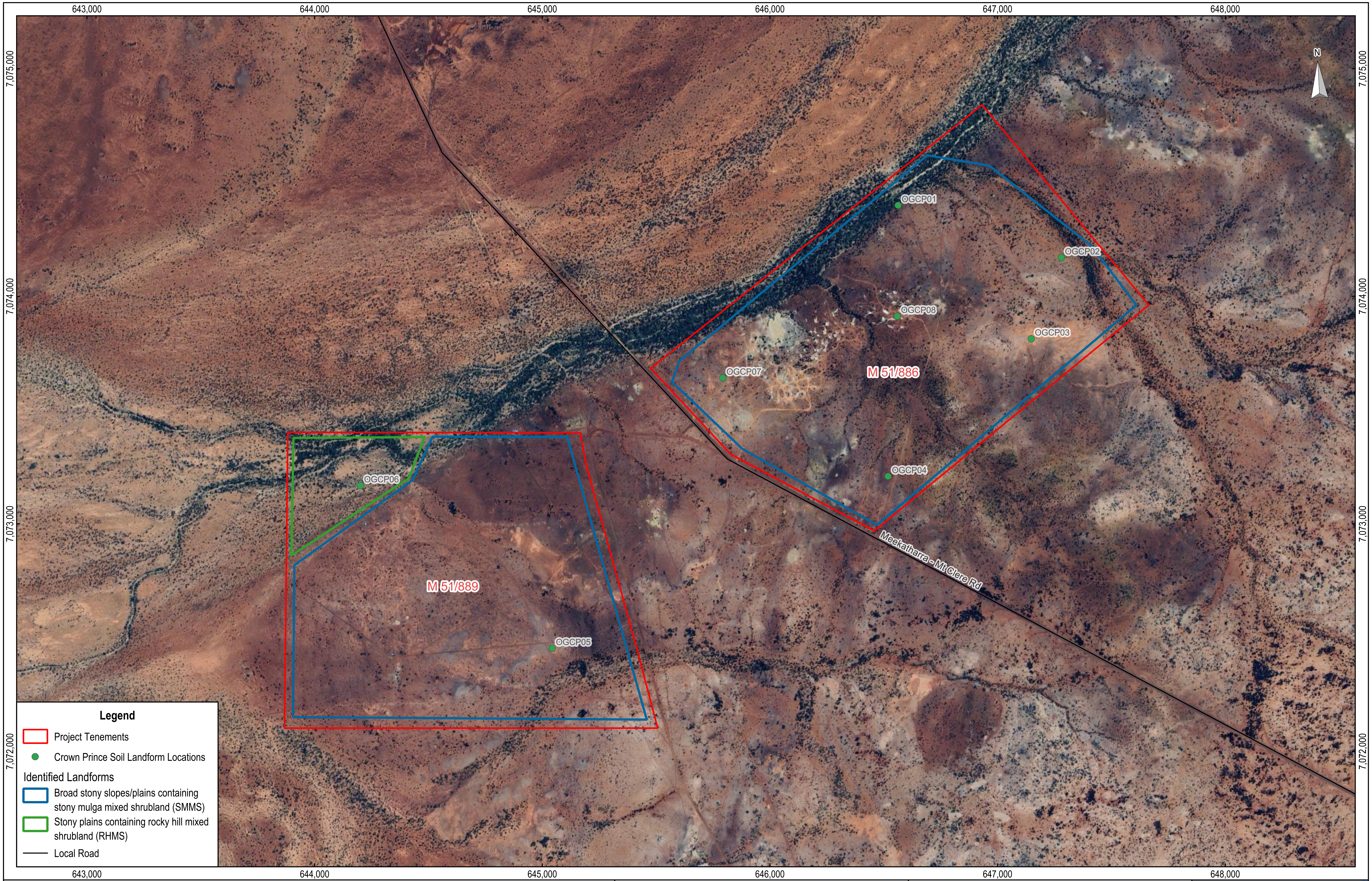
- **Variety:** The landform is a particularly good or important example of its type. The landform is not well represented over the local, regional or national scale or differs from other examples at these scales, either naturally or as a result of cumulative impacts from existing and reasonably foreseeable activities, developments and land uses.
- **Integrity:** The landform is intact, being largely complete or whole and in good condition.
- **Ecological importance:** The landform has a distinctive or exclusive role in maintaining existing ecological and physical processes; for example, by providing a unique microclimate, source of water flow, or shade. The landform supports endemic or highly restricted plants or animals.
- **Scientific importance:** The landform provides evidence of past ecological processes or is an important geomorphological or geological site. The landform is of recognised scientific interest as a reference site, or an example of where important natural processes are operating.
- **Rarity:** The landform is rare or relatively rare, being one of the few of its type at a national, regional or local level.
- **Social importance:** The landform supports significant amenity, cultural or heritage values linked to its defining physical features.

From the desktop and field assessments the following landform types were observed within the project area and in wider surrounding region:

- Stony plains.
- Broad stony slopes/plains.

Based on the field and desktop assessments both identified landforms are not considered significant with respect to the EPA (2018) criteria outlined above for the following reasons:

- Landforms are widely represented locally and regionally.
- Landforms within the project area have been subjected to geological exploration and pastoral land use and are thus not considered pristine.
- Landforms within the project area are not of any known ecological, geological or cultural significance.
- The proposed disturbance area is <400 ha which represents a very minor area with respect to the distribution of these landforms regionally.



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Original Size: A3

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 km

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Figure 3

Identified Landforms Across the Project Area

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5. PREVIOUS SOIL AND LANDFORM ASSESSMENTS

5.1 PREVIOUS SOIL AND LANDFORM ASSESSMENTS

To MBS's knowledge, no previous soil and landform assessments have been conducted at the Crown Prince site. An assessment was, however, conducted at the nearby Sabbath gold project under Big Bell/Meekatharra Gold Operations (Westgold Resources, 2019). Key results from this assessment included:

- Soil profiles were assessed and sampled from three locations, with six testpits excavated.
- Soils were classified as Emerson Class 2-3 indicating some capacity for clay minerals to be spontaneously dispersive.
- Soils were typically acidic, ranging from 4.6 – 6.1.
- Soils were non-saline: Electrical Conductivity (EC) <5.3 mS/m.
- Organic carbon concentrations (0.09 – 0.31%) were low by WA standards.
- Cation exchange capacities (CEC) were low to moderate ranging from 1.4 – 11 cmol(+)/kg.
- Exchangeable sodium percentages (ESP%) were highly variable with samples ranging from non-sodic (<2.5%) to highly sodic (24 – 36%).
- Plant available nutrient (nitrogen, phosphorus, potassium and sulfur) concentrations were generally low, as were concentrations of metal(loids) which were well below relevant NEPM (2013) Environmental Investigation Levels (EILs).

5.2 DPIRD (2018) DATABASE

The spatial data made available by the Department of Primary Industries and Regional Development (DPIRD, 2018) also contains soil physical and chemical data used to classify soils during the land system mapping process. Data for soils present in the Wiluna (272Wi) and Yandil (272Yn) land systems in which the Crown Prince project lies are summarised below in Table 2 and Table 3.

Table 2: Summarised Soil Physical Data from DPIRD (2018) Database

Soil Group (DAFWA ID)	Proportion of mapped area (%)		Coarse Materials: Gravel (%)		Clay (%)		Erodibility	Stability	Dispersion Potential
	Wiluna (272Wi)	Yandil (272Yn)	Min	Max	Min	Max			
Red shallow Loam	40	-	20	95	14	31	Moderate - high	Poor - very poor	Nil - partial
Red shallow sandy duplex	25	-	3	5	8	40	Moderate - high	Fair - poor	Nil - partial
Red shallow sand	20	5	3	99	0	8	Moderate - high	Good - poor	Nil - partial
Red-brown hardpan shallow loam	10	70	15	99	0	31	Moderate - high	Poor - very poor	Nil - partial
Red loamy earth	-	25	5	65	18	31	Moderate	Fair - poor	Nil
Stony soil	5	-	80	90	0	40	Moderate - high	Poor - very poor	Nil - partial

Key observations from this dataset include:

- Soil groups present in the project area contain highly variable coarse materials/gravel contents, with soils containing >80% gravel by mass relatively common in the mapped area.

- A number of soil groups also have the potential to be a source of clay materials, with subsoils in particular often containing >30% clay (mass of <2-mm fraction).
- All soil groups are likely to have some degree of erodibility and limited stability. They are, however, generally unlikely to be overly prone to spontaneous dispersion.

Table 3: Summarised Soil Chemical Data from DPIRD (2018) Database

Soil Group (DAFWA ID)	Proportion of mapped area (%)		pH		ECE (mS/m)		PRI (mL/g)		Exchangeable Sodium % (ESP%)		Organic C (%)	
	Wiluna (272Wi)	Yandil (272Yn)	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Red shallow Loam	40	-	7	7	80	100	5	12	3	6	0.04	0.3
Red shallow sandy duplex	25	-	7	9	100	500	5	150	3	15	0.02	0.2
Red shallow sand	20	5	7	7	50	75	7	10	0	4	0.02	0.2
Red-brown hardpan shallow loam	10	70	7	7	100	250	5	30	8	10	0.04	0.3
Red loamy earth	-	25	7	8	50	300	15	50	4	10	0.04	0.3
Stony soil	5	-	7	7	50	50	10	50	4	15	0.04	0.3

Key observations from this dataset include:

- All soil groups are predicted to be in the circum-neutral to alkaline pH range.
- Most surface soils are considered moderately saline, however, some subsoils (red shallow sandy duplex, red brown hardpan shallow loam and red loamy earth) are likely to be highly saline (especially those with high clay contents).
- Surface soils typically have low phosphate retention capacities, however, in subsoils (particularly red shallow sandy duplex) high retention capacity is likely.
- Most surface soils are of low sodicity, however sodic subsoils are likely for some soil groups particularly red shallow sandy duplex).
- Organic carbon concentrations are likely to be low and tend to decrease dramatically into subsoils.

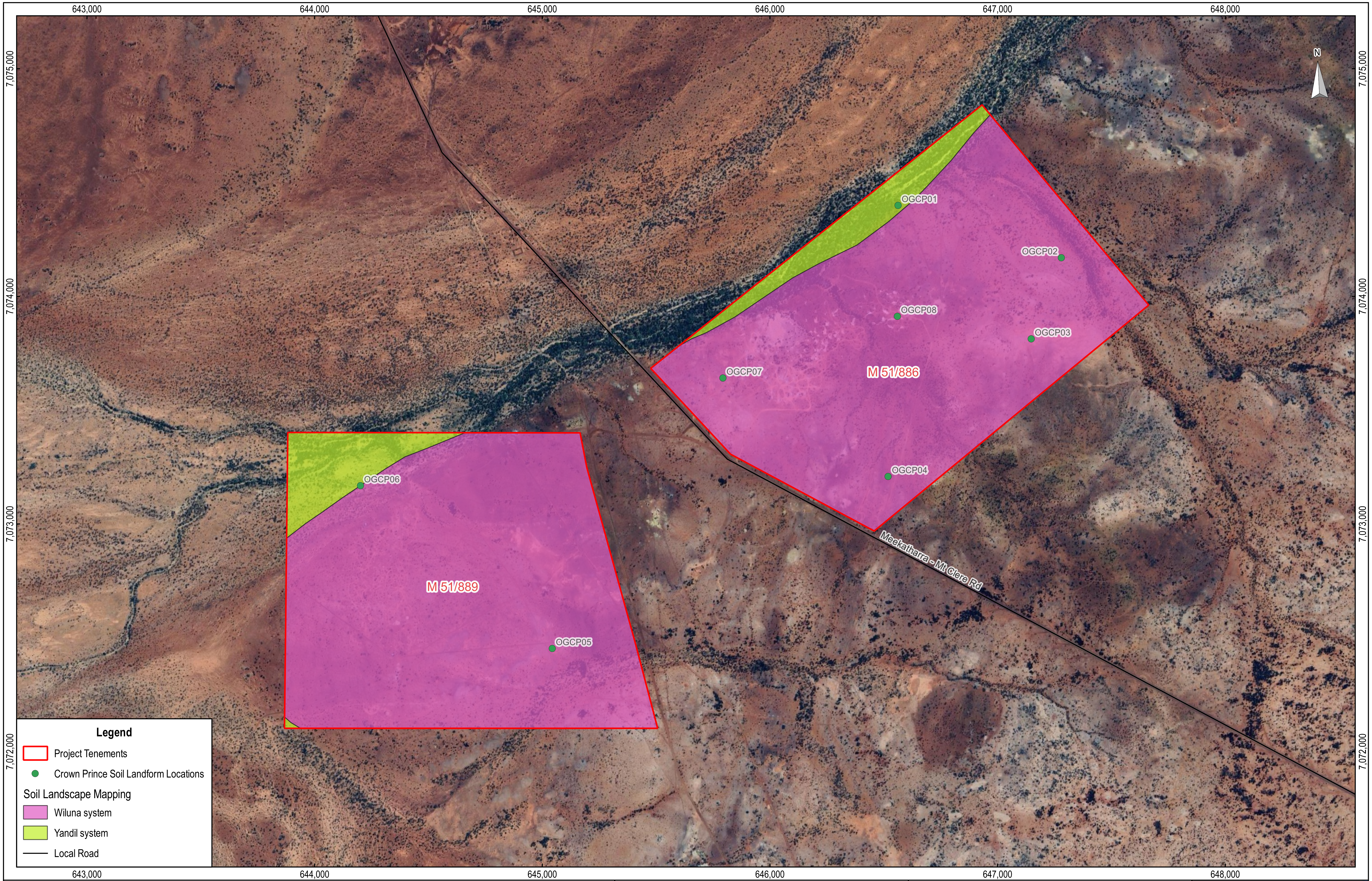
6. DETAILED FIELD INVESTIGATION

6.1 SAMPLING LOCATIONS

Soil and subsoil profiles from eight (8) locations within the Crown Prince site (Figure 4) were sampled in this assessment as outlined in Table 4. From these locations, 18 soil and subsoil samples were collected for laboratory analysis.

Table 4: Details of Samples Collected in this Assessment.

Sample ID	Proposed Disturbance Area	Land System	Easting	Northing
OGCP01	Reference Site	Yandil (272Yn)	646563	7074399
OGCP02	Waste Rock Landform	Wiluna (272Wi)	647281	7074169
OGCP03	Waste Rock Landform	Wiluna (272Wi)	647148	7073813
OGCP04	Ancillary Infrastructure	Wiluna (272Wi)	646519	7073208
OGCP05	Waste Rock Landform (option)	Wiluna (272Wi)	645044	7072452
OGCP06	Reference Site	Yandil (272Yn)	644201	7073168
OGCP07	Pit	Wiluna (272Wi)	645794	7073641
OGCP08	Pit	Wiluna (272Wi)	646608	7073920



Scale: 1: 15,000
Original Size: A3

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 km

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Crown Prince Gold Project

Figure 4

Soil Sampling Locations

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W:\Ora Gold\GIS-Common\OraGold_Project.qgz 25/09/2024 F4 Soil Sampling Locations

6.2 SOIL PROFILE CHARACTERISATION

In order to ensure an appropriate characterisation of topsoil and subsoil resources within the disturbance area, soil profiles were logged at each sampling location. Testpits were dug using an excavator to a depth of approximately 2 m or until refusal was reached. Grab samples were collected during the preparation of testpits, whereby soils were removed from the profile in 350-mm layers, with the removed soil placed in separate piles to ensure changes in characteristics could be documented accurately.

The following information was logged at each sample location:

- Land system.
- Landform.
- Vegetation type and characteristics.
- Ground cover type and percentage.
- Elevation and slope.
- Date and time of assessment.

For each grab sample that was evaluated, the profile by depth was classified and paired with a description of the dominant soil type based off the descriptions in Schoknecht and Pathan (2013). The characteristics of soils can change throughout the profile and thus profiles are described across different horizons (layers) as follows:

- 'O Horizons': Partly decomposed organic matter accumulated at the surface of the topsoil and overlies the A horizon. O-horizons are noted, when present, but not generally sampled.
- 'A Horizons': topsoil or first horizon. Can also be sub-classified (A1, A2, etc.) if multiple types of different soils occur within the same horizon. Soils in the A horizon are typically enriched in organic matter content (plant debris and humus) and more coarse texture (less clay) compared to underlying horizons.
- 'B Horizons': second horizon (subsoil). Clay, soluble salts, gravel and/or iron staining are commonly found in this horizon as a result of illuviation. It is common for more than one B horizon to be present — these are sequentially identified as B1, B2, etc. when present.
- 'C Horizons': third horizon (substratum). Underlies horizon B before fresh bedrock is found. Typically, characteristic of weathered bedrock (saprock). Depth to C horizon if found should be noted but does not require sampling.
- 'E Horizons'. If present, this is a distinctive layer (usually pale/white) formed between A and B horizons as a result of heavy leaching, leaving only resistant minerals behind (i.e. quartz).
- 'R Layer': Hard bedrock.
- Within each layer of the profile the following characteristics were noted and recorded:
  - Horizon depth and boundary type (transitional or abrupt).
  - Soil colour (grey, grey-brown, dark brown, red-brown, yellow-brown, yellow, etc.).
  - Field texture description (e.g. sand, light clay, gravelly loam, silty gravel).
  - Moisture content (dry, damp, moist or saturated).
  - Presence, depth, and types of plant roots (fine, medium, coarse).
  - Presence and characteristics of coarse fragments such as pisolitic gravels, rock fragments, and charcoal (proportions of total matrix, rounded or angular, composition/possible source of fragments).
  - Presence or absence of pedogenic features (terrace gravels, mottles, hardpans — silcrete, calcrete, ferricrete, nodular calcrete, ferruginous pisoliths, etc).
  - Underlying bedrock or saprock geology, where observable.

- This information is recorded in the soil profile descriptions log which is presented in Appendix 1.

Along with the soil profile classification and description, photographs were taken and included in the log:

- One photograph of the bagged and labelled soil sample(s) for the location to help indicate the sequence of photos by location.
- One photograph of the soil profile (e.g. Plate 1).
- At least one photograph of the surrounding landscape and vegetation.

Plate 1: Example of Soil Profile Photograph

6.3 LABORATORY TESTS

In order to characterise the physical and chemical properties of project area soils a laboratory analysis program was undertaken through a NATA accredited laboratory. The aim of the laboratory analysis program is to achieve the following:

- Identify soils that could cause environmental degradation if disturbed.
- Identify soils that are suitable for use as cover materials for rehabilitation.

Consequently, the test program focused on parameters related to:

- Physical stability.
- Plant nutrition.
- Environmental contamination.

In this assessment the following tests were undertaken by ChemCentre (Bentley, Western Australia):

- Particle size (sand, silt, clay, and gravel contents).
- Potential for clay dispersion (Emerson Class, AS 1289 3.8.1 2006).
- pH and electrical conductivity (EC).

- Exchangeable cations (calcium, sodium, potassium, and sodium), exchangeable sodium percentage (ESP%) and base saturation percentage (BS%).
- Exchangeable acidic cations (aluminium and manganese) were also measured on acidic soils with pH values below 6.5.
- Organic carbon, total nitrogen, total phosphorus, and phosphorus retention index (PRI).
- Plant available nutrients, metals and metalloids (Mehlich-3 extract, Mehlich, 1984).
- Aqua regia digestible concentrations of eight metals and metalloids to establish a baseline for future contaminated site assessments in accordance with NEPC (2013) guidelines.

A brief explanation of the relevance of these tests in the context of soil and landform assessments is provided in the following section.

6.4 EXPLANATION OF LABORATORY ANALYSES

6.4.1 Particle Size Distributions

Soil texture describes the proportions of sand, silt and clay particles, the particle size distribution. Sands are mineral particles with an effective diameter between 0.02 and 2 mm, silt from 0.002 to 0.02 mm and clay less than 0.002 mm. In this context, gravels refer to particles with an effective diameter greater than 2 mm which are removed prior to the quantification of sand, silt and clay contents.

Generally, the method outlined by Rayment and Lyons (2011) is used for the determination of particle size distributions. This method utilises a combination of sieving and sedimentation (hydrometer measurements) to determine the relative proportions of sand, silt and clay. A soil texture triangle (Chart 1) is then used to classify the soil texturally on the basis of sand, silt and clay content.

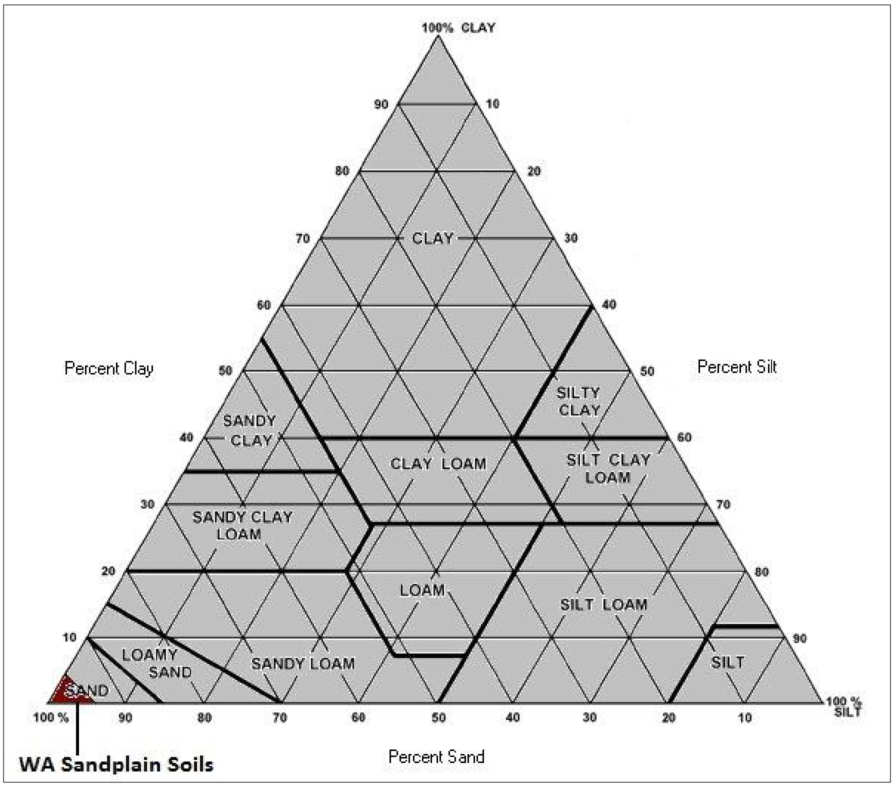


Chart 1: Soil Texture Triangle

6.4.2 Clay Dispersion — Emerson Class

The structural stability of loams and clay soils can be assessed by a simple field test referred to as the Emerson aggregate test (AS 1289 C8.1 1980). The test involves observation of the behaviour of natural soil aggregates (peds) and subsamples of soil remoulded at field capacity when placed in deionised water. Poorly structured soils, often containing sodic clays, exhibit low strength when wet, resulting in rapid slaking of aggregates and dispersion of fine clays, resulting in a cloudy halo when placed in deionised water.

The Emerson Aggregate Test provides an Emerson class number ranging from 1 to 8, with Emerson class number 1 indicating soils with weak structure and high potential for clay dispersion, while Emerson class number 8 indicating soils that do not slake, swell or disperse when placed in water. Soil aggregates that slake and disperse readily (Emerson class numbers 1, 2 and 3) indicate weak structure that is easily disrupted by raindrop impact or mechanical disturbance and therefore prone to water erosion, especially on sloping landforms. Description of Emersion class numbers are presented in Table 5.

Table 5: Emerson Aggregate Test Class Numbers

Class Number	Description
Class 1	Dry aggregates slake and completely disperse within several hours.
Class 2	Dry aggregates slake and partly disperse after 24 hours.
Class 3a	Dry aggregates slake but do not disperse. Remoulded soil disperses completely.
Class 3b	Dry aggregates slake but do not disperse. Remoulded soil partly disperses.
Class 4	Dry aggregates slake but do not disperse. Remoulded soil does not disperse. Soil contains free carbonate minerals and / or gypsum.
Class 5	Dry aggregates slake but do not disperse. Remoulded soil does not disperse. No carbonates or gypsum present. 1:5 suspension in water remains dispersed
Class 6	Dry aggregates slake but do not disperse. Remoulded soil does not disperse. No carbonates or gypsum present. 1:5 suspension in water flocculates.
Class 7	Dry aggregates do not slake. Aggregates swell.
Class 8	Dry aggregates do not slake. Aggregates do not swell.

6.4.3 pH and EC

6.4.3.1 pH

Soil pH estimates are undertaken by shaking a sample of dry, sieved soil with a standard volume of either deionised water or a dilute salt solution, followed by pH measurement with a calibrated pH meter. pH measurements using deionised water at a sample: solution ratio of 1:5 is widely used for land capability assessment and have been used in this assessment. The soil pH rating Table adopted for use by MBS Environmental is presented in Table 6. The rating table applies to measurements using the 1:5 deionised water extraction method.

Table 6: Soil pH Rating Table

pH Range	Rating
1.8 – 3.4	Ultra acid
3.5 – 4.4	Extremely acid
4.5 – 5.0	Very strongly acid
5.1 – 5.5	Strongly acid
5.6 – 6.0	Moderately acid
6.1 – 6.5	Slightly acid
6.6 – 7.3	Circum-neutral
7.4 – 7.8	Slightly alkaline
7.9 – 8.4	Moderately alkaline
8.5 – 9.0	Strongly alkaline
9.1 – 10	Very strongly alkaline
>10	Ultra alkaline

6.4.3.2 EC (Salinity)

Measurement of electrical conductivity (EC) of recovered soil porewater, or more commonly either porewater recovered after wetting the sample to saturation or using the 1:5 soil:water extract from pH measurement. EC of the saturation extract is referred to as ECe, while EC of the 1:5 soil:water extract is referred to as EC (1:5). Salinity risk assessment based on EC (1:5) measurements need to consider the soil type. Table 7 presents soil salinity rating classes used by MBS Environmental for sand, loam and clay soil types.

Table 7: Salinity Rating Table

Soil Type	Salinity Rating Based on EC (1:5) (mS/m)				
	Nil	Slight	Moderate	High	Extreme
Sand	0 – 15	15 – 25	25 – 50	50 – 100	>100
Loam	0 – 20	20 – 35	35 – 70	70 – 150	>150
Clay	0 - 25	25 – 50	50 – 100	100 – 200	>200

6.4.4 Exchangeable Cation Content

At a fixed pH, the sum of all soil cations (when expressed in units of centimoles of positive charge per kilogram, cmol(+)/kg) is constant. This value is referred to as the Cation Exchange Capacity (CEC), which is measured at either pH 7 for circum-neutral soils or pH 8.5 for soils containing free calcium carbonate.

The main soil components contributing to CEC are organic matter and clay minerals. CEC values typically range from <2 cmol(+)/kg) for highly weathered siliceous sands, to 10 cmol(+)/kg) for clay loam soils containing kaolinite as the dominant clay mineral, to greater than 50 cmol(+)/kg) for soils containing clay minerals belonging to the smectite (montmorillonite) or illite group.

While most laboratories provide cost-effective methods for measuring soil CEC, it is more common to measure the individual soil cations after extraction with ammonium chloride solution (at either pH 7 or pH 8.5). These procedures are effective at extracting the basic soil cations, but the acidic soil cations are not extracted.

For acidic soils, the contribution of the acidic soil cations becomes increasingly significant. In such cases, 0.1 M barium chloride as the cation displacing extractant allows for measurement of extraction aluminium and manganese, in addition to the basic soil cations.

The relative proportions of the four basic cations play a major role on the structure of clay rich soil type. Calcium, magnesium and potassium are essential plant nutrients and contribute to good soil structure by allowing effective exchange of air and water into the soil matrix during both wetting and drying cycles. Exchangeable sodium, however, is not conducive to good soil structure and sodium-rich (sodic) clays are prone to spontaneous dispersion (Section 6.4.2), resulting in hard-setting soils when dry and highly erodible soils when saturated.

The acidic soil cations are also undesirable components of a healthy soil, particularly the aluminium component as soluble aluminium is phytotoxic to plants. Elevated concentrations of soluble manganese, which is associated with high concentrations of exchangeable manganese in acidic soils, may also be phytotoxic.

Two important derived parameters from exchangeable cation soil measurements are Base Saturation Percentage (BS%) and Exchangeable Sodium Percentage (ESP). BS% is the sum of the basic soil cations divided by the measured CEC (or ECEC if exchangeable acidity has been measured) and expressed as a percentage. Circum-neutral and alkaline soils have very high BS% values, while acidic soils may have much lower BS% values. BS% provides a better indication of potential soil acidity problems than pH measurements. For example, a soil with a pH of 4.5 and BS% of 30% is likely to be toxic to plants, while a soil with pH of 4.5 and BS% of 80% may not be toxic.

ESP is the exchangeable sodium concentration divided by the measured CEC (or ECEC for circum-neutral and alkaline soils) and expressed as a percentage. ESP values as low as 6% can be responsible for poor structure. ESP values greater than 6% identify sodic soils (Northcote and Skene 1972), which are highly susceptible to structural degradation and erosion. Ratings descriptions for cation exchange capacity, individual exchangeable cations, BS% and ESP% are presented below in Table 8.

Table 8: Ratings for Exchangeable Cations and Related Parameters

Parameter	Units	Rating		
		Low	Medium	High
CEC	cmol(+)/kg	<5	5 – 15	>15
Calcium	cmol(+)/kg	<5	5 – 10	>10
Magnesium	cmol(+)/kg	<1	1 – 5	>5
Sodium	cmol(+)/kg	<0.3	0.3 – 1.0	>1.0
Potassium	cmol(+)/kg	<0.5	0.5 – 2.0	>2.0
Aluminium	cmol(+)/kg	<0.1	0.1 – 1.0	>1.0
Manganese	cmol(+)/kg	<0.02	0.02 – 1.0	>1.0
BS%	%	<20	20 – 60	>60
ESP	%	<6 (non-sodic)	6 – 15 (moderately sodic)	>15 (highly sodic)

6.4.5 Major Nutrients

6.4.5.1 Organic Carbon and Total Nitrogen

Soil organic matter is a critical component of a healthy soil. It plays a major role in maintaining good soil structure, retaining moisture and nutrients and a source of food and energy for soil microbial activity.

Soil organic matter contains 45% to 55% carbon, with most of the balance being oxygen, hydrogen and nitrogen, with lower but still important concentrations of phosphorus and sulfur. There are two reliable laboratory methods for measuring soil organic carbon, which is a very good indicator of soil organic matter content:

- Wet oxidation, with the Walkley and Black method (Walkley and Black 1934) being the most common variation.
- Combustion, occasionally referred to as LECO® Total Organic Carbon.

By international standards, WA soils contain low concentrations of organic carbon. Organic carbon content is dependent upon soil texture and climate, with sandy soils and soils from tropical northern WA and arid central WA containing lower carbon contents (typically <1% in topsoil) compared to clay and loam soils from the temperature southwest corner of WA.

Soil organic matter is also responsible for most of the total nitrogen content of soil, with the remainder (typically <5% of total nitrogen) being in the mineral ammonium (NH_4^+) and nitrate (NO_3^-) forms. Mineralisation of soil organic matter by microbial activity can convert some of this organic nitrogen into mineral nitrogen, which is then available for uptake by plants. However, the amount of nitrogen that can be released by mineralisation is variable and determined largely by the ratio of organic carbon to nitrogen (C/N ratio). For soils with low C/N ratios, mineralisation of soil organic matter releases substantial amounts of mineral nitrogen. Alternatively, microbes breaking down carbon-rich soil organic matter require more nitrogen than is available from organic matter, resulting in removal of mineral forms of nitrogen naturally present in soil. Ratings descriptions for organic carbon, total nitrogen and C/N ratio are presented in Table 9.

Table 9: Ratings Table for Organic Carbon, Total Nitrogen and C/N Ratio

Parameter	Rating		
	Low	Medium	High
Organic carbon, A1 horizon, northern and eastern WA	<0.5%	0.5 – 1.5%	>1.5%
Organic carbon, A2 and B horizon, northern and eastern WA	<0.05%	0.05 – 0.3%	>0.3%
Organic carbon, A1 horizon, southwest WA	<1%	1 – 2%	>2%
Organic carbon, A2 and B horizon, southwest WA	<0.1%	0.1 – 0.5%	>0.5%
Total nitrogen, A1 horizon, northern and eastern WA	<0.05%	0.05 – 0.3%	>0.3%
Total nitrogen, A1 horizon, southwest WA	<0.1	0.1 – 0.5%	>0.5%
Total nitrogen, A2 and B horizons	Generally not measured		
C/N ratio	<10	10 – 16	>16

Adapted from DAFWA 2004.

6.4.6 Mehlich 3 Extractable Nutrients (Plant Available)

MBS Environmental has adopted the Mehlich 3 multi-element soil test methodology (Mehlich 1984) as a cost-effective means of determining plant available concentrations of common metal and metalloid nutrients and contaminants. The aim of utilising this analysis is to identify potential nutrient deficiencies, toxicities or imbalances on mine site soils that may affect revegetation outcomes.

For most elements concentrations have been assigned to low, typical and elevated ranges presented in Table 10. These ranges were derived from the following information:

- Correlations between calibrated single nutrient soil test values (specific for each nutrient) and plant response, typically crop plants under glasshouse or controlled field experiments (Peverill *et al.* 1999).
- Correlations between Mehlich 3 and calibrated single nutrient soil test results (Walton and Allen 2004). Most of the single nutrient tests correlate well the Mehlich 3 test for acidic, neutral and slightly alkaline (but non-calcareous) WA soil types.
- Results for surface samples analysed from DAFWA and DPaW soil surveys, and previous mine site surveys conducted by MBS Environmental.

The 'Low' rating corresponds approximately to the lowest fifth percentile of unfertilised WA surface soil types and indicates conditions that may result in deficiency to plants not adapted to very low nutrient concentrations in soils. These soil types are often highly weathered siliceous sands in moderate to high rainfall areas in the southwest of WA.

The 'Elevated' rating corresponds approximately to the 95th percentile of unfertilised WA surface soil types and may indicate conditions resulting in either nutrient imbalances or toxicities to plant not adapted to high nutrient (especially micronutrients such as boron) concentrations.

Table 10: Ratings Table for Plant-available Elements (mg/kg), Mehlich 3 Test

Nutrient	Rating		
	Low	Typical Range	Elevated
Phosphorus	<2	2 – 10	>10
Potassium	<10	10 – 300	>300
Calcium	<50	50 – 5,000	>5,000
Magnesium	<20	20 – 2,000	>2,000
Sulfur	<5	5 – 200	>200
Boron	<0.1	0.1 – 2	>2
Copper	<0.1	0.1 – 5	>5
Iron	<10	10 – 200	>200
Manganese	<5	5 – 100	>100
Molybdenum	<0.01	0.01 – 0.05	>0.05
Zinc	<0.2	0.2 – 5	>5

6.4.7 Total Metals and Metalloids (Aqua Regia Digestible)

Baseline concentrations of selected metals and metalloids (Ag, As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Se, Zn) in project area soils are determined using an aqua regia (Nitric and hydrochloric acid in a 1:3 ratio) digestion coupled with ICPAES finish performed by ChemCentre (Bentley, WA). The results from this analysis represent concentrations of potential metal(loid) contaminants that may be released by geochemical processes such as weathering over geological timescales. Aqua regia digestible concentrations are typically compared to ecological investigation levels

(EILs) set out in the NEPC (2013) guidelines. In a practical sense the determination of total (environmental) metal and metalloid concentrations in project area soils has two major benefits which includes:

- Establishing whether soils are 'contaminated' and should therefore be avoided as a cover material for rehabilitation.
- Establishing baseline contaminant concentrations in project area soils to establish site specific environmental criteria to support closure requirements.

6.5 INTERPRETATION OF RESULTS

The following sources of information were used to assess the significance of laboratory test results:

- Soil Analysis: An Interpretation Manual (Peverill *et al*. 1999).
- Interpreting Soil Test Results. What do all the numbers mean? (Hazelton and Murphy, 2007).
- Soil Groups of Western Australia. In Resource Management Technical Report 380, Soil Physical Measurement and Interpretation for Land Evaluation, Australian Soil and Land Survey Handbooks Series 5 (4th ed). DAFWA, Perth (Schoknecht and Pathan, 2013).
- Soil Guide. A handbook for understanding and managing agricultural soils. DAFWA Bulletin 4343 (DAFWA, 1998).
- Soil-Landscapes of Western Australia's Rangelands and Arid Interior. Resource Management Technical Report 313 (Tille, 2006).

7. SOIL PROFILE DESCRIPTIONS

Soil logs for each sample location are provided in Appendix 1. The following soil groups were identified across the Project area:

- Red-brown Hardpan Shallow Loam (DAFWA Soil Group 523).
- Red Shallow Loam (DAFWA Soil Group 522).
- Shallow Gravel (DAFWA Soil Group 304).

The distribution of these soil groups across the Project area is presented in Figure 5.

7.1 RED-BROWN HARDPAN SHALLOW LOAM (DAFWA SOIL GROUP 523)

Generally, these soils consisted of a shallow (<50 cm) to very shallow (<20 cm) red-brown loamy topsoil layer that overlies red-brown coloured hardpan materials (Plate 2). This soil group was the most widely identified group at the Crown Prince site and was present at the following locations: OGCP01, OGCP02, OCGP04, OGCP05 and OGCP06.

This soil group was typically associated with flat to gently inclined landscapes with the main vegetation type being mulga mixed shrublands. The anticipated extent of this soil type is shown in Figure 5.

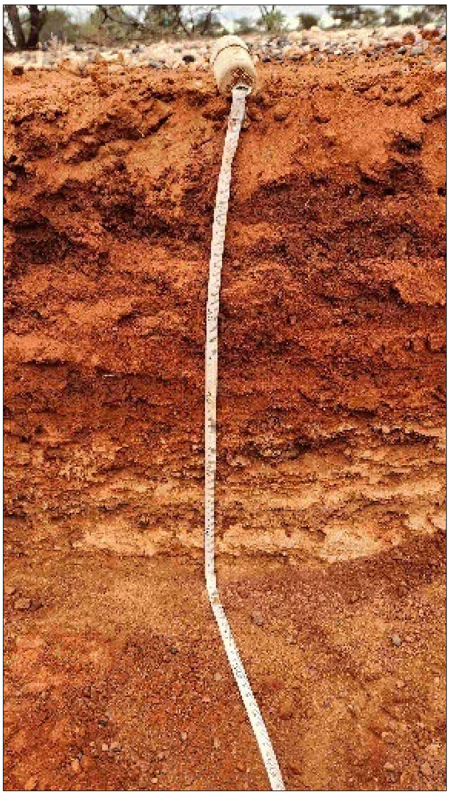


Plate 2: Example of a Red-Brown Hardpan Shallow Soil (OGCP06)

7.2 RED SHALLOW LOAM (DAFWA SOIL GROUP 522)

These soils are typically very shallow and contain red to red brown sandy loams to a depth of around 20 – 45 cm which overlies Indurated (hardpan) or gravelly clay material (Plate 3). At the Crown Prince site, red shallow loams were the dominant soil group at the OGCP03 and OGCP08 locations. These soils were also flat to gently inclined landscapes with the main vegetation type being mulga mixed shrublands.

Plate 3: Example of a Red Shallow Loam Soil (OGCP03)

7.3 SHALLOW GRAVEL (DAFWA SOIL GROUP 304)

The profile at site OGCP07 was extremely shallow (<15 cm) and contained a high gravel content overlying hardpan (Plate 4). This soil was thus classified as a shallow gravel, in accordance with the DAFWA classifications.

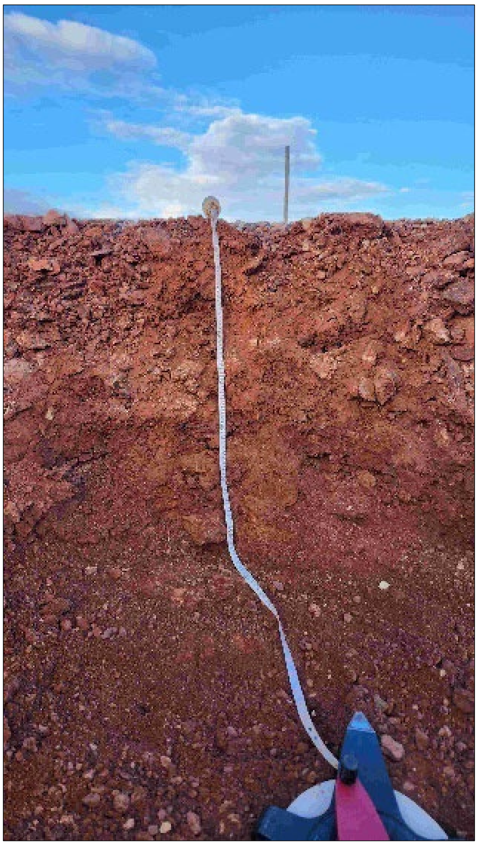
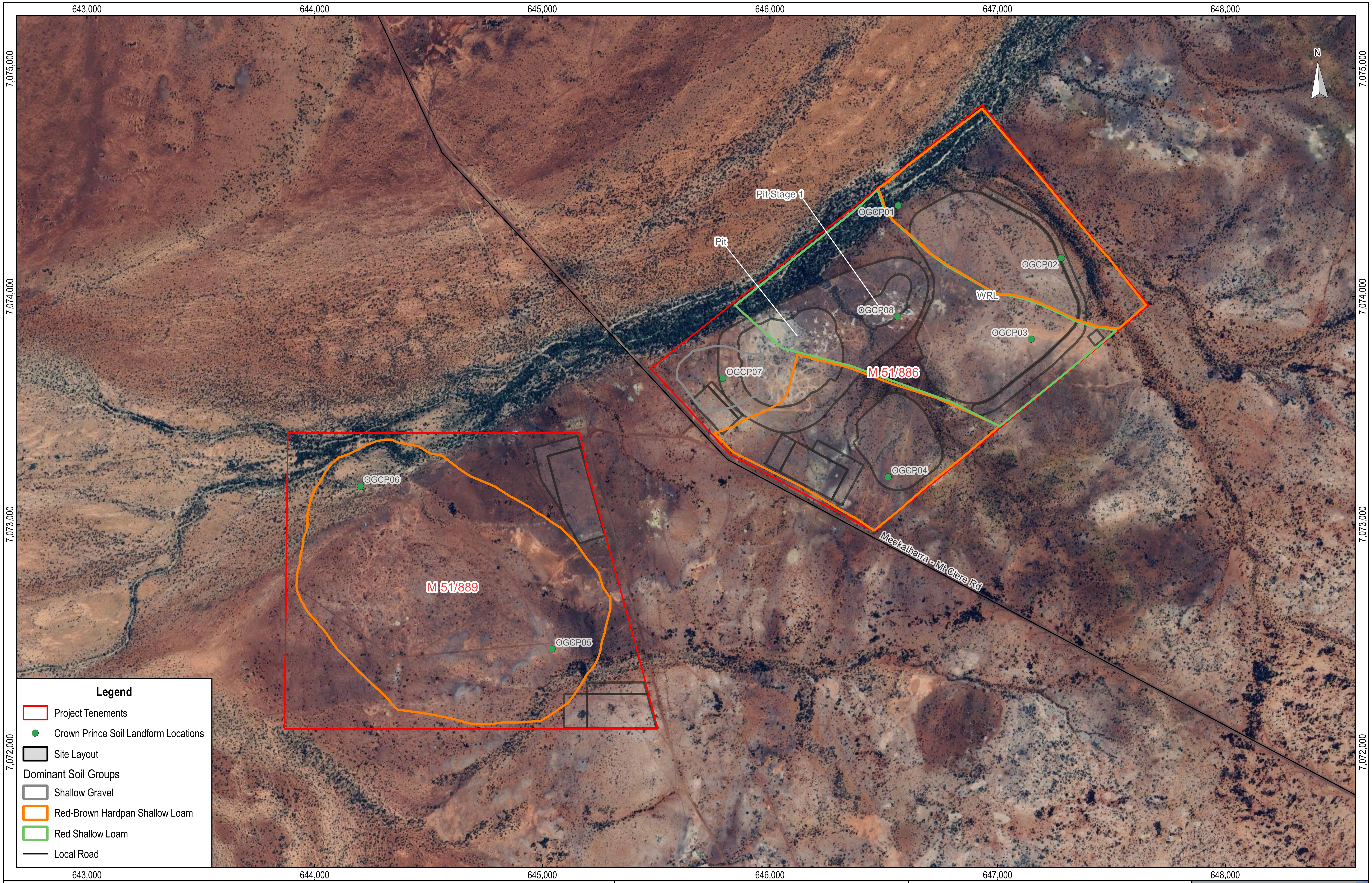


Plate 4: Example of a Shallow Gravel Soil (OGCP07)



Scale: 1: 15,000
Original Size: A3

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 km

Ora Gold
Crown Prince Gold Project

Figure 5

Dominant Soil Groups Across the Project Area

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W:\Ora Gold\GIS-Common\OraGold_Project.qgz 25/09/2024 F5 Dominant Soil Groups

8. PHYSICAL PROPERTIES

8.1 GRAVEL CONTENT

The average gravel content of surface and subsoils is presented in Table 11 and in detail in Appendix 2.

Table 11: Gravel Content of Soils

Horizon	No of Samples	Gravel Content % (>2 mm)		
		Average	Minimum	Maximum
Surface	8	20	6	40
Subsoil	10	26	2	65

The following key points are noted:

- Gravel contents (classified as particles with a diameter >2 mm) varied considerably across samples from 2.1% (OGCP03 B2) to 65% (OGCP07 B).
- In most instances surface soils contained lower gravel contents than their respective subsoils. The exceptions to this were OGCP01 (40%) and OGCP08 (36%).
- Subsoils from samples OGCP03 (43%) and OGCP07 (65%) contained relatively high gravel contents. OGCP07 was thus classified as a shallow gravel (DAFWA soil group 304) given that the high gravel contents were largely present throughout the profile.

8.2 PARTICLE SIZE DISTRIBUTION

The textural classification of selected soil samples (<2 mm fraction) is presented in Table 12 and in detail in Appendix 2.

Table 12: Particle Size Distribution of Selected Soil Samples

Sample	Identified Soil Group	<2-mm Soil Fraction			Texture
		Sand %	Silt %	Clay %	
Surface Soils					
OGCP03	Red shallow loam (522)	62	24.5	13.5	Sandy Loam
Subsoils					
OGCP01	Red-brown hardpan shallow loam (523)	64.5	8	27.5	Sandy Clay Loam
OGCP03 B2-3*	Red shallow loam (522)	32	22	46	Clay
OGCP05B	Red-brown hardpan shallow loam (523)	65	8.5	26.5	Sandy Clay Loam
OGCP08B2-3*	Red shallow loam (522)	78	4	18	Sandy Loam

** Represents average of B2-B3 horizons*

The following key points are noted:

- Particle sizing was only performed on one surface soil sample (OGCP03) which was classified texturally as a sandy loam. Given the similarity in surface soils across the project area soils from other sampling locations are also likely to be sandy loams or similar.

- The texture of subsoils, however, varied considerably across sampling locations. For example, the subsoil layers at the OGCP03 site contained relatively high clay contents (46%), whereas the subsoil layers at the OGCP08 site contain far less clay and were thus classified as sandy loams.
- Three of the four sampling locations contained clay contents of >26% which indicates that clay resources suitable for harvesting for infrastructure or post closure requirements may be available within the Crown Prince area.

8.3 EMERSON CLASS

Data for Emerson Class number which is used to estimate the likelihood of clay dispersion is presented in Table 13 and in detail in Appendix 2

Table 13: Emerson Class Data for Selected Soils

Sample	Horizon	Identified Soil Group	Emerson Class	Classification
OGCP01	B — Subsoil	Red-brown hardpan shallow loam (523)	1	Dispersive
OGCP02	B — Subsoil	Red-brown hardpan shallow loam (523)	5	Not dispersive
OGCP03	B3 — Subsoil	Red shallow loam (522)	4	Not dispersive
OGCP05	B — Subsoil	Red-brown hardpan shallow loam (523)	1	Dispersive
OGCP06	B — Subsoil	Red-brown hardpan shallow loam (523)	3	Not dispersive
OGCP08	B2 — Subsoil	Red shallow loam (522)	2	Dispersive — low clay content
OGCP08	B3 — Subsoil	Red shallow loam (522)	5	Not dispersive

The following key points are noted:

- High variability in Emerson Class ratings existed across samples which ranged from 1 (dispersive) to 5 (non-dispersive.
- Three samples (OGCP01, OGCP02 and OGCP08; B2 layer) were considered to be potentially dispersive given they received an Emerson Class rating of 1 or 2.
- Based on the textural classifications described in Table 12 the subsoils from OGCP01 and OGCP05 are likely to be dispersion prone given the clay contents were measured as 27.5% and 26.5% respectively.
- Conversely, OGCP08 (B2) is unlikely to be as dispersion prone given it contains a much lower clay content of 16.5%.
- Subsoils from the remaining locations all contained Emerson Class ratings of >3 and are thus unlikely to be dispersion-prone.

9. CHEMICAL PROPERTIES

9.1 PH AND SALINITY

Data for soil pH and salinity is presented in Table 14 and in detail in Appendix 2.

Table 14: pH and EC (Salinity) Data for Selected Soils

<table>
<tr><th rowspan="2">Horizon</th><th rowspan="2">No. of Samples</th><th colspan="4">pH</th><th colspan="3">EC (mS/m)</th></tr>
<tr><th>Average</th><th>Minimum</th><th colspan="2">Maximum</th><th>Average</th><th>Minimum</th><th>Maximum</th></tr>
<tr><td>Surface</td><td>8</td><td>6.0</td><td>4.6</td><td colspan="2">7.1</td><td>38</td><td>2</td><td>240</td></tr>
<tr><td>Subsoil</td><td>10</td><td>6.7</td><td>4.6</td><td colspan="2">8.5</td><td>99</td><td>2</td><td>480</td></tr>
<tr><td colspan="2" rowspan="2">Criteria</td><td><5</td><td>5 – 6.5</td><td>6.5 – 7.3</td><td>7.3 – 8.5</td><td><25</td><td>25 – 100</td><td>>100</td></tr>
<tr><td>Highly Acidic</td><td>Moderately Acidic</td><td>Circum Neutral</td><td>Moderately Alkaline</td><td>Non-Saline</td><td>Moderately Saline</td><td>Highly Saline</td></tr>
</table>

The following key points are noted:

- Across the Crown Prince site soil pH varied considerably with some highly acidic soils (pH 4.6) and some moderate to strongly alkaline soils (pH 8.5) present.
- Across nearly all of the sampling locations there was a trend of increasing pH with soil depth i.e. more alkaline subsoils. In some instances (OGCP03, OGCP07 and OGCP08) these increases were considerable: 1.6 to 1.8 pH units.
- Two samples (OGCP04 B and OGCP08 A) contained pH values of 4.6 which are classified as highly acidic. A further four samples (OGCP02, OGCP04 and OGCP08) contained pH values in the 5.1 – 5.2 range which are on the high end of the moderately acidic category.
- The most alkaline soils (pH 8.4 – 8.5) were present in the subsoils of OCGP03 and OGCP08.
- Salinity (measured as EC) values were also highly variable ranging from 2 – 480 mS/m.
- EC values at the OCGP03 site were classified as extreme as they ranged from 240 mS/m in surface soils and 460 – 480 mS/m in subsoils. These soils are thus likely to be hostile to most plant species (excluding salt-tolerant species) and thus soils and subsoils from this area should be avoided with respect to use in post-closure rehabilitation.
- Surface and subsoil samples from all other locations contained EC values <35 mS/m, with most <10 mS/m which are of slight to no salinity and thus are unlikely to influence plants used in site rehabilitation.

9.2 EFFECTIVE CATION EXCHANGE CAPACITY (ECEC)

Characteristics of effective cation exchange capacity (ECEC) (cmol(+)/kg) and ESP for selected samples are presented in detail in Table 15.

Table 15: Average Exchangeable Cation Characteristics

Soil Type	No of Samples	Measurement	Exchangeable Cation Content – cmol(+)/kg							%	
			Ca	K	Mg	Na	Al	Mn	ECEC	BS	ESP
Surface	4	Mean	1.35	0.40	0.72	0.05	0.39	0.06	3.0	85	1.6
		Min	0.71	0.32	0.31	0.04	0.38	0.04	2.1	78	1.2
		Max	2.80	0.53	1.10	0.06	0.40	0.08	4.3	100	2.9
Subsoil	5	Mean	1.55	0.23	0.91	0.07	0.27	0.05	3.1	90	2.3
		Min	0.97	0.13	0.38	0.03	0.11	0.03	2.0	79	1.5
		Max	2.30	0.29	1.30	0.16	0.52	0.08	3.7	100	4.4
Low			<5	<0.5	<1	<0.3	<0.1	<0.02	<5	<20	<6
Moderate/Typical			5–10	0.5–2	1–5	0.3–1	0.1–1	0.02–1	5–15	20–60	6–15
High			>10	>2	>5	>1	>1	>1	>15	>60	>15

The following key observations are noted:

- For the majority of samples ECEC values were classified as low (<4.3 cmol(+)/kg) and as a result exchangeable concentrations of base cations (i.e. Ca, K, Mg and Na) were generally classed as low with respect to typical concentrations present in unfertilised WA soils.
- Exchangeable aluminium and manganese concentrations in all samples (excluding OGCP06: alkaline pH) were in the moderate-typical range found in WA soils.
- Despite low ECEC values and moderate exchangeable aluminium concentrations base saturation percentages (BS%: proportion of ECEC made up by base cations) were >78% for all samples. BS values of >60% indicate that soils are unlikely to exhibit aluminium toxicity and thus on this basis the risk of soils developing aluminium toxicity within the Crown Prince project appear low.
- All samples contained low exchangeable sodium percentages (ESP%) of <4.4%. This indicates that project soils are non-sodic and thus unlikely to be erosion prone.

9.3 MAJOR NUTRIENTS

Results for organic carbon and total nitrogen concentrations in selected samples are presented in Table 16 and in detail in Appendix 2.

Table 16: Average Organic Carbon and Total Nitrogen Concentrations in Selected Surface Soils

Horizon	Number of samples	Measurement	Organic C (%)	Total N (%)	C:N
Surface	8	Mean	0.26	0.03	9
		Min	0.15	0.02	6
		Max	0.51	0.05	11
Low			<0.5	<0.05	<10
Moderate/Typical			0.5–1.5	0.05–0.3	10–16
High			>1.5	>0.3	>16

Major observations included:

- The vast majority of samples contained both low organic carbon and total nitrogen concentrations with respect to concentrations typically present in WA soils.
- C:N ratios in the majority of samples were low <10. This indicates that soils are likely to release nitrogen and sequester carbon if organic matter are applied to soils.

9.4 PLANT AVAILABLE NUTRIENTS, TRACE ELEMENTS AND CONTAMINANTS

Results for a suite of Mehlich-3 extractable nutrients and trace elements in selected soils are presented in Table 17 and in detail in Appendix 2.

Major observations included:

- Elements including boron, calcium, copper, iron, magnesium, phosphorus and zinc were present in plant-available concentrations considered to be typical of unfertilised WA soils across all samples.
- Elements including cobalt, molybdenum, nickel and sulfur were present in plant-available concentrations considered to be low: typical of unfertilised WA soils across all tested samples.
- Selected samples (OGCP01, OGCP0103, OGCP0105 and OGCP0107) contained plant available concentrations of elements such as potassium, manganese and/or sodium that are considered to be high with respect to concentrations typically present in unfertilised WA soils.
- Finally, metal(loid) contaminants such as arsenic, cadmium, lead and selenium were present in low plant-available concentrations across all samples.

Table 17: Concentrations of Plant Available Nutrients and Trace Elements in Selected Surface Samples (mg/kg)

Horizon	Number of samples	Measure	Al	As	B	Ca	Cd	Co	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	S	Se	Zn
			mg/kg																		
Surface	8	Mean	285	<0.1	0.4	369	0.01	1.4	1.2	28	231	127	68	0.03	166	0.5	7	1.0	38	0.07	1.3
		Min	200	<0.1	0.1	100	<0.01	0.1	0.5	17	120	30	15	<0.01	7	<0.1	2	0.4	2	0.05	0.3
		Max	380	<0.1	0.8	850	0.02	3.1	2.1	44	>550	350	150	0.14	>1000	1.1	10	2.7	170	0.20	3.6
Low			-	-	<0.1	<50	-	<1	<0.1	<10	<10	<20	<5	<0.01	-	<1	<2	-	<5	-	<0.2
Moderate/Typical			-	-	0.1–2	50–5,000	-	1–60	0.1–5	10–200	10–200	20–2,000	5–100	0.01–0.05	-	1–20	2–10	-	5–200	-	0.2–5
High			>550	>5	>2	>5,000	>1	>60	>5	>200	>200	>2,000	>100	>0.05	>180	>20	>10	>35	>200	>1.5	>5

9.5 METALS AND METALLOIDS

To establish site-specific background concentrations of selected metals and metalloids, aqua regia digests were performed on selected soils as outlined in Table 18 and Appendix 2.

The National Environmental Protection Council (NEPC) (2013) guidelines (Public Open Spaces) was used as environmental criteria for comparison purposes. Elements including cadmium, mercury and manganese are not provided in the NEPC framework and thus the Department of Environment and Conservation (DEC) soil investigation guidelines (DEC 2010) were used in their absence.

Table 18: Aqua Regia Digestible Metal and Metalloid Concentrations in Selected Samples (mg/kg)

Horizon	Number of samples	Measure	Ag	As	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Zn
			mg/kg											
Surface	8	Mean	<0.05	22	0.04	246	36	0.02	343	28	13	0.2	0.9	38
		Min	<0.05	6	<0.05	130	27	<0.02	150	20	11	0.1	0.4	21
		Max	<0.05	47	0.09	600	49	0.04	580	50	15	0.5	1.6	64
NEPM (2013)			N/G	100	3.00*	470	150	1.00*	500*	80	1,100	N/G	N/G	200
Ambient Baseline (80th percentile)			N/A	37	0.07	282	42	0.03	524	34	14	0.3	1.2	43

*Note: * indicates the DEC (2010) guidelines were used in the absence of NEPM (2013) guideline values. No ambient baseline value for Ag could be calculated as all values were below analytical limits of reporting.*

Major observations included:

- Most samples contained metal(loid) concentrations well below the default criteria set out in the NEPM (2013) criteria.
- The exceptions to this were selected samples (OGCP01, OGCP06 and OGCP08) which slightly exceeded trigger values for manganese and chromium respectively. Manganese and chromium elevations are typical however for lateritic mafic/ultramafic derived soils and hardpan.
- When all soil samples were averaged there were no exceedances of NEPM (2013) criteria for any tested element. In a practical sense this indicates that stockpiled materials (i.e. soils from across the project area) are unlikely to exceed the NEPM criteria, given that exceedances are sporadic (i.e. from a small subset of samples).

10. DISCUSSION AND RECOMMENDATIONS

10.1 LANDFORMS

- From the desktop and field assessments the following landform types were observed within the project area and in wider surrounding region:
  - Stony plains.
  - Broad stony slopes/plains.
- Based on the field and desktop assessments both identified landforms are not considered significant with respect to the EPA (2018) criteria outlined above for the following reasons:
  - Landforms are widely represented locally and regionally.
  - Landforms within the project area have been subjected to geological exploration and pastoral land use and are thus not considered pristine.
  - Landforms within the project area are not of any known ecological, geological or cultural significance.
  - The proposed disturbance area is <400 ha which represents a very minor area with respect to the distribution of these landforms regionally.

10.2 PHYSICAL PROPERTIES OF PROJECT SOILS

- Three (3) main soil groups were identified across the project area which included:
  - Red shallow loams (DAFWA Group 522).
  - Red-brown hardpan shallow loams (DAFWA Group 523).
  - Shallow gravels (DAFWA Group 304).
- Gravel contents were variable across project area soils and subsoils ranging from 2 – 40% in surface soils and 2 – 65% in subsoils.
- Texturally, surface soils were typically sandy loams, whilst subsoils generally contained more clay and were classified as sandy loams, sandy clay loams or clays.
- Subsoils from locations OGCP01 and OGCP05 are likely to be dispersive given they had an Emerson Class rating of 1 and clay contents of around 27 – 28%. Soils from other areas are unlikely to be dispersive given they contained Emerson Class ratings of ≥3.

10.3 CHEMICAL PROPERTIES OF PROJECT SOILS

The main chemical properties of soils included:

- Soils and subsoils from across the project area had highly variable pH values ranging from 4.6 – 8.5.
- Across the project area there was general trend in which soil pH increased with soil depth. A total of six (6) samples contained pH values of ≤5.2 which are consistent with moderate to highly acidic soils.
- Most project area soils were of low salinity, with the notable exception of location OGCP03 which contained higher clay contents and very high EC values of 240 mS/m in surface soils and 460 – 480 mS/m in subsoils. Soils from this location were thus classified as extremely saline.
- Exchangeable cation concentrations were generally low across all tested soils and subsoils. Whilst most soils contained typical/moderate exchangeable aluminium concentrations, aluminium toxicity was not considered likely across the project area. All soils also contained low ESP(%) values and are thus non-sodic.

- Project area soils typically contained low organic C, total N concentrations plus plant available cobalt, molybdenum, nickel and sulfur concentrations. Potential metal(loid) contaminants such as arsenic, cadmium, lead and selenium were present in low plant-available concentrations across all samples.
- On an average basis project area soils were unlikely to contain total metal(loid) concentrations that exceed the NEPM (2013) default environmental criteria used as a reference throughout this assessment.

10.4 IMPLICATIONS FOR SOIL MANAGEMENT

The physical and chemical characteristics of project area soils are summarised in Table 19.

Table 19: Summarised Physical and Chemical Characteristics of Project Area Soils

Parameter	Red Shallow Loam (522)	Red-Brown Hardpan Shallow Loam (523)	Shallow Gravel (304)
Key Disturbance Areas	Pit & WRD	WRD, Stockpiles, Associated infrastructure	Pit
Area (m^2)	764,600	2,241,110	80,240
Harvestable Volume (m^3)#	229,380	672,333	24,072
Dominant Texture	Sandy loams: surface Sandy loams to clays: subsoil	Sandy loams: surface Sandy clay loams: subsoil	Gravel
Gravel Content	Variable	Variable	High
Dispersivity	Clays around location OGCP03 may become dispersive if exposed.	Possible	Non-dispersive
pH	Variable: highly acidic samples identified	Variable: highly acidic samples identified	Circum-neutral – alkaline
Salinity	Generally low: OGCP03 extremely saline	Low	Low
Cation Exchange Capacity	Low	Low	Low
Sodicity	Low-risk	Low-risk	Low-risk
Aluminium Toxicity	Unlikely	Unlikely	Unlikely
Nutrients	Potentially low in C, N, Co, Mo, Ni, S	Potentially low in C, N, Co, Mo, Ni, S	Potentially low in C, N, Co, Mo, Ni, S
Metals and Metalloids	Unlikely to trigger NEPM (2013) criteria when stockpiled	Unlikely to trigger NEPM (2013) criteria when stockpiled	Unlikely to trigger NEPM (2013) criteria when stockpiled

 # Assumes the top 30 cm of the profile is harvested

10.4.1 Soil Re-use Options and Limitations

Overall, the vast majority of the Crown Prince consists of shallow loam soils (Figure 5) and given their similarities soils from across the area can be harvested and managed as one discrete soil unit. A summary of re-use options and limitations is provided below for the main disturbance areas, i.e. mining pit and WRD footprints (Figure 6).

10.4.1.1 Mining Pit

Locations OGCP07 (shallow gravel) and OGCP08 (red shallow loam) lie within the proposed mining pit footprint (Figure 5). Key characteristics in the context of harvesting and re-use from these areas (Figure 6) include:

- Soils from both of these areas are likely to contain appreciable clay (27%-45% by mass) and gravel (up to 65% by mass) resources which can be harvested and utilised for mining activities as required.
- Some surface and subsoils within the proposed pit footprint (particularly around OGCP08) have acidic pH values in the 4.6 – 5.2 range.
- These pH values are likely to inhibit the growth of non-acid-tolerant plants used in rehabilitation. It must be noted, however, that many local plant species may be adapted to the acidic conditions present in these soils and as a result these pH values will not be an impediment to re-use.
- There is also a slight chance that soils in the proposed pit footprint (particularly around OGCP08) will exceed NEPM (2013)/DEC (2010) default guideline concentrations for elements such as chromium or manganese. Stockpiling soils from these areas with those harvested elsewhere is likely to lower concentrations to below the relevant criteria, and thus it is unlikely that concentrations of either element represent and impediment to re-use.
- Soils from the pit footprint are of low salinity, are non-sodic and non-dispersive and thus none of these factors are likely to influence their re-use potential. They are also, however, likely to have low cation exchange capacities and will thus have a limited capacity to supply nutrients to plants for rehabilitation. Locally adapted plant species with limited nutrient requirements should, however, not be affected by this.

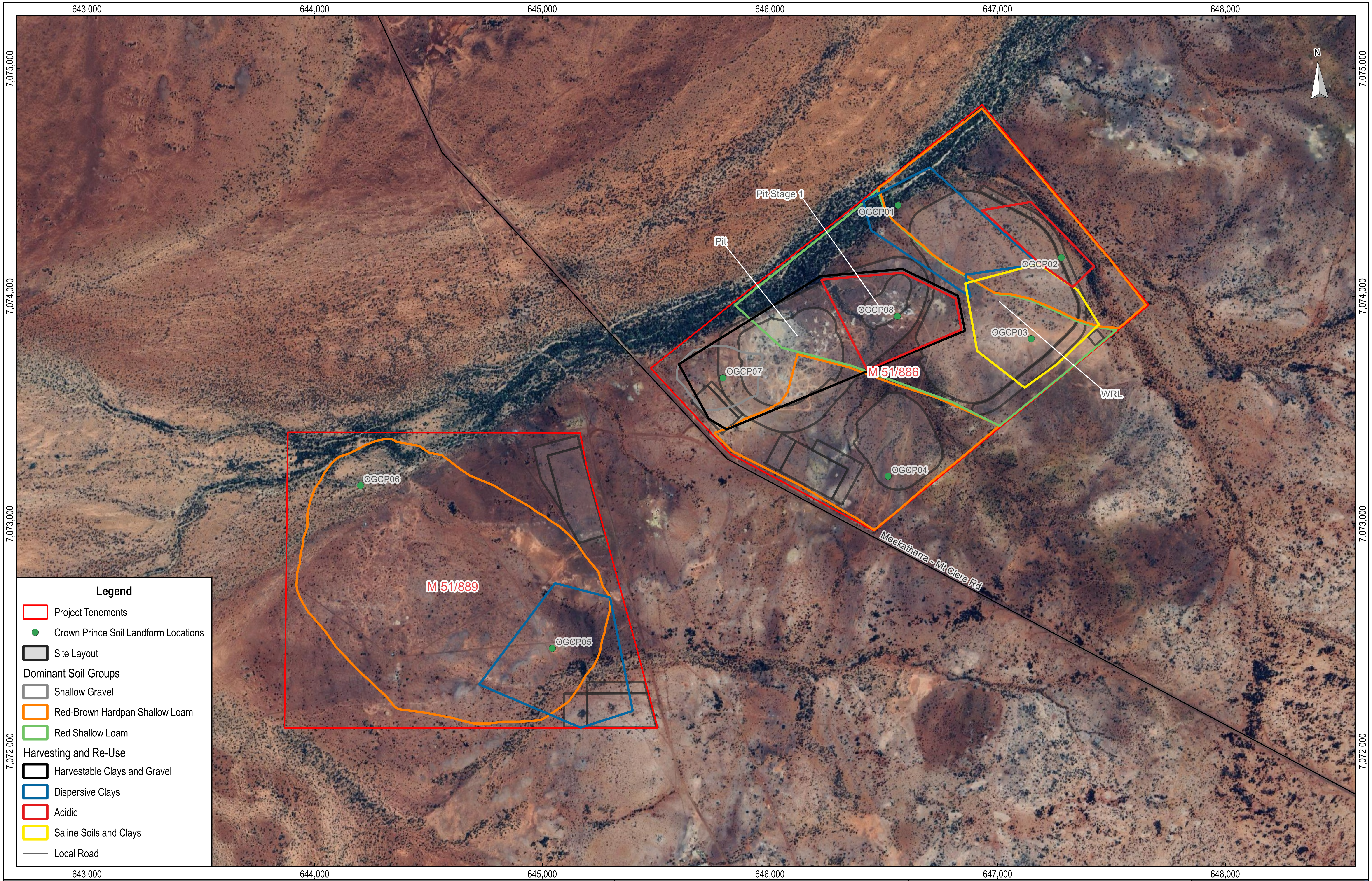
10.4.1.2 WRD

Locations OGCP02, OGCP03 were located within the proposed WRD footprint, whilst OGCP01 was located just beyond the northern extent of the footprint (Figure 5). Key characteristics in the context of harvesting and re-use from these areas (Figure 6) include:

- Soils from within this area (predominantly around sampling locations OGCP01, OGCP03) contained appreciable gravel and/or clay contents that have the potential to be used in construction and/or rehabilitation activities under the following conditions:
  - Clay material from subsoils from the OGCP01 location (and surroundings) have the potential to be dispersive and thus their use on sloping surfaces should be avoided.
  - Surface and subsoils from the OGCP03 location are hypersaline (240 – 480 mS/m) and thus should not be utilised as a rehabilitation medium.
- Soils from OGCP02, and surrounding areas within the proposed WRD footprint contained pH values in the 4.6 – 5.2 range. As stated previously these pH values have the potential to inhibit the growth of non-acid-tolerant plants, however, that many local plant species which may be utilised in rehabilitation are likely to be adapted to the acidic conditions.
- All soils and subsoils contained low ECEC values and are thus likely to have limited nutrient holding capacity.

10.4.2 Final Comments

The majority of soils and subsoils from across the project area can be stripped, harvested, stockpiled and re-used as required. There are some localised impediments to re-use such as dispersivity, acidity (Pit and WRD footprints) and salinity (primarily within the WRD footprints) which has the potential to impact both landform stability and revegetation activities. In addition, many areas of the Crown Prince site contain gravels, which may be useful resources for mine infrastructure i.e. gravel for roadbases. Clay-rich but potentially saline-to-extremely saline subsoils (especially in the WRL footprint) may be harvested if required for use as an impermeable clay layer (e.g. for any potentially acid-forming waste rocks). Subsoil clays are, however, otherwise unlikely to be suitable to rehabilitation, especially if saline and/or exposed on slopes.



Scale: 1: 15,000
Original Size: A3

Grid: GDA2020 / MGA zone 50 (EPSG:7850)

0 0.5 1 km

Ora Gold
Crown Prince Gold Project

Figure 6

Harvesting and Re-use Characteristics of Project Area Soils

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MBS ENVIRONMENTAL

11. REFERENCES

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APPENDICES

APPENDIX 1: SOIL PROFILE DESCRIPTIONS

Sample Location and Details						
Site	OGCP01	**GPS Coordinates**	50	646563.2242	mE	Page 1 of 8
				7074399.373	mN	
Locality	REFERENCE, Yandil System (272Yn)	**Date**	9-Jul-24		**Time**	8:20

Vegetation and Landscape	
Slope & Elevation	Flat to gently inclined 2-5% - 488m
Vegetation	Stony mulga mixed shrubland (SMMS)
Landscape	Broad stony slopes

Soil / Soil Profile Annotation	
Profile	Description
0-10cm	Clayey sand; slight coherent very sandy; 5-10 mm ribbons. Ahz massive to weak; well drained / dry solum.
10-35cm	Sandy loam; coherent very sandy; 10-15 mm ribbons. B2hz massive to weak; strongly cemented red-brown hardpan at 0.35 m
Sample Register	OGCP01A, OGCP01B

Photographs

Photo 1:

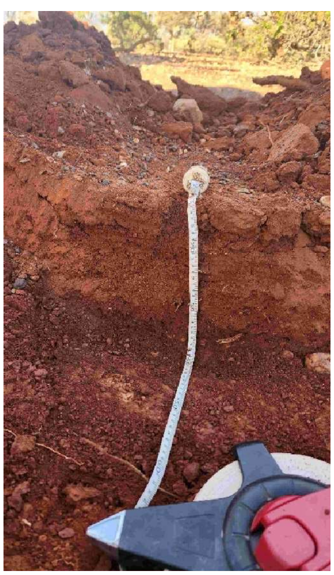

Photo 2:

Sample Location and Details							
Site	OGCP02	**GPS Coordinates**	50	647281	mE	Page 2 of 8	
				7074169	mN		
Locality	WRD, Wiluna System (272Wi)	**Date**	9-Jul-24		**Time**	8:45	

Vegetation and Landscape	
Slope & Elevation	Broad stony low hill; 2-5% gradient - 492m
Vegetation	Stony mulga mixed shrubland (SMMS)
Landscape	Broad stony slopes

Soil / Soil Profile Annotation	
Profile	Description
0-30cm	Clayey sand; slight coherent very sandy; 5-10 mm ribbons. Ahz massive to weak; little OM / leaf litter; well drained / dry solum.
30-45cm	Sandy loam; coherent very sandy; 10-15 mm ribbons. B2hz massive to weak; strongly cemented red-brown hardpan at 0.45 m
Sample Register	OGCP02A, OGCP02B

Photographs

Photo 1:

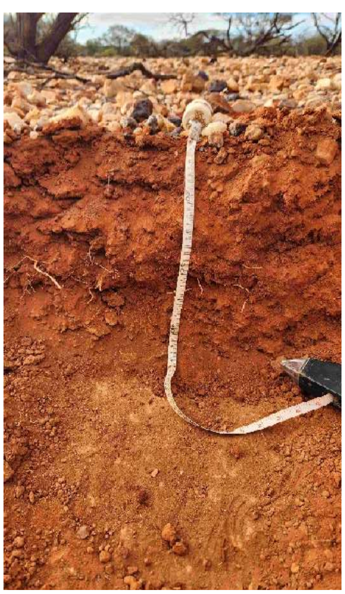

Photo 2:

Sample Location and Details							
Site	OGCP03	**GPS Coordinates**	50	647148.2	mE	Page 3 of 8	
				7073813	mN		
Locality	WRD, Wiluna System (272Wi)	**Date**	9-Jul-24		**Time**	8:56	

Vegetation and Landscape	
Slope & Elevation	Flat - 492m
Vegetation	Stony mulga mixed shrubland (SMMS)
Landscape	Broad stony slopes

Soil / Soil Profile Annotation	
Profile	Description
0-10cm	Clayey sand; slight coherent very sandy; 5-10 mm ribbons. Ahz massive to weak; well drained / dry solum.
10-45cm	Sandy loam; coherent very sandy; 10-15 mm ribbons. B2hz massive to weak; overlying weakly cemented ferricrete / duricrust pan
45-100cm	Chz weakly cemented ferricrete / duricrust; can be crushed by finger unlike previously encountered red-brown hardpan.
Sample Register	OGCP03A, OGCP03B2, OGCP03B3

Photographs

Photo 1:

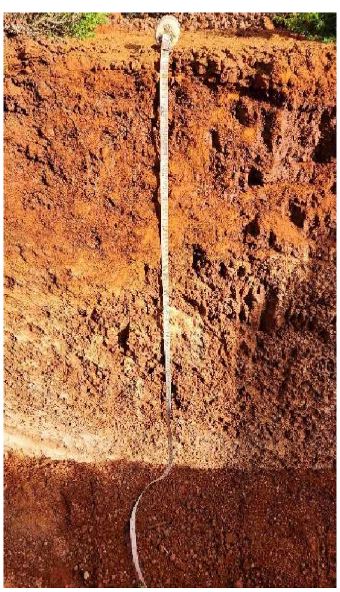

Photo 2:

Sample Location and Details							
Site	OGCP04	**GPS Coordinates**	50	646519.2	mE	Page 4 of 8	
				7073208	mN		
Locality	ANC INFRASTRUCTURE, Wiluna System (272Wi)	**Date**	9-Jul-24		**Time**	Not Provided	

Vegetation and Landscape	
Slope & Elevation	Broad stony low hill; 2-5% gradient - 499m
Vegetation	Stony mulga mixed shrubland (SMMS)
Landscape	Broad stony slopes

Soil / Soil Profile Annotation	
Profile	Description
0-10cm	Clayey sand; slight coherent very sandy; 5-10 mm ribbons. Ahz massive to weak; well drained / dry solum.
10-25cm	Sandy loam; coherent very sandy; 10-15 mm ribbons, B2hz massive to weak; strongly cemented red-brown hardpan at 0.25 m
Sample Register	OGCP04A, OGCP04B

Photographs

Photo 1:

Photo 2:

<table>
<tr><th colspan="7">Sample Location and Details</th></tr>
<tr><td rowspan="2">Site</td><td rowspan="2">OGCP05</td><td rowspan="2">GPS Coordinates</td><td rowspan="2">50</td><td>645043.8</td><td>mE</td><td rowspan="2">Page 5 of 8</td></tr>
<tr><td>7072452</td><td>mN</td></tr>
<tr><td>Locality</td><td>WRD, Wiluna System (272Wi)</td><td>Date</td><td colspan="2">9-Jul-24</td><td>Time</td><td>10:19</td></tr>
<tr><th colspan="7">Vegetation and Landscape</th></tr>
<tr><td colspan="2">Slope & Elevation</td><td colspan="5">Flat to gently inclined 2-5% gradient - 486m</td></tr>
<tr><td colspan="2">Vegetation</td><td colspan="5">Stony mulga mixed shrubland (SMMS)</td></tr>
<tr><td colspan="2">Landscape</td><td colspan="5">Broad stony slopes</td></tr>
<tr><th colspan="7">Soil / Soil Profile Annotation</th></tr>
<tr><td colspan="2">Profile</td><td colspan="5">Description</td></tr>
<tr><td colspan="2">0-10cm</td><td colspan="5">Clayey sand; slight coherent very sandy; 5-10 mm ribbons. Ahz massive to weak; well drained/ dry solum</td></tr>
<tr><td colspan="2">10-45cm</td><td colspan="5">Sandy loam; coherent very sandy; 10-15 mm ribbons. B2hz massive to weak; strongly cemented red-brown hardpan at 0.45 m / refusal</td></tr>
<tr><td colspan="2"></td><td colspan="5"></td></tr>
<tr><td colspan="2"></td><td colspan="5"></td></tr>
<tr><td colspan="2">Sample Register</td><td colspan="5">OGCP05A, OGCP05B</td></tr>
<tr><th colspan="7">Photographs</th></tr>
</table>

Photo 1:

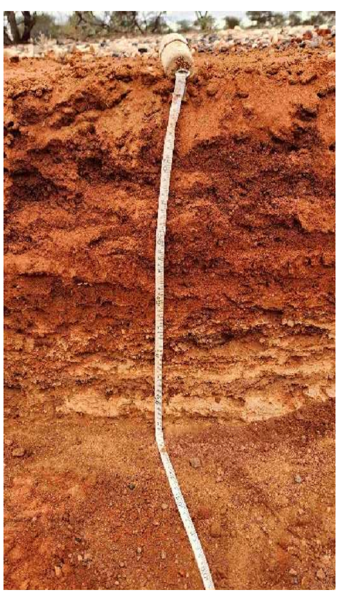

Photo 2:

Sample Location and Details							
Site	OGCP06	**GPS Coordinates**	50	644201.1	mE	Page 6 of 8	
				7073168	mN		
Locality	REFERENCE, Yandil System (272Yn)	**Date**	9-Jul-24		**Time**	10:52	

Vegetation and Landscape	
Slope & Elevation	Flat - 484m
Vegetation	Rocky hill mixed shrubland (RHMS)
Landscape	Stony Plains

Soil / Soil Profile Annotation	
Profile	Description
0-10cm	Clayey sand; slight coherent very sandy; 5-10 mm ribbons. Ahz massive to weak; well drained / dry solum
10-35cm	Sandy loam; coherent very sandy; 10-15 mm ribbons. B2hz massive to weak; strongly cemented red-brown hardpan at 0.35 m / refusal
Sample Register	OGCP06A, OGCP06B

Photographs

Photo 1:

Photo 2:

Sample Location and Details							
Site	OGCP07	**GPS Coordinates**	50	645793.5	mE	Page 7 of 8
				7073641	mN	
Locality	PIT, Wiluna System (272Wi)	**Date**	8-Jul-24		**Time**	16:40

Vegetation and Landscape	
Slope & Elevation	Flat - 489m
Vegetation	Stony mulga mixed shrubland (SMMS)
Landscape	Broad stony slopes

Soil / Soil Profile Annotation	
Profile	Description
0-15cm	Loamy sand dominate; slight coherence bolus; no ribbons
Sample Register	OGCP07A

Photographs

Photo 1:

Photo 2:

Sample Location and Details						
Site	OGCP08	**GPS Coordinates**	50	646608	mE	Page 8 of 8
				7073920	mN	
Locality	PIT, Wiluna System (272Wi)	**Date**	9-Jul-24		**Time**	11:45

Vegetation and Landscape	
Slope & Elevation	Broad stony low hill; 2.5% gradient - 490m
Vegetation	Stony mulga mixed shrubland (SMMS)
Landscape	Broad stony slopes

Soil / Soil Profile Annotation	
Profile	Description
0-10cm	Ahz massive to weak; well drained/ dry solum; roots to 0.2 m, Clayey sand; slight coherent very sandy; 5-10 mm ribbons.
10-50cm	Dispersed coarse fragments rounded and sub-angular 20% 10-30 mm, Sandy loam; coherent very sandy; 10-15 mm ribbons
Sample Register	OGCP08A, OGCP08B2, OGCP08B3

Photographs

Photo 1:

Photo 2:

APPENDIX 2: COLLATED ANALYTICAL RESULTS

Coarse Fragments >2mm

Sample	Coarse Fragments (>2mm)
	%
OGCP01 A	39.5
OGCP01 B	30.9
OGCP02 A	22.4
OGCP02 B	28.1
OGCP03 A	5.6
OGCP03 B2	2.1
OGCP03 B3	42.5
OGCP04 A	17.6
OGCP04 B	16.3
OGCP05 A	20.4
OGCP05 B	15.6
OGCP06 A	5.6
OGCP06 B	15.8
OGCP07 A	14.4
OGCP07 B	65
OGCP08 A	36.5
OGCP08 B2	20.2
OGCP08 B3	23.3

pH and EC

Sample	EC (1:5)	pH (1:5 H2O)
	mS/m	
OGCP01 A	12	6.5
OGCP01 B	5	6.2
OGCP02 A	2	5.1
OGCP02 B	4	5.2
OGCP03 A	240	6.7
OGCP03 B2	480	8.2
OGCP03 B3	460	8.5
OGCP04 A	3	5.1
OGCP04 B	4	4.6
OGCP05 A	36	6.4
OGCP05 B	25	7
OGCP06 A	2	7.1
OGCP06 B	3	7
OGCP07 A	2	6.8
OGCP07 B	6	8.4
OGCP08 A	8	4.6
OGCP08 B2	2	5.2
OGCP08 B3	2	6.2

Particle Size Distribution and Emerson Class

Client Id	Sand. fraction %	Silt. fraction %	Clay. fraction %	Soil Texture	Emerson Class
OGCP01 B	64.5	8	27.5	Sandy Clay Loam	1
OGCP02 B	-	-	-		5
OGCP03 A	62	24.5	13.5	Sandy Loam	
OGCP03 B2	29.5	23	47.5	Clay	
OGCP03 B3	34	21	45	Clay	4
OGCP05 B	65	8.5	26.5	Sandy Clay Loam	1
OGCP06 B	-	-	-		3
OGCP07 A	86	7	7	Loamy Sand	
OGCP07 B	89	5.5	5.5	Sand	1
OGCP08 B2	80	3.5	16.5	Sandy Loam	2
OGCP08 B3	76	5	19	Sandy Loam	5

Effective Cation Exchange Capacity (ECEC)

Client ID	Ca	K	Mg	Na	Al	Mn	ECEC	BS	ESP
	cmol(+)/kg	cmol(+)/kg	cmol(+)/kg	cmol(+)/kg	cmol(+)/kg	cmol(+)/kg	cmol(+)/kg	%	%
OGCP02 A	0.89	0.42	0.62	0.04	0.4	0.04	2.4	82	1.7
OGCP02 B	1.7	0.25	1.3	0.16	0.16	0.03	3.6	95	4.4
OGCP04 A	1	0.34	0.84	0.04	0.4	0.05	2.7	83	1.5
OGCP04 B	1.1	0.29	0.67	0.04	0.52	0.04	2.7	79	1.5
OGCP06 A	2.8	0.32	1.1	0.05	-	-	4.3	100	1.2
OGCP06 B	2.3	0.13	1.2	0.06	-	-	3.7	100	1.6
OGCP08 A	0.71	0.53	0.31	0.06	0.38	0.08	2.1	78	2.9
OGCP08 B2	0.97	0.27	0.38	0.03	0.27	0.08	2.0	83	1.5
OGCP08 B3	1.7	0.21	0.98	0.07	0.11	0.04	3.1	95	2.3
Low	<5	<0.5	<1	<0.3	<0.1	<0.02	<5	<20	<6
Typical	5-10	0.5-2	1-5	0.3-1	0.1-1.0	0.02-1.0	5-15	20-60	6-15
High	>10	>2	>5	>1	>1.0	>1	>15	>60	>15

Nutrients

Sample	OrgC	N	C:N
	%	%	
OGCP01 A	0.51	0.047	11
OGCP02 A	0.2	0.028	7
OGCP03 A	0.17	0.027	6
OGCP04 A	0.15	0.022	7
OGCP05 A	0.15	0.022	7
OGCP06 A	0.3	0.028	11
OGCP07 A	0.24	0.026	9
OGCP08 A	0.36	0.036	10
Low	<0.5	<0.05	<10
Typical	0.5-1.5	0.05-0.3	10-16
High	>1.5	>0.3	>16

Mehlich-3 Extractable Nutrients

Sample	Al	As	B	Ca	Cd	Co	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	S	Se	Zn
	mg/kg																		
OGCP01 A	270	<0.1	0.5	670	0.02	2.8	2.1	37	310	150	150	0.14	27	1.1	10	0.9	8	<0.1	1.1
OGCP02 A	360	<0.1	0.2	150	<0.01	0.6	1.1	22	150	70	22	<0.01	22	0.1	5	0.6	14	<0.1	0.5
OGCP03 A	380	<0.1	0.6	850	<0.01	3.1	1.3	30	>550	350	120	0.02	>1000	0.8	9	1.1	170	<0.1	1.2
OGCP04 A	360	<0.1	0.3	160	<0.01	0.2	1.6	24	120	88	15	0.01	12	<0.1	9	0.5	13	<0.1	0.6
OGCP05 A	280	<0.1	0.8	300	<0.01	0.8	1.1	17	250	110	15	<0.01	240	0.2	5	0.7	71	<0.1	1.7
OGCP06 A	200	<0.1	0.2	480	0.01	1.7	1.3	44	150	120	82	0.02	9	0.5	4	1.0	2	<0.1	1.7
OGCP07 A	210	<0.1	0.1	240	0.02	1.6	0.8	30	150	100	120	0.05	7	0.6	8	2.7	2	0.2	3.6
OGCP08 A	220	<0.1	0.3	100	<0.01	0.1	0.5	22	170	30	18	<0.01	12	<0.1	2	0.4	26	<0.1	0.3
Low	-	-	<0.1	<50	-	<1	<0.1	<10	<10	<20	<5	<0.01	-	<1	<2	-	<5	-	<0.2
Typical	-	-	0.1-2	50-5000	-	1-10	0.1-5	10-200	10-300	20-2000	5-100	0.01 - 0.05	-	1-20	2-10	-	5-200	-	0.2-5
High	>550	>5	>2	>5000	>1	>10	>5	>200	>300	>2000	>100	>0.05	180	>20	>10	>35	>200	>1.5	>5

Total Metal(loids)

Sample	Ag	As	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Zn
	mg/kg											
OGCP01 A	<0.05	9.2	0.09	210	37	0.02	580	29	14	0.14	1.0	33
OGCP02 A	<0.05	7.3	<0.05	160	32	<0.02	180	20	11	0.14	0.8	35
OGCP03 A	<0.05	6.4	0.06	130	30	<0.02	440	25	12	0.17	0.4	45
OGCP04 A	<0.05	29	<0.05	180	49	<0.02	150	37	13	0.34	1.3	39
OGCP05 A	<0.05	9.2	<0.05	210	29	<0.02	170	21	11	0.20	0.8	34
OGCP06 A	<0.05	22	<0.05	150	27	0.04	560	20	11	0.16	0.5	32
OGCP07 A	<0.05	47	0.08	330	43	0.03	470	50	15	0.29	0.9	64
OGCP08 A	<0.05	42	<0.05	600	41	<0.02	190	22	13	0.51	1.6	21
NEPM (2013)	N/G	100	3*	470	150	1*	500*	80	1,100	N/G	N/G	200
Ambient Background (80th percentile value)	N/A	37	0.07	282	42	0.03	524	34	14	0.32	1.2	43

APPENDIX 3: LABORATORY REPORTS

GOVERNMENT OF
WESTERN AUSTRALIA

ChemCentre
Scientific Services Division
Report of Examination

Resources and Chemistry Precinct
Cnr Manning Road and Townsing Drive
Bentley
WA 6102
T +61 8 9422 9800
F +61 8 9422 9801
www.chemcentre.wa.gov.au
ABN 40 991 885 705

Purchase Order: ORLCPSLA
ChemCentre Reference: 24S0254 R0

MBS Environmental
4 Cook St
West Perth WA 6005

Attention: Eric Hopwood

Report on: 18 samples received on 16/07/2024

LAB ID	Material	Client ID and Description
24S0254 / 001	soil	OGCP01 A
24S0254 / 002	soil	OGCP01 B
24S0254 / 003	soil	OGCP02 A
24S0254 / 004	soil	OGCP02 B
24S0254 / 005	soil	OGCP03 A
24S0254 / 006	soil	OGCP03 B2
24S0254 / 007	soil	OGCP03 B3
24S0254 / 008	soil	OGCP04 A
24S0254 / 009	soil	OGCP04 B
24S0254 / 010	soil	OGCP05 A
24S0254 / 011	soil	OGCP05 B
24S0254 / 012	soil	OGCP06 A
24S0254 / 013	soil	OGCP06 B
24S0254 / 014	soil	OGCP07 A
24S0254 / 015	soil	OGCP07 B
24S0254 / 016	soil	OGCP08 A
24S0254 / 017	soil	OGCP08 B2
24S0254 / 018	soil	OGCP08 B3

LAB ID			001	002	003	004
Client ID^			OGCP01 A	OGCP01 B	OGCP02 A	OGCP02 B
Sampled^						
Analyte	**Method**	**Unit**				
> 2mm fraction*	(>2mm)	%	39.5	30.9	22.4	28.1
Electrical Conductivity	(1:5)	mS/m	12	5	2	4
pH	(H2O)		6.5	6.2	5.1	5.2
Sand (fine/course)	fraction	%		64.5		
Silt	fraction	%		8.0		
Clay (fine/course)	fraction	%		27.5		
Carbon, total organic	(W/B)	%	0.51		0.20	
Emerson Class number*	Class			1		5
Exchangeable Sodium %*	(calc)	%			1.8	4.4
Nitrogen	(total)	%	0.047		0.028	
Calcium	(exch)	cmol(+)/kg			0.89	1.7
Magnesium	(exch)	cmol(+)/kg			0.62	1.3
Potassium	(exch)	cmol(+)/kg			0.42	0.25
Sodium	(exch)	cmol(+)/kg			0.04	0.16
Aluminium	(exch)	cmol(+)/kg			0.40	0.16

LAB ID			001	002	003	004
Client ID^			OGCP01 A	OGCP01 B	OGCP02 A	OGCP02 B
Sampled^						
Analyte	**Method**	**Unit**				
Manganese	(exch)	cmol(+)/kg			0.04	0.03
Aluminium*	(M3)	mg/kg	270		360	
Boron*	(M3)	mg/kg	0.5		0.2	
Cadmium*	(M3)	mg/kg	0.02		<0.01	
Calcium*	(M3)	mg/kg	670		150	
Cobalt*	(M3)	mg/kg	2.8		0.62	
Copper*	(M3)	mg/kg	2.1		1.1	
Iron*	(M3)	mg/kg	37		22	
Magnesium*	(M3)	mg/kg	150		70	
Manganese*	(M3)	mg/kg	150		22	
Molybdenum*	(M3)	mg/kg	0.14		<0.01	
Nickel*	(M3)	mg/kg	1.1		0.1	
Phosphorus*	(M3)	mg/kg	10		5	
Potassium*	(M3)	mg/kg	310		150	
Sodium*	(M3)	mg/kg	27		22	
Sulfur*	(M3)	mg/kg	8		14	
Zinc*	(M3)	mg/kg	1.1		0.5	
Arsenic*	(M3)	mg/kg	<0.1		<0.1	
Lead*	(M3)	mg/kg	0.9		0.6	
Selenium*	(M3)	mg/kg	<0.1		<0.1	
Antimony	iMET2SAMS	mg/kg	0.14		0.14	
Arsenic	iMET2SAMS	mg/kg	9.2		7.3	
Cadmium	iMET2SAMS	mg/kg	0.09		<0.05	
Chromium	iMET2SAICP	mg/kg	210		160	
Copper	iMET2SAMS	mg/kg	37		32	
Lead	iMET2SAMS	mg/kg	14		11	
Manganese	iMET2SAICP	mg/kg	580		180	
Mercury	iMET2SAMS	mg/kg	0.02		<0.02	
Nickel	iMET2SAMS	mg/kg	29		20	
Selenium	iMET2SAMS	mg/kg	1.0		0.77	
Silver	iMET2SAMS	mg/kg	<0.05		<0.05	
Zinc	iMET2SAMS	mg/kg	33		35	
Date Analysed	(>2mm)		29/07/2024	29/07/2024	29/07/2024	29/07/2024
	(1:5)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(calc)				07/08/2024	07/08/2024
	(exch)				07/08/2024	07/08/2024
	(H2O)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(M3)		06/08/2024		06/08/2024	
	(total)		08/08/2024		08/08/2024	
	(W/B)		08/08/2024		02/08/2024	
	Class			19/07/2024		19/07/2024
	fraction			01/08/2024		
	iMET2SAICP		02/08/2024		02/08/2024	
	iMET2SAMS		06/08/2024		06/08/2024	
Sample Condition			Ambient	Ambient	Ambient	Ambient

LAB ID			005	006	007	008
Client ID^			OGCP03 A	OGCP03 B2	OGCP03 B3	OGCP04 A
Sampled^						
Analyte	**Method**	**Unit**				
> 2mm fraction*	(>2mm)	%	5.6	2.1	42.5	17.6
Electrical Conductivity	(1:5)	mS/m	240	480	460	3
pH	(H2O)		6.7	8.2	8.5	5.1
Sand (fine/course)	fraction	%	62.0	29.5	34.0	
Silt	fraction	%	24.5	23.0	21.0	
Clay (fine/course)	fraction	%	13.5	47.5	45.0	
Carbon, total organic	(W/B)	%	0.17			0.15
Emerson Class number*	Class				4	
Exchangeable Sodium %*	(calc)	%				1.5
Nitrogen	(total)	%	0.027			0.022
Calcium	(exch)	cmol(+)/kg				1.0
Magnesium	(exch)	cmol(+)/kg				0.84
Potassium	(exch)	cmol(+)/kg				0.34
Sodium	(exch)	cmol(+)/kg				0.04
Aluminium	(exch)	cmol(+)/kg				0.40
Manganese	(exch)	cmol(+)/kg				0.05
Aluminium*	(M3)	mg/kg	380			360
Boron*	(M3)	mg/kg	0.6			0.3
Cadmium*	(M3)	mg/kg	<0.01			<0.01
Calcium*	(M3)	mg/kg	850			160
Cobalt*	(M3)	mg/kg	3.1			0.22
Copper*	(M3)	mg/kg	1.3			1.6
Iron*	(M3)	mg/kg	30			24
Magnesium*	(M3)	mg/kg	350			88
Manganese*	(M3)	mg/kg	120			15
Molybdenum*	(M3)	mg/kg	0.02			0.01
Nickel*	(M3)	mg/kg	0.8			<0.1
Phosphorus*	(M3)	mg/kg	9			9
Potassium*	(M3)	mg/kg	>550			120
Sodium*	(M3)	mg/kg	>1000			12
Sulfur*	(M3)	mg/kg	170			13
Zinc*	(M3)	mg/kg	1.2			0.6
Arsenic*	(M3)	mg/kg	<0.1			<0.1
Lead*	(M3)	mg/kg	1.1			0.5
Selenium*	(M3)	mg/kg	<0.1			<0.1
Antimony	iMET2SAMS	mg/kg	0.17			0.34
Arsenic	iMET2SAMS	mg/kg	6.4			29
Cadmium	iMET2SAMS	mg/kg	0.06			<0.05
Chromium	iMET2SAICP	mg/kg	130			180
Copper	iMET2SAMS	mg/kg	30			49
Lead	iMET2SAMS	mg/kg	12			13
Manganese	iMET2SAICP	mg/kg	440			150
Mercury	iMET2SAMS	mg/kg	<0.02			<0.02
Nickel	iMET2SAMS	mg/kg	25			37
Selenium	iMET2SAMS	mg/kg	0.43			1.3
Silver	iMET2SAMS	mg/kg	<0.05			<0.05
Zinc	iMET2SAMS	mg/kg	45			39
Date Analysed	(>2mm)		29/07/2024	29/07/2024	29/07/2024	29/07/2024
	(1:5)		30/07/2024	30/07/2024	30/07/2024	30/07/2024

LAB ID						008
Client ID^						
Sampled^						
Analyte	**Method**	**Unit**				
Date Analysed	(calc)					07/08/2024
	(exch)					07/08/2024
	(H2O)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(M3)		06/08/2024			06/08/2024
	(total)		08/08/2024			08/08/2024
	(W/B)		02/08/2024			02/08/2024
	Class				19/07/2024	
	fraction		01/08/2024	07/08/2024	07/08/2024	
	iMET2SAICP		02/08/2024			02/08/2024
	iMET2SAMS		06/08/2024			06/08/2024
Sample Condition			Ambient	Ambient	Ambient	Ambient

LAB ID			009	010	011	012
Client ID^			OGCP04 B	OGCP05 A	OGCP05 B	OGCP06 A
Sampled^						
Analyte	**Method**	**Unit**				
> 2mm fraction*	(>2mm)	%	16.3	20.4	15.6	5.6
Electrical Conductivity	(1:5)	mS/m	4	36	25	2
pH	(H2O)		4.6	6.4	7.0	7.1
Sand (fine/course)	fraction	%			65.0	
Silt	fraction	%			8.5	
Clay (fine/course)	fraction	%			26.5	
Carbon, total organic	(W/B)	%		0.15		0.30
Emerson Class number*	Class				1	
Exchangeable Sodium %*	(calc)	%	1.6			1.1
Nitrogen	(total)	%		0.022		0.028
Calcium	(exch)	cmol(+)/kg	1.1			2.8
Magnesium	(exch)	cmol(+)/kg	0.67			1.1
Potassium	(exch)	cmol(+)/kg	0.29			0.32
Sodium	(exch)	cmol(+)/kg	0.04			0.05
Aluminium	(exch)	cmol(+)/kg	0.52			
Manganese	(exch)	cmol(+)/kg	0.04			
Aluminium*	(M3)	mg/kg		280		200
Boron*	(M3)	mg/kg		0.8		0.2
Cadmium*	(M3)	mg/kg		<0.01		0.01
Calcium*	(M3)	mg/kg		300		480
Cobalt*	(M3)	mg/kg		0.84		1.7
Copper*	(M3)	mg/kg		1.1		1.3
Iron*	(M3)	mg/kg		17		44
Magnesium*	(M3)	mg/kg		110		120
Manganese*	(M3)	mg/kg		15		82
Molybdenum*	(M3)	mg/kg		<0.01		0.02
Nickel*	(M3)	mg/kg		0.2		0.5
Phosphorus*	(M3)	mg/kg		5		4
Potassium*	(M3)	mg/kg		250		150
Sodium*	(M3)	mg/kg		240		9
Sulfur*	(M3)	mg/kg		71		2
Zinc*	(M3)	mg/kg		1.7		1.7

LAB ID			009	010	011	012
Client ID^			OGCP04 B	OGCP05 A	OGCP05 B	OGCP06 A
Sampled^						
Analyte	**Method**	**Unit**				
Arsenic*	(M3)	mg/kg		<0.1		<0.1
Lead*	(M3)	mg/kg		0.7		1.0
Selenium*	(M3)	mg/kg		<0.1		<0.1
Antimony	iMET2SAMS	mg/kg		0.20		0.16
Arsenic	iMET2SAMS	mg/kg		9.2		22
Cadmium	iMET2SAMS	mg/kg		<0.05		<0.05
Chromium	iMET2SAICP	mg/kg		210		150
Copper	iMET2SAMS	mg/kg		29		27
Lead	iMET2SAMS	mg/kg		11		11
Manganese	iMET2SAICP	mg/kg		170		560
Mercury	iMET2SAMS	mg/kg		<0.02		0.04
Nickel	iMET2SAMS	mg/kg		21		20
Selenium	iMET2SAMS	mg/kg		0.76		0.46
Silver	iMET2SAMS	mg/kg		<0.05		<0.05
Zinc	iMET2SAMS	mg/kg		34		32
Date Analysed	(>2mm)		29/07/2024	29/07/2024	29/07/2024	29/07/2024
	(1:5)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(calc)		07/08/2024			06/08/2024
	(exch)		07/08/2024			06/08/2024
	(H2O)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(M3)			06/08/2024		06/08/2024
	(total)			08/08/2024		08/08/2024
	(W/B)			08/08/2024		02/08/2024
	Class				19/07/2024	
	fraction				01/08/2024	
	iMET2SAICP			02/08/2024		02/08/2024
	iMET2SAMS			06/08/2024		06/08/2024
Sample Condition			Ambient	Ambient	Ambient	Ambient

LAB ID			013	014	015	016
Client ID^			OGCP06 B	OGCP07 A	OGCP07 B	OGCP08 A
Sampled^						
Analyte	**Method**	**Unit**				
> 2mm fraction*	(>2mm)	%	15.8	14.4	65.0	36.5
Electrical Conductivity	(1:5)	mS/m	3	2	6	8
pH	(H2O)		7.0	6.8	8.4	4.6
Sand (fine/course)	fraction	%		86.0	89.0	
Silt	fraction	%		7.0	5.5	
Clay (fine/course)	fraction	%		7.0	5.5	
Carbon, total organic	(W/B)	%		0.24		0.36
Emerson Class number*	Class		3		1	
Exchangeable Sodium %*	(calc)	%	1.6			3.0
Nitrogen	(total)	%		0.026		0.036
Calcium	(exch)	cmol(+)/kg	2.3			0.71
Magnesium	(exch)	cmol(+)/kg	1.2			0.31
Potassium	(exch)	cmol(+)/kg	0.13			0.53
Sodium	(exch)	cmol(+)/kg	0.06			0.06
Aluminium	(exch)	cmol(+)/kg				0.38
Manganese	(exch)	cmol(+)/kg				0.08

LAB ID			013	014	015	016
Client ID^			OGCP06 B	OGCP07 A	OGCP07 B	OGCP08 A
Sampled^						
Analyte	**Method**	**Unit**				
Aluminium*	(M3)	mg/kg		210		220
Boron*	(M3)	mg/kg		0.1		0.3
Cadmium*	(M3)	mg/kg		0.02		<0.01
Calcium*	(M3)	mg/kg		240		100
Cobalt*	(M3)	mg/kg		1.6		0.14
Copper*	(M3)	mg/kg		0.8		0.5
Iron*	(M3)	mg/kg		30		22
Magnesium*	(M3)	mg/kg		100		30
Manganese*	(M3)	mg/kg		120		18
Molybdenum*	(M3)	mg/kg		0.05		<0.01
Nickel*	(M3)	mg/kg		0.6		<0.1
Phosphorus*	(M3)	mg/kg		8		2
Potassium*	(M3)	mg/kg		150		170
Sodium*	(M3)	mg/kg		7		12
Sulfur*	(M3)	mg/kg		2		26
Zinc*	(M3)	mg/kg		3.6		0.3
Arsenic*	(M3)	mg/kg		<0.1		<0.1
Lead*	(M3)	mg/kg		2.7		0.4
Selenium*	(M3)	mg/kg		0.2		<0.1
Antimony	iMET2SAMS	mg/kg		0.29		0.51
Arsenic	iMET2SAMS	mg/kg		47		42
Cadmium	iMET2SAMS	mg/kg		0.08		<0.05
Chromium	iMET2SAICP	mg/kg		330		600
Copper	iMET2SAMS	mg/kg		43		41
Lead	iMET2SAMS	mg/kg		15		13
Manganese	iMET2SAICP	mg/kg		470		190
Mercury	iMET2SAMS	mg/kg		0.03		<0.02
Nickel	iMET2SAMS	mg/kg		50		22
Selenium	iMET2SAMS	mg/kg		0.94		1.6
Silver	iMET2SAMS	mg/kg		<0.05		<0.05
Zinc	iMET2SAMS	mg/kg		64		21
Date Analysed	(>2mm)		29/07/2024	29/07/2024	29/07/2024	29/07/2024
	(1:5)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(calc)		06/08/2024			07/08/2024
	(exch)		06/08/2024			07/08/2024
	(H2O)		30/07/2024	30/07/2024	30/07/2024	30/07/2024
	(M3)			06/08/2024		06/08/2024
	(total)			08/08/2024		08/08/2024
	(W/B)			02/08/2024		02/08/2024
	Class		19/07/2024		19/07/2024	
	fraction			01/08/2024	01/08/2024	
	iMET2SAICP			02/08/2024		02/08/2024
	iMET2SAMS			06/08/2024		06/08/2024
Sample Condition			Ambient	Ambient	Ambient	Ambient

LAB ID			017	018
Client ID^			OGCP08 B2	OGCP08 B3
Sampled^				
Analyte	**Method**	**Unit**		

LAB ID			017	018
Client ID^			OGCP08 B2	OGCP08 B3
Sampled^				
Analyte	**Method**	**Unit**		
> 2mm fraction*	(>2mm)	%	20.2	23.3
Electrical Conductivity	(1:5)	mS/m	2	2
pH	(H2O)		5.2	6.2
Sand (fine/course)	fraction	%	80.0	76.0
Silt	fraction	%	3.5	5.0
Clay (fine/course)	fraction	%	16.5	19.0
Emerson Class number*	Class		2	5
Exchangeable Sodium %*	(calc)	%	1.5	2.2
Calcium	(exch)	cmol(+)/kg	0.97	1.7
Magnesium	(exch)	cmol(+)/kg	0.38	0.98
Potassium	(exch)	cmol(+)/kg	0.27	0.21
Sodium	(exch)	cmol(+)/kg	0.03	0.07
Aluminium	(exch)	cmol(+)/kg	0.27	0.11
Manganese	(exch)	cmol(+)/kg	0.08	0.04
Date Analysed	(>2mm)		29/07/2024	29/07/2024
	(1:5)		30/07/2024	30/07/2024
	(calc)		07/08/2024	07/08/2024
	(exch)		07/08/2024	07/08/2024
	(H2O)		30/07/2024	30/07/2024
	Class		19/07/2024	19/07/2024
	fraction		01/08/2024	01/08/2024
Sample Condition			Ambient	Ambient

Method	**Method Description**
(>2mm)	Sieved particles greater than 2 mm
(1:5)	Electrical conductivity of 1:5 soil extract at 25 C by in-house method S02 (Method 3A1; Rayment & Lyons (2011)).
(calc)	Result based on calculation from another analyte
(exch)	Exchangeable cations extracted in NH4Cl or BaCl2 by in house methods S22.0, S22.1 and S21. (Methods 15A1, 15C1 and 15E1; Rayment & Lyons (2011))
(H2O)	pH of 1:5 soil:water extract by in-house method S01 (Method 4A1; Rayment & Lyons (2011))
(M3)	Extractable elements in acidic or neutral soils using Mehlich No 3 – extractant by in house method S42 (Method 18F; Rayment & Lyons (2011)).
(total)	Total nitrogen, Kjeldhal digestion by in house method S10 (Method 7A2a; Rayment & Lyons (2011)).
(W/B)	Organic Carbon C, Walkley and Black by in house method S09 (Method 6B1; Rayment & Lyons (2011)).
Class	Soil classification, Emerson class number by in house method S72 and Texture of soil by in house method S06-1 and turbidity rating 1:5 extract.
fraction	Sand, 0.02 to 2.0mm, Clay, less than 0.002mm, Silt, 0.02 to 0.002mm by in house method S06 (Australian Standard AS1289.C6.3).
iMET2SAICP	Acid digestable metals (dry wt basis) by digestion and ICPAES.
iMET2SAMS	Acid digestable metals (dry wt basis) by ICPMS.

Results are based on a air-dry (40C) , <2 mm basis. Stones (>2mm) if present are reported on an air dry whole sample basis. The results apply only to samples as received. This report may only be reproduced in full. Unless otherwise advised, the samples in this job will be disposed of after a holding period of 30 days from the report date shown below.

EMERSON CLASS CLASSIFICATION

The swelling and dispersive properties of the soils were tested by placing natural peds and samples re-moulded at or near field capacity moisture content in deionised water. Based on their slaking and dispersive behaviour, the samples were classified into one of 8 classes according to the Emerson Classification scheme as described in Australian Standard AS 1289.C8.1-1980.

Summary of classification scheme:

Class 1 Soil slakes, air-dried crumbs are strongly dispersive
Class 2 Soil slakes, air-dried crumbs show slight to moderate dispersion
Class 3 Soil slakes, air-dried crumbs do not disperse, re-moulded soil disperses
Class 4 Soil slakes, air-dried crumbs do not disperse, calcium carbonate or calcium sulphate are present.
Class 5 Soil slakes, air-dried and re-moulded soil do not disperse, 1:5 soil:water extract remains dispersed after 5 minutes.
Class 6 Soil slakes, air-dried and re-moulded soil do not disperse, 1:5 soil:water extract begins to flocculate within 5 minutes.
Class 7 Soil does not slake, air-dried crumbs remain coherent and swell.
Class 8 Soil does not slake, air-dried crumbs remain coherent, but do not swell.

A sample with a result of 0, indicates the sample was not suitable for the test, i.e air-dried sample did not contain soil peds between 4.75 - 2.36mm diameter.

Exchangeable Sodium Percentage (ESP)

The ESP is a measure of sodicity (i.e exchangeable Na+) based on a soils exchange complex . High levels of sodium can adversley effect plant growth and soil structure .
The table below (categorised by Northcote and Skene, 1972) relates % ESP to soil sodicity. This table should only be used as a guide as it tolerance can vary on soil type and plant species.

ESP<6	non-sodic
ESP 6-15	sodic
ESP>15	strongly sodic

*Analysis not covered by scope of ChemCentre's NATA accreditation.
^Information provided by client, unless otherwise stated.

[redacted]

Team Leader
SSD Inorganic Chemistry
13-Aug-2024

APPENDIX 4: RECONNAISSANCE FLORA AND BASIC FAUNA ASSESSMENT

CROWN PRINCE PROJECT

Reconnaissance Flora and Basic Fauna Assessment

Prepared for Ora Gold Ltd
August 2024

Prepared by
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Disclaimer

Quality Assurance

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents is carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

Cover Photo: Vegetation within the Crown Prince project area (26/06/2024)

Prepared by: [redacted] [redacted]

Reviewed by:

Approved by:

Contents

EXECUTIVE SUMMARY iv

1 INTRODUCTION 5

1.1 Objectives 5

2 BIOPHYSICAL ENVIRONMENT 8

2.1 Regional Environnent 8

2.2 Land Use 8

2.3 Soil Landscape Systems 10

2.4 Regional Vegetation 12

2.4.1 Pre-European Vegetation 12

2.5 Climate 14

2.6 Conservation Values 14

2.7 Hydrology 17

3 Survey Methodology 19

3.1 Desktop Assessment 19

3.2 Flora and Vegetation Field Assessment 21

3.3 Data Analysis Tools 23

3.4 Terrestrial Fauna Field Assessment 23

3.5 Scientific Licences 24

3.6 Survey Limitations and Constraints 24

4 Results 26

4.1 Desktop Assessment 26

4.1.1 Flora 26

4.1.2 Introduced Flora 26

4.1.3 Significant Flora 27

4.1.4 Fauna 30

4.2 Field Assessment 33

4.2.1 Flora 33

4.2.2 Vegetation Communities 36

4.2.3 Vegetation Condition 40

4.2.4 Significant Vegetation 42

4.2.5 Fauna 42

4.3 Matters of National Environmental Significance 47

4.3.1 Environment Protection and Biodiversity Conservation Act 1999 47

4.4 Matters of State Environmental Significance 48

4.4.1 Environmental Protection Act WA 1986 48

4.4.2 Biodiversity Conservation Act 2016 49

4.5 Other Areas of Conservation Significance 49

5 Discussion and Conclusions 50

6 Bibliography 51

APPENDIX A: Conservation Ratings BC Act and EPBC Act 53
Appendix B: Vegetation Condition Rating 57
Appendix C: List of species identified within the survey area 58
Appendix D: Priority Flora Locations (GDA 2020) 61
Appendix E: DANDJOO and ALA Search results(40km) 62
Appendix F: EPBC Protected Matters Search (40km buffer) 77

Tables

Table 2-1: Soil landscape systems within the survey area 10
Table 2-2: Pre-European vegetation associations within the survey area 12
Table 2-3: Priority Ecological Communities within a 40 km radius of the survey area 14
Table 2-4: Potential terrestrial groundwater dependent ecosystems (BoM, 2024b) 17
Table 3-1: Scientific Licenses of Botanica Staff coordinating the survey 24
Table 3-2: Limitations and constraints associated with the flora/ vegetation and fauna survey 25
Table 4-1: Introduced flora known to occur within 40 km of the survey area 26
Table 4-2: Significant flora potentially occurring within the survey area 28
Table 4-3: Conservation significant fauna previously recorded within 40 km of the survey area 31
Table 4-4: Introduced flora species within the survey area 33
Table 4-5: Significant flora recorded within the survey area 34
Table 4-6: Summary of vegetation types within the survey area 37
Table 4-7: Vegetation condition rating within the survey area 40
Table 4-8: Fauna species observed during the field survey 42
Table 4-9: Main terrestrial fauna habitats within the survey area 44

Figures

Figure 1-1: Regional map of the survey area 7
Figure 2-1: Map of IBRA Bioregions in relation to the survey area 9
Figure 2-2: Map of soil landscape systems within the survey area 11
Figure 2-3: Pre-European vegetation systems within the survey area 13
Figure 2-4: Climate data for Meekatharra Airport (#7045) (BoM, 2024) 14
Figure 2-5: Conservation Values in relation to the survey area 16
Figure 2-6: Regional hydrology of the survey area 18
Figure 3-1 GPS tracklog of the 2024 survey effort 22
Figure 4-1: Significant flora within the desktop search area 29
Figure 4-2: Location of Priority flora in the survey area 35
Figure 4-3: Vegetation types within the survey area 39
Figure 4-4: Vegetation condition within the survey area 41
Figure 4-5: Fauna habitats within the survey area 46

EXECUTIVE SUMMARY

Botanica Consulting Pty Ltd (Botanica) was commissioned by Ora Gold Limited to undertake a reconnaissance flora/ vegetation survey and basic fauna survey of their Crown Prince project area (referred to as the 'survey area'). It is located approximately 15 km north-west of Meekatharra, Western Australia. The survey area is split into two blocks on either side of the Meekatharra-Mount Clere Road and is in total approximately 394 ha in extent. This assessment is intended to support approvals for the Ora Gold Ltd Crown Prince Project.

The survey area lies within the Western Murchison (MUR1) subregion of the Murchison Bioregion, as defined by the Interim Biogeographic Regionalisation of Australia (IBRA). The survey area is located within the Yoothapina Pastoral Lease in the Shire of Meekatharra.

Botanica conducted flora/ vegetation and basic fauna survey on the 26th of June 2024. The area was surveyed by Jennifer Jackson (Senior Botanist, BSc Environmental Management (Honours)). The area was traversed on foot and by 4WD.

The field survey identified 80 vascular flora taxa within the survey area. These taxa represented 44 genera across 26 families. Twenty annual species were observed during the survey. Six weed species were recorded within the survey. These species are not listed as Declared Pests on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management* (BAM) *Act 2007* or as Weeds of National Significance.

One Priority flora species was identified in the survey area. *Grevillea inconspicua* (P4) was observed growing in a drainage line. No Threatened flora was identified within the survey area.

A total of four broad-scale vegetation communities were identified within the survey area. Native vegetation within the survey area was categorised as 'Good'. Impacts to vegetation within the survey area include access tracks, historical and current mining and exploration activities, and grazing by large feral herbivores.

No Threatened, Priority or otherwise significant ecological communities were identified within the survey area. No Environmentally Sensitive Areas were identified within the survey area. There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within the survey area.

Based on vegetation and associated landforms identified during the flora and vegetation assessment, two broad scale terrestrial fauna habitats were identified as occurring within the survey area. No evidence of significant fauna species were observed during the survey.

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1 INTRODUCTION

Botanica Consulting Pty Ltd (Botanica) was commissioned by Ora Gold Ltd. to undertake a reconnaissance flora/vegetation survey and basic fauna assessment of their Crown Prince project area (referred to as the 'survey area'). The survey area was split into two blocks on either side of the Meekatharra-Mount Clere Road of approximately 189 ha (M51/889) and 204 ha (M51/886) in extent (total extent approximately 394 ha). The survey area is located approximately 15 km north-west of Meekatharra, Western Australia (Figure 1-1). This assessment is intended to support approvals for the Ora Gold Ltd Crown Prince Project.

1.1 Objectives

The flora assessment was conducted in accordance with the requirements of a reconnaissance flora survey as defined in Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016 (EPA, 2016a). The objectives of the assessment were to:

- gather background information on flora and vegetation in the target area (literature review, database and map-based searches);
- identify significant flora, vegetation and ecological communities;
- conduct a field survey to verify / ground truth the desktop assessment findings;
- undertake floristic community mapping to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) structure and floristics;
- undertake vegetation condition mapping;
- assess the project area's plant species diversity, density, composition, structure and weed cover, using NVIS classification system for vegetation description;
- identify Matters of National Environmental Significance (MNES) protected under the EPBC Act; and
- determine the State legislative context of environmental aspects required for the assessment.

The fauna assessment was conducted in accordance with the requirements of a basic terrestrial fauna survey as defined in *Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment – June 2020* (EPA, 2020). The objectives of the assessment were to:

- Undertake a literature review, including map-based information searches of all current and relevant literature sources and databases relating to the survey area;
- Undertake a desktop investigation to identify any previously recorded occurrences of or potentially occurring Threatened and Priority listed fauna within the survey area;

- Undertake searches on available databases for details relating to any Threatened and Priority listed fauna previously identified as occurring or potentially occurring within the survey area;
- Conduct fauna habitat mapping and identify habitat types which are suitable for each significant fauna considered likely or possible to occur, or fauna recorded in the survey area;
- Undertake opportunistic, low intensity sampling of fauna; and
- Report on the conservation status of species present using the Western Australian Museum and *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) databases for presence of Threatened and Priority listed fauna species within the survey area.

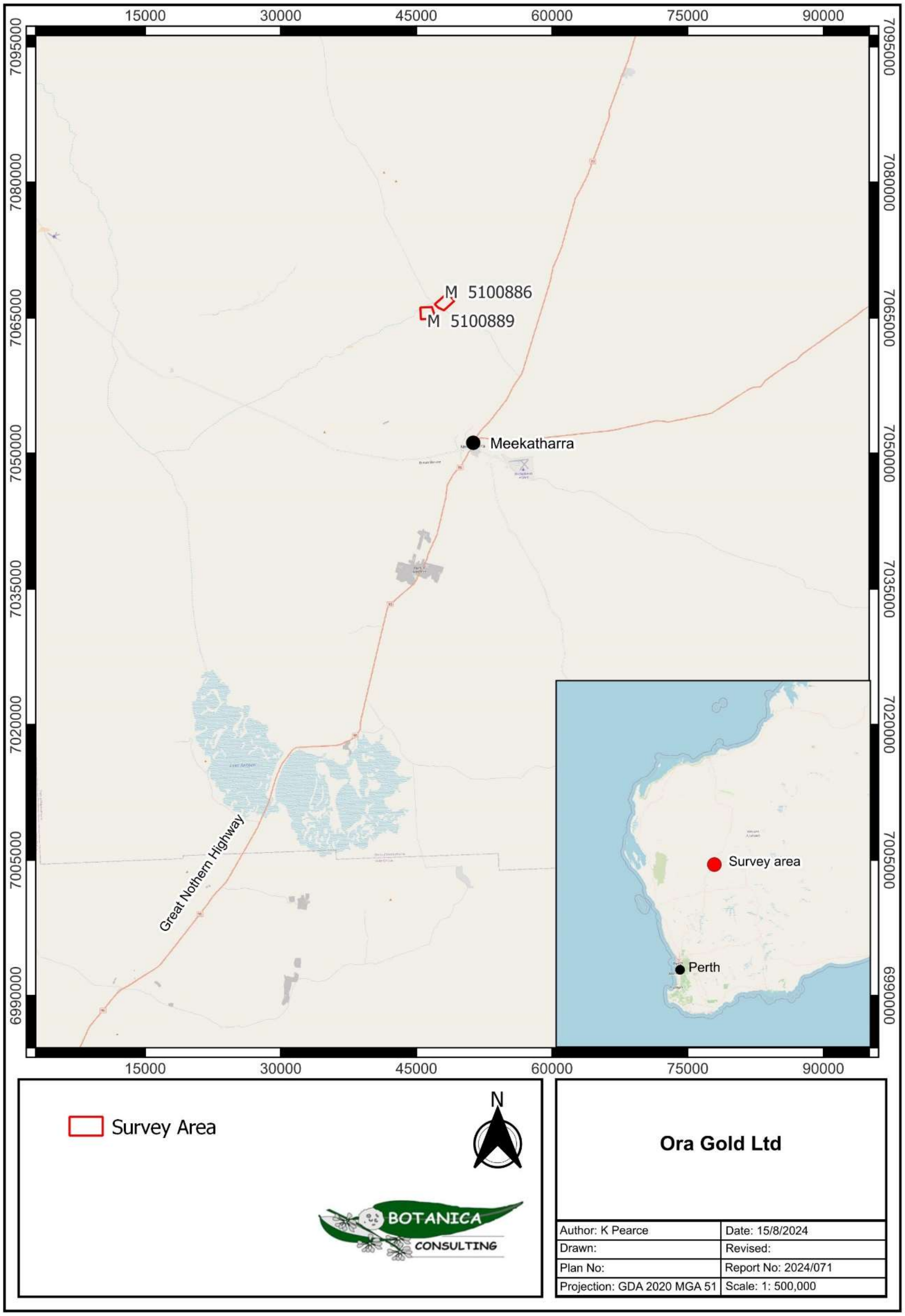

Figure 1-1: Regional map of the survey area

2 BIOPHYSICAL ENVIRONMENT

2.1 Regional Environnent

The survey area lies within the Eremaean Province of Western Australia (WA). Based on the Interim Biogeographic Regionalisation of Australia (IBRA, Version 7) (DotEE, 2012) the survey area is located within the Murchison Bioregion of WA. This bioregion is further divided into subregions with the survey area located within the Western Murchison (MUR2) subregion of the Murchison Bioregion (Figure 2-1).

The landscape of the Murchison Bioregion comprises low hills, mesas of duricrust separated by flat colluvium and alluvial plains (Commonwealth Government, 2020). It is dominated by the Archaean (over 2500 million years ago) granite greenstone terrain of the Yilgarn Craton (Commonwealth Government, 2008). Alluvial soils and sands mantle the granitic and greenstone units of the Yilgarn Craton. These soils are shallow, sandy and infertile. Underlying the soils in low areas is a red-brown siliceous hard pan (Curry *et al.* 1994). The soils in the eastern half of the bioregion are typically red sands, calcareous red earth soil, duplex soil and clays. There are 41 vegetation associations (hummock grasslands, succulent steppe or low woodlands) that have at least 85 per cent of their total area in the bioregion. The bioregion is rich and diverse in both its flora and fauna, but most species are wide ranging and usually occur in adjoining regions (McKenzie, May and McKenna, 2002).

The Western Murchison comprises the northern part of the 'Murchison' Terrains of the Yilgarn Craton. It is characterised by mulga low woodlands, often rich in ephemerals (usually with bunch grasses), on outcrop and fine textured Quaternary alluvial and eluvial surfaces (extensive hardpan washplains that dominate and characterise the subregion) mantling granitic and greenstone strata of the northern part of the Yilgarn Craton. Surfaces associated with the occluded drainage occur throughout with hummock grasslands on Quaternary sandplains, saltbush shrublands on calcareous soils and Tecticornia low shrublands on saline alluvia (Desmond, Cowan and Chant, 2001).

2.2 Land Use

The dominant land uses of the Western Murchison subregion include grazing native pastures (96.2%), unallocated crown land and crown reserves (2.81%) and conservation (0.06%). Mining has not been scored as these still come under Pastoral leases (Desmond, Cowan and Chant, 2001). The survey area is located within the Yoothapina Pastoral Lease in the Shire of Meekatharra.

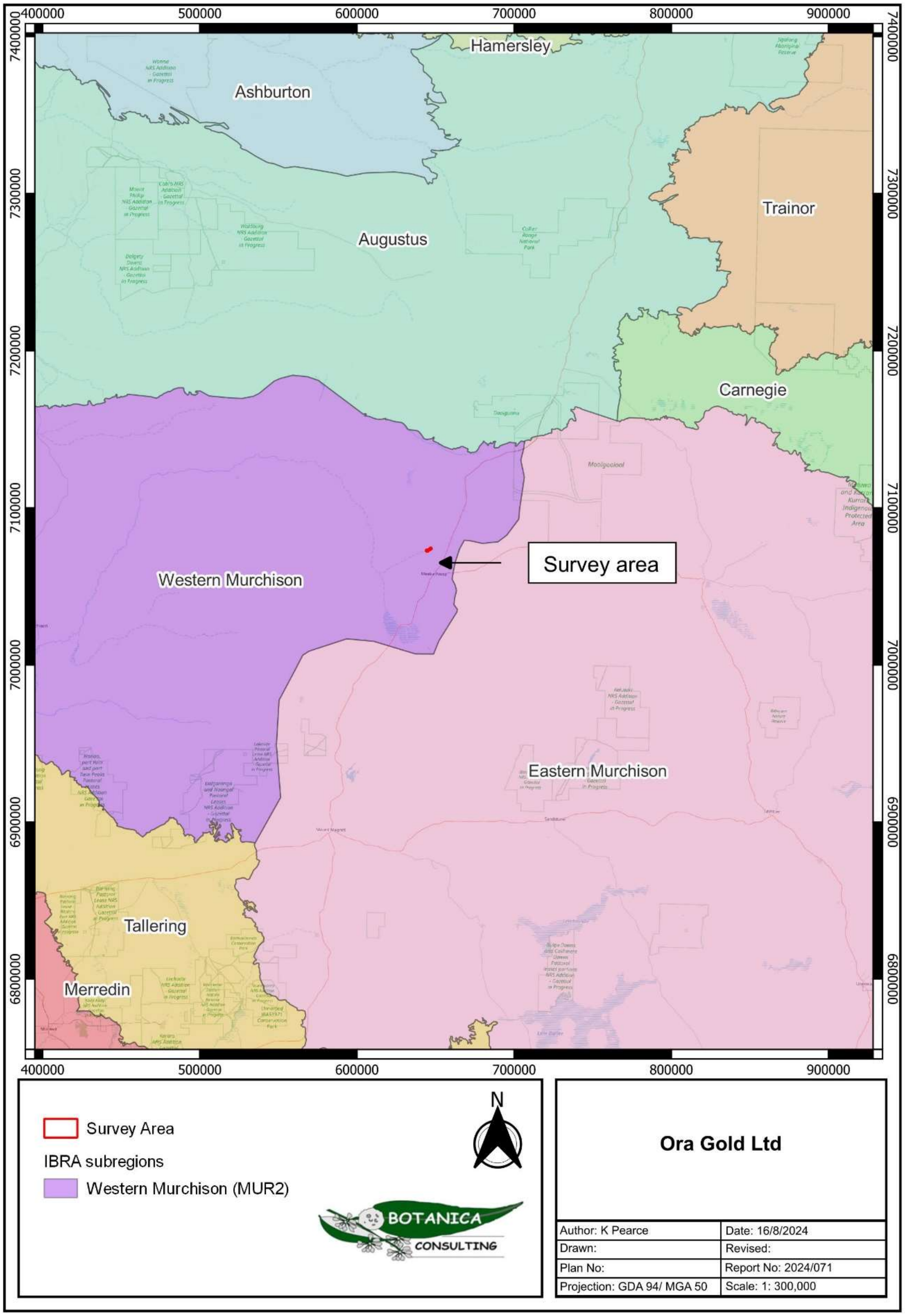

Figure 2-1: Map of IBRA Bioregions in relation to the survey area

2.3 Soil Landscape Systems

The survey area lies within the Murchison Province, which consists of hardpan wash plains and sandplains (with some stony plains, hills, mesas and salt lakes) on the granitic rocks and greenstone of the Yilgarn Craton. The Murchison Province is located in the inland Mid-west and northern Goldfields between three Springs, the Gascoyne River, Wiluna, Cosmo Newberry and Menzies. Soil types consist of red loamy earths, red sandy earths, red shallow loams, red deep sands and red-brown hardpan shallow loams with some red shallow sands and red shallow sandy duplexes present. Vegetation communities are predominately Mulga shrublands with spinifex grasslands, with areas of bowgada shrublands, Eucalypt woodlands and halophytic shrublands (Tille, 2006).

The Murchison Province is further divided into soil-landscape zones, with the survey area located within the Upper Murchison Zone (272). The Upper Murchinson Zone comprises of hardpan wash plains (with stony plains, sandplains, hills and mesas) on granite and gneiss of the Yilgarn Craton with red-brown hardpan shallow loams, red shallow loams, red loamy earths and red sands. Soils include red sandy earths, red deep sands, red shallow loams and red loamy earths with some red-brown hardpan shallow loams, salt lake soils and red shallow sandy duplexes. Vegetation is dominated by Mulga shrublands, with some halophytic shrublands. This zone is located in the north-western Murchison between Lake Nerramyne, Meekatharra, Cue and the Gascoyne River. (Tille, 2006).

In accordance with soil landscape system mapping data (Government of Western Australia, 2019), the soil landscape zones are divided into soil landscape systems, with the survey area located within two soil landscape systems, as described in Table 2-1 and shown in Figure 2-2.

Table 2-1: Soil landscape systems within the survey area

Soil Landscape System	Description	Extent within Survey Area
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	363 ha (92.2%)
Yandil System	Flat hardpan wash plains with mantles of small pebbles and gravels; supporting groved mulga shrublands and occasional wanderrie grasses.	31 ha (7.8%)
	Total	394 ha (100%)

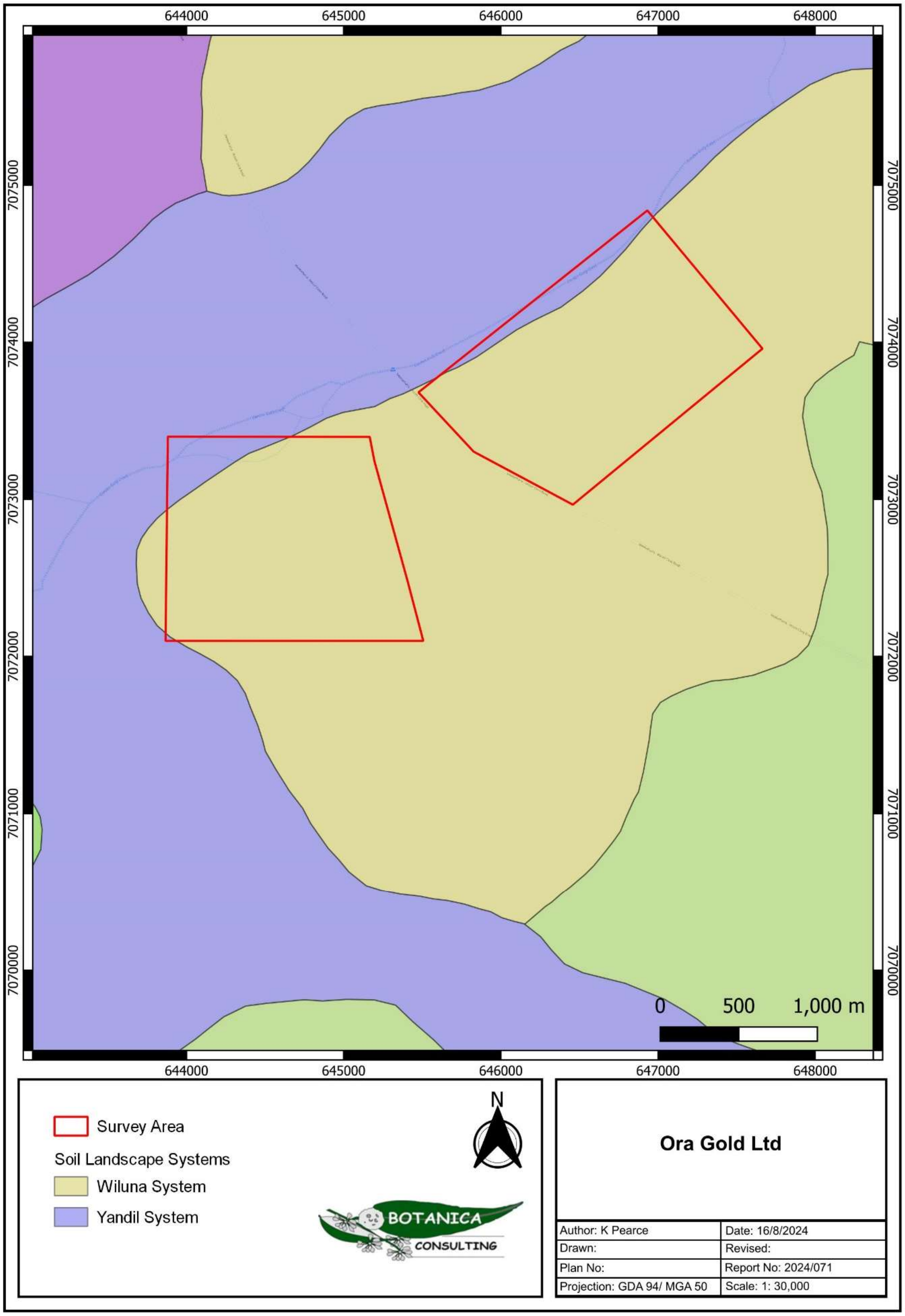

Figure 2-2: Map of soil landscape systems within the survey area

2.4 Regional Vegetation

Vegetation of the Murchison Bioregion is predominantly Mulga low woodlands on plains, often rich in ephemerals, which reduce to scrub on hills. It is also characterised by hummock grasslands, Saltbush shrublands and Samphire shrublands (Beard, 1990; McKenzie, May, and McKenna, 2002).

2.4.1 Pre-European Vegetation

The Pre-European vegetation association spatial mapping dataset (DPIRD, 2018) identified two vegetation associations as occurring within the survey area (Figure 2-3Figure 2-3). The association description and their remaining extent, as specified in the 2018 Statewide Vegetation Statistics (DBCA, 2019) are provided in Table 2-2. Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered "endangered" (EPA, 2000). Both vegetation associations retain >99% of their pre-European extent, and development within the survey area will not significantly reduce the current extent of these vegetation associations.

The most extensive vegetation type in Western Australia is the *Acacia aneura* (mulga) low woodland, open low woodland and sparse woodland, covering over 36 million ha. These low woodlands of mulga and associated species (mainly Acacias) are distributed throughout the Murchison, Gascoyne, Great Victoria Desert, Central Ranges and Pilbara Bioregions and they also extend into the Gibson Desert, Little Sandy Desert, Nullarbor and Yalgoo Bioregions (Beard *et al*, 2013).

Table 2-2: Pre-European vegetation associations within the survey area

Vegetation Association	Pre-European extent remaining	% Protected for Conservation	Floristic Description	Extent within Survey Area
Upper Murchison 29	99.97%	0	Low woodland, open low woodland or sparse woodland of Mulga (*Acacia aneura*) and associated species.	45.4 ha (11.5%)
Upper Murchison 18	99.73%	0	Low woodland, open low woodland or sparse woodland of Mulga (*Acacia aneura*) and associated species.	348.6 ha (88.5%)
			Total	394 ha (100%)

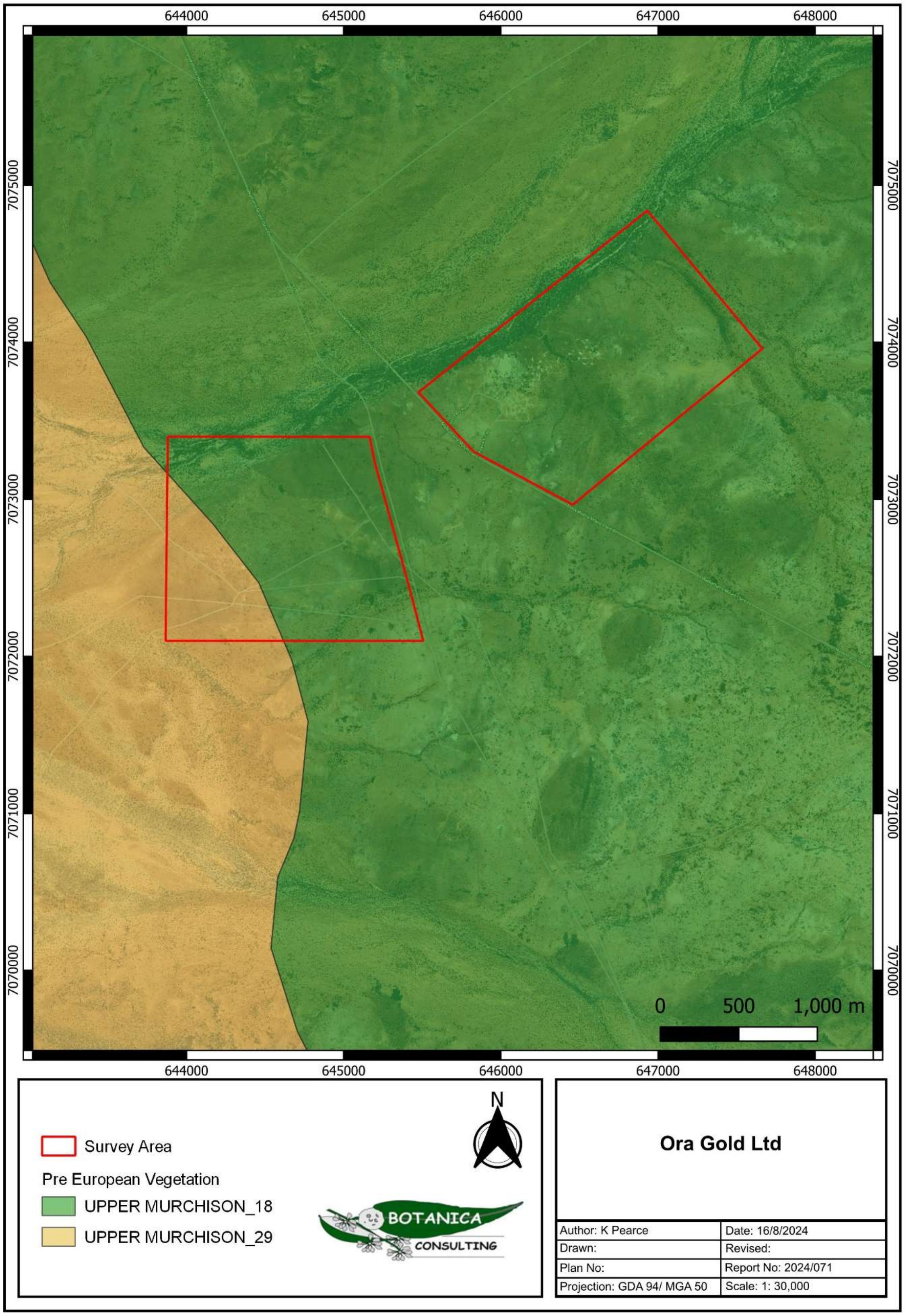

Figure 2-3: Pre-European vegetation systems within the survey area

2.5 Climate

The climate of the Western Murchison subregion is characterised as an arid climate with bimodal rainfall that usually falls in winter (Desmond, Cowan and Chant, 2001). Rainfall data for the Meekatharra Airport weather station (#7045), located approximately 20 km south-east of the survey area, is shown in Figure 2-4. The Meekatharra Airport weather station has an annual rainfall average of 233.8 mm. The rainfall for January and April 2024 was above average. Rainfall for June 2024 was significantly higher than the average, 46 mm of this fell prior to the survey being done (BoM, 2024a).

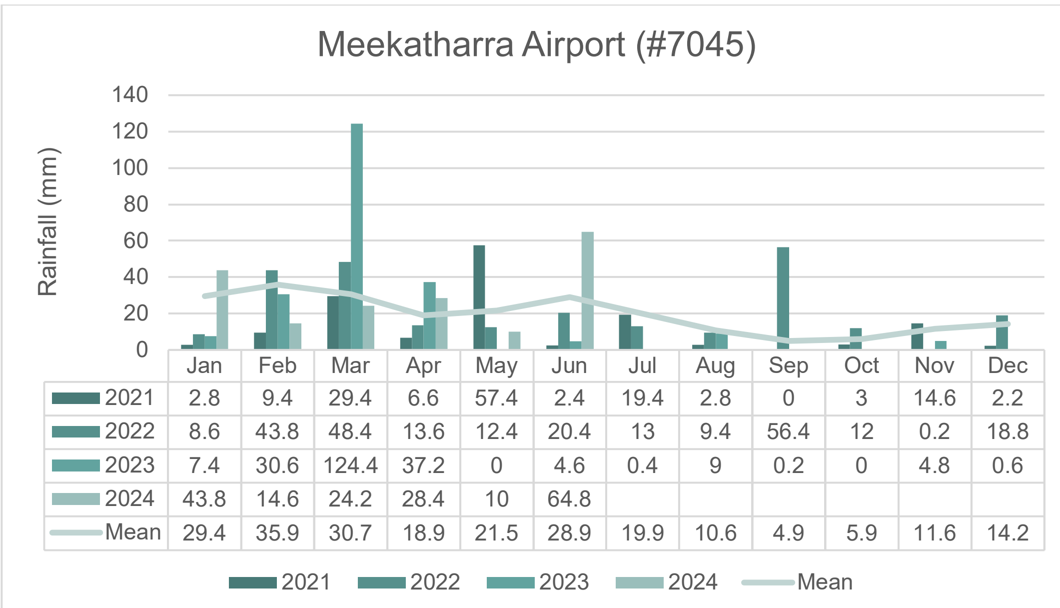

Figure 2-4: Climate data for Meekatharra Airport (#7045) (BoM, 2024)

2.6 Conservation Values

No Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) listed under the Commonwealth EPBC Act, or the Western Australian BC Act are known to occur within the survey area. There are six PECs within 40 km of the survey area (Table 2-3, Figure 2-5).

Table 2-3: Priority Ecological Communities within a 40 km radius of the survey area

Community	Conservation Status	Description (DBCA, 2023)	Locality
Yagahong Land System	Priority 3	Rough greenstone ridges, hills and cobble-strewn footslopes supporting mulga shrublands.	Four occurrences within 40 km of the survey area, the nearest is approximately 7 km to the west of the survey area.
Austin Land System	Priority 3	Saline stony plains with low rises and drainage foci supporting low halophytic shrublands with scattered mulga; occurs mainly adjacent to lakes Austin and Annean below greenstone hill systems.	The nearest occurrence is approximately 7 km to the south of the survey area.

Community	Conservation Status	Description (DBCA, 2023)	Locality
Belele calcrete groundwater assemblage type on Murchison palaeodrainage on Belele Station	Priority 1	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Located approximately 32 km west of the survey area.
Trillbar Land System	Priority 3	Gently sloping stony plains with low rises of metamorphic rocks and gilgaied drainage foci; supports more or less saline shrublands of snakewood, mulga, bluebush and samphire with patches of tussock grassland.	Located approximately 28 km southeast of the survey area.
Karalundi calcrete groundwater assemblage type on Murchison palaeodrainage on Karalundi Station	Priority 1	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Located approximately 36 km northeast of the survey area.
Killara North calcrete groundwater assemblage types on Murchison palaeodrainage on Killara Station	Priority 1	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	Located approximately 38 km northeast of the survey area.

There are no Ramsar wetlands or wetlands of national importance (ANCA Wetlands) within the survey area or within 40 km of the survey area. Lake Annean (Lake Nannine) is a wetland of national importance but is located 50 km south of the survey area. There are no Environmentally Sensitive Areas (ESA) as listed under the EP Act within the survey area, or within 40 km of the survey area (Figure 2-5).

There are no DBCA-managed lands, gazetted or proposed Reserves within the survey area, or within 40 km of the survey area. The nearest Legislated Reserve is the Lakeside Conservation Park (R54420), approximately 130 km south west of the survey area.

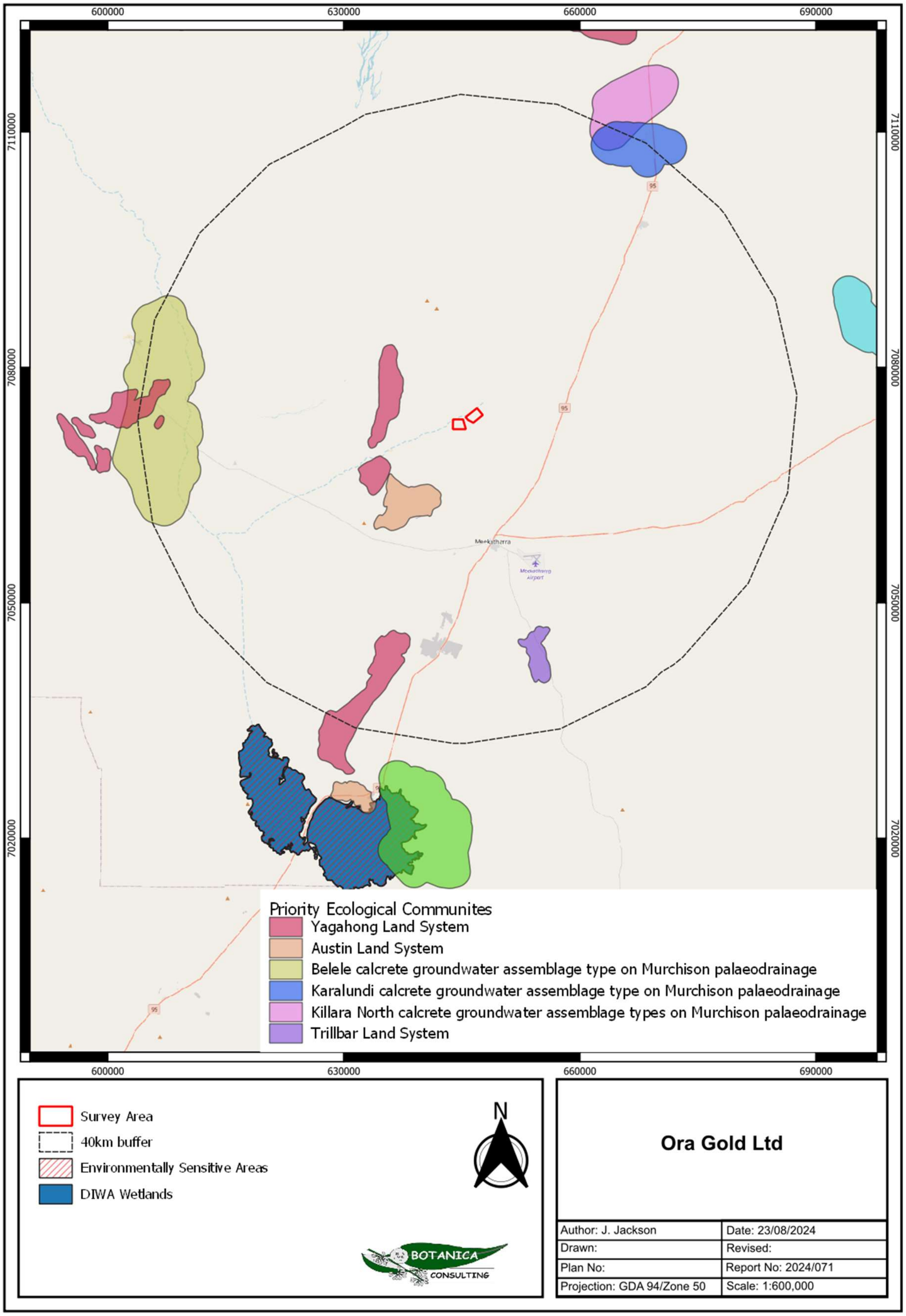

Figure 2-5: Conservation Values in relation to the survey area

2.7 Hydrology

The survey area is in the Murchison River Catchment. One Major and several minor ephemeral drainage lines intersect the survey area (Figure 2-6). The Garden Gully Creek is listed as a Major ephemeral drainage line and intersects the northern part of the survey area (Crossman and Li, 2015).

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or woodlands that use groundwater either opportunistically or as their primary water source. For the purposes of this report, a GDE is defined as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency. In accordance with the BoM *Atlas of Groundwater Dependent Ecosystems* (BoM, 2024b) database, there are no known or potential aquatic GDEs within the survey area. There are two potential terrestrial GDEs in the survey area (Table 2-4, Figure 2-6).

Table 2-4: Potential terrestrial groundwater dependent ecosystems (BoM, 2024b)

Ecosystem Description	GDE Potential based on national assessment (BoM, 2024b)
Low greenstone hills with occasional lateritic breakaways and broad stony slopes, lower saline stony plains and broad drainage tracts.	Low potential
Flat hardpan wash plains with mantles of small pebbles and gravels; supporting groved mulga shrublands and occasional wanderrie grasses.	Low potential

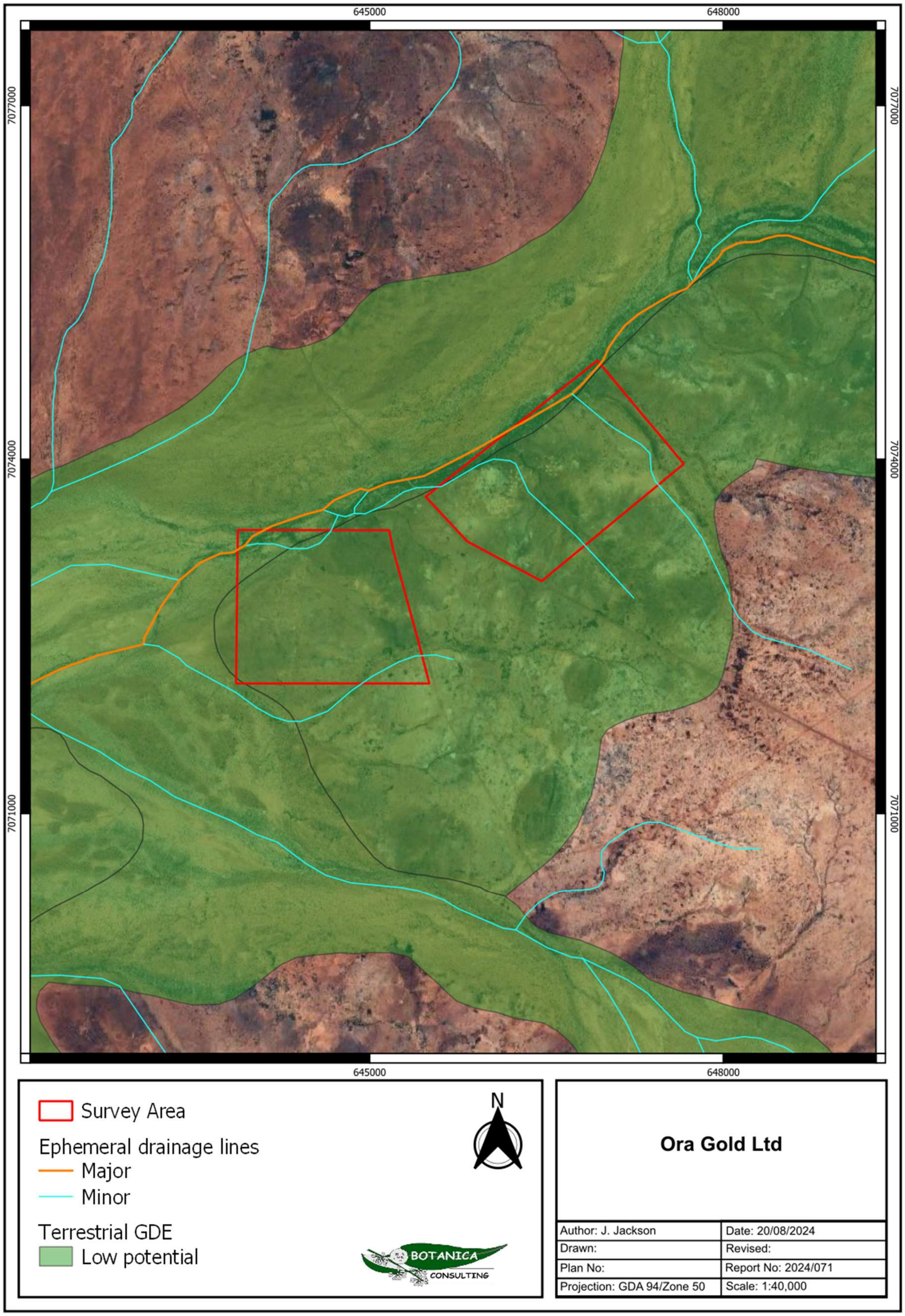

Figure 2-6: Regional hydrology of the survey area

3 SURVEY METHODOLOGY

3.1 Desktop Assessment

Prior to the field assessment a literature review was undertaken of previous flora and fauna assessments conducted within the local region. Documents reviewed included:

- Botanica (2021). *Desktop Flora and Fauna Assessment: Murchison Exploration Project.* Unpublished report prepared for Evolution Mining Group, April 2021.
- MWH (2015). *Lake Annean Flora and Fauna Assessment.* Unpublished report prepared for Metals X Ltd, September 2015.
- MWH (2017). *Aladdin Project: Reconnaissance Flora and Fauna Assessment*. Unpublished report prepared for Westgold Resources Ltd., March 2017.
- Native Vegetation Solutions (2018). *Reconnaissance Flora and Vegetation Survey, Golden Shamrock Prospect, Central Murchison Gold Project.* Unpublished Report for Westgold Resources Ltd., May 2018.

Database search requests for significant flora (ref: 62-0824FL) (DBCA, 2024b), fauna (ref: 44-0824FA) (DBCA, 2024c) and communities (ref: 40-0824EC) (DBCA, 2024d) were submitted to DBCA for records within the survey area, with a 40 km buffer applied.

In addition to the literature review and DBCA database search requests, searches of the following online databases were also undertaken (using the survey area and 40 km buffer as stated above) to aid in the compilation of a list of potential significant flora and fauna within the survey area:

- Atlas of Living Australia (ALA) database (ALA, 2024);
- Dandjoo database (DBCA, 2024a); and
- EPBC Protected Matters search tool (DCCEEW, 2024).

Significant flora species identified by the desktop review were assessed with regards to their population extent and distribution and preferred habitat to determine their likelihood of occurrence within the survey area. The assessment categorised flora species as follows:

- **Unlikely:** Suitable habitat is not expected to occur and/or the survey area is outside the known range of the species.
- **Possible:** Suitable habitat may be present, and the area is within the known range of the species. This option is also used when there is insufficient information to determine the preferred habitat of a species.
- **Likely:** Suitable habitat is expected to occur and there are records within 10 km of the survey area.

- **Previously Recorded:** A record for this species is located within the survey area. Field survey will ground-truth currently occurring individuals and populations.

It should be noted that these lists are based on observations from a broader area than the assessment area (40 km radius) and therefore may include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

The conservation significance of flora taxa was assessed using data from the following sources:

- Environment Protection and Biodiversity and Conservation (EPBC) Act 1999. Administered by the Australian Government (DCCEEW);
- Biodiversity Conservation (BC) Act 2016. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- Priority Flora/ Fauna list. A non-legislative list maintained by DBCA for management purposes (fauna list released 30th April 2024, flora list released 1st May 2024).

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)[1];
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

Most but not all migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as Matters of National Environmental Significance (MNES) under the EPBC Act. Descriptions of conservation significant species and communities are provided in APPENDIX A.

[1] Most but not all species listed under JAMBA are also specially protected under Specially Protected Species of the BC Act.

3.2 Flora and Vegetation Field Assessment

Botanica conducted a reconnaissance flora/ vegetation and basic fauna surveys on the 26th June 2024. This was conducted by Jennifer Jackson (Senior Botanist, BSc Environmental Management (Honours)) and Kiefer Millet (Field Technician). The area was traversed on foot and by 4WD.

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between existing vegetation communities.

The survey was conducted using a series of survey sites (relevés) as shown in Figure 3-1. At each relevé site, the area was walked on foot to observe and record all flora species. The distance surveyed at each relevé varied dependent on the diversity/ variability of species and landforms/ vegetation types. At each relevé, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum;
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the Botanica Herbarium and Western Australian Herbarium. Vegetation was classified in accordance with NVIS classifications.

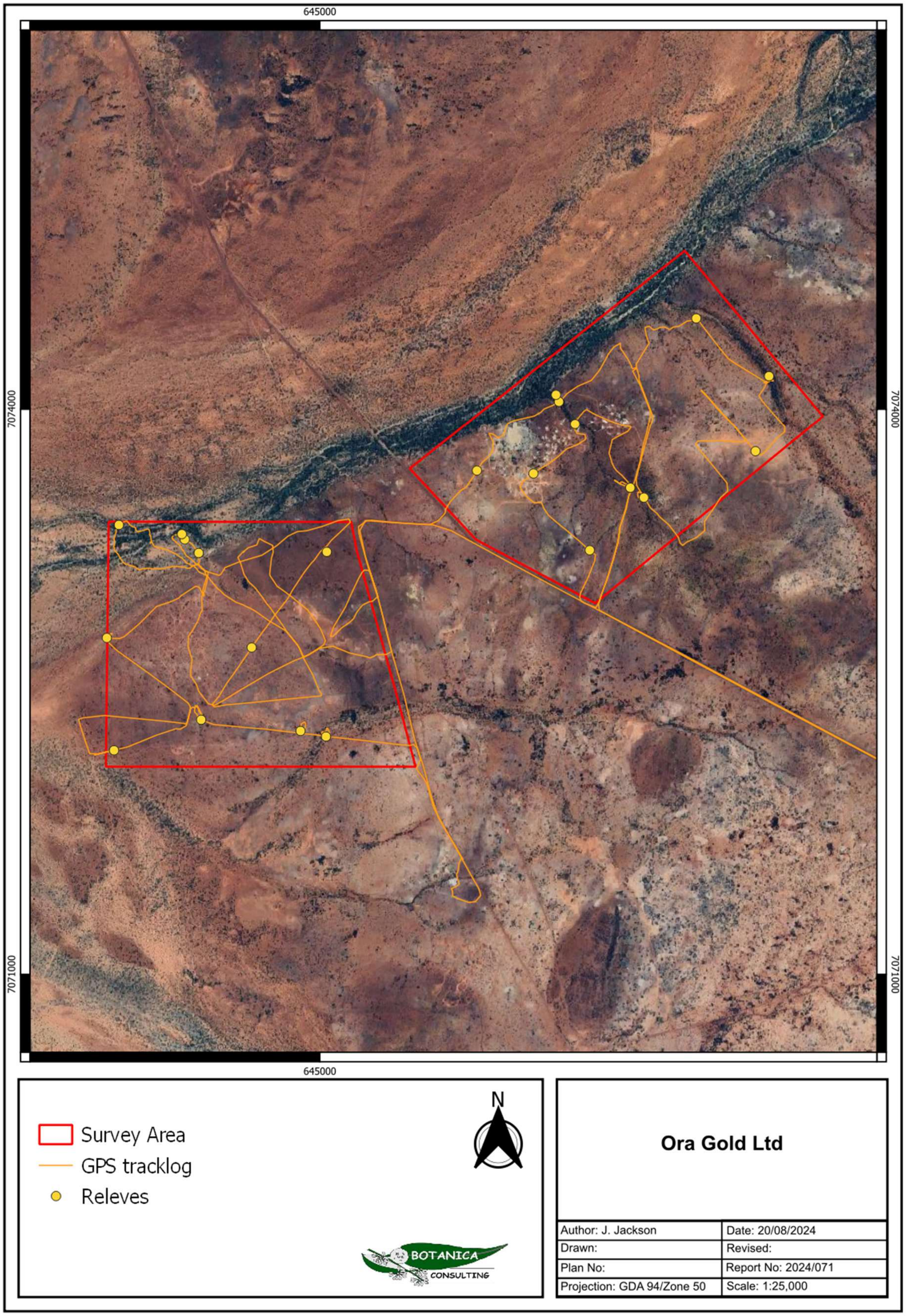

Figure 3-1 GPS tracklog of the 2024 survey effort

3.3 Data Analysis Tools

Following field assessments, vegetation types and condition were mapped using the GIS program QGIS, and the hectare area/ percentage area of each vegetation type and condition within the survey area was calculated. Spatial maps illustrating the location of vegetation types, and any significant flora/ vegetation and fauna were generated using QGIS.

3.4 Terrestrial Fauna Field Assessment

Fauna habitat types were identified across the survey area based on broad major vegetation groups and associated landform. A handheld GPS unit was used to record the coordinates of the boundaries between fauna habitats and each habitat was photographed.

The main aim of the fauna habitat assessment was to determine the likelihood of a species of conservation significance utilising habitat within the survey area. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

Available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area (determined from the desktop assessment) was researched. During the field survey, the habitats within the survey area were assessed and specific elements identified, if present, to determine the likelihood of listed Threatened and Priority species utilising habitat within the survey area.

Fauna of conservation significance identified during the literature review and database searches as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the survey area. The rankings and criteria used were:

- **Would Not Occur:** There is no suitable habitat for the species in the survey area and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
- **Locally Extinct:** Populations no longer occur within a small part of the species natural range, in this case within 10 or 20 km of the survey area. Populations do however persist outside of this area.
- **Regionally Extinct:** Populations no longer occur in a large part of the species natural range, in this case within the Eastern Murchison subregion. Populations do however persist outside of this area.
- **Unlikely to Occur:** The survey area is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the site itself would not support a population or part population of the species.

- **Possibly Occurs:** Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in literature from within or near the survey area. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- **Known to Occur**: The species in question has been positively identified as being present (for sedentary species) or as using the survey area as habitat for some other purpose (for non-sedentary/mobile species) during field surveys within or near the survey area. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. tracks, foraging debris, scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

3.5 Scientific Licences

Table 3-1: Scientific Licenses of Botanica Staff coordinating the survey

Licensed Staff	Permit Number	Date of Expiry
Jennifer Jackson	FB62000309-02 (Licence to take flora for scientific purposes)	11/01/2027

3.6 Survey Limitations and Constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 3-2.

The conclusions presented in this report are based upon field data and environmental assessments and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. Also, it should be recognised that site conditions can change with time. Information not available at the time of this assessment which may subsequently become available may alter the conclusions presented.

Some species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the survey area or immediately adjacent. The habitat requirements and ecology of many of the species known to occur in the wider area are however often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitats or microhabitats within the survey area. As a consequence of this limitation, the potential species list produced is most likely an overestimation of those species that actually utilise the survey area for some purpose.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any flora species that would possibly occur within the survey area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the author, has been listed as having the potential to occur.

Table 3-2: Limitations and constraints associated with the flora/ vegetation and fauna survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot. The survey area was accessible by numerous access tracks.
Competency/ Experience	Not a constraint	The Botanica personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Staff**: Jennifer Jackson (Senior Environmental Consultant). **Data Interpretation**: Jim Williams (Botanist), Kym Pearce and Jennifer Jackson.
Timing of survey, weather & season	Not a constraint	Fieldwork was undertaken outside the EPA's recommended primary survey time period for the Eremaean Province (i.e., 6-8 weeks following winter rainfall). Above average rainfall was received in April 2024, eight weeks prior to the survey and immediately prior to the survey in June.
Area disturbance	Not a constraint	The majority of native vegetation survey area was in completely degraded to good condition.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a reconnaissance survey completed to identify vegetation types/fauna habitats and conservation significant species/communities.
Availability of contextual information at a regional and local scale	Not a constraint	BoM, DWER, DPIRD, DBCA and DCCEEW databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Botanica has conducted numerous surveys within the Murchison bioregion and was also able to obtain information about the area from previous research conducted within the area. Results of previous assessments in the local area were reviewed to provide context on the local environment.
Completeness	Not a constraint	In the opinion of Botanica, the survey area was covered sufficiently in order to identify vegetation assemblages. All observed flora individuals were able to be identified to species level. The vegetation associations for this study were based on visual descriptions of locations in the field. The distribution of these vegetation associations outside the survey area is not known, however vegetation associations identified were categorised via comparison to vegetation distributions throughout WA given on NVIS (DotEE, 2017).

4 RESULTS

4.1 Desktop Assessment

4.1.1 Flora

The Dandjoo database search (DBCA, 2024a) identified 640 vascular flora species as previously being recorded within 40 km of the survey area. The full list of vascular flora identified by the desktop search is contained in Appendix B.

4.1.2 Introduced Flora

The desktop review identified 19 introduced flora (weed) species as previously being recorded within 40 km of the survey area (DBCA, 2024a). Of these, one species is listed as a Declared Pest on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management* (BAM) *Act 2007* and also as a Weed of National Significance (WONS) (Table 4-1).

Table 4-1: Introduced flora known to occur within 40 km of the survey area

Taxon	Common Name	Declared Pest	WONS
Brassica tournefortii	Mediterranean Turnip	N	N
Cenchrus ciliaris	Buffel grass	N	N
Cenchrus setiger	Birdwood grass	N	N
Chenopodium murale	Nettle-leaf Goosefoot	N	N
Cuscuta epithymum	Lesser dodder	N	N
Hordeum glaucum	Northern Barley Grass	N	N
Malva parviflora	Marshmallow	N	N
Opuntia stricta	Common Prickly Pear	Y	Y
Papaver hybridum	Rough poppy	N	N
Portulaca pilosa	Djanggara	N	N
Rostraria pumila	Tiny bristle-grass	N	N
Rumex vesicarius	Ruby dock	N	N
Schinus molle var. areira	Peppercorn	N	N
Schismus arabicus	Araby grass	N	N
Sisymbrium erysimoides	Smooth mustard	N	N
Sisymbrium irio	London rocket	N	N
Sisymbrium orientale	Indian Hedge Mustard	N	N
Solanum nigrum	Black Berry Nightshade	N	N
Sonchus oleraceus	Common Sowthistle	N	N

4.1.3 Significant Flora

Assessment of the DBCA's Threatened and Priority Flora database records (Ref: 62-0824FL) (DBCA, 2024b), EPBC Protected Matters (DCCEEW, 2024), Dandjoo database (DBCA, 2024a) and previous relevant literature identified one Threatened Flora and 15 Priority Flora as occurring within a 40 km radius of the survey area.

These taxa were assessed for distribution and known habitat to determine their likelihood of occurrence within the survey area (Table 4-2). The locations of the DBCA database records are illustrated spatially in Figure 4-1.

Table 4-2: Significant flora potentially occurring within the survey area

Taxon	Rank			Habitat Description	Assessment
	EPBC	BC Act	DBCA		
Acacia speckii			P4	Rocky soils over granite, basalt or dolerite. Rocky hills or rises.	Unlikely, no habitat fitting this description in the survey area.
Calytrix verruculosa	-	-	P3	Sandy clay. Shallow hardpan plain.	Possible.
Drummondita miniata			P3	Laterite. Breakaways.	Unlikely, no breakaways in the survey area.
Eremophila fasciata			P3	Stony hill.	Unlikely, no habitat fitting this description in the survey area.
Eremophila retropila	-	-	P1	Gravelly loam. Stony flats.	Possible.
Euploca mitchellii			P1	Rocky hills.	Unlikely, no rocky hills in the survey area.
Goodenia berringbinensis			P4	Red sandy loam. Along watercourses.	Possible.
Grevillea inconspicua	-	-	P4	Along drainage lines on rocky outcrops, creeklines.	Possible.
Hemigenia virescens			P3	Yellow-red sandy clay.	Unlikely, no habitat fitting this description in the survey area.
Homalocalyx echinulatus			P3	Laterite. Breakaways, sandstone hills.	Unlikely, no habitat fitting this description in the survey area.
Indigofera rotula			P3	Red loamy banks of watercourses.	Possible.
Lepidium xylodes	-	-	P1	Gravelly loam, clayey sand.	Possible.
Menkea draboides	-	-	P3	Red sand or clay, granite.	Possible.
Pityrodia augustensis	VU	VU		Amongst rocks on slopes or in drainage lines.	Not likely, nearest known population is >300 km to the north west.
Ptilotus lazaridis			P3	Clay loam. Floodplains.	Possible.
Ptilotus luteolus			P3	Hillslopes.	Unlikely, no hillslopes in the survey area.

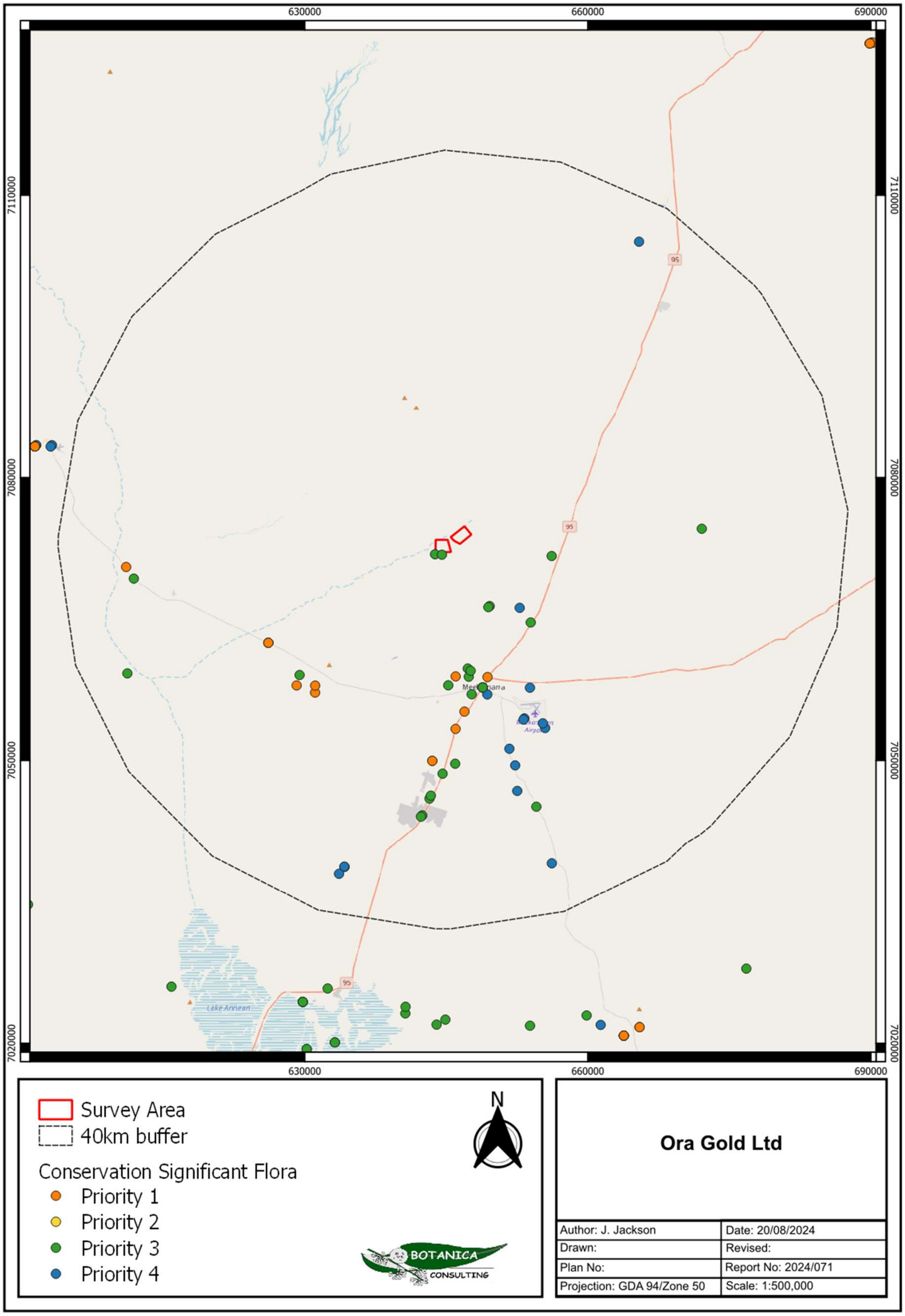

Figure 4-1: Significant flora within the desktop search area

4.1.4 Fauna

The combined Dandjoo database search (DBCA, 2024a) and ALA spatial portal results (ALA, 2024) identified a total of 204 terrestrial vertebrate fauna taxa within 40 km of the survey area, consisting of 154 bird, 10 mammal, 38 reptile and two amphibian taxa. The full list of vertebrate fauna identified by the desktop search is contained in Appendix B.

4.1.4.1 Conservation Significant Fauna

The desktop review (DBCA 2024b, DCCEEW 2024) identified nine terrestrial vertebrate species and one invertebrate species of conservation significance as previously being recorded in the regional area, consisting of eight Threatened and one otherwise specially protected species. In addition, several migratory wading/shorebird species were assessed collectively due to their similar habitat requirements.

Habitat and distribution data was used to determine the likelihood of occurrence within the survey area. The assessment identified two significant fauna species as possibly occurring in the survey area (Table 4-3).

Table 4-3: Conservation significant fauna previously recorded within 40 km of the survey area

Class	Taxon	Conservation Status			Habitat Description	Likelihood of Occurrence
		EPBC Act	BC Act	Priority		
Reptile	*Liopholis kintorei* Great desert skink	VU	-	-	Endemic to the Australian arid zone in the western deserts region (DCCEEW, 2024).	The PMST report suggests that the species or species habitat may occur in the buffer area. Would not occur. Nearest mainland population is >280 km to the northeast.
Bird	*Aphelocephala leucopsis* Southern whiteface	VU	-	-	Occur across most of mainland Australia south of the tropics, Southern whitefaces live in a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both (DCCEEW, 2024).	Unlikely, no DBCA records of any sightings within 40 km of the survey area. The PMST report suggests that the species or species habitat may occur in the area.
	Falco hypoleucos Grey falcon	VU	VU	-	occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia, frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses (DCCEEW, 2024).	Possible- area may form part of larger home range.
	Leipoa ocellata Mallee fowl	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species (DCCEEW, 2024).	Unlikely, no DBCA records of any sightings within 40 km of the survey area. The PMST report suggests that the species or species habitat may occur in the area.
	Falco peregrinus Peregrine falcon	-	OS	-	Known to inhabit open grasslands, wooded areas (ALA, 2024).	Possible- area may form part of larger home range.
	Calidris acuminata Sharp-tailed Sandpiper	VU	MI		Intertidal mudflats, also freshwater swamps and saltwater lakes (ALA, 2024).	Would not occur, no habitat in the survey area.
	Calidris ferruginea Curlew Sandpiper	CR	CR		Intertidal mudflats, also freshwater swamps and saltwater lakes (ALA, 2024).	Would not occur, no habitat in the survey area.
	Pezoporus occidentalis Night parrot	EN	CR	-	Broad habitat requirements include areas of old-growth spinifex (Triodia) for roosting and nesting, together with foraging habitats that are likely to include various native grasses and herbs and may or may not contain shrubs or low trees. (DPaW, 2017).	Would not occur. Considered to be regionally extinct.

Class	Taxon	Conservation Status			Habitat Description	Likelihood of Occurrence
		EPBC Act	BC Act	Priority		
	Migratory Shorebirds (inc Common sandpiper, Red necked stint)	MI	IA	-	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland (DotEE, 2018).	No suitable habitat (wetlands) present within the survey area. Would not occur.
Invertebrate	*Idiosoma nigrum* Shield-backed trapdoor spider	VU	EN	-	Dry woodlands east of the Darling Scarp and north to Moore River (ALA, 2024).	The PMST report suggests that the species or species habitat may occur in the buffer area. Would not occur. Nearest mainland populations are >250 km to the southwest.

4.2 Field Assessment

4.2.1 Flora

The field survey identified 80 vascular flora taxa within the survey area. These taxa represented 44 genera across 26 families, with the most diverse families being Fabaceae (17 species), Chenopodiaceae (ten species) and Scrophulariaceae (nine species), followed by dominant genera include *Acacia* (12 species) and *Eremophila* (nine species). Twenty annual species were observed during the survey. The full field species inventory is listed in Appendix C.

4.2.1.1 Introduced Flora

Six introduced flora (weeds) species were observed within the survey area during the survey (Table 4-4). These were observed in disturbed areas and along tracks, and their locations were not marked. None of these species are listed as a Declared Pest on the Western Australian Organism List (WAOL) under the Biosecurity and Agriculture Management (BAM) Act 2007 or as a Weed of National Significance.

Table 4-4: Introduced flora species within the survey area

Family	Taxon	Common Name
Aizoaceae	*Mesembryanthemum crystallinum*	Iceplant
Asteraceae	*Bidens bipinnata*	Bipinnate Beggartick
Brassicaceae	*Sisymbrium irio*	London rocket
Cucurbitaceae	*Cucumis myriocarpus*	Paddy Melon
Poaceae	*Cenchrus ciliaris*	Buffel grass
Zygophyllaceae	*Tribulus terrestris*	Caltrop

4.2.1.2 Significant Flora

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant flora includes:

- flora being identified as threatened or priority species;
- locally endemic flora or flora associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- flora representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);

- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- flora with relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

One Priority flora species was observed within the survey area, *Grevillea inconspicua* (P4) (Table 4-5 and Figure 4-2). Approximately 30 plants were seen growing in a dry drainage line.

Grevillea inconspicua is known from more than 30 populations (WAHERB, 1998-) and is known to occur in two IBRA subregions, the Eastern Murchison and Western Murchison. There are seven populations within approximately 100 km of the survey area (DBCA, 2024a), and according to Florabase (WAHERB, 1998-) the species covers a range of more than 50,000 km².

No Threatened or otherwise significant flora species were identified within the survey area.

Table 4-5: Significant flora recorded within the survey area

Taxon	Conservation Code	Description	Image
Grevillea inconspicua	Priority 4	Intricately branched, spreading shrub, 0.6-2 m high. Flowers are white/pink-white, flowers from June to August (WAHERB, 1998-). Known from numerous populations in the Western and Eastern Murchison sub-regions. Approximately 30 plants were observed in a drainage line.	

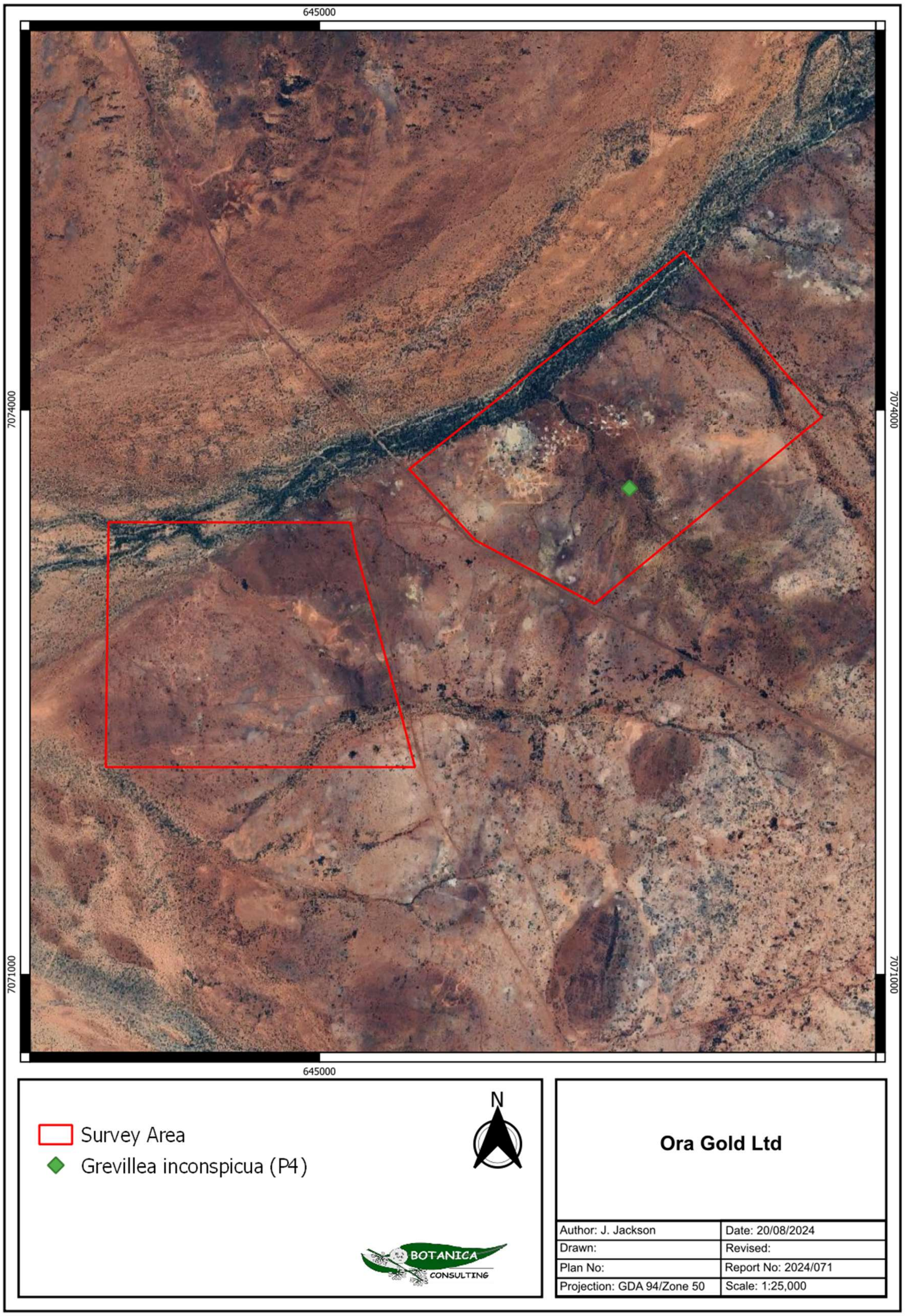

Figure 4-2: Location of Priority flora in the survey area

4.2.2 Vegetation Communities

A total of four broad-scale vegetation communities were identified within the survey area. Vegetation community descriptions and extent are listed below in Table 4-6 and illustrated spatially in Figure 4-3. These vegetation types were identified within two landform types and comprised of three major vegetation groups. Vegetation community descriptions and extents were determined from field survey results, aerial imagery interpretation and extrapolation of the communities.

The survey found RP-AOW1 was the most widespread community in the survey area, occupying 175 ha (44.4 %), while DD-EFW1 was the most restricted with 16 ha (4 %). The most diverse vegetation type was DD-AFW1 with 49 species (61%), while the least diverse was DD-EFW1 and CLP-AOW1 both with 14 species (17.5%).

Table 4-6: Summary of vegetation types within the survey area

Landform	NVIS Vegetation Group	Veg Code	Vegetation Type	Area (ha)	Area (%)	Image
Plain	Acacia open woodlands (MVG 13)	RP-AOW1	Mid woodland of *Acacia pruinocarpa* and *Acacia incurvaneura* over mid open shrubland of *Acacia grasbyi, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Maireana triptera* and *Enchylaena tomentosa* on rocky plain.	175	44.4	
	Acacia open woodlands (MVG 13)	CLP-AOW1	Mid woodland of *Acacia incurvaneura* over mid shrubland of *Eremophila compacta* over low sparse shrubland of *Solanum lasiophyllum* and *Aristida contorta* on clay loam plain.	115	29.3	

Landform	NVIS Vegetation Group	Veg Code	Vegetation Type	Area (ha)	Area (%)	Image
Drainage depression	Acacia forests and woodlands (MVG 6)	DD-AFW1	Mid open forest of *Acacia incurvaneura* over mid open shrubland of *Acacia tetragonophylla, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* in drainage depression.	63	16	
	Eucalypt woodlands (MVG 5)	DD-EFW1	Mid open forest of *Eucalyptus camaldulensis* over mid open shrubland of *Acacia tetragonophylla, Eremophila galeata and Senna* sp. Meekatharra over low sparse shrubland of *Ptilotus obovatus* and *Solanum lasiophyllum* in drainage depression.	16	4.0	
Cleared areas				25	6.3	
Total				**394**	**100**	

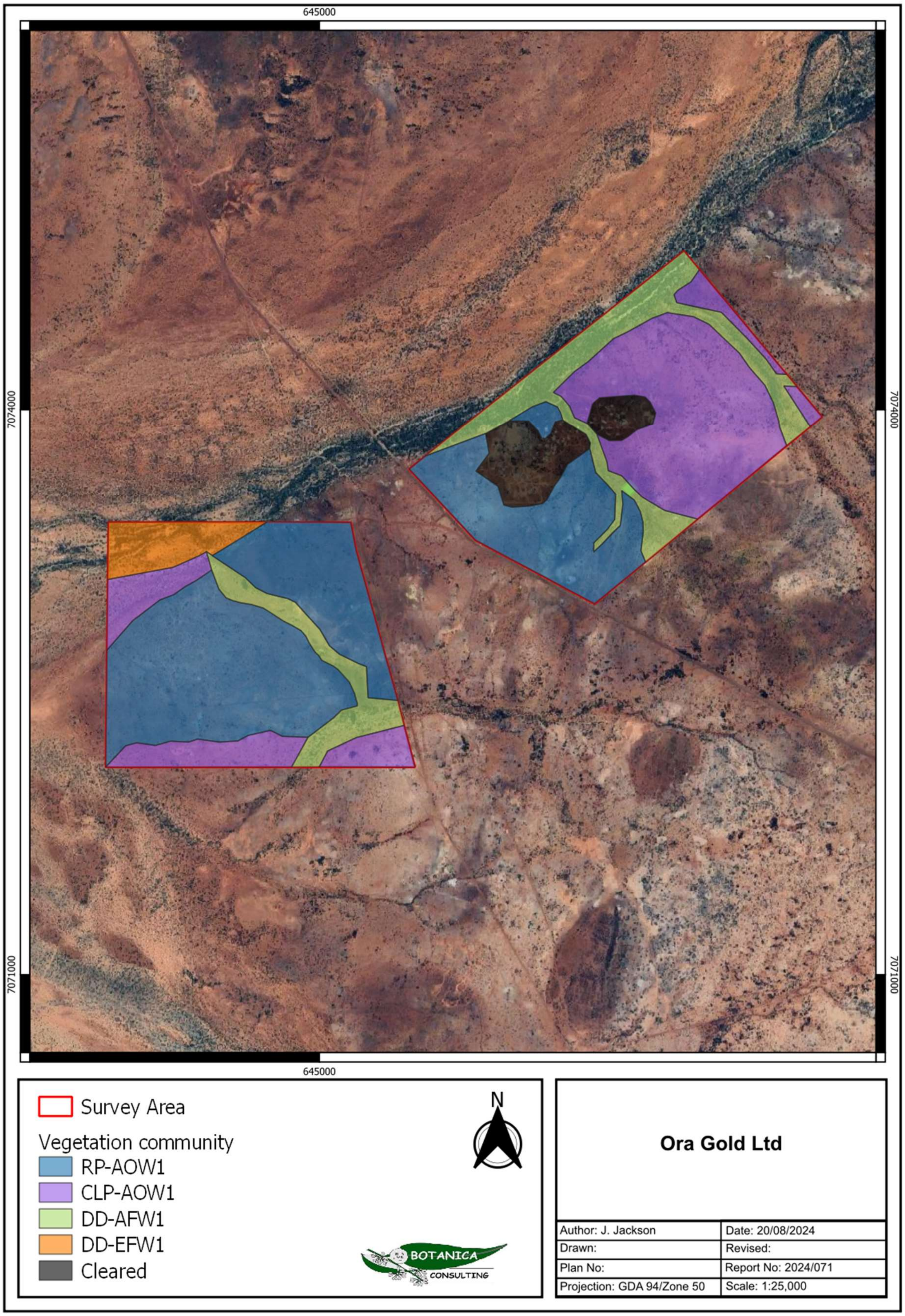

Figure 4-3: Vegetation types within the survey area

4.2.3 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery (1994) and Trudgen, (1988), native vegetation within the survey area was categorized as 'good', with cleared areas considered completely degraded (Table 4-7, Figure 4-4). Vegetation condition rating descriptions are listed in Appendix B. Impacts to vegetation within the survey area include access tracks, historical and current mining and exploration disturbances and heavy grazing.

Table 4-7: Vegetation condition rating within the survey area

Condition rating	Description	Area (ha)	Area (%)
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.	369	93.7%
Completely degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.	25	6.3%
TOTAL		**394**	**100**

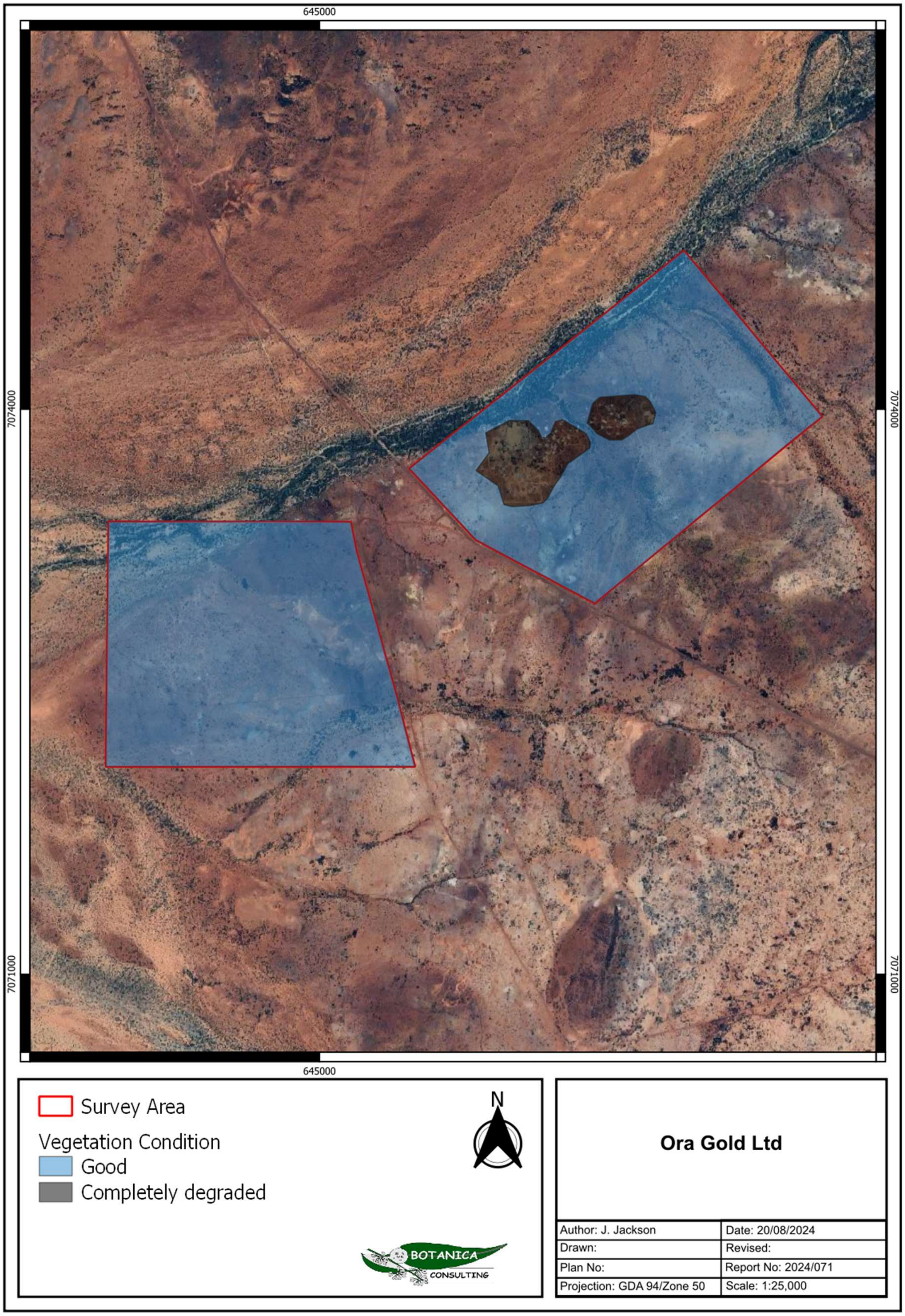

Figure 4-4: Vegetation condition within the survey area

4.2.4 Significant Vegetation

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant vegetation includes:

- vegetation being identified as threatened or priority ecological communities;
- vegetation with restricted distribution;
- vegetation subject to a high degree of historical impact from threatening processes;
- vegetation which provides a role as a refuge; and
- vegetation providing an important function required to maintain ecological integrity of a significant ecosystem.

No Threatened, Priority or otherwise significant ecological communities were identified within the survey area.

4.2.5 Fauna

4.2.5.1 Fauna Habitat

Based on vegetation and associated landforms identified during the flora and vegetation assessment, two broad scale terrestrial fauna habitats were identified as occurring within the survey area. Table 4-9 provides the area and a visual representation of fauna habitat types, and the extent of fauna habitats is shown spatially in Figure 4-5.

Table 4-8 provides a list of opportunistic observations of fauna species were made during the field survey with a total of 12 fauna species observed.

Table 4-8: Fauna species observed during the field survey

Taxon	Common Name	Comments
Avifauna		
Aquila audax	Wedge-tailed eagle	Observed
Barnardius zonarius	Ringneck parrot	Observed
Corvus orru	Torresian crow	Heard
Geopelia cuneata	Diamond Dove	Observed
Lichmera indistincta	Brown honey eater	Observed
Oreoica gutturalis	Crested bellbird	Heard
Phaps chalcoptera	Common bronzewing	Observed
Psephotellus varius	Mulga Parrot	Observed
Taeniopygia castanotis	Zebra finch	Observed
Mammals		
Bos taurus	Cattle	Tracks and Scats Observed
Oryctolagus cuniculus	Rabbit	Scats Observed
Macropus sp.	Kangaroo and/or Euro	Tracks and Scats Observed

Table 4-9: Main terrestrial fauna habitats within the survey area

Fauna Habitat	Description	Representative Fauna Attributes	Example Image
Acacia open woodland on rocky or clay-loam plain Area= 290 ha (73.6%)	Open *Acacia* woodland over *Eremophila* shrubland	• Ground not particularly suited to burrowing species. • Low diversity vegetation strata supporting a reduced avifauna assemblage. • Low vegetation density and low leaf litter supporting some small reptiles.	

Fauna Habitat	Description	Representative Fauna Attributes	Example Image
Acacia and/or *Eucalypt* woodland in drainage line Area=79 ha (20%)	Closed *Acacia* and/or *Eucalypt* woodland over mixed *Acacia* and *Eremophila* shrubland	• Ground moderately suited to burrowing species in some areas. • Moderate diversity vegetation strata supporting a good avifauna assemblage. • Moderate vegetation density and moderate leaf litter supporting small reptiles.	

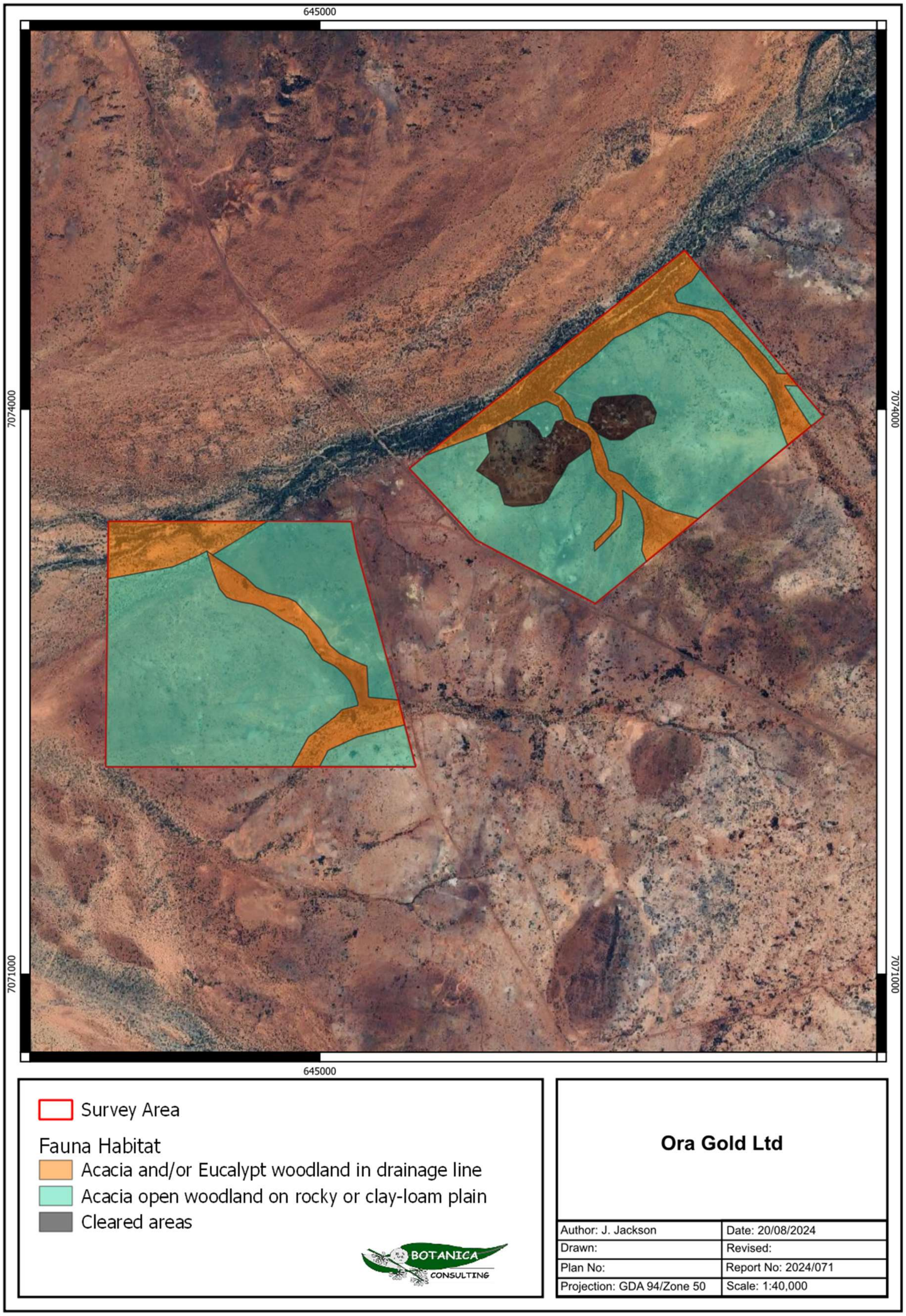

Figure 4-5: Fauna habitats within the survey area

4.2.5.2 Significant Fauna

According to the EPA *Environmental Factor Guideline for Terrestrial Fauna* (EPA, 2016c) significant fauna includes:

- Fauna being identified as a Threatened or Priority species;
- Fauna species with restricted distribution;
- Fauna subject to a high degree of historical impact from threatening processes; and
- Fauna providing an important function required to maintain the ecological integrity of a significant ecosystem.

No evidence of significant fauna species was observed during the survey.

The current status of some species on site and/or in the general area is difficult to determine, however, based on the habitats present and, in some cases, direct observations or recent nearby records, the following species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

- **Grey Falcon (*Falco hypoleucos)* - Vulnerable (EPBC Act and BC Act)**

  This species is sparsely recorded throughout inland Australia. Suitable habitat may be present but is unlikely to represent critical habitat.

- **Peregrine Falcon (Falco peregrinus) - OS (DBCA)**

  This species is sparsely recorded throughout inland Australia. Suitable habitat may be present but is unlikely to represent critical habitat.

It should be noted that while habitats onsite for one or more of the species listed above are considered possibly suitable, some or all may be marginal in extent/quality and therefore the fauna species considered as possibly occurring may in fact only visit the area for short periods as infrequent vagrants.

4.3 Matters of National Environmental Significance

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act protects matters of national environmental significance and is used by the Commonwealth DCCEEW to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance. Matters of national environmental significance as defined by the Commonwealth EPBC Act include:

- Nationally threatened flora and fauna species;
- World heritage properties;
- National heritage places;
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- Nationally threatened ecological communities;
- Commonwealth marine area;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

No Matters of National Environmental Significance were identified within the survey area.

4.4 Matters of State Environmental Significance

4.4.1 *Environmental Protection Act WA 1986*

The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The Act is administered by The Department of Water and Environment Regulation (DWER), which is the State Government's environmental regulatory agency.

Under Section 51C of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations (Regulations) WA 2004* any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the *EP Act 1986* or under the Regulations 2004 requires a clearing permit from the DWER or DEMIRS. Under Section 51A of the *EP Act 1986* native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the *EP Act 1986* defines clearing as "the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above". Exemptions under Schedule 6 of the EP Act and the EP Regulations do not apply in ESAs as declared under Section 51B of the EP Act or TEC listed under State and Commonwealth legislation.

No Matters of State Environmental Significance were identified within the survey area. No Environmentally Sensitive Areas were identified within the survey area.

4.4.2 *Biodiversity Conservation Act 2016*

This Act is used by the Western Australian DBCA for the conservation and protection of biodiversity and biodiversity components in Western Australia and to promote the ecologically sustainable use of biodiversity components in the State. Taxa are classified as ‘Threatened” when their populations are geographically restricted or are threatened by local processes (see following sections for Threatened definitions). Under this Act all native flora and fauna are protected throughout the State. Financial penalties are enforced under this Act if threatened species are collected without an appropriate license.

Under Section 54(1) of the BC Act, habitat is eligible for listing as critical habitat if:

a) it is critical to the survival of a threatened species or a threatened ecological community; and
b) its listing is otherwise in accordance with the ministerial guidelines.

No threatened species or critical habitat listed under the BC Act were recorded within the survey area.

4.5 Other Areas of Conservation Significance

The DBCA lists ‘Priority’ species and communities which are under consideration for declaration as ‘Threatened’ under the BC Act. These Priority species/ communities have no formal legal protection until they are endorsed by the Minister as being Threatened. No PECs as listed by DBCA were identified within the survey area. One Priority Flora taxon was observed within the survey area: *Grevillea inconspicua* (P4).

There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within the survey area.

There are no gazetted or proposed conservation reserves within the survey area. The nearest Legislated Reserve is the Lakeside Conservation Park (R54420), approximately 130 km south west of the survey area.

5 DISCUSSION AND CONCLUSIONS

The field survey identified 80 vascular flora taxa within the survey area. These taxa represented 44 genera across 26 families. Twenty annual species were observed during the survey. Six weed species were recorded within the survey. These species are not listed as Declared Pests on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management* (BAM) *Act 2007* or as Weeds of National Significance.

One Priority flora species was identified in the survey area. *Grevillea inconspicua* (P4) was observed growing in a drainage line. This taxon is apparently widespread across the Murchison Bioregion. No other Priority flora, Threatened flora or otherwise significant flora species were identified within the survey area.

A total of four broad-scale vegetation communities were identified within the survey area. These vegetation communities are considered to be of low biological diversity and are well represented outside the survey area.

Native vegetation within the survey area was categorised as 'Good' with cleared areas considered completely degraded. Impacts to vegetation within the survey area include access tracks, historical and current mining and exploration activities, and grazing by large feral herbivores.

No Threatened, Priority or otherwise significant ecological communities were identified within the survey area. No Environmentally Sensitive Areas were identified within the survey area. There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within the survey area.

The vegetation types identified in the survey area mostly aligned with the Ecosystem descriptions provided by the BoM *Atlas of Groundwater Dependent Ecosystems (BoM, 2024b),* however it is difficult to determine how dependant these communities are on groundwater, they are more likely to obtain their water requirements from surface water.

Two broad scale terrestrial fauna habitats were identified as occurring within the survey area. No evidence of significant fauna species were observed during the survey.

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APPENDIX A: CONSERVATION RATINGS BC ACT AND EPBC ACT

Definitions of Conservation Significant Species

Code	Category
State categories of Threatened and Priority species	
Threatened Species (T) 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).	
CR	**Critically Endangered** 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** 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** 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 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 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.	
IA	**International Agreement/ Migratory** 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

Code	Category
	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** 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*.
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.	
P1	**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.
P2	**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.
P3	**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.
P4	**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.
Commonwealth categories of Threatened species	
EX	**Extinct**

Code	Category
	Taxa where there is no reasonable doubt that the last member of the species has died.
EW	**Extinct in the Wild** Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CR	**Critically Endangered** Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
EN	**Endangered** Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
VU	**Vulnerable** Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Definitions of conservation significant communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PD	**Presumed Totally Destroyed**
	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:
	• records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or;
	• all occurrences recorded within the last 50 years have since been destroyed.
CR	**Critically Endangered**
	An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria:
	The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification;
	The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;
	The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**
	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. The ecological community must meet any one of the following criteria:
	The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short-term future, or is unlikely to be substantially rehabilitated in the short-term future due to modification;
	The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;
	The ecological community is highly modified with potential of being rehabilitated in the short-term future.

Category Code	Category
VU	**Vulnerable**
	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:
	The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated;
	The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution;
	The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	**Critically Endangered** If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
EN	**Endangered** If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
VU	**Vulnerable** If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).
Priority Ecological Communities	
P1	**Poorly-known ecological communities**
	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities**
	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities**
	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:
	Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;
	Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**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.
P5	**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.

APPENDIX B:
VEGETATION CONDITION RATING

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor		Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	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 and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e., areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX C:
LIST OF SPECIES IDENTIFIED WITHIN THE SURVEY AREA

(A) denotes annual flora; (W) denotes weed species.

Family	Genus	Species	RP-AOW1	DD-AFW1	DD-EFW1	CLP-AOW1
Aizoaceae	*Mesembryanthemum*	*crystallinum (A) (W)*	*			
Amaranthaceae	*Ptilotus*	*exaltatus (A)*	*			
Amaranthaceae	*Ptilotus*	*obovatus*	*	*	*	*
Amaranthaceae	*Ptilotus*	*roei*	*	*		
Amaranthaceae	*Ptilotus*	*rotundifolius*	*			
Asteraceae	*Bidens*	*bipinnata (W)*		*		
Boraginaceae	*Trichodesma*	*zeylanicum (A)*		*		
Brassicaceae	*Sisymbrium*	*irio (A) (W)*	*			
Chenopodiaceae	*Atriplex*	*codonocarpa (A)*	*			
Chenopodiaceae	*Dysphania*	*kalpari (A)*	*	*	*	
Chenopodiaceae	*Dysphania*	*melanocarpa (A)*	*			
Chenopodiaceae	*Enchylaena*	*tomentosa*	*			*
Chenopodiaceae	*Maireana*	*georgei*	*			*
Chenopodiaceae	*Maireana*	*triptera*	*			*
Chenopodiaceae	*Rhagodia*	*eremaea*	*			*
Chenopodiaceae	*Salsola*	*australis (A)*	*			*
Chenopodiaceae	*Sclerolaena*	*cuneata*	*			
Chenopodiaceae	*Sclerolaena*	*diacantha*	*	*		*
Convolvulaceae	*Duperreya*	*commixta*	*	*		
Cucurbitaceae	*Cucumis*	*myriocarpus (W)*	*	*		
Cyperaceae	*Bulbostylis*	*barbata*		*	*	

Family	Genus	Species	RP-AOW1	DD-AFW1	DD-EFW1	CLP-AOW1
Cyperaceae	*Cyperus*	*iria*		*	*	
Euphorbiaceae	*Euphorbia*	*boophthona (A)*		*	*	
Euphorbiaceae	*Euphorbia*	*drummondii (A)*	*	*	*	*
Fabaceae	*Acacia*	*acuminata*		*		
Fabaceae	*Acacia*	*aptaneura*	*			
Fabaceae	*Acacia*	*caesaneura*	*			*
Fabaceae	*Acacia*	*exocarpoides*		*		
Fabaceae	*Acacia*	*grasbyi*	*			
Fabaceae	*Acacia*	*incurvaneura*	*	*	*	*
Fabaceae	*Acacia*	*murrayana*		*		
Fabaceae	*Acacia*	*pruinocarpa*	*			
Fabaceae	*Acacia*	*quadrimarginea*	*	*		
Fabaceae	*Acacia*	*ramulosa var. linophylla*				*
Fabaceae	*Acacia*	*tetragonophylla*	*	*	*	
Fabaceae	*Acacia*	*victoriae*	*			
Fabaceae	*Senna*	*artemisioides* subsp. *helmsii*		*		*
Fabaceae	*Senna*	*artemisioides* subsp. *×artemisioides*		*		
Fabaceae	*Senna*	*artemisioides* subsp. *×sturtii*	*			
Fabaceae	*Senna*	*glutinosa* subsp. *chatelainiana*	*			
Fabaceae	*Senna*	*sp.* Meekatharra (E. Bailey 1-26)	*	*	*	
Haloragaceae	*Haloragis*	*odontocarpa (A)*		*	*	
Lamiaceae	*Teucrium*	*teucriiflorum*	*	*		
Loranthaceae	*Amyema*	*fitzgeraldii*	*	*		*
Malvaceae	*Abutilon*	*cryptopetalum*		*	*	
Malvaceae	*Hibiscus*	*burtonii*		*		
Malvaceae	*Sida*	*calyxhymenia*		*	*	
Malvaceae	*Sida*	*spodochroma*		*		
Marsileaceae	*Marsilea*	*hirsuta*			*	
Montiaceae	*Calandrinia*	*eremaea (A)*		*		
Montiaceae	*Calandrinia*	*ptychosperma (A)*		*	*	

Family	Genus	Species	RP-AOW1	DD-AFW1	DD-EFW1	CLP-AOW1
Myrtaceae	*Calytrix*	*carinata*		*		
Myrtaceae	*Eucalyptus*	*camaldulensis* subsp. *obtusa*		*	*	
Poaceae	*Aristida*	*contorta (A)*	*	*	*	*
Poaceae	*Cenchrus*	*ciliaris (W)*		*		
Poaceae	*Cymbopogon*	*ambiguus*			*	
Poaceae	*Enneapogon*	*caerulescens (A)*	*			*
Poaceae	*Enteropogon*	*ramosus*		*	*	
Poaceae	*Eragrostis*	*dielsii (A)*		*	*	
Poaceae	*Eragrostis*	*eriopoda*				*
Poaceae	*Eriachne*	*pulchella (A)*	*			*
Portulacaceae	*Portulaca*	*oleracea (A)*	*			
Proteaceae	*Grevillea*	*berryana*	*	*		*
Proteaceae	*Grevillea*	*inconspicua (Priority 4)*		*		
Proteaceae	*Hakea*	*lorea*		*	*	
Rubiaceae	*Psydrax*	*latifolia*	*	*	*	
Rubiaceae	*Psydrax*	*suaveolens*		*		
Santalaceae	*Santalum*	*spicatum*		*		
Scrophulariaceae	*Eremophila*	*compacta*				*
Scrophulariaceae	*Eremophila*	*exilifolia*	*	*		
Scrophulariaceae	*Eremophila*	*fraseri* subsp. *fraseri*	*	*	*	
Scrophulariaceae	*Eremophila*	*galeata*	*			*
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *latrobei*	*	*		*
Scrophulariaceae	*Eremophila*	*linearis*	*			
Scrophulariaceae	*Eremophila*	*longifolia*	*	*	*	
Scrophulariaceae	*Eremophila*	*macmillaniana*	*			
Scrophulariaceae	*Eremophila*	*phyllopoda*	*	*		
Solanaceae	*Solanum*	*lasiophyllum*	*	*	*	*
Zygophyllaceae	*Tribulus*	*astrocarpus (A)*	*			*
Zygophyllaceae	*Tribulus*	*terrestris (A) (W)*	*			*

APPENDIX D:
PRIORITY FLORA LOCATIONS (GDA 2020)

Taxon	Easting	Northing	Comments
Grevillea inconspicua (P4)	646644.1	7073581.5	Approximately 30 plants observed.

APPENDIX E:
DANDJOO AND ALA SEARCH RESULTS(40KM)

Vascular Flora

Accepted Name
Abutilon cryptopetalum (F.Muell.) Benth.
Abutilon fraseri (Hook.) Walp.
Acacia acuminata Benth.
Acacia aneura Benth.
Acacia aptaneura Maslin & J.E.Reid
Acacia ayersiana Maconochie
Acacia brachystachya Benth.
Acacia burkittii Benth.
Acacia caesaneura Maslin & J.E.Reid
Acacia citrinoviridis Tindale & Maslin
Acacia coolgardiensis Maiden
Acacia craspedocarpa F.Muell.
Acacia cuthbertsonii Luehm.
Acacia cuthbertsonii Luehm. subsp. cuthbertsonii
Acacia cuthbertsonii subsp. linearis R.S.Cowan & Maslin
Acacia cyperophylla Benth. var. cyperophylla
Acacia demissa R.S.Cowan & Maslin
Acacia effusifolia Maslin & Buscumb
Acacia exocarpoides W.Fitzg.
Acacia fuscaneura Maslin & J.E.Reid
Acacia grasbyi Maiden
Acacia incurvaneura Maslin & J.E.Reid
Acacia kempeana F.Muell.
Acacia ligulata Benth.
Acacia macraneura Maslin & J.E.Reid
Acacia mulganeura Maslin & J.E.Reid
Acacia murrayana Benth.
Acacia paraneura Randell
Acacia pruinocarpa Tindale
Acacia pteraneura Maslin & J.E.Reid
Acacia pyrifolia DC.
Acacia pyrifolia DC. var. pyrifolia
Acacia quadrimarginea F.Muell.
Acacia ramulosa var. linophylla (W.Fitzg.) Pedley
Acacia ramulosa W.Fitzg. var. ramulosa
Acacia rhodophloia Maslin
Acacia sclerosperma F.Muell.
Acacia sclerosperma F.Muell. subsp. sclerosperma
Acacia sclerosperma subsp. glaucescens A.R.Chapm. & Maslin
Acacia sibirica S.Moore
Acacia sp. Wiluna (B.R. Maslin 7090)
Acacia speckii R.S.Cowan & Maslin
Acacia subtessarogona Tindale & Maslin
Acacia synchronicia Maslin
Acacia tetragonophylla F.Muell.
Acacia thomae Maslin
Acacia tysonii Luehm.

Accepted Name
Acacia victoriae Benth.
Acacia victoriae Benth. subsp. victoriae
Acacia victoriae subsp. victoriae Benth.
Acacia wanyu Tindale
Acacia xanthocarpa R.S.Cowan & Maslin
Accepted name (dwc:acceptedNameUsage)
Actinobole oldfieldianum P.S.Short
Actinobole uliginosum (A.Gray) H.Eichler
Alternanthera angustifolia R.Br.
Alternanthera denticulata R.Br. var. denticulata
Aluta maisonneuvei (F.Muell.) Rye & Trudgen
Aluta maisonneuvei (F.Muell.) Rye & Trudgen subsp. maisonneuvei
Aluta maisonneuvei subsp. auriculata (F.Muell.) Rye & Trudgen
Amyema fitzgeraldii (Blakely) Danser
Amyema gibberula (Tate) Danser var. gibberula
Amyema nestor (S.Moore) Danser
Androcalva luteiflora (E.Pritz.) C.F.Wilkins & Whitlock
Angianthus cyathifer P.S.Short
Angianthus tomentosus J.C.Wendl.
Anthotroche pannosa Endl.
Areocleome oxalidea (F.Muell.) R.L.Barrett & Roalson
Argemone ochroleuca Sweet subsp. ochroleuca
Aristida contorta F.Muell.
Aristida holathera Domin var. holathera
Aristida inaequiglumis Domin
Aristida obscura Henrard
Asteridea chaetopoda (F.Muell.) Kroner
Atriplex amnicola Paul G.Wilson
Atriplex codonocarpa Paul G.Wilson
Atriplex lindleyi subsp. inflata (F.Muell.) Paul G.Wilson
Atriplex semilunaris Aellen
Atriplex vesicaria Benth.
Austrostipa elegantissima (Labill.) S.W.L.Jacobs & J.Everett
Austrostipa nitida (Summerh. & C.E.Hubb.) S.W.L.Jacobs & J.Everett
Austrostipa scabra (Lindl.) S.W.L.Jacobs & J.Everett
Boerhavia repleta Hewson
Brachyscome ciliaris (Labill.) Less.
Brachyscome simulans P.S.Short
Brassica tournefortii Gouan
Brunonia australis R.Br.
Bulbostylis barbata (Rottb.) C.B.Clarke
Calandrinia balonensis Lindl.
Calandrinia creethae Morrison
Calandrinia eremaea Ewart
Calandrinia lehmannii Endl.
Calandrinia monosperma Obbens
Calandrinia papillata Syeda
Calandrinia polyandra Benth.
Calandrinia ptychosperma F.Muell.
Calandrinia pumila (Benth.) F.Muell.
Calandrinia reticulata Syeda
Calandrinia schistorhiza Morrison
Calandrinia sp. Bungalbin (G.J. Keighery & N. Gibson 1656)
Calandrinia stagnensis J.M.Black
Calandrinia translucens Obbens
Callitris columellaris F.Muell.
Calocephalus beardii P.S.Short
Calocephalus francisii (F.Muell.) Benth.
Calocephalus knappii (F.Muell.) Ewart & Jean White

Accepted Name
Calocephalus multiflorus (Turcz.) Benth.
Calocephalus pilbarensis P.S.Short
Calotis hispidula (F.Muell.) F.Muell.
Calotis multicaulis (Turcz.) Druce
Calotis plumulifera F.Muell.
Calytrix amethystina Craven
Calytrix desolata S.Moore
Calytrix uncinata Craven
Calytrix verruculosa Craven
Cenchrus ciliaris L.
Cenchrus setiger Vahl
Centipeda thespidioides F.Muell.
Centrolepis cephaloformis Reader subsp. cephaloformis
Cephalipterum drummondii A.Gray
Chamelaucium gracile F.Muell.
Chara behriana A.Braun
Cheilanthes lasiophylla Pic.Serm.
Cheilanthes sieberi Kunze subsp. sieberi
Cheilanthes sieberi subsp. sieberi Kunze
Chenopodium gaudichaudianum (Moq.) Paul G.Wilson
Chenopodium murale L.
Chrysocephalum gilesii (F.Muell.) Paul G.Wilson
Chrysocephalum puteale (S.Moore) Paul G.Wilson
Chthonocephalus pseudevax Steetz
Chthonocephalus viscosus P.S.Short
Codonocarpus cotinifolius (Desf.) F.Muell.
Convolvulus clementii Domin
Corymbia candida K.D.Hill & L.A.S.Johnson
Corymbia candida K.D.Hill & L.A.S.Johnson subsp. candida
Corymbia candida subsp. candida K.D.Hill & L.A.S.Johnson
Corymbia ferriticola (Brooker & Edgecombe) K.D.Hill & L.A.S.Johnson
Corymbia lenziana (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson
Cotula australis (Spreng.) Hook.f.
Crassula colorata var. acuminata (Reader) Toelken
Cullen cinereum (Lindl.) J.W.Grimes
Cuscuta epithymum (L.) L.
Cymbopogon ambiguus (Hack.) A.Camus
Cymbopogon obtectus S.T.Blake
Cynanchum floribundum R.Br.
Cynodon prostratus (C.A.Gardner & C.E.Hubb.) P.M.Peterson
Cyperus betchei subsp. commiscens K.L.Wilson
Cyperus bulbosus Vahl
Cyperus concinnus R.Br.
Cyperus dactylotes Benth.
Cyperus gymnocaulos Steud.
Cyperus iria L.
Cyperus squarrosus L.
Dactyloctenium radulans (R.Br.) P.Beauv.
Daucus glochidiatus (Labill.) Fisch., C.A.Mey. & Ave-Lall.
Dichanthium sericeum (R.Br.) A.Camus subsp. sericeum
Dichanthium sericeum subsp. humilius (J.M.Black) B.K.Simon
Dicrastylis sessilifolia Munir
Dielitzia tysonii P.S.Short
Digitaria brownii (Roem. & Schult.) Hughes
Diplachne fusca subsp. muelleri (Benth.) P.M.Peterson & N.Snow
Dissocarpus paradoxus (R.Br.) Ulbr.
Dodonaea pachyneura F.Muell.
Dodonaea petiolaris F.Muell.
Drosera finlaysoniana Arn.

Accepted Name
Drummondita miniata (C.A.Gardner) Paul G.Wilson
Duboisia hopwoodii (F.Muell.) F.Muell.
Duperreya commixta (Staples) Staples
Duperreya sericea Gaudich.
Dysphania glandulosa Paul G.Wilson
Dysphania glomulifera subsp. eremaea Paul G.Wilson
Dysphania kalpari Paul G.Wilson
Dysphania melanocarpa (J.M.Black) Mosyakin & Clemants
Dysphania rhadinostachya (F.Muell.) A.J.Scott
Dysphania rhadinostachya subsp. inflata (Aellen) Paul G.Wilson
Dysphania saxatilis (Paul G.Wilson) Mosyakin & Clemants
Eleocharis pallens S.T.Blake
Enchylaena tomentosa R.Br. var. tomentosa
Enneapogon caerulescens (Gaudich.) N.T.Burb.
Enneapogon polyphyllus (Domin) N.T.Burb.
Eragrostis cumingii Steud.
Eragrostis dielsii Pilg.
Eragrostis eriopoda Benth.
Eragrostis falcata (Gaudich.) Steud.
Eragrostis filicaulis Lazarides
Eragrostis kennedyae F.Turner
Eragrostis lanipes C.E.Hubb.
Eragrostis leptocarpa Benth.
Eragrostis pergracilis S.T.Blake
Eragrostis setifolia Nees
Eragrostis sp. Erect spikelets (P.K. Latz 2122)
Eragrostis tenellula (Kunth) Steud.
Eremophea spinosa (Ewart & O.B.Davies) Paul G.Wilson
Eremophila clarkei A.F.Oldfield & F.Muell.
Eremophila compacta subsp. fecunda Chinnock
Eremophila enata Chinnock
Eremophila eriocalyx F.Muell.
Eremophila exilifolia F.Muell.
Eremophila fasciata Chinnock
Eremophila flabellata Chinnock
Eremophila foliosissima Kraenzl.
Eremophila forrestii F.Muell. subsp. forrestii
Eremophila forrestii subsp. forrestii F.Muell.
Eremophila forrestii subsp. hastieana (W.Fitzg.) Chinnock
Eremophila fraseri F.Muell.
Eremophila fraseri F.Muell. subsp. fraseri
Eremophila fraseri subsp. parva Chinnock
Eremophila freelingii F.Muell.
Eremophila galeata Chinnock
Eremophila georgei Diels
Eremophila gilesii F.Muell.
Eremophila gilesii F.Muell. subsp. gilesii
Eremophila gilesii subsp. variabilis Chinnock
Eremophila glabra (R.Br.) Ostenf. subsp. glabra
Eremophila glabra subsp. tomentosa Chinnock
Eremophila glutinosa Chinnock
Eremophila granitica S.Moore
Eremophila hygrophana Chinnock
Eremophila jucunda Chinnock subsp. jucunda
Eremophila jucunda subsp. jucunda Chinnock
Eremophila jucunda subsp. pulcherrima Chinnock
Eremophila lachnocalyx C.A.Gardner
Eremophila latrobei F.Muell.
Eremophila latrobei F.Muell. subsp. latrobei

Accepted Name
Eremophila latrobei subsp. glabra (L.S.Sm.) Chinnock
Eremophila latrobei subsp. latrobei F.Muell.
Eremophila linearis Chinnock
Eremophila longifolia (R.Br.) F.Muell.
Eremophila mackinlayi subsp. spathulata Chinnock
Eremophila macmillaniana C.A.Gardner
Eremophila maculata subsp. brevifolia (Benth.) Chinnock
Eremophila maitlandii Benth.
Eremophila malacoides Chinnock
Eremophila margarethae S.Moore
Eremophila oppositifolia subsp. angustifolia (S.Moore) Chinnock
Eremophila pantonii F.Muell.
Eremophila phyllopoda Chinnock
Eremophila phyllopoda Chinnock subsp. phyllopoda
Eremophila phyllopoda subsp. phyllopoda Chinnock
Eremophila platycalyx F.Muell.
Eremophila platycalyx F.Muell. subsp. platycalyx
Eremophila platycalyx subsp. Granites (D.J. Edinger & G. Marsh DJE 4782)
Eremophila platycalyx subsp. platycalyx F.Muell.
Eremophila platycalyx subsp. Yalgoo (A. Markey & S. Dillon 3337)
Eremophila pterocarpa W.Fitzg. subsp. pterocarpa
Eremophila punctata Chinnock
Eremophila retropila Chinnock
Eremophila serrulata (A.DC.) Druce
Eremophila setacea Chinnock
Eremophila simulans Chinnock subsp. simulans
Eremophila simulans subsp. lapidensis Chinnock
Eremophila spathulata W.Fitzg.
Eremophila spectabilis C.A.Gardner subsp. spectabilis
Eremophila spectabilis subsp. brevis Chinnock
Eremophila spectabilis subsp. spectabilis C.A.Gardner
Eremophila spuria Chinnock
Eremophila strongylophylla F.Muell.
Eremophila youngii F.Muell. subsp. youngii
Eremophila youngii subsp. youngii F.Muell.
Eriachne aristidea F.Muell.
Eriachne benthamii Hartley
Eriachne flaccida Hartley
Eriachne helmsii Hartley
Eriachne ovata Nees
Eriachne pulchella Domin
Erodium cygnorum Nees
Erymophyllum compactum Paul G.Wilson
Erymophyllum ramosum (A.Gray) Paul G.Wilson
Erymophyllum ramosum (A.Gray) Paul G.Wilson subsp. ramosum
Erymophyllum ramosum subsp. ramosum (A.Gray) Paul G.Wilson
Erymophyllum tenellum (Turcz.) Paul G.Wilson
Eucalyptus brevifolia F.Muell.
Eucalyptus camaldulensis subsp. obtusa (Blakely) Brooker & M.W.McDonald
Eucalyptus camaldulensis subsp. refulgens Brooker & M.W.McDonald
Eucalyptus carnei C.A.Gardner
Eucalyptus kingsmillii (Maiden) Maiden & Blakely
Eucalyptus leptopoda subsp. elevata L.A.S.Johnson & K.D.Hill
Eucalyptus striaticalyx W.Fitzg.
Eucalyptus trivalva Blakely
Eucalyptus victrix L.A.S.Johnson & K.D.Hill
Eulalia aurea (Bory) Kunth
Euphorbia boophthona C.A.Gardner
Euphorbia porcata Halford & W.K.Harris

Accepted Name
Euphorbia tannensis subsp. eremophila (A.Cunn.) Hassall
Euploca heterantha (F.Muell.) M.W.Frohl. & M.W.Chase
Euploca inexplicita (Craven) M.W.Frohl. & M.W.Chase
Euploca mitchellii (Craven) M.W.Frohl. & M.W.Chase
Euploca ovalifolia (Forssk.) Diane & Hilger
Exocarpos aphyllus R.Br.
Frankenia pauciflora DC.
Frankenia setosa W.Fitzg.
Gilruthia osbornei Ewart & Jean White
Glycine canescens F.J.Herm.
Gnephosis arachnoidea Turcz.
Gnephosis brevifolia (A.Gray) Benth.
Gnephosis tenuissima Cass.
Gomphrena verecunda R.W.Davis
Gonocarpus nodulosus Nees
Goodenia berardiana (Gaudich.) Carolin
Goodenia berringbinensis Carolin
Goodenia collaris (F.Muell.) K.A.Sheph.
Goodenia cycnopotamica (F.Muell.) K.A.Sheph.
Goodenia discophora (F.Muell.) K.A.Sheph.
Goodenia glabrata (Carolin) K.A.Sheph.
Goodenia havilandii Maiden & Betche
Goodenia kingiana Carolin
Goodenia macroplectra (F.Muell.) Carolin
Goodenia maideniana W.Fitzg.
Goodenia mimuloides S.Moore
Goodenia occidentalis Carolin
Goodenia peacockiana Carolin
Goodenia quasilibera Carolin
Goodenia reinwardtii (de Vriese) K.A.Sheph.
Goodenia rosea (S.Moore) K.A.Sheph.
Goodenia sp. Midwest (K.A. Shepherd & C.F. Wilkins KS 1609)
Goodenia tenuiloba F.Muell.
Goodenia wilunensis Carolin
Grevillea deflexa F.Muell.
Grevillea inconspicua Diels
Grevillea nematophylla subsp. supraplana Makinson
Grevillea sarissa S.Moore
Grevillea sarissa subsp. succincta McGill.
Grevillea stenostachya C.A.Gardner
Grevillea striata R.Br.
Gunniopsis propinqua Chinnock
Gymnema graniticola (P.I.Forst.) P.I.Forst.
Hakea lorea (R.Br.) R.Br.
Hakea loreus subsp. loreus (R.Br.) R.Br.
Hakea preissii Meisn.
Hakea recurva Meisn.
Hakea recurva subsp. arida (Diels) W.R.Barker & R.M.Barker
Halgania cyanea Lindl.
Halgania cyanea var. Allambi Stn (B.W. Strong 676)
Halgania gustafsenii F.Muell.
Haloragis gossei F.Muell.
Haloragis gossei F.Muell. var. gossei
Haloragis odontocarpa F.Muell.
Haloragis odontocarpa forma pterocarpa Orchard
Haloragis trigonocarpa F.Muell.
Harnieria kempeana (F.Muell.) R.M.Barker
Harnieria kempeana subsp. muelleri (R.M.Barker) R.M.Barker
Helipterum craspedioides W.Fitzg.

Accepted Name
Hemigenia tomentosa G.R.Guerin
Hemigenia virescens G.R.Guerin
Hibiscus burtonii F.M.Bailey
Hibiscus sp. Belele (D.W. Goodall 3417)
Hibiscus sp. Gardneri (A.L. Payne PRP 1435)
Hibiscus sturtii Hook.
Hibiscus sturtii var. forrestii F.Muell.
Hibiscus sturtii var. grandiflorus Benth.
Homalocalyx staminosus (F.Muell.) Craven
Hordeum glaucum Steud.
Hyalosperma glutinosum subsp. venustum (S.Moore) Paul G.Wilson
Indigofera brevidens Benth.
Indigofera chamaeclada Peter G.Wilson & Rowe subsp. chamaeclada
Indigofera georgei E.Pritz.
Indigofera kingiana Peter G.Wilson & Rowe
Indigofera monophylla DC.
Indigofera rotula Peter G.Wilson
Ipomoea calobra W.Hill & F.Muell.
Iseilema membranaceum (Lindl.) Domin
Isoetopsis graminifolia Turcz.
Isolepis australiensis (Maiden & Betche) K.L.Wilson
Isolepis congrua Nees
Isotropis forrestii F.Muell.
Isotropis iophyta Wege & R.W.Davis
Lactuca serriola L.
Lactuca serriola L. forma serriola
Lawrencella davenportii (F.Muell.) Paul G.Wilson
Lawrencella rosea Lindl.
Lawrencia densiflora (Baker f.) Melville
Lawrencia helmsii (F.Muell. & Tate) Lander
Leichhardtia australis R.Br.
Lemooria burkittii (Benth.) P.S.Short
Lemphoria andraeana (F.Muell.) Al-Shehbaz & Lysak
Lepidium echinatum Hewson
Lepidium muelleri-ferdinandi Thell.
Lepidium oxytrichum Sprague
Lepidium phlebopetalum (F.Muell.) F.Muell.
Lepidium platypetalum Hewson
Lepidium xylodes Hewson
Leptosema chambersii F.Muell.
Levenhookia chippendalei F.L.Erickson & J.H.Willis
Levenhookia leptantha Benth.
Lobelia heterophylla Labill.
Lobelia heterophylla Labill. subsp. heterophylla
Lotus cruentus Court
Lysiana murrayi (F.Muell. & Tate) Tiegh.
Macgregoria racemigera F.Muell.
Maireana amoena (Diels) Paul G.Wilson
Maireana carnosa (Moq.) Paul G.Wilson
Maireana convexa Paul G.Wilson
Maireana georgei (Diels) Paul G.Wilson
Maireana melanocoma (F.Muell.) Paul G.Wilson
Maireana planifolia (F.Muell.) Paul G.Wilson
Maireana pyramidata (Benth.) Paul G.Wilson
Maireana thesioides (C.A.Gardner) Paul G.Wilson
Maireana tomentosa Moq.
Maireana tomentosa subsp. tomentosa Moq.
Maireana trichoptera (J.M.Black) Paul G.Wilson
Maireana triptera (Benth.) Paul G.Wilson

Accepted Name
Maireana villosa (Lindl.) Paul G.Wilson
Malva parviflora L.
Marsilea drummondii A.Braun
Marsilea hirsuta R.Br.
Menkea australis Lehm.
Menkea draboides (Hook.f.) Benth.
Menkea sphaerocarpa F.Muell.
Menkea villosula (F.Muell. & Tate) J.M.Black
Micromyrtus sulphurea W.Fitzg.
Millotia perpusilla (Turcz.) P.S.Short
Minuria leptophylla DC.
Mirbelia microphylla (Turcz.) Benth.
Mirbelia rhagodioides Crisp & J.M.Taylor
Monachather paradoxus Steud.
Muelleranthus trifoliolatus (F.Muell.) A.T.Lee
Myoporum montanum R.Br.
Myriocephalus gueriniae F.Muell.
Myriocephalus oldfieldii (F.Muell.) Paul G.Wilson
Myriocephalus pygmaeus (A.Gray) P.S.Short
Myriocephalus rudallii Benth.
Nellica maderaspatensis (L.) Raf.
Neurachne alopecuroidea R.Br.
Neurachne minor S.T.Blake
Nicotiana cavicola N.T.Burb.
Nicotiana gascoynica M.W.Chase & Christenh.
Nicotiana murchisonica M.W.Chase & Christenh.
Nicotiana obliqua (N.T.Burb.) M.W.Chase & Christenh.
Nicotiana pila M.W.Chase & Christenh.
Nicotiana rosulata (S.Moore) Domin
Nicotiana rotundifolia Lindl.
Nicotiana simulans N.T.Burb.
Nicotiana stenocarpa H.-M.Wheeler
Olearia stuartii (F.Muell.) Benth.
Ophioglossum lusitanicum L.
Opuntia stricta (Haw.) Haw.
Papaver hybridum L.
Parietaria cardiostegia Greuter
Paspalidium clementii (Domin) C.E.Hubb.
Paspalidium gracile (R.Br.) Hughes
Peplidium aithocheilum W.R.Barker
Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)
Pigea floribunda Lindl.
Pimelea microcephala R.Br.
Pimelea microcephala R.Br. subsp. microcephala
Pimelea microcephala subsp. microcephala R.Br.
Pimelea trichostachya Lindl.
Pittosporum angustifolium Lodd., G.Lodd. & W.Lodd.
Plantago drummondii Decne.
Pluchea dentex Benth.
Podolepis gardneri G.L.Davis
Pogonolepis stricta Steetz
Polycarpaea corymbosa (L.) Lam.
Portulaca cyclophylla F.Muell.
Portulaca oleracea L.
Portulaca pilosa L.
Prostanthera albiflora B.J.Conn
Prostanthera campbellii F.Muell.
Prostanthera wilkieana F.Muell.
Psydrax latifolia (Benth.) S.T.Reynolds & R.J.F.Hend.

Accepted Name
Psydrax rigidula S.T.Reynolds & R.J.F.Hend.
Psydrax suaveolens (S.Moore) S.T.Reynolds & R.J.F.Hend.
Ptilotus actinocladus T.Hammer & R.W.Davis
Ptilotus aervoides (F.Muell.) F.Muell.
Ptilotus albidus (C.A.Gardner) Benl
Ptilotus chamaecladus Diels
Ptilotus divaricatus (Gaudich.) F.Muell.
Ptilotus drummondii var. minor (Nees) Benl
Ptilotus exaltatus Nees
Ptilotus gaudichaudii (Steud.) J.M.Black
Ptilotus gomphrenoides Benth.
Ptilotus grandiflorus F.Muell.
Ptilotus helipteroides (F.Muell.) F.Muell.
Ptilotus lazaridis Benl
Ptilotus luteolus (Benl & H.Eichler) R.W.Davis
Ptilotus macrocephalus (R.Br.) Poir.
Ptilotus nobilis (Lindl.) F.Muell.
Ptilotus obovatus (Gaudich.) F.Muell.
Ptilotus obovatus (Gaudich.) F.Muell. var. obovatus
Ptilotus polystachyus (Gaudich.) F.Muell.
Ptilotus roei (Benth.) F.Muell.
Ptilotus rotundifolius (F.Muell.) F.Muell.
Ptilotus schwartzii (F.Muell.) Tate
Ptilotus schwartzii Tate var. schwartzii
Ptilotus xerophilus T.Hammer & R.W.Davis
Rhodanthe battii (F.Muell.) Paul G.Wilson
Rhodanthe charsleyae (F.Muell.) Paul G.Wilson
Rhodanthe chlorocephala subsp. rosea (Hook.) Paul G.Wilson
Rhodanthe chlorocephala subsp. splendida (Hemsl.) Paul G.Wilson
Rhodanthe citrina (Benth.) Paul G.Wilson
Rhodanthe floribunda (DC.) Paul G.Wilson
Rhodanthe humboldtiana (Gaudich.) Paul G.Wilson
Rhodanthe maryonii (S.Moore) Paul G.Wilson
Rhodanthe propinqua (W.Fitzg.) Paul G.Wilson
Rhodanthe sphaerocephala Paul G.Wilson
Rhodanthe sterilescens (F.Muell.) Paul G.Wilson
Rhodanthe stricta (Lindl.) Paul G.Wilson
Roebuckiella cheilocarpa (F.Muell.) P.S.Short var. cheilocarpa
Roebuckiella ciliocarpa (W.Fitzg.) P.S.Short
Roebuckiella oncocarpa (Diels) P.S.Short
Roebuckiella similis (P.S.Short) P.S.Short
Roepera aurantiaca Lindl. subsp. aurantiaca
Roepera eichleri (R.M.Barker) Beier & Thulin
Roepera kochii (Tate) Beier & Thulin
Roepera tetraptera (R.M.Barker) Beier & Thulin
Rostraria pumila (Desf.) Tzvelev
Rumex vesicarius L.
Salsola australis R.Br.
Samolus repens (J.R.Forst. & G.Forst.) Pers.
Santalum lanceolatum R.Br.
Santalum spicatum (R.Br.) A.DC.
Scaevola spinescens R.Br.
Scaevola tomentosa Gaudich.
Schinus molle var. areira (L.) DC.
Schismus arabicus Nees
Schoenia ayersii (F.Muell.) J.M.Black
Schoenia cassiniana (Gaudich.) Steetz
Schoenoplectiella dissachantha (S.T.Blake) Lye
Sclerolaena burbidgeae (Ising) A.J.Scott

Accepted Name
Sclerolaena cuneata Paul G.Wilson
Sclerolaena densiflora (W.Fitzg.) A.J.Scott
Sclerolaena deserticola Paul G.Wilson
Sclerolaena diacantha (Nees) Benth.
Sclerolaena divaricata (R.Br.) Domin
Sclerolaena eriacantha (F.Muell.) Ulbr.
Sclerolaena fimbriolata (F.Muell.) A.J.Scott
Sclerolaena gardneri (Ising) A.J.Scott
Sclerolaena glabra (F.Muell.) Domin
Sclerolaena lanicuspis (F.Muell.) Benth.
Sclerolaena patenticuspis (R.H.Anderson) Ulbr.
Sclerolaena tetragona Paul G.Wilson
Senecio glossanthus (Sond.) Belcher
Senna artemisioides (DC.) Randell
Senna artemisioides subsp. filifolia Randell
Senna artemisioides subsp. helmsii (Symon) Randell
Senna artemisioides subsp. oligophylla (F.Muell.) Randell
Senna artemisioides subsp. x artemisioides (DC.) Randell
Senna artemisioides subsp. x petiolaris Randell
Senna artemisioides subsp. x sturtii (R.Br.) Randell
Senna artemisioides subsp. zygophylla (Benth.) Randell
Senna charlesiana (Symon) Randell
Senna glaucifolia (Randell) Randell
Senna glutinosa (DC.) Randell
Senna glutinosa subsp. chatelainiana (Gaudich.) Randell
Senna glutinosa subsp. pruinosa (F.Muell.) Randell
Senna glutinosa subsp. x luerssenii (Domin) Randell
Senna pleurocarpa var. pleurocarpa (F.Muell.) Randell
Senna sp. Austin (A. Strid 20210)
Senna sp. Meekatharra (E. Bailey 1-26)
Senna stricta (Randell) Randell
Seringia exastia (C.F.Wilkins) C.F.Wilkins & Whitlock
Setaria dielsii R.A.W.Herrm.
Sida ammophila J.H.Willis
Sida calyxhymenia DC.
Sida ectogama W.R.Barker & R.M.Barker
Sida fibulifera Lindl.
Sida intricata F.Muell.
Sida petrophila F.Muell.
Sida platycalyx Benth.
Sida sp. Excedentifolia (J.L. Egan 1925)
Siemssenia capillaris Steetz
Sisymbrium erysimoides Desf.
Sisymbrium irio L.
Sisymbrium orientale L.
Solanum austropiceum A.R.Bean
Solanum lachnophyllum Symon
Solanum lasiophyllum Poir.
Solanum nigrum L.
Solanum orbiculatum Poir.
Solanum orbiculatum Poir. subsp. orbiculatum
Solanum sturtianum F.Muell.
Sonchus oleraceus L.
Spergularia marina (L.) Besser
Sporobolus australasicus Domin
Stackhousia muricata Lindl.
Stenanthemum petraeum Rye
Stenopetalum anfractum E.A.Shaw
Stenopetalum filifolium Benth.

Accepted Name
Stenopetalum lineare DC. var. lineare
Stenopetalum nutans F.Muell.
Stenopetalum pedicellare Benth.
Stenopetalum sphaerocarpum F.Muell.
Streptoglossa cylindriceps (J.M.Black) Dunlop
Streptoglossa liatroides (Turcz.) Dunlop
Stylidium longibracteatum Carlquist
Stylobasium spathulatum Desf.
Swainsona affinis (A.T.Lee) Joy Thomps.
Swainsona canescens (Lindl.) F.Muell.
Swainsona elegans A.T.Lee
Swainsona elegantoides (A.T.Lee) Joy Thomps.
Swainsona formosa (G.Don) Joy Thomps.
Swainsona gracilis Benth.
Swainsona kingii F.Muell.
Swainsona leeana J.Z.Weber
Swainsona oroboides Benth.
Swainsona paucifoliolata Joy Thomps.
Swainsona pedunculata A.T.Lee
Swainsona pterostylis (DC.) Bakh.f.
Swainsona tenuis E.Pritz.
Synaptantha tillaeacea (F.Muell.) Hook.f.
Synaptantha tillaeacea (F.Muell.) Hook.f. var. tillaeacea
Taplinia saxatilis Lander
Tecticornia cymbiformis K.A.Sheph. & Paul G.Wilson
Tecticornia disarticulata (Paul G.Wilson) K.A.Sheph. & Paul G.Wilson
Tecticornia doliiformis (Paul G.Wilson) K.A.Sheph. & Paul G.Wilson
Tecticornia indica subsp. bidens (Nees) K.A.Sheph. & Paul G.Wilson
Tecticornia sp. Yoothapina Station (A.A. Mitchell 883)
Tetragonia cristata A.M.Prescott
Tetragonia moorei M.Gray
Teucrium teucriiflorum (F.Muell.) Kattari & Salmaki
Themeda avenacea (F.Muell.) Maiden & Betche
Themeda triandra Forssk.
Thryptomene decussata (W.Fitzg.) J.W.Green
Thyridolepis multiculmis (Pilg.) S.T.Blake
Thysanotus manglesianus Kunth
Thysanotus sp. Eremaean (S. van Leeuwen 1067)
Thysanotus speckii Brittan
Trachymene ornata (Endl.) Druce
Tragus australianus S.T.Blake
Trianthema glossostigmum F.Muell.
Trianthema triquetrum Willd.
Tribulus astrocarpus F.Muell.
Tribulus forrestii F.Muell.
Tribulus platypterus Benth.
Tribulus suberosus R.M.Barker
Trichanthodium skirrophorum Sond.
Trichodesma zeylanicum (Burm.f.) R.Br.
Trichodesma zeylanicum (Burm.f.) R.Br. var. zeylanicum
Trichodesma zeylanicum var. zeylanicum (Burm.f.) R.Br.
Triglochin isingiana (J.M.Black) Aston
Triglochin mucronata R.Br.
Triodia melvillei (C.E.Hubb.) Lazarides
Tripogonella loliiformis (F.Muell.) P.M.Peterson & Romasch.
Verticordia interioris A.S.George
Vincetoxicum lineare (Decne.) Meve & Liede
Wahlenbergia tumidifructa P.J.Sm.
Waitzia acuminata Steetz

Accepted Name
Waitzia acuminata Steetz var. acuminata
Walshia kendallii (F.Muell.) Jeanes
Wurmbea densiflora (Benth.) T.Macfarlane
Wurmbea tenella (Endl.) Benth.

Terrestrial Fauna

Accepted Name	Kingdom	Phylum	Class
Cyclorana occidentalis	Animalia	Chordata	Amphibia
Litoria rubella	Animalia	Chordata	Amphibia

Accepted Name	Kingdom	Phylum	Class	Common name
Manorina (Myzantha) flavigula	Animalia	Chordata	Aves	Yellow-throated Miner
Taeniopygia guttata	Animalia	Chordata	Aves	Zebra Finch
Grallina cyanoleuca	Animalia	Chordata	Aves	Magpie-lark
Ptilotula penicillata	Animalia	Chordata	Aves	White-plumed Honeyeater
Gavicalis virescens	Animalia	Chordata	Aves	Singing Honeyeater
Acanthagenys rufogularis	Animalia	Chordata	Aves	Spiny-cheeked Honeyeater
Aquila (Uroaetus) audax	Animalia	Chordata	Aves	Wedge-tailed Eagle
Rhipidura (Sauloprocta) leucophrys	Animalia	Chordata	Aves	Willie Wagtail
Ocyphaps lophotes	Animalia	Chordata	Aves	Crested Pigeon
Haliastur sphenurus	Animalia	Chordata	Aves	Whistling Kite
Corvus bennetti	Animalia	Chordata	Aves	Little Crow
Oreoica gutturalis	Animalia	Chordata	Aves	Crested Bellbird
Artamus (Angroyan) cinereus	Animalia	Chordata	Aves	Black-faced Woodswallow
Corvus orru	Animalia	Chordata	Aves	Torresian Crow
Gymnorhina tibicen	Animalia	Chordata	Aves	Australian Magpie
Falco (Tinnunculus) cenchroides	Animalia	Chordata	Aves	Nankeen Kestrel
Cracticus nigrogularis	Animalia	Chordata	Aves	Pied Butcherbird
Hirundo (Hirundo) neoxena	Animalia	Chordata	Aves	Welcome Swallow
Anthus (Anthus) novaeseelandiae	Animalia	Chordata	Aves	Australian Pipit
Petrochelidon (Hylochelidon) nigricans	Animalia	Chordata	Aves	Tree Martin
Eolophus roseicapilla	Animalia	Chordata	Aves	Galah
Chlamydera guttata	Animalia	Chordata	Aves	Western Bowerbird
Petroica (Petroica) goodenovii	Animalia	Chordata	Aves	Red-capped Robin
Dromaius novaehollandiae	Animalia	Chordata	Aves	Emu
Acanthiza (Geobasileus) uropygialis	Animalia	Chordata	Aves	Chestnut-rumped Thornbill
Melopsittacus undulatus	Animalia	Chordata	Aves	Budgerigar
Cracticus torquatus	Animalia	Chordata	Aves	Grey Butcherbird
Falco (Ieracidea) berigora	Animalia	Chordata	Aves	Brown Falcon
Pachycephala (Alisterornis) rufiventris	Animalia	Chordata	Aves	Rufous Whistler
Colluricincla (Colluricincla) harmonica	Animalia	Chordata	Aves	Grey Shrike-thrush
Pomatostomus (Pomatostomus) temporalis	Animalia	Chordata	Aves	Grey-crowned Babbler
Barnardius zonarius	Animalia	Chordata	Aves	Australian Ringneck
Elseyornis melanops	Animalia	Chordata	Aves	Black-fronted Dotterel
Coracina (Coracina) novaehollandiae	Animalia	Chordata	Aves	Black-faced Cuckoo-shrike
Pomatostomus (Morganornis) superciliosus	Animalia	Chordata	Aves	White-browed Babbler
Cincloramphus (Maclennania) mathewsi	Animalia	Chordata	Aves	Rufous Songlark
Aphelocephala leucopsis	Animalia	Chordata	Aves	Southern Whiteface
Falco (Falco) longipennis	Animalia	Chordata	Aves	Australian Hobby
Melanodryas (Melanodryas) cucullata	Animalia	Chordata	Aves	Hooded Robin
Anas gracilis	Animalia	Chordata	Aves	Grey Teal
Epthianura (Parepthianura) tricolor	Animalia	Chordata	Aves	Crimson Chat
Geopelia cuneata	Animalia	Chordata	Aves	Diamond Dove
Anas (Anas) superciliosa	Animalia	Chordata	Aves	Pacific Black Duck
Artamus (Campbellornis) personatus	Animalia	Chordata	Aves	Masked Woodswallow
Tadorna (Casarca) tadornoides	Animalia	Chordata	Aves	Australian Shelduck
Nymphicus hollandicus	Animalia	Chordata	Aves	Cockatiel
Dicaeum (Dicaeum) hirundinaceum	Animalia	Chordata	Aves	Mistletoebird

Accepted Name	Kingdom	Phylum	Class	Common name
Acanthiza (Milligania) robustirostris	Animalia	Chordata	Aves	Slaty-backed Thornbill
Egretta novaehollandiae	Animalia	Chordata	Aves	White-faced Heron
Acanthiza (Geobasileus) chrysorrhoa	Animalia	Chordata	Aves	Yellow-rumped Thornbill
Todiramphus (Cyanalcyon) pyrrhopygius	Animalia	Chordata	Aves	Red-backed Kingfisher
Cincloramphus (Cincloramphus) cruralis	Animalia	Chordata	Aves	Brown Songlark
Phaps (Phaps) chalcoptera	Animalia	Chordata	Aves	Common Bronzewing
Malurus (Leggeornis) assimilis	Animalia	Chordata	Aves	Purple-backed Fairy-wren
Psophodes (Sphenostoma) occidentalis	Animalia	Chordata	Aves	Chiming Wedgebill
Poliocephalus poliocephalus	Animalia	Chordata	Aves	Hoary-headed Grebe
Malurus (Malurus) splendens	Animalia	Chordata	Aves	Splendid Fairy-wren
Cinclosoma (Samuela) marginatum	Animalia	Chordata	Aves	Western Quail-thrush
Milvus migrans	Animalia	Chordata	Aves	Black Kite
Cheramoeca leucosterna	Animalia	Chordata	Aves	White-backed Swallow
Psephotellus varius	Animalia	Chordata	Aves	Mulga Parrot
Fulica atra	Animalia	Chordata	Aves	Eurasian Coot
Ardea pacifica	Animalia	Chordata	Aves	White-necked Heron
Malacorhynchus membranaceus	Animalia	Chordata	Aves	Pink-eared Duck
Petrochelidon (Petrochelidon) ariel	Animalia	Chordata	Aves	Fairy Martin
Purnella albifrons	Animalia	Chordata	Aves	White-fronted Honeyeater
Todiramphus (Todiramphus) sanctus	Animalia	Chordata	Aves	Sacred Kingfisher
Malurus (Leggeornis) lamberti	Animalia	Chordata	Aves	Variegated Fairy-wren
Gelochelidon nilotica	Animalia	Chordata	Aves	Gull-billed Tern
Cinclosoma (Samuela) castaneothorax	Animalia	Chordata	Aves	Chestnut-breasted Quail-thrush
Certhionyx (Certhionyx) variegatus	Animalia	Chordata	Aves	Pied Honeyeater
Aythya (Nyroca) australis	Animalia	Chordata	Aves	Hardhead
Hieraaetus (Hieraaetus) morphnoides	Animalia	Chordata	Aves	Little Eagle
Cygnus atratus	Animalia	Chordata	Aves	Black Swan
Cladorhynchus leucocephalus	Animalia	Chordata	Aves	Banded Stilt
Neopsephotus bourkii	Animalia	Chordata	Aves	Bourke's Parrot
Chenonetta jubata	Animalia	Chordata	Aves	Australian Wood Duck
Malurus (Musciparus) leucopterus	Animalia	Chordata	Aves	White-winged Fairy-wren
Gerygone fusca	Animalia	Chordata	Aves	Western Gerygone
Podargus strigoides	Animalia	Chordata	Aves	Tawny Frogmouth
Merops (Merops) ornatus	Animalia	Chordata	Aves	Rainbow Bee-eater
Himantopus himantopus	Animalia	Chordata	Aves	Black-winged Stilt
Aphelocephala nigricincta	Animalia	Chordata	Aves	Banded Whiteface
Tachybaptus novaehollandiae	Animalia	Chordata	Aves	Australasian Grebe
Heteroscenes pallidus	Animalia	Chordata	Aves	Pallid Cuckoo
Accipiter (Paraspizias) cirrocephalus	Animalia	Chordata	Aves	Collared Sparrowhawk
Falco (Hierofalco) peregrinus	Animalia	Chordata	Aves	Peregrine Falcon
Cacatua (Licmetis) sanguinea	Animalia	Chordata	Aves	Little Corella
Circus assimilis	Animalia	Chordata	Aves	Spotted Harrier
Rhipidura (Rhipidura) albiscapa	Animalia	Chordata	Aves	Grey Fantail
Sugomel niger	Animalia	Chordata	Aves	Black Honeyeater
Columba (Columba) livia	Animalia	Chordata	Aves	Rock Dove
Coracina (Pteropodocys) maxima	Animalia	Chordata	Aves	Ground Cuckoo-shrike
Aegotheles (Aegotheles) cristatus	Animalia	Chordata	Aves	Australian Owlet-nightjar
Calidris (Erolia) acuminata	Animalia	Chordata	Aves	Sharp-tailed Sandpiper
Epthianura (Aurepthianura) aurifrons	Animalia	Chordata	Aves	Orange Chat
Microcarbo melanoleucos	Animalia	Chordata	Aves	Little Pied Cormorant
Ardeotis australis	Animalia	Chordata	Aves	Australian Bustard
Erythrogonys cinctus	Animalia	Chordata	Aves	Red-kneed Dotterel
Acanthiza (Geobasileus) iredalei	Animalia	Chordata	Aves	Slender-billed Thornbill
Tringa (Rhyacophilus) glareola	Animalia	Chordata	Aves	Wood Sandpiper
Microeca (Microeca) fascinans	Animalia	Chordata	Aves	Jacky Winter
Ptilotula plumula	Animalia	Chordata	Aves	Grey-fronted Honeyeater
Calidris (Ereunetes) ruficollis	Animalia	Chordata	Aves	Red-necked Stint
Platalea (Platibis) flavipes	Animalia	Chordata	Aves	Yellow-billed Spoonbill
Tribonyx ventralis	Animalia	Chordata	Aves	Black-tailed Native-hen

Accepted Name	**Kingdom**	**Phylum**	**Class**	**Common name**
Falco (Hierofalco) hypoleucos	Animalia	Chordata	Aves	Grey Falcon
Acanthiza (Acanthiza) apicalis	Animalia	Chordata	Aves	Red-rumped Tit
Chlidonias (Pelodes) hybrida	Animalia	Chordata	Aves	Whiskered Tern
Chalcites osculans	Animalia	Chordata	Aves	Black-eared Cuckoo
Corvus coronoides	Animalia	Chordata	Aves	Australian Raven
Ninox (Ninox) novaeseelandiae	Animalia	Chordata	Aves	Southern Boobook
Artamus (Angroyan) minor	Animalia	Chordata	Aves	Little Woodswallow
Daphoenositta (Neositta) chrysoptera	Animalia	Chordata	Aves	Varied Sittella
Hamirostra melanosternon	Animalia	Chordata	Aves	Black-breasted Buzzard
Turnix (Alphaturnia) velox	Animalia	Chordata	Aves	Little Button-quail
Pyrrholaemus brunneus	Animalia	Chordata	Aves	Redthroat
Charadrius (Eupoda) veredus	Animalia	Chordata	Aves	Oriental Plover
Lichmera (Lichmera) indistincta	Animalia	Chordata	Aves	Brown Honeyeater
Porzana (Porzana) fluminea	Animalia	Chordata	Aves	Australian Spotted Crake
Burhinus (Burhinus) grallarius	Animalia	Chordata	Aves	Bush Stone-curlew
Chalcites basalis	Animalia	Chordata	Aves	Horsfield's Bronze-cuckoo
Tringa (Glottis) nebularia	Animalia	Chordata	Aves	Common Greenshank
Nycticorax caledonicus	Animalia	Chordata	Aves	Nankeen Night-heron
Chroicocephalus novaehollandiae	Animalia	Chordata	Aves	Silver Gull
Pardalotus (Pardalotinus) striatus	Animalia	Chordata	Aves	Striated Pardalote
Elanus axillaris	Animalia	Chordata	Aves	Black-shouldered Kite
Calidris (Erolia) ferruginea	Animalia	Chordata	Aves	Curlew Sandpiper
Vanellus (Lobivanellus) tricolor	Animalia	Chordata	Aves	Banded Lapwing

Accepted Name	Kingdom	Phylum	Class
Antechinomys laniger (Gould, 1856)	Animalia	Chordata	Mammalia
Antechinomys longicaudatus (Spencer, 1909)	Animalia	Chordata	Mammalia
Bettongia anhydra Finlayson, 1957	Animalia	Chordata	Mammalia
Felis catus Linnaeus, 1758	Animalia	Chordata	Mammalia
Notomys alexis Thomas, 1922	Animalia	Chordata	Mammalia
Osphranter rufus Desmarest, 1822	Animalia	Chordata	Mammalia
Nyctophilus geoffroyi Leach, 1821	Animalia	Chordata	Mammalia
Pseudantechinus woolleyae Kitchener & Caputi, 1988	Animalia	Chordata	Mammalia
Sminthopsis crassicaudata (Gould, 1844)	Animalia	Chordata	Mammalia
Vespadelus baverstocki (Kitchener, Jones & Caputi, 1987)	Animalia	Chordata	Mammalia
Vespadelus finlaysoni (Kitchener, Jones & Caputi, 1987)	Animalia	Chordata	Mammalia
Vulpes vulpes Linnaeus, 1758	Animalia	Chordata	Mammalia

Accepted Name	Kingdom	Phylum	Class
Anilios grypus (Waite, 1918)	Animalia	Chordata	Reptilia
Antaresia childreni (Gray, 1842)	Animalia	Chordata	Reptilia
Brachyurophis approximans (Glauert, 1954)	Animalia	Chordata	Reptilia
Chelodina steindachneri Siebenrock, 1901	Animalia	Chordata	Reptilia
Ctenophorus caudicinctus (GÃ¼nther, 1875)	Animalia	Chordata	Reptilia
Ctenophorus nuchalis (De Vis, 1884)	Animalia	Chordata	Reptilia
Ctenophorus reticulatus (Gray, 1845)	Animalia	Chordata	Reptilia
Ctenophorus scutulatus (Stirling & Zietz, 1893)	Animalia	Chordata	Reptilia
Ctenotus helenae Storr, 1969	Animalia	Chordata	Reptilia
Ctenotus leonhardii (Sternfeld, 1919)	Animalia	Chordata	Reptilia
Demansia reticulata (Gray, 1842)	Animalia	Chordata	Reptilia
Diplodactylus pulcher Steindachner, 1870	Animalia	Chordata	Reptilia
Egernia depressa (GÃ¼nther, 1875)	Animalia	Chordata	Reptilia
Eremiascincus richardsonii (Gray, 1845)	Animalia	Chordata	Reptilia
Gehyra crypta Kealley, Doughty, Pepper, Keogh, Hillyer & Huey, 2018	Animalia	Chordata	Reptilia
Gehyra polka Doughty, Bauer, Pepper, Keogh & Ellis, 2018	Animalia	Chordata	Reptilia
Gehyra variegata (DumÃ©ril & Bibron, 1836)	Animalia	Chordata	Reptilia
Gowidon longirostris (Boulenger, 1883)	Animalia	Chordata	Reptilia
Heteronotia binoei (Gray, 1845)	Animalia	Chordata	Reptilia
Lerista eupoda Smith, 1996	Animalia	Chordata	Reptilia

Accepted Name	Kingdom	Phylum	Class
Lerista macropisthopus fusciceps Storr, 1991	Animalia	Chordata	Reptilia
Lerista timida (de Vis, 1888)	Animalia	Chordata	Reptilia
Lucasium squarrosum (Kluge, 1962)	Animalia	Chordata	Reptilia
Menetia greyii Gray, 1845	Animalia	Chordata	Reptilia
Nephrurus wheeleri Loveridge, 1932	Animalia	Chordata	Reptilia
Nephrurus wheeleri wheeleri Loveridge, 1932	Animalia	Chordata	Reptilia
Pseudonaja mengdeni Wells & Wellington, 1985	Animalia	Chordata	Reptilia
Pseudonaja modesta (GÃ¼nther, 1872)	Animalia	Chordata	Reptilia
Strophurus wellingtonae (Storr, 1988)	Animalia	Chordata	Reptilia
Suta fasciata Rosen, 1905	Animalia	Chordata	Reptilia
Suta monachus (Storr, 1964)	Animalia	Chordata	Reptilia
Tympanocryptis pseudopsephos Doughty, Kealley, Shoo & Melville, 2015	Animalia	Chordata	Reptilia
Varanus caudolineatus Boulenger, 1885	Animalia	Chordata	Reptilia
Varanus panoptes rubidus Storr, 1980	Animalia	Chordata	Reptilia
Varanus panoptes Storr, 1980	Animalia	Chordata	Reptilia

APPENDIX F:
EPBC PROTECTED MATTERS SEARCH (40KM BUFFER)

Australian Government

Department of Climate Change, Energy, the Environment and Water

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. Please see the caveat for interpretation of information provided here.

Report created: 16-Aug-2024

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	9
Listed Migratory Species:	8

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	10
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
PLANT			
Pityrodia augustensis Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat may occur within area	In buffer area only
REPTILE			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Liopholis kintorei			
Great Desert Skink, Tjakura, Warrarna, Mulyamiji, Tjalapa, Nampu [83160]	Vulnerable	Species or species habitat may occur within area	In buffer area only
SPIDER			
Idiosoma nigrum			
Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus			
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [51658]	WA	In buffer area only
Commonwealth Land - [51659]	WA	In buffer area only
Commonwealth Land - [51662]	WA	In buffer area only
Commonwealth Land - [51946]	WA	In buffer area only
Commonwealth Land - [51657]	WA	In buffer area only
Commonwealth Land - [51663]	WA	In buffer area only
Commonwealth Land - [51660]	WA	In buffer area only
Commonwealth Land - [51661]	WA	In buffer area only
Commonwealth Land - [51656]	WA	In buffer area only
Commonwealth Land - [51654]	WA	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

Nationally Important Wetlands [Resource Information]

Wetland Name	State	Buffer Status
Lake Annean (Lake Nannine)	WA	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Jack Hills Expansion Project	2011/5853	Not Controlled Action	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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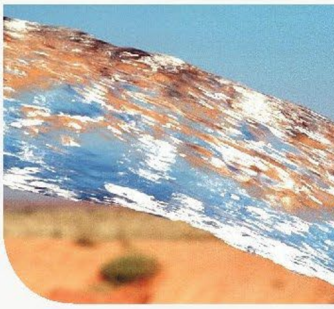
APPENDIX 5: HYDROLOGICAL AND HYDROGEOLOGICAL ASSESSMENT




GARDEN GULLY PROJECT
MEEKATHARRA

HYDROLOGICAL & HYDROGEOLOGICAL ASSESSMENT

REPORT FOR
ORA GOLD LTD

OCTOBER 2024

Report No. 586.0/24/02b

Rockwater
HYDROGEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

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TABLE OF CONTENTS

1 INTRODUCTION 1
2 SURFACE WATER HYDROLOGY 1
2.1 TOPOGRAPHY AND DRAINAGE 1
2.2 CLIMATE 1
2.3 RAINFALL ANALYSIS 2
2.4 CATCHMENT CHARACTERISTICS 2
2.5 TIME OF CONCENTRATION 2
2.6 RATIONAL METHOD 2
2.7 FLOOD INDEX METHOD 3
2.8 PEAK FLOWS 3
3 HYDRAULIC ANALYSIS 3
3.1 IMPACT OF FLOOD FLOWS ON THE PROJECT AREA 3
3.1.1 CATCHMENT A, GARDEN GULLY DRAINAGE 4
3.1.2 CATCHMENT B, EASTERN SIDE OF PLANNED WRL 4
3.1.3 CATCHMENT C, SOUTH OF PLANNED MINING AREA 5
3.1.4 CATCHMENT D, DRAINAGE BETWEEN THE TWO PLANNED PITS 6
4 HYDROGEOLOGICAL ASSESSMENT 6
4.1 MINING AND GENERAL HISTORY 6
4.2 GEOLOGY 7
4.3 FIELD INVESTIGATIONS 7
4.3.1 BORE REHABILITATION AND DOWNHOLE CAMERA SURVEY 7
4.3.2 MONITORING BORES 8
4.3.3 PUMPING TESTS 8
4.4 HYDROGEOLOGY 10
4.4.1 GENERAL 10
4.4.2 WATER INFORMATION REPORTING DATA 11
4.4.3 AQUIFER CHARACTERISTICS, GARDEN GULLY 11
4.4.4 GROUNDWATER LEVELS, FLOW DIRECTIONS 13
4.4.5 GROUNDWATER QUALITY 13
5 DEWATERING ASSESSMENT 14
5.1 MINE PLAN 14
5.2 DEWATERING FLOWS 14
5.2.1 MODEL DESCRIPTION 14
5.2.2 MODEL CALIBRATION 15
5.2.3 DEWATERING FLOW RATES 15
5.2.4 SENSITIVITY ANALYSIS 16
5.3 POTENTIAL IMPACTS OF MINING 16
5.4 WATER DISPOSAL 17
5.5 NATURE OF FINAL VOIDS 18
5.6 RECOMMENDED INVESTIGATION AND MONITORING PROGRAMME 19
6 CONCLUSIONS 19
REFERENCES 21

TABLE OF CONTENTS (CONT.)

Tables

Table 1: Average rainfalls and Dam Evaporation, Meekatharra (mm)	1
Table 2: Catchment Characteristics	2
Table 3: Estimated Peak Flows	3
Table 4: Garden Gully Catchment Section, 100-year ARI Flood and PMF Summary	4
Table 5: Cross-Section 2, 100-year ARI Flood and PMF Summary	5
Table 6: Cross-Section 3, 100-year ARI Flood and PMF Summary	5
Table 7: Cross-Section 4, 100-year ARI Flood and PMF Summary	6
Table 8: Summary of drilling and bore construction details at Crown Prince	9
Table 9: Aquifer parameters from pumping test of Bore CP	10
Table 10: Maximum Drawdowns at end of Bore CP Pumping Test	10
Table 11: Bores and Wells Recorded in WIR Database	12
Table 12: Results of Water Analysis, Kyarra Shaft	13
Table 13: Results of Chemical Analyses, Key Parameters, October 2024	14
Table 14: Summary of Adopted Aquifer Parameters	15
Table 15: Comparison between Measured and Modelled Pumping Test Drawdowns	15
Table 16: Estimated Average Dewatering Flow Rates, Crown Prince Pits	16
Table 17: Results of Sensitivity Analysis	16
Table 18: Final Void Water Balances, Crown Prince Pits	18

Text-Figures

Text-Figure 1: Section Across Garden Gully drainage with 100-year ARI Flood Level and PMF	4
Text-Figure 2: Cross-Section 2 Across Drainage East of WRL	5
Text-Figure 3: Cross-Section 3 Across Drainage near Southern Workshop Site	5
Text-Figure 4: Cross-Section 4 between the Planned Pits	6

TABLE OF CONTENTS (CONT.)

Figures

1 Locality Map
2 Garden Gully Catchments & Water Reserve
3 Site Layout, Section Lines, Lidar Contours & Flood Protection
4 Predicted 1-in-100 Year Flood Extent Main Drainage, without Control Structures
5 Bore Locations, Garden Gully
6 Bores & Wells, WIR Database
7 Wet Holes, Stopes, Faults & Strongly Jointed Core
8 Groundwater Levels (m AHD), WIR Database and Garden Gully Bores
9 Groundwater Salinity (mg/L TDS), WIR Database
10 Model-Predicted Drawdowns (m) at End of Mining of West Pit
11 Model-Predicted Drawdowns (m) at End of Mining, Both Pits

Appendices

I IFD Chart and Tables
II Monitoring Bore Completion Data
III Pumping Test Analyses
IV Water Quality Analyses Certificates

REVISION	AUTHOR	REVIEW	AUTHORISED	ISSUED
0	PHW	JRP	PHW	3/10/2024
1	PHW		PHW	7/10/2024
2	PHW		PHW	29/10/2024

1 INTRODUCTION

Ora Gold Limited is planning to mine gold at its Crown Prince deposit at Garden Gully, 15 km north of Meekatharra (Figure 1). This hydrogeological assessment of the deposit and surrounding area has been prepared to provide estimates of the mine dewatering requirements and the potential groundwater-related impacts of mining. In addition, a hydrological (surface water) study has been made of the Garden Gully catchment, in which the project is located. The study was conducted to estimate the extent of peak floods in the vicinity of the deposit.

This report presents the data collected and the results of the hydrological and hydrogeological assessment by Rockwater, to be used in mine planning and in obtaining approvals for the project. It is an update of an earlier report (Rockwater, March 2024) following the drilling and construction of monitoring bores, completion of a pumping test on the existing dewatering bore, passive seismic surveying to define a palaeochannel, and revision of the surface water assessment using accurate topographic data that are available following a LIDAR survey.

2 SURFACE WATER HYDROLOGY

2.1 TOPOGRAPHY AND DRAINAGE

Garden Gully drains a moderately-large catchment that lies to the north and east of Garden Gully (Fig. 2). It drains to the south-west, towards Hope River, a palaeodrainage (35 km from the project site) that is a zone of groundwater (and surface water) discharge. Topographic contours (10 m interval) derived from the DEM-H version of the one-second SRTM dataset (Geoscience Australia, 2011) are shown for the main catchment area (A), together with the project site layout, and three local catchments (B to D) with the potential to impact pits and mine infrastructure, in Figures 2 and 3.

2.2 CLIMATE

Garden Gully is located within the Arid Region as delineated in Australian Rainfall and Runoff 1987. The nearest Bureau of Meteorology (BoM) station with a long data record is at Meekatharra Airport (Stn. 007045), located 19 km south-east of the project site.

Rainfall at Meekatharra AP has been recorded since 1944. Annual rainfall is highly variable, ranging from 66 mm to 573 mm over the period of record. The long-term mean annual rainfall is 234 mm, with the month of February having the highest monthly average of 36.1 mm and September the lowest at 5.0 mm (Table 1). Rainfall over the winter months is generally associated with the passage of cold fronts from May through to August. Summer rainfall is highly erratic, and generally results from thunderstorms or cyclonic weather activity in the north.

Table 1: Average rainfalls and Dam Evaporation, Meekatharra (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall	29.2	36.1	30.8	18.8	21.6	28.5	20.0	10.6	5.0	6.0	11.7	14.4	234.0
Dam Evap.	380	314	267	190	131	87	92	121	170	259	293	333	2,637

Average dam evaporation (Luke, Burke, and O'Brien, 1988) is also given in Table 1. It exceeds average rainfall in all months, and by a factor of 11 overall.

Monthly mean maximum temperatures at Meekatharra range from 19.3 °C in July to 38.4 °C in January; and monthly mean minimum temperatures range from 7.5 °C in July to 24.4 °C in January.

2.3 RAINFALL ANALYSIS

The methods given in the Australian Rainfall and Runoff 1987 guidelines (Pilgrim et. al., 1987) were used for hydrologic analysis of the Garden Gully catchment A and local catchments B to D at the project site, to predict flood flows in the main and local drainages. It should be noted that a revision of the guidelines (ARR, 2019) was published to replace the 1987 version. However, the new publication uses the Regional Flood Frequency Estimation (RFFE) model, which is not applicable for the arid region of WA and so was not used in this assessment.

Intensity-Frequency-Duration (IFD) curves for the project area were obtained from the Bureau of Meteorology web-site, and are based on the statistical and meteorological analyses given in the ARR 1987 Guideline (Pilgrim et. al., 1987). The IFD tables and curves are included in Appendix I.

The Probable Maximum Precipitation (PMP) was taken to be a 1-in-2000-year event, with a 0.05 % probability of it occurring in any year. The Probable Maximum Flood (PMF) would result from a PMP event.

2.4 CATCHMENT CHARACTERISTICS

The catchments are shown in Fig. 2, and the local catchments in more detail with LIDAR contours in Fig. 3; their characteristics are summarised in Table 2.

Table 2: Catchment Characteristics

Catchment	Area (km^2)	Length (km)
A	546.5	31.2
B	6.1	3.68
C	2.5	2.54
D	0.96	1.42

2.5 TIME OF CONCENTRATION

The time of concentration is required in order to estimate the critical storm duration for peak flows in each catchment. This was estimated using Equation 1 for the Arid Interior Region of Western Australia as recommended by ARR 1987 and later editions:

$$t_c = 0.76 \cdot A^{0.38}$$ ***Equation 1***

Where:
t_c is the time of concentration (hours)
A is the catchment area (km^2)

2.6 RATIONAL METHOD

The Statistical Rational Method, used in peak-flow estimation, is presented in Equation 2.

$$Q_y = 0.278 \cdot C_y \cdot I_{tcy} \cdot A$$ ***Equation 2***

Where:
Q_y is the peak flow for return period of y years (m^3/s)
0.278 is a dimensionless metric conversion factor
C_y is the runoff coefficient for y years (dimensionless)
I_{tcy} is rainfall intensity (mm/hr)
A is catchment area (km^2)

2.7 FLOOD INDEX METHOD

The Australian Rainfall and Runoff Guideline (1987) does not provide equations for peak flow estimation using the flood index method for the Arid Region. However, the Garden Gully area is similar to the Wheatbelt, with loamy soils, and so the Flood Index Method for that region, presented in Equation 3, was used for comparative purposes.

$$Q_5 = 2.77 \times 10^{-6} \cdot \mathrm{A}^{0.52} \cdot \mathrm{P}^{2.12} \qquad \textit{Equation 3}$$

Where:
Q_5 is the peak discharge for the 5-year ARI flow (m^3/s)
A is the catchment area (km^2)
p average annual rainfall (mm)

2.8 PEAK FLOWS

Design peak flows for the catchments, as estimated using the Rational and Flood Index Methods, are given in Table 3.

Table 3: Estimated Peak Flows

Catchment A:

ARI Years	2	5	10	20	50	100	PMF*
Rational	15.9	49.2	86.1	135.5	216.7	298.9	449.6
Index	9.0	18.0	31.7	54.9	101.7	179.0	
Adopted	15.9	49.2	86.1	135.5	216.7	299	450

Catchment B:

ARI Years	2	5	10	20	50	100	PMF*
Rational	1.4	4.2	7.2	11.0	17.1	23.2	34.8
Index	0.6	1.2	2.1	3.7	6.9	12.1	
Adopted	1.4	4.2	7.2	11.0	17.1	23.2	34.8

Catchment C:

ARI Years	2	5	10	20	50	100	PMF*
Rational	0.9	2.5	4.2	6.4	9.9	13.4	20.1
Index	0.4	0.7	1.2	2.1	4.0	7.0	
Adopted	0.9	2.5	4.2	6.4	9.9	13.4	20.1

Catchment D:

ARI Years	2	5	10	20	50	100	PMF*
Rational	0.5	1.5	2.6	4.0	6.1	8.3	12.4
Index	0.2	0.4	0.7	1.2	2.3	4.0	
Adopted	0.5	1.5	2.6	4.0	6.1	8.3	12.4

* PMF (probable maximum flood) taken to be a 1-in-2000-year event, estimated by multiplying factors from CRC-Forge results

3 HYDRAULIC ANALYSIS

3.1 IMPACT OF FLOOD FLOWS ON THE PROJECT AREA

Peak flows in the catchment for 100-year ARI and PMF events were analysed to assess whether they could adversely impact the Garden Gully pits and infrastructure.

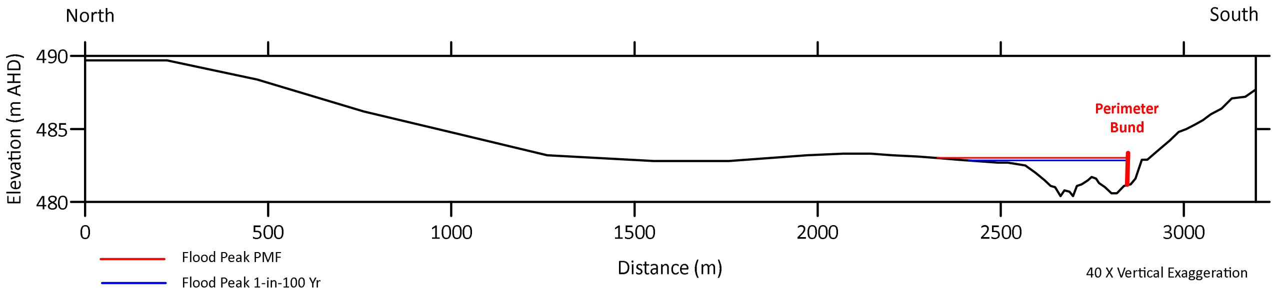
3.1.1 CATCHMENT A, GARDEN GULLY DRAINAGE

The width, depth and velocity of flows along the Garden Gully drainage were estimated at a cross-section (Cross-Section 1) trending north-westerly from the planned western pit (Fig. 3), from stage-discharge and stage-velocity relationships that were calculated using Manning's equation. The new LIDAR contours indicate the reach of the drainage adjacent to the planned pits is relatively flat and so would result in higher flood flows.

The results of the hydraulic analyses are presented below.

During a 1-in-100-year flood event, the flood levels from the catchment at the cross-section, with a protective bund on the northern side of the pit, would peak at a calculated 482.6 m AHD with a flow width of about 480 m (Text-Figure 1), and the level would be about 0.2 m higher in a Probable Maximum Flood (PMF).

Text-Figure 1: Section Across Garden Gully Drainage with 100-year ARI Flood Level and PMF



The approximate extent of the 1-in-100 Year flood without a protective bund is shown in Figure 4. The planned position of the bund is shown in Figure 3. The design of the bund, which would need to be about 2.5 m high, should be checked to ensure it can withstand low velocities of about 0.54 m/d during flood flows. The presence of the bund would not significantly impact flood levels.

The calculated maximum depth of water in the 1-in-100-year flood would be about 2.2 m and the maximum velocity in the order of 0.51 m/s (Table 4). At that velocity there should be minimal risk of erosion of the perimeter bund.

Table 4: Garden Gully Catchment Section, 100-year ARI Flood and PMF Summary

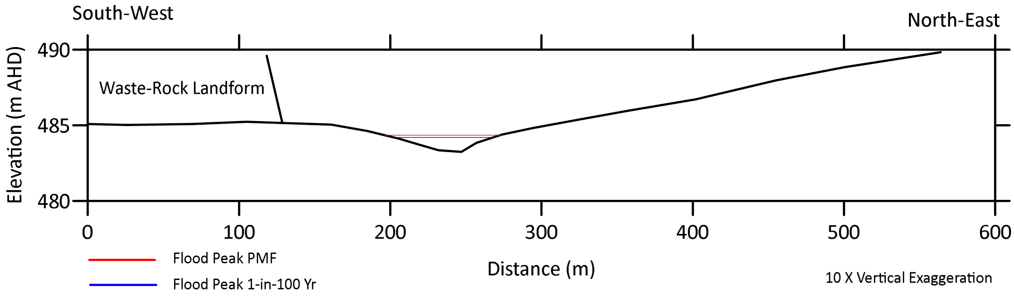
Flood Analysis	Peak Flow	Flood Level	Max. Depth	Velocity	Extent of Flood Level
	(m^3/s)	(m AHD)	(m)	(m/s)	(m)
100-Year	299	482.6	2.2	0.51	480
PMF	450	482.8	2.4	0.54	512

3.1.2 CATCHMENT B, EASTERN SIDE OF PLANNED WRL

Catchment B has a northerly-trending drainage that flows into Garden Gully after passing near the eastern wall of the planned waste rock landform (WRL), as shown in Figure 3. Peak flood flows in the drainage were calculated on Cross-Section 2, which extends to the north-east from the WRL.

During a 1-in-100-year flood event, the flood levels from the catchment at the cross-section would peak at a calculated 484.2 m AHD with a flow width of about 67 m (Text-Figure 2), and the level would be about 0.14 m higher in a Probable Maximum Flood (PMF). Flood flows should not extend to the WRL wall.

Text-Figure 2: Cross-Section 2 across Drainage East of WRL



The calculated maximum depth of water in the 1-in-100-year flood would be about 0.95 m and the maximum velocity in the order of 0.76 m/s (Table 5).

Table 5: Cross-Section 2, 100-year ARI Flood and PMF Summary

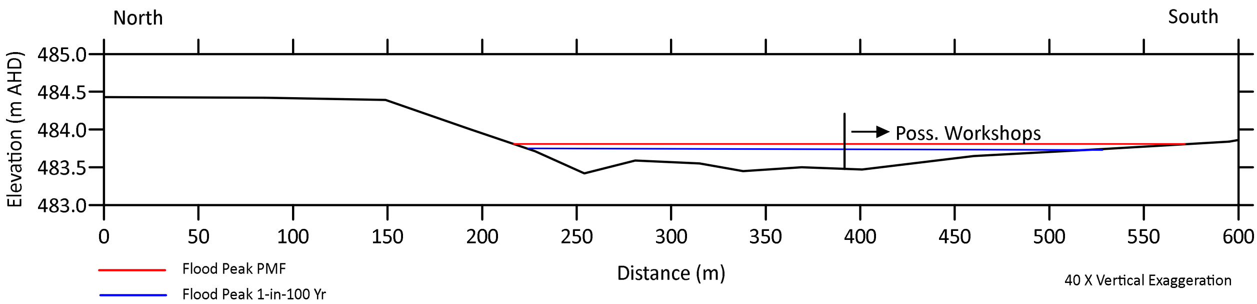
Flood Analysis	Peak Flow	Flood Level	Max. Depth	Velocity	Extent of Flood Level
	(m^3/s)	(m AHD)	(m)	(m/s)	(m)
100-Year	23.2	484.18	0.95	0.76	67
PMF	34.8	484.32	1.09	0.83	77

3.1.3 CATCHMENT C, SOUTH OF PLANNED MINING AREA

Catchment C has a westerly-trending drainage that flows passes near to the southern potential workshop site, as shown in Figure 3. Peak flood flows in the drainage were calculated on Cross-Section 3, which extends from north to south at the workshop site.

During a 1-in-100-year flood event, the flood levels from the catchment at the cross-section would peak at a calculated 483.7 m AHD with a flow width of about 304 m (Text-Figure 3) extending at shallow depth over the planned workshops site. The level would be about 0.07 m higher in a Probable Maximum Flood (PMF).

Text-Figure 3: Cross-Section 3 across Drainage near Southern Workshop Site



The calculated maximum depth of water in the 1-in-100-year flood would be about 0.32 m and the maximum velocity in the order of 0.32 m/s (Table 6).

Table 6: Cross-Section 3, 100-year ARI Flood and PMF Summary

Flood Analysis	Peak Flow	Flood Level	Max. Depth	Velocity	Extent of Flood Level
	(m^3/s)	(m AHD)	(m)	(m/s)	(m)
100-Year	16.5	483.7	0.32	0.32	304
PMF	25	483.8	0.39	0.36	355

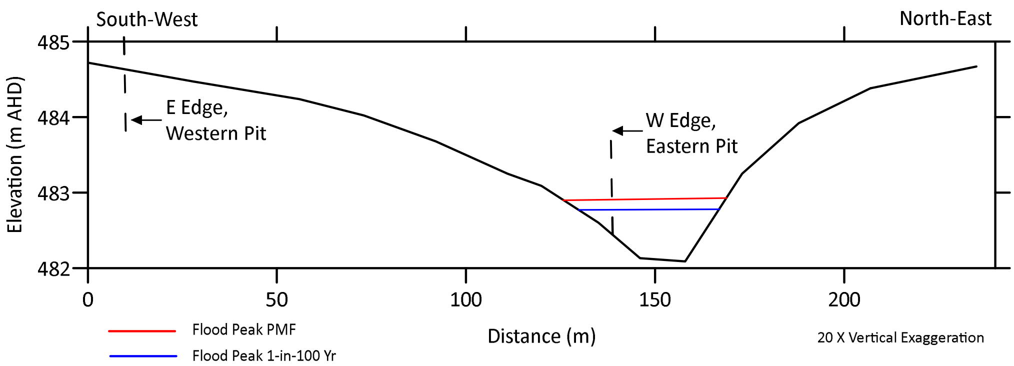
If workshops are to be built at the southern site, the ground level would need to be raised or a low bund constructed on the northern side of the site, to prevent flooding.

3.1.4 CATCHMENT D, DRAINAGE BETWEEN THE TWO PLANNED PITS

Catchment D is small, extends south-east of the planned pits, and drains between the pits to Garden Gully (Fig. 3). Peak flood flows in the drainage were calculated on Cross-Section 4, which extends between the pits.

During a 1-in-100-year flood event, the flood levels from the catchment at the cross-section would peak at a calculated 482.8 m AHD with a flow width of about 37 m (Text-Figure 4). The level would be about 0.13 m higher in a Probable Maximum Flood (PMF). The planned eastern pit extends into the drainage, and so a diversion drain would be need around the western side of the pit. The western pit would not be affected.

Text-Figure 4: Cross-Section 4 between the Planned Pits



The calculated maximum depth of water in the 1-in-100-year flood (without the pit) would be about 0.69 m and the maximum velocity in the order of 0.63 m/s (Table 7).

Table 7: Cross-Section 4, 100-year ARI Flood and PMF Summary

Flood Analysis	Peak Flow	Flood Level	Max. Depth	Velocity	Extent of Flood Level
	(m^3/s)	(m AHD)	(m)	(m/s)	(m)
100-Year	8.3	482.8	0.69	0.63	37
PMF	12.4	482.9	0.82	0.71	43

A conceptual plan for the diversion drain is shown in Figure 3. The drain should have a cross-sectional area of about 17 m^2, and so could be about 20 m wide and 0.9 m deep; with excavated material used to form a bund on its eastern side for additional protection. Also, the pit bund should not extend around both pits as shown in the mine design, as the existing drainage and diversion drain will need to discharge to Garden Gully unimpeded.

4 HYDROGEOLOGICAL ASSESSMENT

4.1 MINING AND GENERAL HISTORY

Mining at Garden Gully commenced in 1897 to 1901 at the Crown/Old Battery workings (Department of Mines, 1954): the first battery at Meekatharra was located there, as was the first town well. This was followed by the Kyarra discovery (1909 to 1915). There were further minor workings in 1935-36 at Kyarra, and 1935 to 1942 (Sabbath).

Garden Gully was listed as a Heritage Site by the Shire of Meekatharra (Gray and Sauman, 2012) and the following information was included for the site. Gold was found there and a 10-head battery was installed in 1894 by Garden Gully G.M. Co., and crushed ore until 1901 when the State Battery commenced operation.

Around 1910, Bennett's Hotel was constructed on the main track between Meekatharra and Garden Gully and on to Abbotts and Peak Hill. Wells were sunk along the edge of Garden Gully creek around 1905, and pumping stations were established to provide water for Meekatharra (Reserve A10633 was presumably proclaimed then to cover the wellfield). The water from Garden Gully was highly mineralised and found to be unsuitable for domestic use, but was used for at least one mine, the Fenian at Paddy's Flat.

4.2 GEOLOGY

The Tieraco 1:100,000 Geological map for the area (Chen and Ivanic, 2009) shows that the Garden Gully gold deposits are situated in an area of colluvial footslope (including ferruginous gravel and duricrust) with a northerly-trending, Proterozoic dolerite dyke.

A description of the Archaean geology in the area of the Kyarra workings at Garden Gully, close to the Meekatharra – Mount Clere Road is taken from St Barbara (1994). The mineralised area is underlain by undifferentiated felsic sedimentary rocks to the west, sheared felsic volcanic and volcaniclastic rocks to the east, with some local mafic to ultramafic units. Further east there is a thin unit of Stockyard Basalt, and then granitic intrusives. Geological interpretation by Boddington (2015) shows the host rock to be mainly a mafic volcanic (dolerite or basalt) with some ultramafic units (talc-chlorite and sericite schists).

Gold mineralization is associated with steeply dipping quartz veins within a series of anastomosing ductile shear zones. The linear drainage of Garden Gully is interpreted to follow a cross-cutting, north-easterly trending fault (Garden Gully Shear Zone) which truncates rock units to the south. Three other north-north-easterly trending faults are shown truncating mineralised zones on a plan in the Ora Gold October 2023 Investor Presentation. Aeromagnetic survey results for the area (MagSpec, 2016) show a complex structure for the area, including apparent northerly faults trending west of north, and east – west faults.

A tributary palaeochannel of Tertiary age follows the Garden Gully drainage on its northern side (Fig. 5) and has been defined by a passive-seismic survey (Resource Potentials, 2024). The survey results suggest that the palaeochannel is about 70 m deep. The palaeochannel is likely to contain basal sands (Werillup Formation). One drillhole north of the drainage is reported to have intersected about 100 m of sand; and the Main Roads bore probably intersects the southern edge of the channel.

4.3 FIELD INVESTIGATIONS

4.3.1 BORE REHABILITATION AND DOWNHOLE CAMERA SURVEY

The Crown Prince production bore (Bore CP, Fig. 5) was inspected using a downhole camera survey on 16 July 2024. The survey determined the downhole bore construction, including depths of blank PVC casing and slotted lengths, which were previously unknown. The slotted PVC lengths appear to be manually slotted from 38.13 m to the base of the bore at 73.13 m

The camera survey identified a raised lip at a depth of 49.78 m, restricting the internal diameter and preventing the lowering of a 4" submersible pump beyond this point for subsequent hydraulic testing (discussed in Section 4.3.3). Bore CP appears to be partially clogged at the time of the survey. Babylon Power and Pump contractors rehabilitated the bore using a downhole brush on 8 September 2024 prior to conducting pumping tests.

Whilst not anticipated as a requirement for this assessment, the nearby Main Roads Bore was also inspected with a downhole camera survey. A summary of the surveyed bore construction details is provided in Table 8, and a log of bore construction details are shown in Appendix II.

4.3.2 MONITORING BORES

Six monitoring bores were drilled and constructed from 27 to 30 August 2024 by Caswell, utilising a 660 Schramm drilling rig employing reverse-circulation (RC) drilling methods. At each site, a hole was drilled to 73 m depth with a 143 mm diameter hammer bit. Airlift water-yields, pH, and electrical conductivity (EC) generally were measured at each rod change. Initial (measurable) water-yields were obtained at around 13 to 25 m depths, within the weathered bedrock (saprolite). The highest groundwater air-lift rates (~ 1.5 L/s) were generally measured at the end of the holes, with notable increases at the interfaces between the weathered and fresh rock at about 50 depth (below ground level).

Monitoring bores were constructed at each drilled borehole to enable monitoring of groundwater drawdown during pumping tests. The bores have been designed to meet the Minimum Construction Requirements for Water Bores in Australia – Fourth Edition (NUDLC, 2020). Details of the monitoring bores are summarised in Table 8, and composite bore logs are included with completion data in Appendix II.

4.3.3 PUMPING TESTS

The Crown Prince production bore (Bore CP) was tested by Babylon Pump and Power from 4 to 8 September 2024, using a 7.5 kW Caprari E4XP60/25 submersible pump installed at 50 m depth. An initial step-rate test, comprising three steps at increasing rates of one-hour each, was conducted at rates of 3, 5, and 7 L/s.

The constant-rate test (CRT) was commenced at a discharge rate of 4 L/s, but the rate of groundwater drawdown quickly exceeded the estimated rates from around 90 minutes into the test. The pumping rate was reduced to 3.5 L/s at 280 minutes into the test, and it was planned to change to a constant head test method if the drawdown approached the pump inlet depth. A drawdown of 36.49 m (final water level of 44.94 m bgl) was measured at the end of the 48-hour test. The bore recovered to within one metre of the initial water level after 50 minutes from the cessation of pumping.

The drawdown data for Bore CP suggest that initially, the drawdown rate was small because much of the water was being pumped from storage in old workings. The rate of drawdown increased as water was then drawn from rocks of relatively low permeability.

Table 8: Summary of drilling and bore construction details at Crown Prince

Bore ID	Target ID	GPS Coordinates GDA2020 Zone 50		Top of PVC Casing	Drilled Depth	Constructed Depth	Constructed Material	Slotted (open) interval	Bore Annulus			Standing Water Level	Electrical Conductivity (field)	pH	Final Airlift Yield
									Gravel Pack	Bentonite Seal	Cement Seal				
		mE	mN	(magl)	(mbgl)	(mbgl)		(mbgl)				(mbgl)	(µS/cm)		(L/s)
Bore CP[#]	Existing	645,918	7,073,789	0.2	-	-	150 mm ID PVC Vertical slotted	38.13 - 73.13	-	-	-	8.51	1,966	7.05	-
Main Roads bore[#]	Existing	644,884	7,074,214	0.2	74	63.63	125 mm ID PVC	22.13 - 34.13, 40.13 - 52.13, 58.13 - 63.63	-	-	-	5.76	-	-	-
OGGMB856	MB01	645,929	7,073,758	0.5	73	72	50 mm PVC CL9 (Blank), 50 mm PVC CL12 (Slotted)	54 - 72	6-47 & 49-73	5-6 & 47-48.5	0 – 5	9.92	4,300	8.18	0.7
OGGMB857	MB02	645,925	7,073,871	0.5	73	72		18 - 72	6-73	5-6	0 – 5	7.58	3,930	8.2	1
OGGMB858	MB03	645,946	7,073,788	0.5	73	72		18 - 72	6-73	5-6	0 – 5	9.6	3,460	8.01	2.5
OGGMB859	MB04	645,123	7,073,650	0.5	27	24		6 - 24	6-27	5-6	0 – 5	5.83	-	7.6	-

Existing bore with no prior lithology or bore construction log. Information derived from downhole camera survey on 16 July 2024

Table 9: Aquifer parameters from pumping test of Bore CP

Pumped bore	Monitoring points analysed	Transmissivity	Aquifer Thickness	Hydraulic Conductivity	Storativity	Comment
		m^2/d	m	m/d		
Bore CP	MB01, MB03	48.15	64.62	0.74	0.069	Each located ~ 30 m from Bore CP, near the abandoned Kyarra Shaft workings
Bore CP	MB02	33.74	64.62	0.52	0.004	Located 83 m north of Bore CP, towards Garden Gully Creek

The results of the pumping test indicate that the pumping capacity of Bore CP is low, 2 L/s or less.

An assessment of the pumping test data was undertaken using AQTESOLV software to assess the aquifer parameters. Drawdown data from monitoring bores MB01, MB02 and MB03 were analysed using the Theis type-curve solution for an unconfined aquifer that allowed for variable pumping rates. The aquifer parameters determined from the analyses are provided in Table 9 and are given in Appendix III.

Maximum drawdowns measured at the end of the pumping test are given in Table 10.

Table 10: Maximum Drawdowns at end of Bore CP Pumping Test

Bore	Max. Drawdown
	(m)
CP (Prod.)	37.30
MB01	0.81
MB02	0.62
MB03	1.15
MB04	0.02
Main Roads	0.00

Electrical conductivity (EC) measurements of the discharge water throughout the constant-rate test varied from 1,762 to 1,966 µS/cm. Groundwater samples were collected by Babylon on completion of the pumping test and sent to ALS Environmental laboratory (a NATA-accredited laboratory) by courier. Water quality results are presented in Section 4.4.5 and certificates of laboratory analyses are included in Appendix IV.

4.4 HYDROGEOLOGY

4.4.1 GENERAL

There are a number of pastoral bores and wells in the Garden Gully area that are recorded in the Department of Water and Environmental Regulation (DWER) Water Information Reporting (WIR) database, and shown on the 1:100 000 Geological Sheets, in particular the Tieraco sheet referred to in Section 4.1 above (Table 11, and Fig. 6). Locations in the WIR database are inaccurate and often don’t coincide with the positions shown on the geological map, as can be seen in the above figure.

There is also a series of Garden Gully bores that are all recorded at or near the same location. They were drilled for Whim Creek Consolidated, presumably in exploration for a mine water supply.

4.4.2 WATER INFORMATION REPORTING DATA

Hydrogeological data for the area that are available in the WIR database are summarised in Table 11.

Some of the Garden Gully bores, located upstream of the Ora Gold project, intersected significant thicknesses of porous calcrete and had moderately high yields (up to 790 m^3/d). Pastoral bores and wells generally had low yields (sufficient for that needed for stock) except Hill 60 Well (250 m^3/d).

The groundwater is fresh to slightly saline, with salinities ranging from 690 to 3,500 mg/L TDS.

4.4.3 AQUIFER CHARACTERISTICS, GARDEN GULLY

Photographs from four diamond-cored drillholes at Garden Gully, cored from ground surface, indicate that the main permeable broken zones are weathered, sheared mafics (generally dolerite) or ultramafics; or altered quartz mineralised zones. Locations of the strongly-jointed core zones are shown in Figure 7. Most of the rocks below 90 m downhole (at 60^{o} dip) appear to be weakly jointed and of relatively low permeability, although locally some open fractures extend down to about 140 m depth (downhole).

Many drillholes were recorded as having intersected water, commonly from depths below about 12 to 30 m (downhole) in completely oxidised or transition-zone rocks (Fig. 7). Five drillhole logs recorded faults or shears along a north-north-easterly line (Fig. 7). A few holes intersected old stopes. A number of drillholes intersected high water flows from strongly fractured rocks or stopes, generally resulting in the cessation of drilling. The locations of the high-flow zones are shown by red symbols in Fig. 7. One of the holes, OGGRC541 was drilled through one of the northerly trending cross-cutting structures that offset the mineralised zones. It was airlifted with a water flow rate of 5 L/s with the rate probably limited by the small hole diameter (140 mm) and is said to be typical of the wet drillholes.

Two drillholes intersecting the eastern of the three faults (Fig. 5) that are within the envelope of the planned western pit are reported to have had high airlift water rates; these include hole SEB17, which air-lifted at 20 L/s.

There are few cored holes, but some of those in/near the southern orebody (planned western pit) had strongly-jointed zones.

The palaeochannel that has been delineated by the passive seismic survey is likely to contain basal sands of moderate permeability.

Overall, the rocks at Garden Gully are likely to be quite permeable, and would probably require moderate to high pumping rates for pit dewatering.

Table 11: Bores and Wells Recorded in WIR Database

Site Ref	Name	Easting	Northing	Depth	TDS	KL/d	SWL	Aquifer
70200131	GG25	650681	7075062	21.0				Calcrete
70211573	Hill 60 Mill W	639925	7067028	23.8	1060	251	16.76	
70211710	Bennett	644279	7073506	15.2		20	12.19	
70211711	Big Gum Mill W	639679	7072720	6.1		14	3.66	
70211712	Deafy	647360	7069234	41.2	700	22	21.95	
70211713	Little Downey W	649639	7077075	3.4		18	2.13	
70211714	Pettiford	647586	7078775	17.7	700	16	7.92	
70211715	White Horse W	639179	7077188	28.0	3500	6	26.82	
70211716	Well	641663	7076025	0.0				
70211717	Red W	640188	7071005	42.7	1000	6	5.58	
70211718	Outcamp	643841	7072856	0.0	1330			
70211719	D1-87	649489	7073021	66.5	690		10.9	
70211720	D1-88	647266	7071162	94.0			20	
70211721	D2-88	646266	7070320	87.0			21.1	
70211722	D3-88	644934	7068623	111.0			23	
70212006	Joe	651016	7074095	8.2	1315	36	3.35	
70212010	Garden Gully 1	650392	7075156	70.0	2325	138		fract basalt
70212011	Garden Gully 2	650392	7075156	81.0	2150	150		basalt
70212012	Garden Gully 3	650398	7075156	18.0	1070	786		Calcrete
70212013	Garden Gully 4	650385	7075156	22.0		346		Calcrete
70212014	Garden Gully 5	650385	7075156	18.0	1126	144		alluv., calc clay
70212015	Garden Gully 6	650385	7075156	24.0	780	144		Calcrete
70212016	Garden Gully 7	650385	7075156	18.0				gabbro
70212017	Garden Gully 8	650385	7075156	18.0				mafic tuff
70212018	Garden Gully 9	650385	7075156	24.0				mafic tuff
70212019	Garden Gully 10	650385	7075156	24.0	2150	<50		clayey alluv.
70212020	Garden Gully 11	650385	7075156	40.0				basalt
70212021	Garden Gully No 12	650385	7075156	34.0				basalt
70212022	Garden Gully 13	650385	7075156	45.0				basalt
70212023	Garden Gully 14	650392	7075156	16.0				Calcrete
70212024	Garden Gully 5	650392	7075156	20.0				calc. alluv.
70212025	Garden Gully 16	650392	7075156	40.0		101		basalt
70212026	Garden Gully 17	650404	7075149	39.0				basalt or tuff
70212027	Garden Gully 18	650405	7075162	42.0				mafic
70212028	Garden Gully 19	650392	7075162	51.0				basalt
70213061	No 2 W	649031	7074787	0.0			7.62	weath. Greenst.
70213273	Downey W	650048	7076450	4.3	1950		3.05	ferricrete
70219012	Garden Gully 2	645528	7073061	0.0			6.88	

4.4.4 GROUNDWATER LEVELS, FLOW DIRECTIONS

Water levels in bores around Garden Gully – that are recorded in the WIR database – were reduced to m AHD using the SRTM topographic contours described in Section 2.1 above, and together with water levels measured in project bores/drillholes; values are contoured in Fig. 8. The levels indicate that groundwater flows westerly from higher ground (in the east) towards the Garden Gully drainage, and then down the drainage to the south-west. The groundwater level at the Garden Gully project site is at about 475 m AHD.

A few of the water levels in the WIR database would have been impacted by pumping from the bores/wells themselves or others nearby, and there is some uncertainty in bore locations and the SRTM levels used to reduce the WIR water-level data to m AHD.

4.4.5 GROUNDWATER QUALITY

The distribution of salinities recorded in the WIR database are shown in Fig. 9. They indicate values of generally around 1,000 mg/L near the drainage, with some higher values of 2,000 to 2,300 mg/L TDS upstream in the deeper bores drilled for Whim Creek Consolidated.

A water sample from the Kyarra shaft was analysed by SGS for selected parameters in 2004 (Holly Mining, 2004). The results are given in Table 12.

Table 12: Results of Water Analysis, Kyarra Shaft

Parameter	Units	LOR	Value
pH	pH	0.1	8.2
Tot. Dissol. Solids (grav) @ 180°C	mg/L	10	1,800
Calcium	mg/L	0.5	110
Sulphate	mg/L	1	290
Carbonate	mg/L	1	<1
Nickel	mg/L	0.05	<0.05
Arsenic	mg/L	0.005	0.045

The results show that the water was brackish (1,800 mg/L TDS) and slightly alkaline (pH 8.2) with a low arsenic concentration.

The results of the analysis of the water sample collected from bore CP at the end of the pumping test, on 8 September 2024, are given in Appendix IV, and show the water to be very similar to that from the Kyarra shaft. The water is of sodium chloride type, slightly alkaline (pH 7.77), and is brackish with a salinity of 1,620 mg/L TDS. Metal concentrations are generally low or below reference levels, although arsenic is slightly elevated (0.128 mg/L). Nutrients are low – Total nitrogen 2.1 mg/L, and total phosphorus 0.04 mg/L.

Eight additional water samples were collected from bores and drillholes on 4 October 2024 and submitted for chemical analysis. The results for key parameters are given in Table 13, and the certificates of analyses (COA) are included in Appendix IV. Note that in the COA, bore CPMB004 should read CPMB003.

Table 13: Results of Chemical Analyses, Key Parameters, October 2024

Site	mE	mN	TDS	pH	As	TN	TP
			(mg/L)		(mg/L)	(mg/L)	(mg/L)
CPMB03	645925	7073871	1,340	7.71	0.002	5.7	0.04
Kyarra Shaft	645950	7073780	1,640	8.04	0.106	0.9	0.05
OGGDD842R	646179	7073847	2,640	7.89	0.012	9.3	0.04
OGGV1	646145	7073736	2,350	7.86	0.093	93.2	6.28
OGGDD927	646081	7073697	3,000	7.90	0.070	11.8	0.0
OGGDD847	645953	7073719	2,500	8.04	0.021	6.3	0.02
OGGDD846	645989	7073634	4,070	7.86	0.044	12.8	0.04
OGGDD844	646144	7073671	1,770	7.85	0.012	0.9	0.03
		Mean:	**2,414**	**7.89**	**0.045**	**17.6**	**0.82**

The nutrients in drillhole OGGV1 are unusually high and could indicate local contamination.

5 DEWATERING ASSESSMENT

5.1 MINE PLAN

The preliminary mine plan is for two pits (Fig. 5), called West and East pits in this report, to be mined to depths of about 136 m and 53 m, respectively, over a three-year period.

5.2 DEWATERING FLOWS

Approximately 295 KL/d were reported to have been pumped from the 95 m-deep Kyarra shaft to keep the shaft and drives dry during early 20th century mining (E. de C. Clarke, 2016, cited in Holly Mining, 2004); and a similar quantity was pumped from a bore alongside the shaft when the shaft was refurbished to a depth of 60 to 70 m in or before 2004.

It is likely that considerably higher dewatering pumping rates would be required during mining of the planned Crown Prince pits, based on the recorded high flows encountered in drillholes and the strong fracturing seen in core photos (see Section 4.3.3 above).

A numerical groundwater model was constructed and run to estimate dewatering flow rates, and groundwater flows to the final mine voids. The calculated flow rates are based on limited data, and should be regarded as approximate only.

5.2.1 MODEL DESCRIPTION

The model consists of a rectangular grid of 80 columns, 122 rows and one layer covering an area of 6 km east-west and 10.2 km north-south centred on the planned pits. The grid is aligned with the geological strike at Crown Prince, 10 degrees east of north. Model cells range in size from 25 m by 25 m at the planned pits, to 100 m by 100 m in peripheral areas.

The model layer extends down from ground level taken to be 484 m AHD, down to 344 m AHD (140 m depth).

The model utilises Processing Modflow Pro version 8.0.47 which incorporates Modflow, finite difference groundwater flow modelling software designed by the U.S. Geological Survey (McDonald and Harbaugh, 1988), and utilises subsequent modifications.

The model was set-up with low values of hydraulic conductivity and storativity for the wall (country) rocks, and low to moderate conductivity and storativity for the mineralised zones based on the values determined from the pumping test results. Relatively high hydraulic conductivity was assumed along the eastern fault where the high air-lift rates were measured. Low hydraulic conductivity of country rock was assumed on cross-cutting structures (Garden Gully shear, and a high-angle shear about 1,500 m south of Crown Prince) where the mineralised zones are offset and there would be restricted groundwater flow along the zones.

Recharge was assumed to be negligible. Constant hydraulic heads were assumed to apply at distances of about 5 km north-and south of Crown Prince, to simulate groundwater flows into the modelled area. The pre-mining water table was assumed to be flat at 480 m AHD.

Model parameters were adjusted in calibrating the model to groundwater-level drawdowns measured during the bore CP pumping test (Section 5.2.2). The adopted model parameters are summarised in Table 14.

Table 14: Summary of Adopted Aquifer Parameters

Horizontal Hyd. Conductivity (m/d)			Specific Yield (v/v)		
Country Rocks	Palaeochannel	Min. Zone	Country Rocks	Palaeochannel	Min. Zone
0.02	0.11	0.04 to 0.30	0.015	0.02	0.03, 0.04

5.2.2 MODEL CALIBRATION

The model was calibrated by using Modflow's Well package to simulate the bore CP pumping test over two days at an average pumping rate of 300 m^3/d (3.5 L/s), and then adjusting parameters until the model-calculated drawdowns were close to those measured. The drawdown values are compared in Table 15.

Table 15: Comparison between Measured and Modelled Pumping Test Drawdowns

Bore	Distance From Pumped Bore (m)	Measured Drawdowns (m)				Modelled Drawdowns (m)			
		3 Mins	29 Mins	288 Mins	2 Days	3 Mins	29 Mins	288 Mins	2 Days
MB01	32	0.00	0.00	0.18	0.69	0.00	0.01	0.15	0.79
MB02	82	0.00	0.00	0.05	0.50	0.00	0.00	0.06	0.66
MB03	28	0.00	0.00	0.18	1.03	0.00	0.03	0.18	0.66
MB04	807	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The calibration should be taken as very approximate, as the modelled drawdowns apply to only a small area of the aquifer.

5.2.3 DEWATERING FLOW RATES

To simulate dewatering, it was assumed that West pit would be mined over two years, and East pit in the third year, with a constant rate of vertical advance in each pit. The numerical model was run using Modflow's Drain package, to estimate dewatering flow rates during development of the two pits. Each model stress period covered a period of four months (122 days).

The estimated average dewatering flow rates calculated using the groundwater model are given in Table 16.

Table 16: Estimated Average Dewatering Flow Rates, Crown Prince Pits

Stress Period	No. Days	Av. m^3/d	Pit
1	122	2790	West
2	122	3680	West
3	122	3680	West
4	122	2670	West
5	122	2280	West
6	122	1310	West
7	122	0	East
8	122	370	East
9	122	440	East

5.2.4 SENSITIVITY ANALYSIS

Model parameters could be higher or lower than the assumed values, and so there is uncertainty in the estimated dewatering flow rates. The most sensitive parameters are horizontal hydraulic conductivity (KH), and drainable porosity (specific yield, SY). A sensitivity analysis was carried out to assess the potential ranges of dewatering flow rates for two cases:

1. Low flows, if values of KH and SY were only half those assumed; and
2. High flows, if values of KH were double those assumed.

The results are given in Table 17. They indicate that the highest average flows in Months 5 to 12 (SP2 and SP3) could possibly range from 1,900 to 5,400 m^3/d, compared to the best estimate of about 3,700 m^3/d.

Table 17: Results of Sensitivity Analysis

Model	Calc. Av. Dewatering Flows (m^3/d)	
Stress Period	**Low Flow Case**	**High Flow Case**
1	1,415	3,780
2	1,870	5,290
3	1,870	5,540
4	1,355	4,375
5	1,150	3,880
6	620	2,480
7	0	0
8	190	360
9	260	620

5.3 POTENTIAL IMPACTS OF MINING

The pit base is likely to be at least 100 m from the vegetation, but even so, there would be groundwater level drawdowns beneath the creek with the potential to impact vegetation. Trees along the creek are likely to be supported solely by soil moisture, but a vegetation survey should be conducted to see whether there are any trees that could be phreatophytic.

The Meekatharra Water Reserve, which includes the Sherwood Borefield that provides water for the town, is about 2.5 km from Crown Prince at its closest point (Fig. 2) but about 9 km from the nearest Sherwood Borefield bore. It is possible that drawdowns could extend as far as the closest edge of the reserve, but not as far as the nearest bore in that borefield. The Crown Prince deposit is also within an old water reserve, No. 10633, that was presumably to cover water that was to have been supplied to Meekatharra early in the 20th Century.

There are three pastoral bores or wells (shown on the Tieraco geological sheet) that could potentially be impacted by dewatering: No. 2 Bore, located about 800 m to the west, Gregg Well about 1 km to the north-north-west, and Bennett Bore, 2.5 km to the south-west (Fig. 6). The status of these watering points should be checked and details recorded (for example, water levels, salinity and aquifers intersected; and whether operational).

Model-calculated groundwater-level drawdowns are shown for the end of mining and dewatering of each pit in Figures 10 and 11. They suggest that the largest drawdowns will occur at the end of mining of the deep West Pit; and that at the end of mining of both pits, drawdowns could extend to Gregg Well, Bennett Well or Bore, No. 2 Bore, and Garden Gully 2 (if it exists); and possibly extend just as far as the corner of the Water Reserve.

5.4 WATER DISPOSAL

Water from pit dewatering will be used for dust suppression in the mining area and on the haul road. The project's mining engineer has estimated the water requirement to be about 854 m^3/d. Surplus water is proposed to be pumped first to the mined-out 5-Mile pit, 12 km south-east of Crown Prince; and then to Sabbath Pit, located 6.2 km south of Crown Prince.

The pre-mining groundwater level at 5-Mile pit was about 512 m AHD, 9.3 m below ground level (Rockwater, 2017), and there was probably a component of groundwater flow to the north towards Sherwood Borefield, four kilometres to the north with a flow velocity of less than 1 m per year. Since completion of mining, the pit lake level has apparently stabilised at 476.1 m, and so the pit is a groundwater sink, with groundwater flowing towards the pit.

The volume in 5-Mile pit between the pit lake and ground level is about 1.2×10^6 m^3. Filling the pit would again result in flow towards the above borefield, but a few years after cessation of mining, the pit lake level would be lowered again by evaporation so that all flow is again towards the pit. There would be no possibility of the discharged water reaching the borefield.

A summary of water quality data provided by Westgold Resources indicates that the pit lake increased in salinity from about 1,400 mg/L TDS initially, to 5,600 mg/L TDS in March 2019, before falling again during and immediately following the latest phase of mining. Arsenic concentrations have ranged from 0.06 to 0.14 mg/L.

No data are available for the as-constructed dimensions of Sabbath Pit, but based on data provided by Westgold, the volume of the pit above the current pit lake level (466.3 m AHD) is about 510,000 m^3. A water sample collected from the pit by Westgold Resources in March 2024 had a salinity of 1300 mg/L TDS, pH 8.8, and arsenic 0.012 mg/L.

A water balance prepared by the project's mining engineer indicates that the two pits should be capable of storing water for about 700 days of mining, without considering seepage losses which would increase the storage capacity.

Other means of water disposal are being considered as a contingency, including the use of evaporators, and discharging excess water to Garden Gully.

5.5 NATURE OF FINAL VOIDS

Water-balance calculations for the planned pits are used to estimate the final, post-mining pit lake levels. The calculations assume the following: that 80 % of the average rainfall within each pit perimeter reaches the pit lake; evaporation from the lakes are at the average dam evaporation rate given in Luke, Burke and O'Brien (1988); and that groundwater inflows are as determined by the numerical model. The calculated pit water balance values are given in Table 18.

Table 18: Final Void Water Balances, Crown Prince Pits

West Pit

RL	GW Inflows	Rain Accum.	Evap.	Balance
(m AHD)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
Perimeter	0	81	1,147	-1,066
475	160	81	935	-694
460	607	81	734	-46
450	866	81	606	341
425	1,380	81	327	1,134

East Pit

RL	GW Inflows	Rain Accum.	Evap.	Balance
(m AHD)	(m^3/d)	(m^3/d)	(m^3/d)	(m^3/d)
Perimeter	0	20	290	-270
476	93	20	181	-68
466	300	20	119	201
456	460	20	67	413

A zero value for the balance term – interpolated from values in the final columns of Table 18 – is indicated to occur at lake levels of 458.8 m AHD (West Pit) and 473.7 m AHD (East Pit). These represent equilibrium pit-lake levels and would be 16 m and 1 m, respectively, below the pre-mining (static) groundwater level.

The lower lake levels, compared to the pre-mining static groundwater levels indicate that the final voids should be permanent groundwater sinks. However, in the case of East Pit, the level are close and so it is possible the lake could be a flow-through feature, with flow from East Pit towards West Pit. Water in the pit lakes will gradually increase in salinity, but (as suggested by the modelling and water balances) there is predicted to be no seepage from the pit lakes back into the surrounding groundwater.

5.6 RECOMMENDED INVESTIGATION AND MONITORING PROGRAMME

It is recommended that a test-dewatering bore be constructed at the site of the high airlift water flows in the eastern fault, and that the bore be test-pumped to assess pumping capacity and groundwater-level drawdowns. The results can be used to refine the numerical groundwater model, which would be run to update dewatering requirements and impacts. The bore would form the basis of the dewatering system during mining.

A groundwater monitoring programme should be instituted prior to the commencement of mining, to include project monitoring bores MB03, MB04 and Main Roads bore; vegetation monitoring; and Yoothapina Station bores within six kilometres of Crown Prince including No. 2 Bore, Gregg Well and Bennett Bore.

Monitoring should also include monthly water volumes used for dust suppression and pumped to each disposal point; and pit lake levels in five-mile and Sabbath pits.

The monitoring programme would be a condition of a licence from DWER to extract water for dewatering and mining purposes, and would be described in a Groundwater Licence Operating Strategy (GLOS).

6 CONCLUSIONS

Two Crown Prince pits, in this report referred to as West and East Pits, are planned to be mined to depths of about 136 m and 53 m, respectively, on the southern side of the Garden Gully drainage, over a three-year period.

The results of hydrological and hydraulic analyses indicate that in a 1-in-100 year flood, the maximum depth of flow in the Garden Gully drainage would be about 2.2 m (in a channel within the creek) and the peak flow velocity 0.5 m/s. A perimeter bund south of the creek would be within the flood plain and should be about 2.5 m high and suitably constructed to withstand flood flows and to protect the West Pit.

Another small catchment drains between the two planned pits, and East Pit extends into the drainage line and the zone that would be impacted by flood flows. A diversion drain and bund are proposed to divert flows around East Pit. West Pit should not be affected but would be protected by a perimeter bund.

The southern of two proposed workshop sites would lie within another drainage, and in an area prone to flooding; and so the northern site has now been selected, as it is predicted to be above flood levels.

A tributary palaeochannel of Tertiary age has been defined by a passive-seismic survey on the northern side of Garden Gully. The survey results suggest that the palaeochannel is about 70 m deep.

Many exploration drillholes at the Crown Prince deposit intersected groundwater, and some reported high flows resulted in holes being unable to be completed. Some of the high flows could have been associated with open stopes in old workings, but some drillhole cores appear to be highly fractured and so quite permeable. Two drillholes intersecting the eastern fault of three northerly-trending faults that cut the planned West Pit are reported to have had high rates of water-airlift, including one at a rate of 20 L/s.

The old Kyarra shaft was reported to have been dewatered at a rate of 295 KL/d; and the pumping test on Bore CP near the shaft indicated a similar or lower pumping capacity, and rocks of moderately low permeability in the western part of West Pit.

A water sample collected from bore CP at the end of the pumping test was slightly alkaline (pH 7.77) and brackish with a salinity of 1,620 mg/L TDS. Metal concentrations were generally low or below reference levels, although arsenic was slightly elevated (0.128 mg/L). Nutrients were low – Total nitrogen 2.1 mg/L, and total phosphorus 0.04 mg/L.

A numerical groundwater model was constructed and run to estimate dewatering flow rates. It was partially calibrated to groundwater-level drawdowns measured during the Bore CP pumping test. The modelling results suggest that dewatering flow rates could average up to 3,700 m^3/d, with the peak rates in month's five to twelve of mining West Pit. There should be much lower rates of dewatering of East Pit.

Pit dewatering would result in groundwater-level drawdowns beneath the Garden Gully creek, with the potential to impact vegetation. Trees are probably supported by soil moisture rather than groundwater, but a vegetation survey should be conducted to see whether there are any trees in the creek that could be phreatophytic. Drawdowns could extend to three pastoral bores and wells (if the bores/wells still exist, and are in the positions recorded), and possibly as far as the corner of the Sherwood borefield Water Reserve.

The Crown Prince deposit is within an old water reserve, No. 10633 that is very unlikely to be needed for public water supply.

Water from pit dewatering will be used for dust suppression in the mining area and on the haul road. Surplus water is proposed to be pumped to the mined-out Five-Mile pit, and then to Sabbath Pit. Five-Mile pit has a capacity of about 1.2 x 10^6 m^3, and Sabbath pit about 510,000 m^3. The pits should have the capacity to store water for about the first 700 days of mining at the predicted dewatering rates, and probably longer with seepage losses from the pits.

The final mine voids should be permanent groundwater sinks, although in the case of East Pit it is possible the lake could be a flow-through feature, with flow towards West Pit. Water in the pit lakes will gradually increase in salinity, but there should be no seepage from the pit lakes back into the surrounding groundwater.

It is recommended that a test-dewatering bore be constructed at the site of the high airlift water flows in the eastern fault zone. Also, a groundwater monitoring programme should be instituted prior to the commencement of mining, to include Yoothapina Station bores within six kilometres of Crown Prince including No. 2 Bore, Gregg Well and Bennett Bore. The monitoring should also include monthly water volumes used for dust suppression and pumped to each disposal point; and pit lake levels in five-mile and Sabbath pits.

Dated: 29 October 2024 **Rockwater Pty Ltd**

[redacted]

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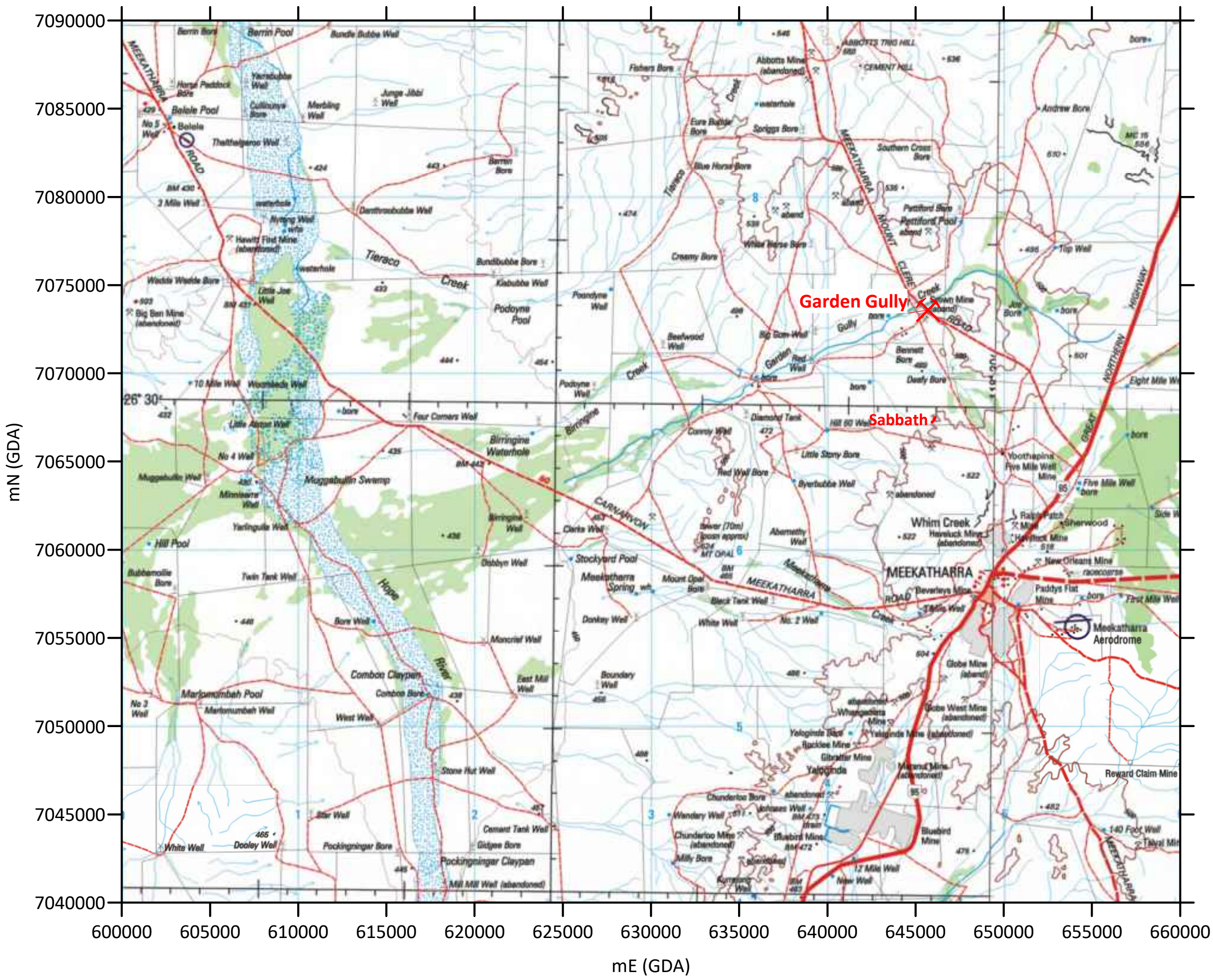
FIGURES

FIGURE 1



location.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

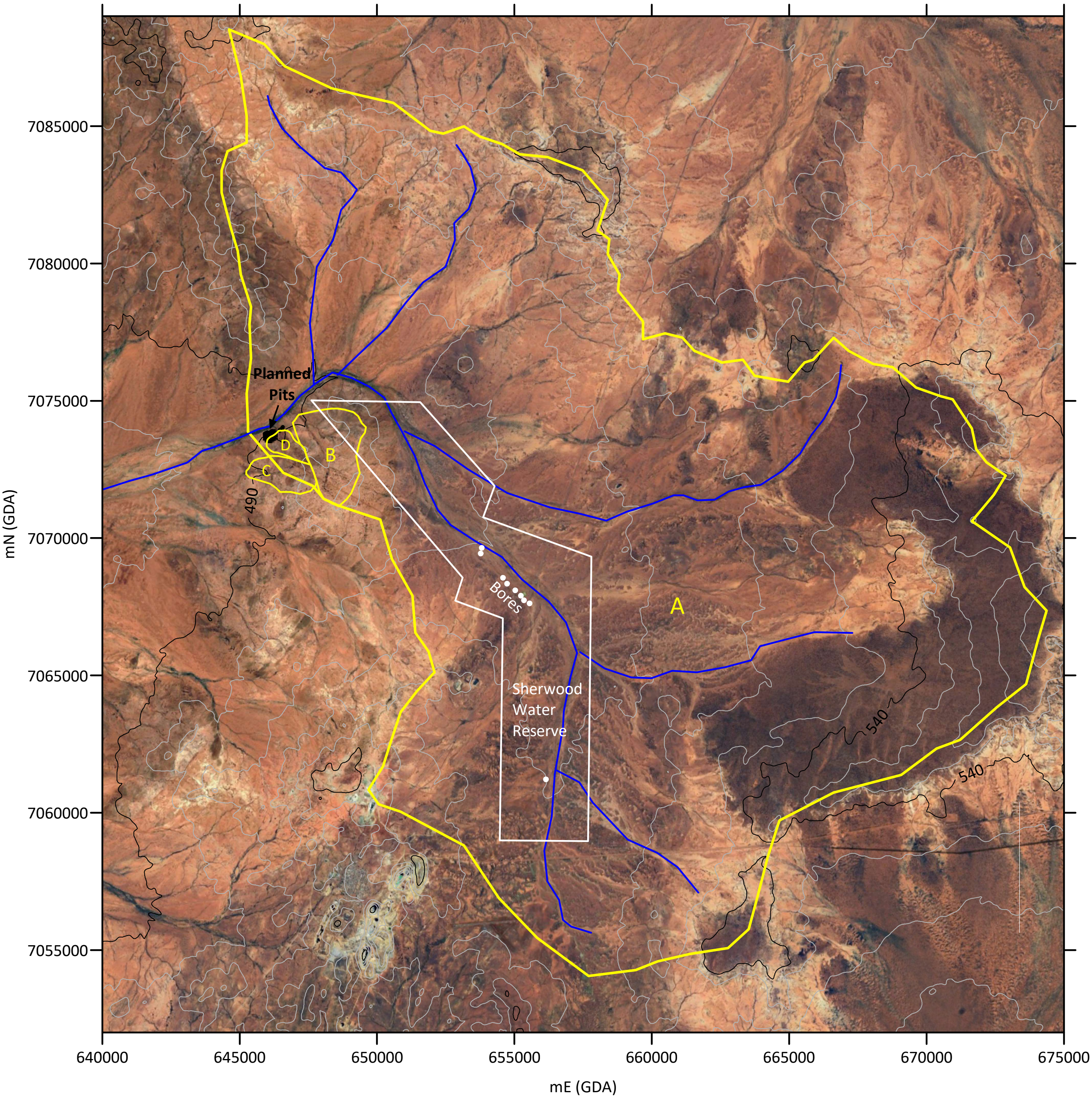
DATE: September 2024

Dwg No: 586-0/24/2-1

LOCALITY MAP

Rockwater Pty Ltd

FIGURE 2



catchment and contours.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

DATE: September 2024

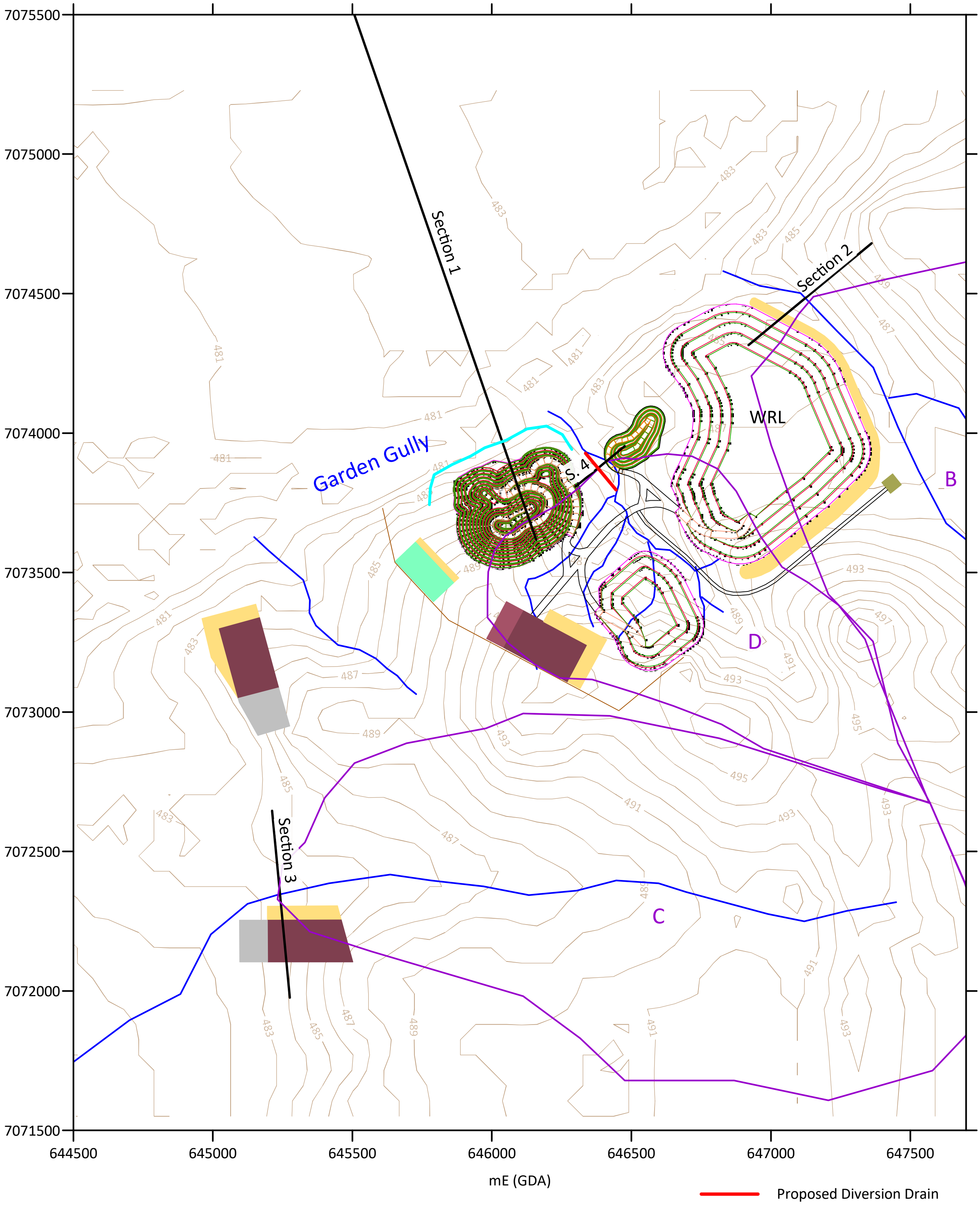
Dwg No: 586-0/23/2-2

GARDEN GULLY CATCHMENTS

& WATER RESERVE

Rockwater Pty Ltd

FIGURE 3



Proposed Diversion Drain
Bund Needed to Protect Pit
Drainage Line
S. 4 Cross-Section 4

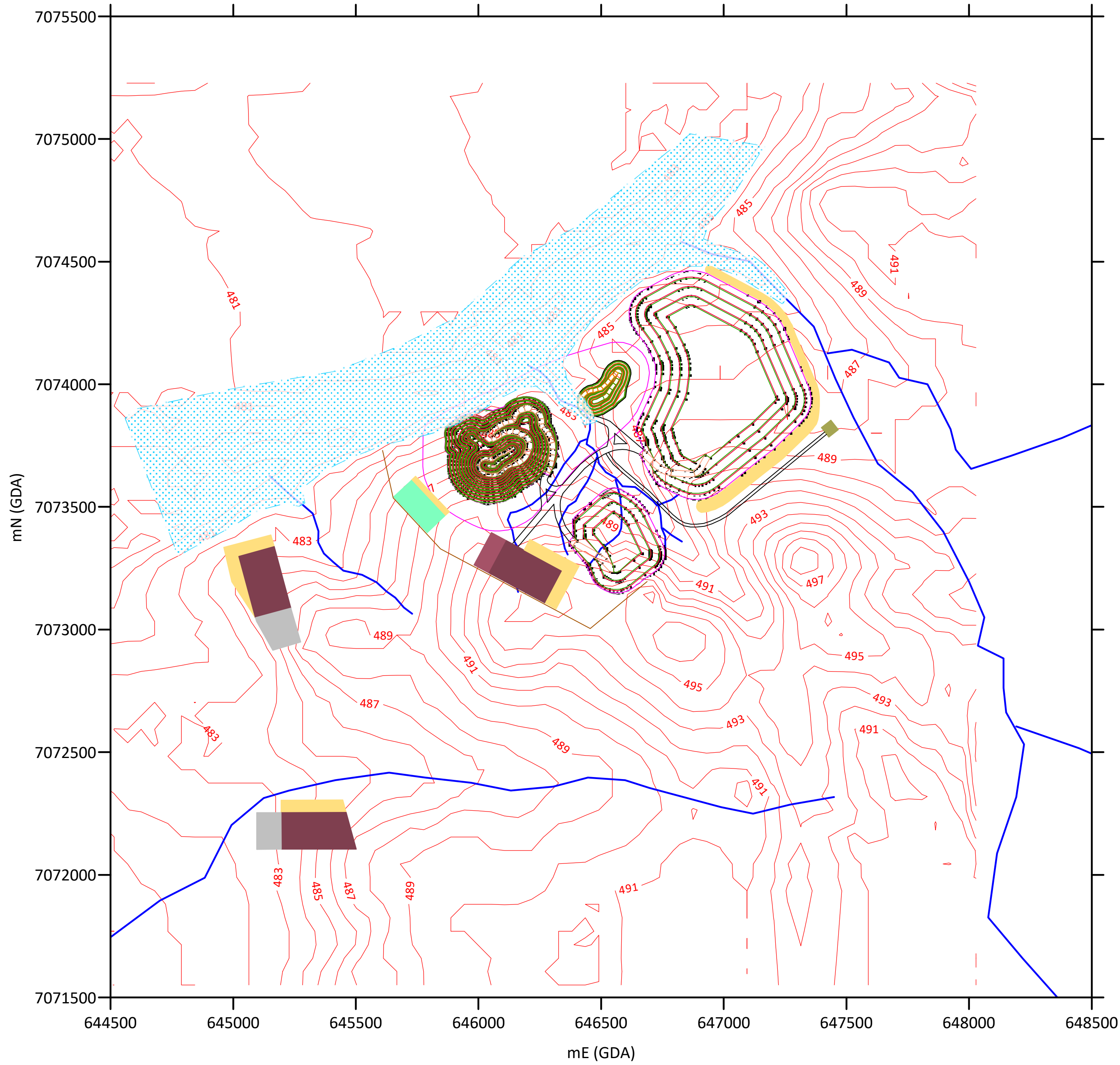
Site Layout Sept & contours.srf

CLIENT: Ora Gold
PROJECT: Garden Gully
DATE: October 2024
Dwg No: 586-0/23/2-3

SITE LAYOUT, SECTION LINES, LIDAR CONTOURS & FLOOD PROTECTION

Rockwater Pty Ltd

FIGURE 4



100-y flood extent.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

DATE: September 2024

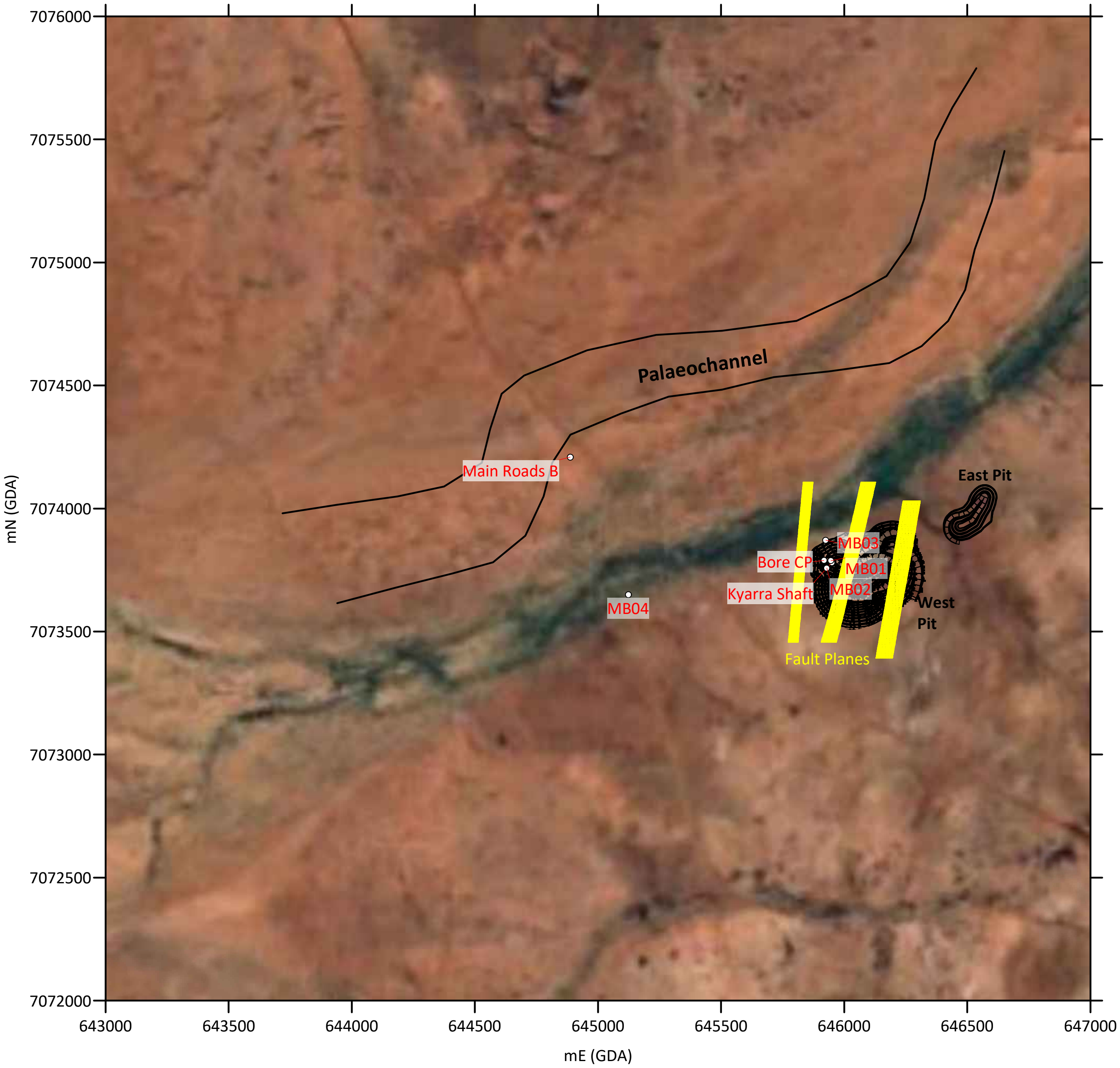
Dwg No: 586-0/23/2-4

PREDICTED 1-IN-100 YEAR FLOOD EXTENT

MAIN DRAINAGE, WITHOUT CONTROL STRUCTURES

Rockwater Pty Ltd

FIGURE 5



bore locations.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

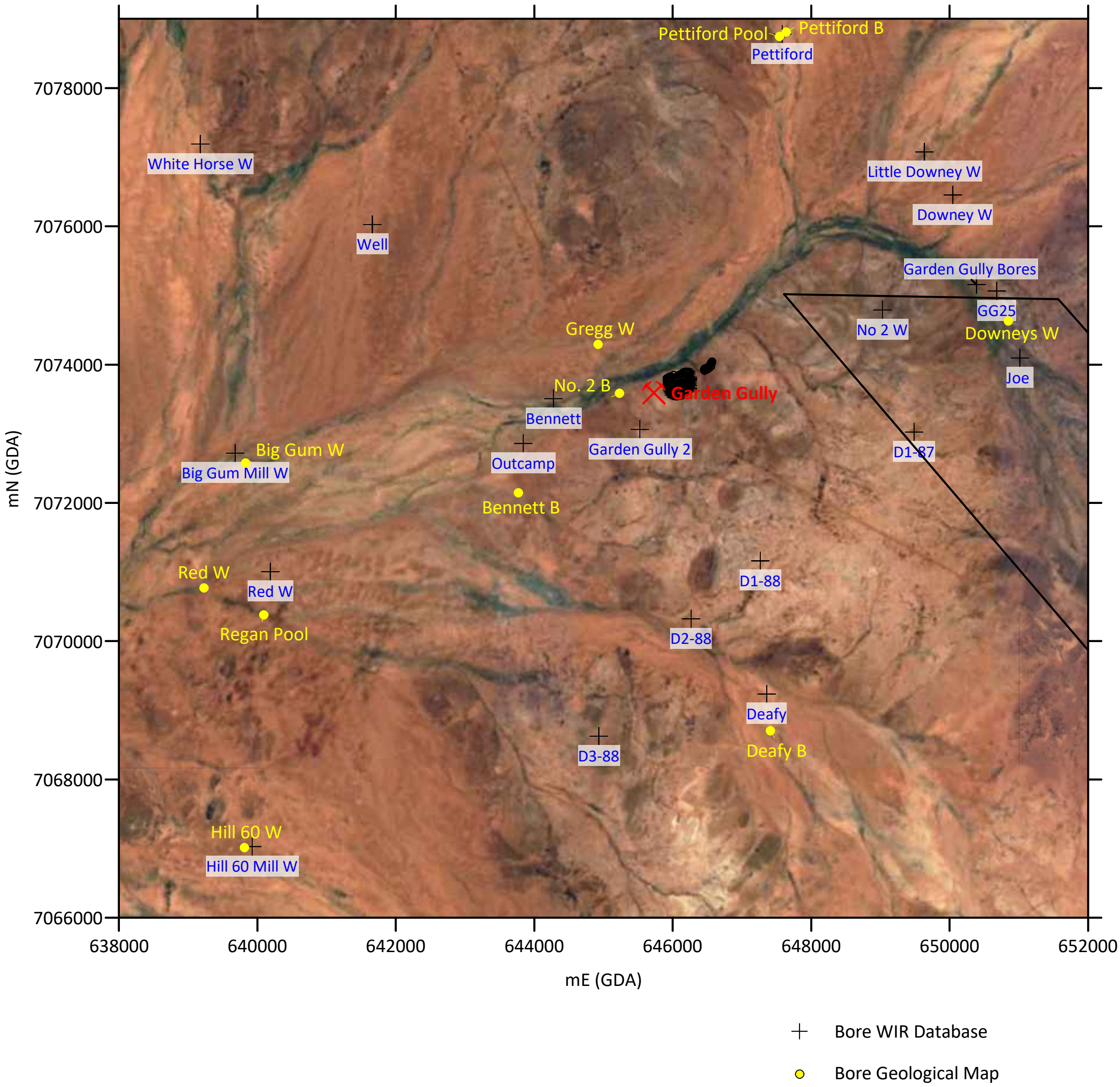
DATE: September 2024

Dwg No: 586-0/24/2-5

BORE LOCATIONS, GARDEN GULLY

Rockwater Pty Ltd

FIGURE 6



wir bores.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

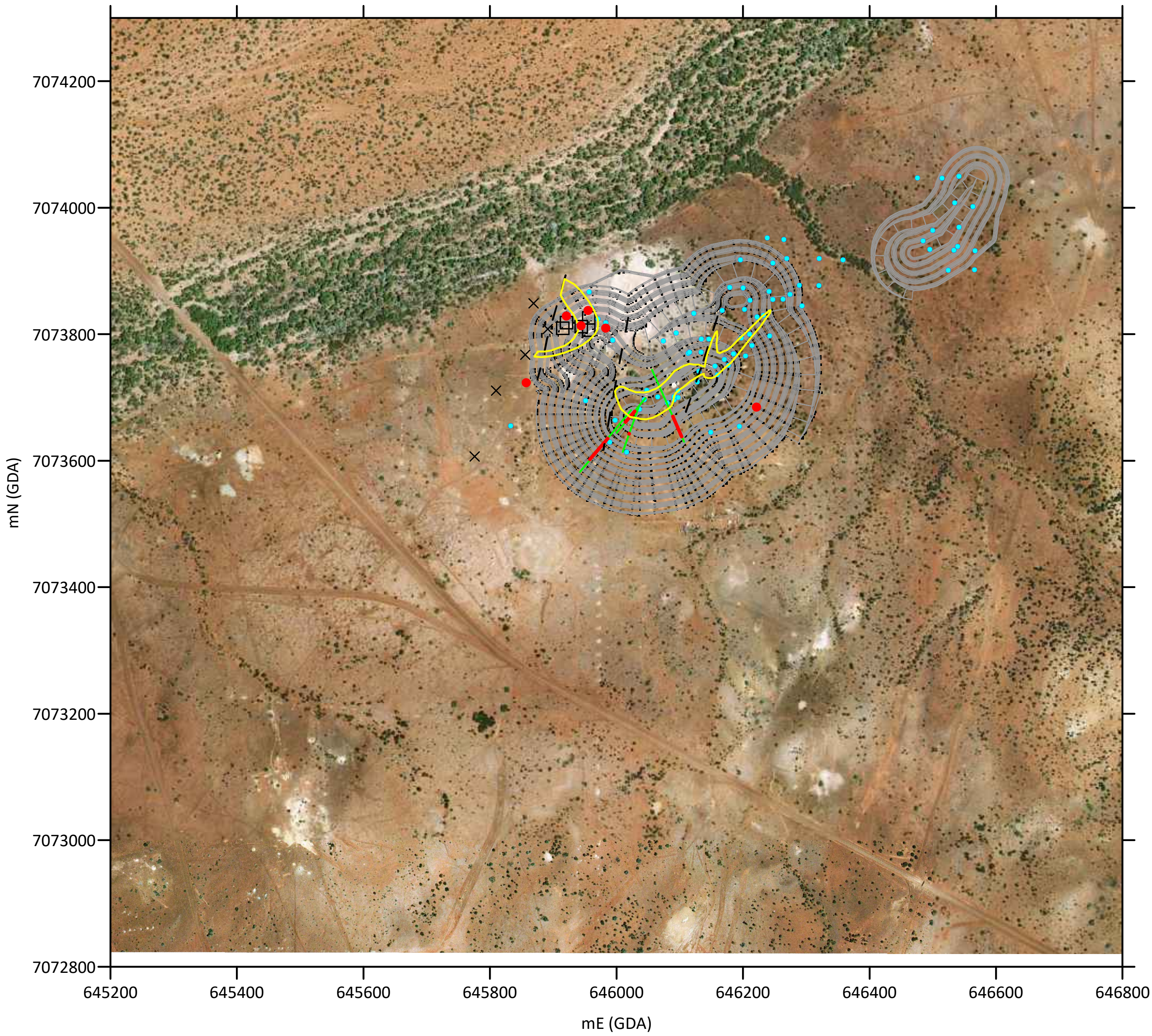
DATE: September 2024

Dwg No: 586-0/24/2-6

BORES & WELLS, WIR DATABASE

Rockwater Pty Ltd

FIGURE 7



Pit Design, Sept. 2024

Mineralised Zone 2023

Fault/Shear, in drillholes

Stope

Wet Hole

Very High Water Flow

Mapped Fault

Strongly-Jointed Core

faults, stopes & water.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

DATE: September 2024

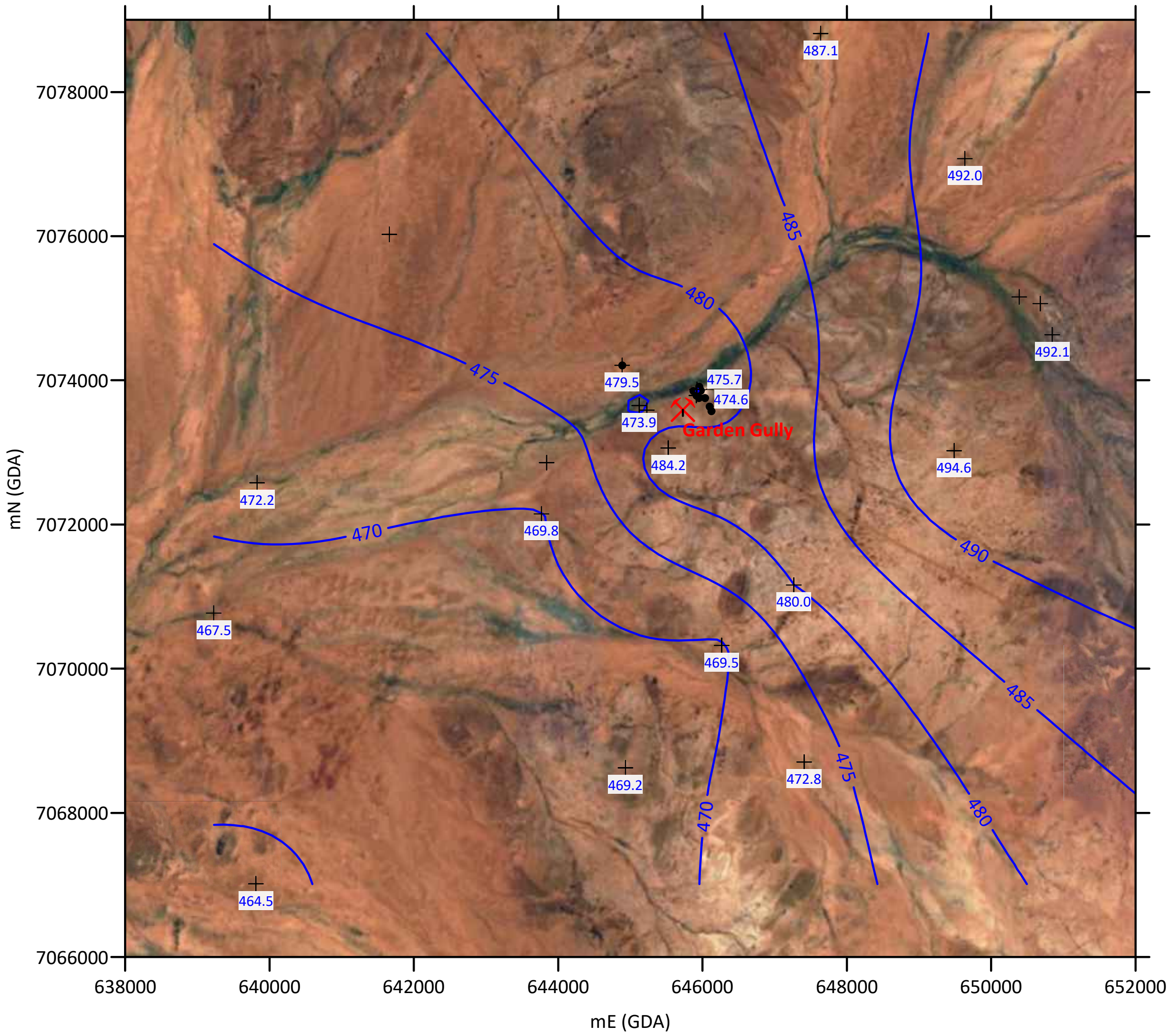
Dwg No: 586-0/24/2-7

WET HOLES, STOPES, FAULTS &

STRONGLY JOINTED CORE

Rockwater Pty Ltd

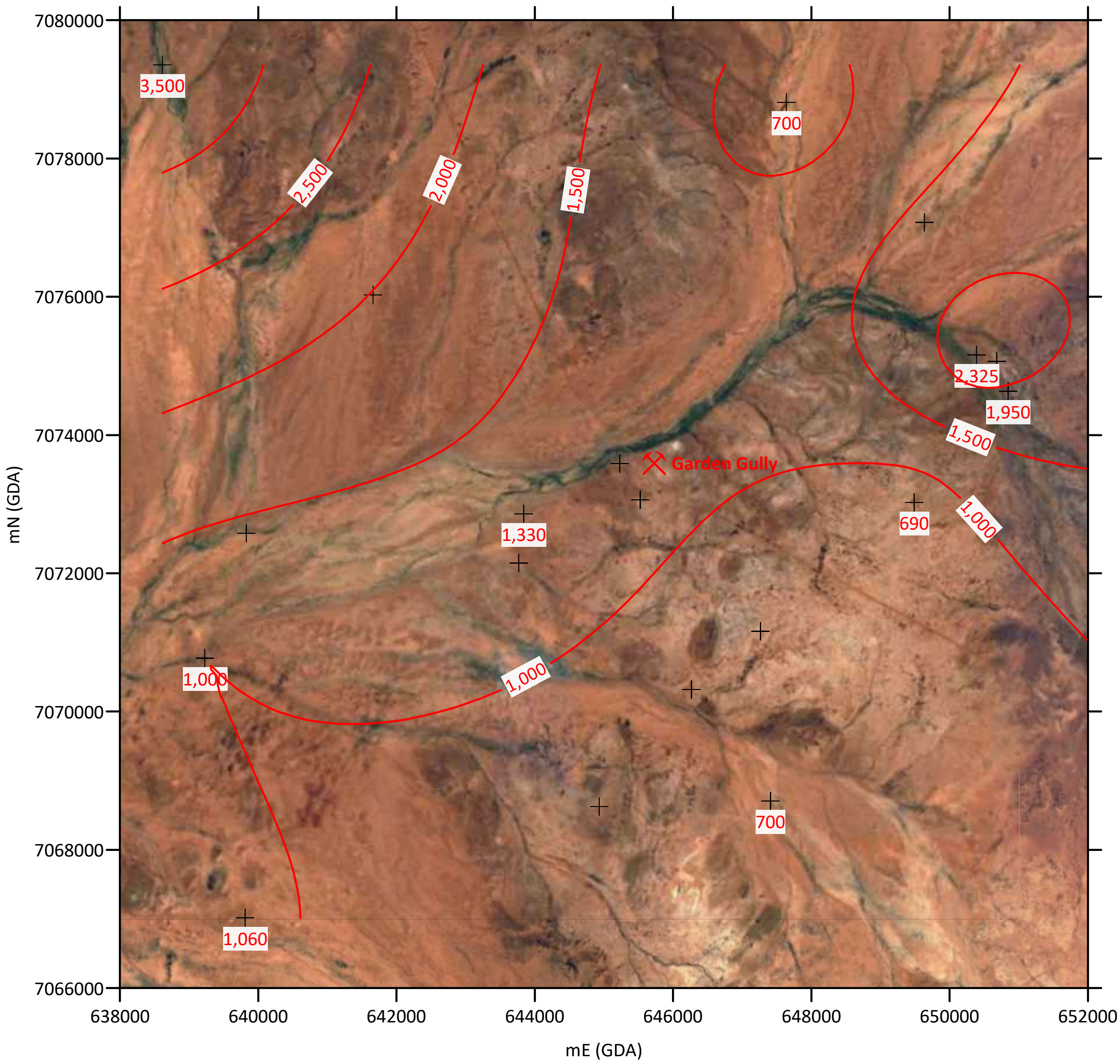
FIGURE 8



rlwls.srf

CLIENT: Ora Gold PROJECT: Garden Gully DATE: September 2024 Dwg No: 586-0/24/2-8	GROUNDWATER LEVELS (m AHD), WIR DATABASE AND GARDEN GULLY BORES Rockwater Pty Ltd

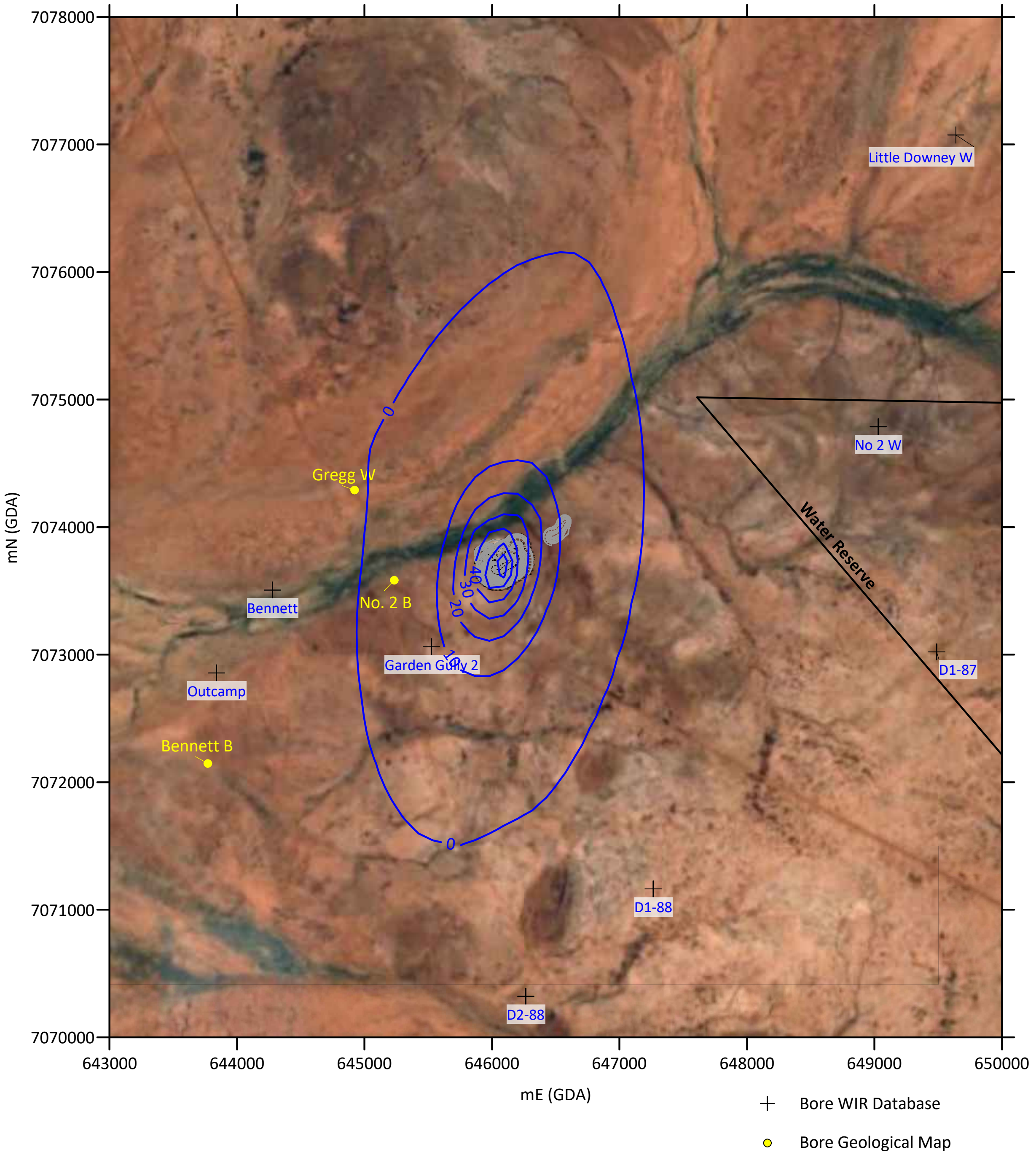
FIGURE 9



salinity.srf

CLIENT: Ora Gold PROJECT: Garden Gully DATE: September 2024 Dwg No: 586-0/24/2-9	GROUNDWATER SALINITY (mg/L TDS), WIR DATABASE Rockwater Pty Ltd

FIGURE 10



sp6dds.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

DATE: September 2024

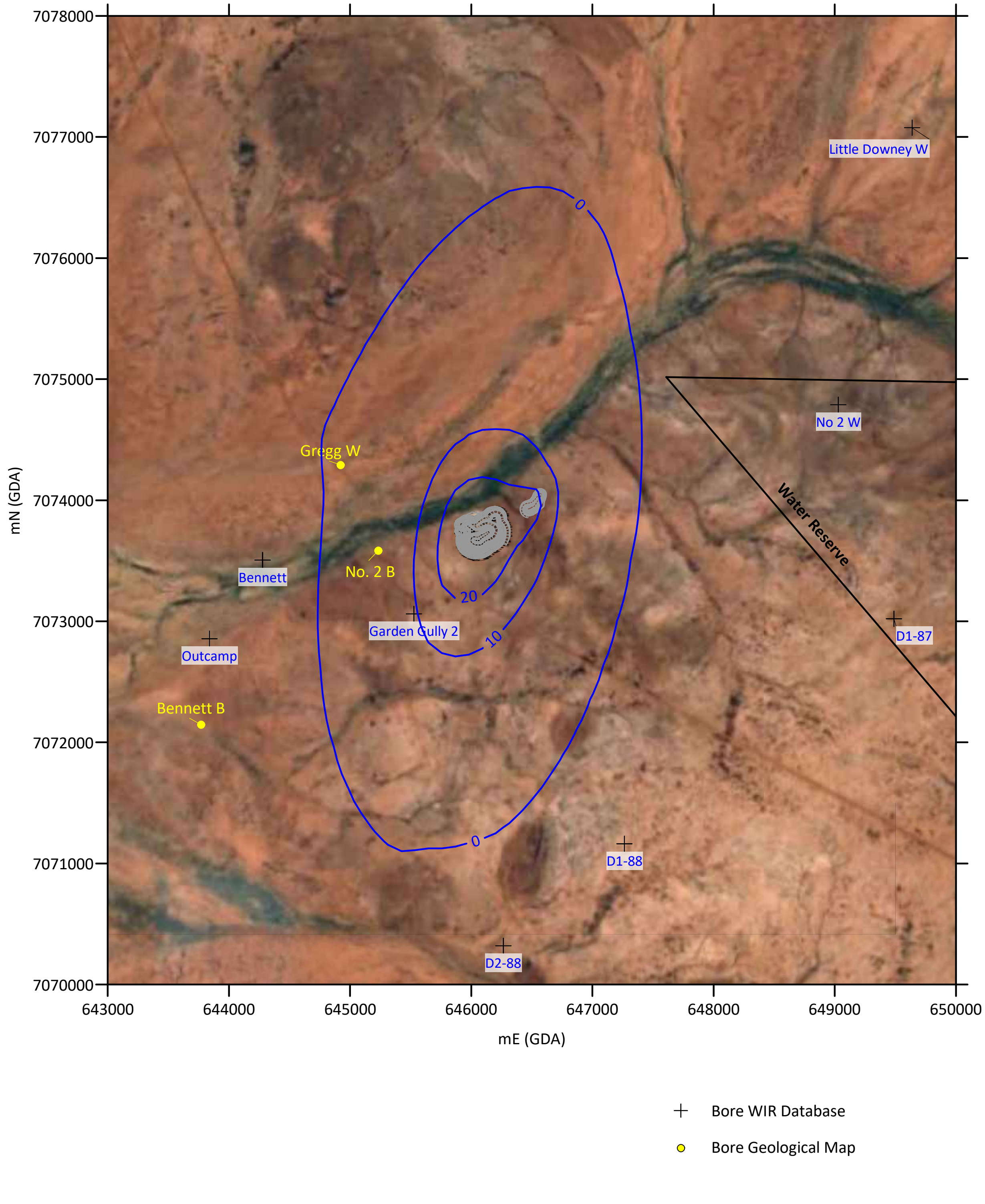
Dwg No: 586-0/24/2-10

MODEL-PREDICTED DRAWDOWNS (m)

AT END OF MINING OF WEST PIT

Rockwater Pty Ltd

FIGURE 11



sp9dds.srf

CLIENT: Ora Gold

PROJECT: Garden Gully

DATE: September 2024

Dwg No: 586-0/24/2-11

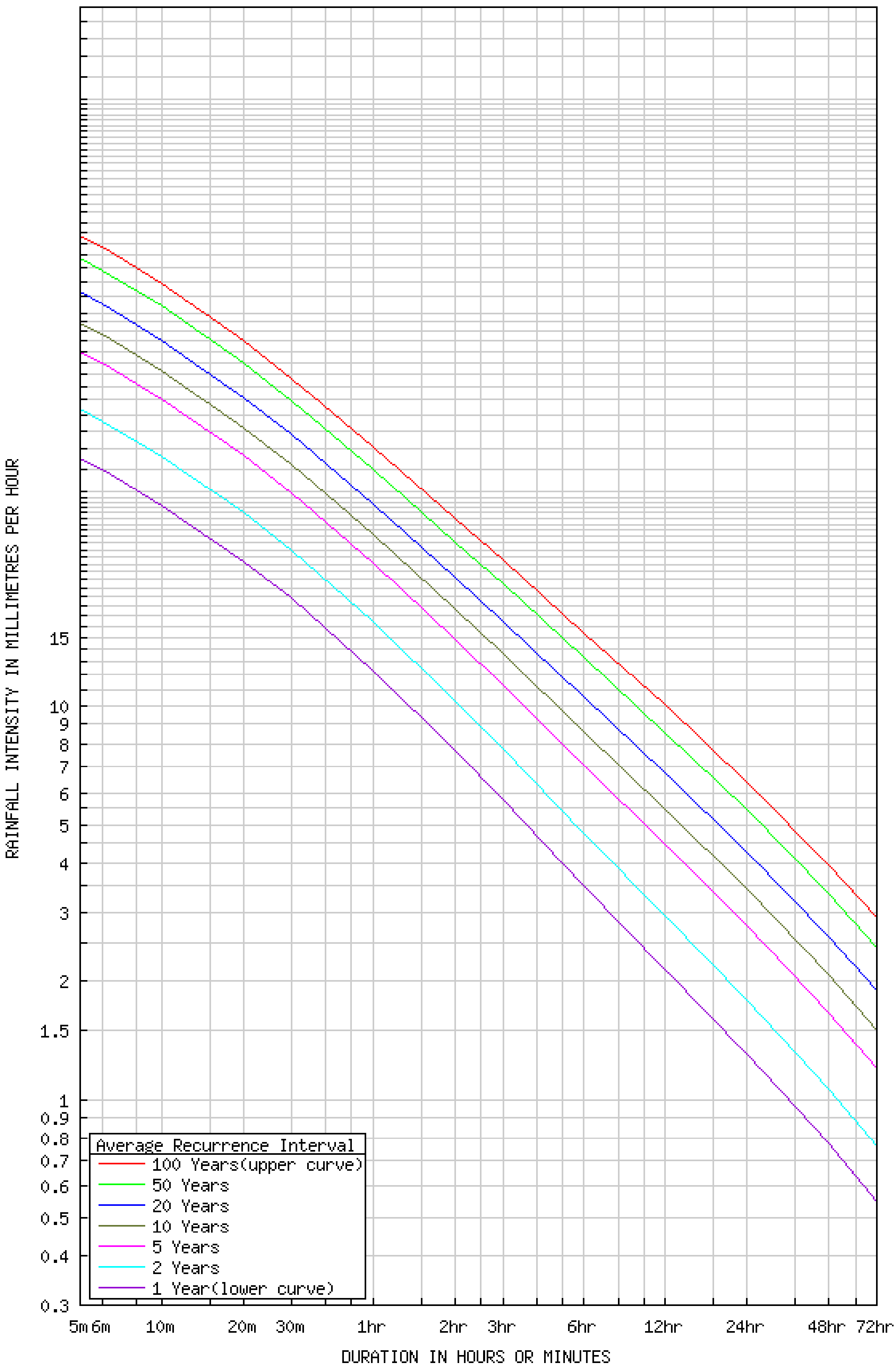
MODEL-PREDICTED DRAWDOWNS (m)

AT END OF MINING, BOTH PITS

Rockwater Pty Ltd

APPENDIX I

IFD CURVES & TABLES


RAINFALL INTENSITY IN MILLIMETRES PER HOUR
15
10
9
8
7
6
5
4
3
2
1.5
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
5m 6m 10m 20m 30m 1hr 2hr 3hr 6hr 12hr 24hr 48hr 72hr
DURATION IN HOURS OR MINUTES
Average Recurrence Interval
100 Years(upper curve)
50 Years
20 Years
10 Years
5 Years
2 Years
1 Year(lower curve)

LOCATION 26.450 S 118.450 E * NEAR.. Garden Gully

LIST OF COEFFICIENTS TO EQUATIONS OF THE FORM

ln(I) = A + B x (ln(T)) + C x (ln(T))2 + D x (ln(T))3 + E x (ln(T))4 + F x (ln(T))5 + G x (ln(T))6

ARI in years	coefficient A	coefficient B	coefficient C	coefficient D	coefficient E	coefficient F	coefficient G
1	2.51233	-6.46E-01	-5.02E-02	9.58E-03	1.53E-03	-4.57E-04	-6.04E-06
2	2.797954	-6.41E-01	-4.61E-02	1.01E-02	1.13E-03	-5.16E-04	1.35E-05
5	3.139261	-6.24E-01	-3.56E-02	9.52E-03	2.95E-04	-4.38E-04	2.37E-05
10	3.307143	-6.15E-01	-2.99E-02	9.26E-03	-1.70E-04	-4.02E-04	3.01E-05
20	3.486369	-6.08E-01	-2.55E-02	8.93E-03	-5.06E-04	-3.61E-04	3.32E-05
50	3.687693	-6.00E-01	-2.00E-02	8.90E-03	-1.01E-03	-3.55E-04	4.67E-05
100	3.821895	-5.95E-01	-1.60E-02	8.82E-03	-1.38E-03	-3.38E-04	5.47E-05

IFD Chart.

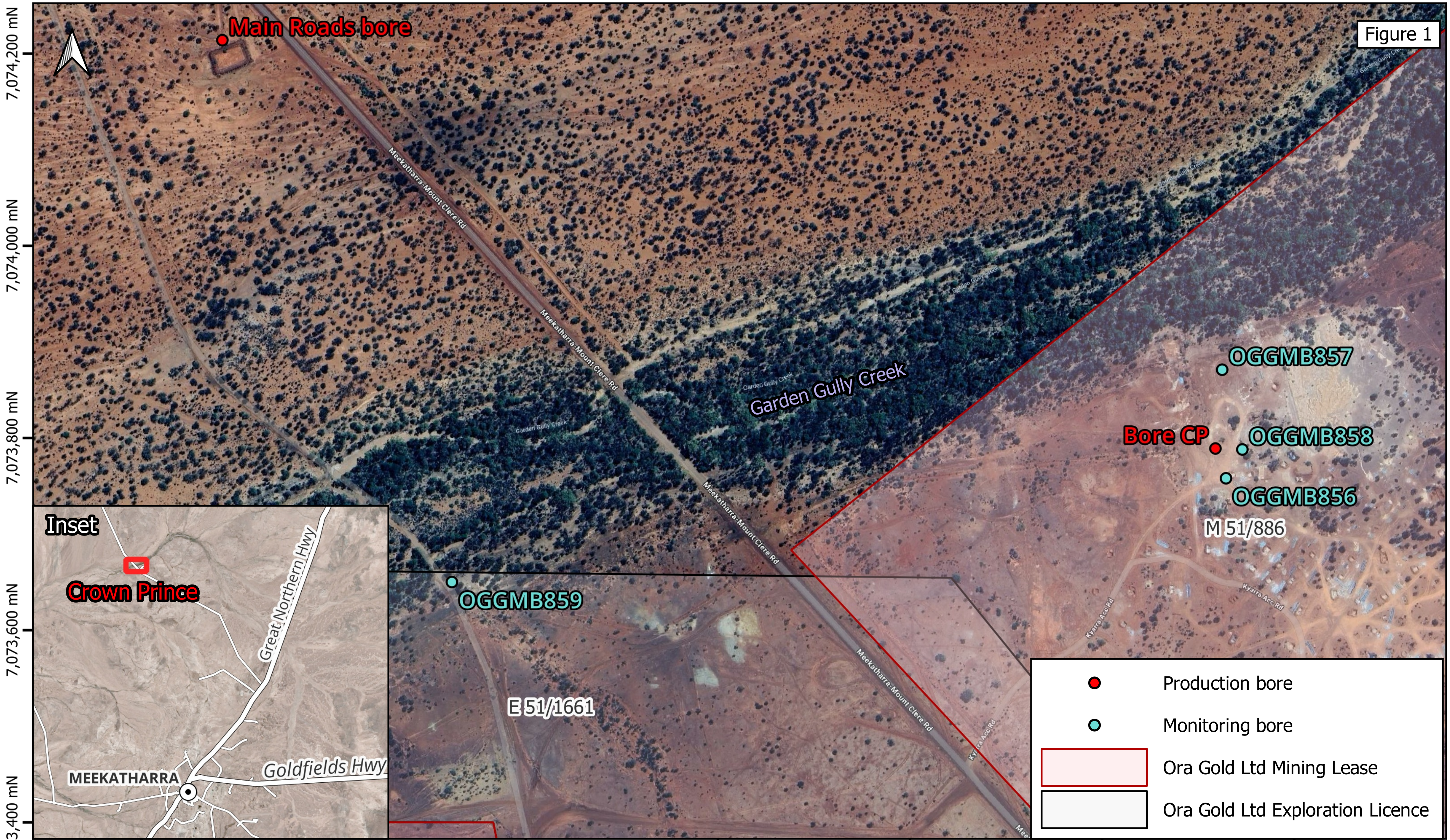
Enter IFD, Time of Concentration (Tc) and Polynomial Coefficients to get time specific rainfall intensities

DURATION	1 Year	2 years	5 years	10 years	20 years	50 years	100 years
5 mins	42.9	57.2	80	94.4	113	138	157
6 mins	39.9	53.1	74.6	88	105	128	147
10 mins	32.4	43	60.4	71.3	85.2	104	119
20 mins	23.4	31	43.4	51.2	61	74.4	85
30 mins	18.8	25	34.9	41.1	49	59.8	68.2
1 hour	12.3	16.4	23.1	27.3	32.7	40	45.7
2 hours	7.72	10.3	14.8	17.6	21.2	26.2	30.1
3 hours	5.79	7.79	11.3	13.6	16.4	20.4	23.5
6 hours	3.51	4.77	7.08	8.62	10.6	13.3	15.4
12 hours	2.13	2.92	4.44	5.46	6.75	8.58	10.1
24 hours	1.3	1.79	2.76	3.42	4.26	5.45	6.42
48 hours	0.772	1.06	1.66	2.07	2.6	3.33	3.94
72 hours	0.55	0.759	1.2	1.5	1.89	2.44	2.9

Tc	8.34	2.77	3.78	5.67	6.95	8.54	10.80	12.62

APPENDIX II

MONITORING BORE COMPLETION DATA



L:\QGIS Projects\586-0\Crown Prince Deposit Hydrological & Hydrogeological Assessment.qgz

Rockwater HYDROGEOLOGICAL + ENVIRONMENTAL

0 100 200 m

1:5,500

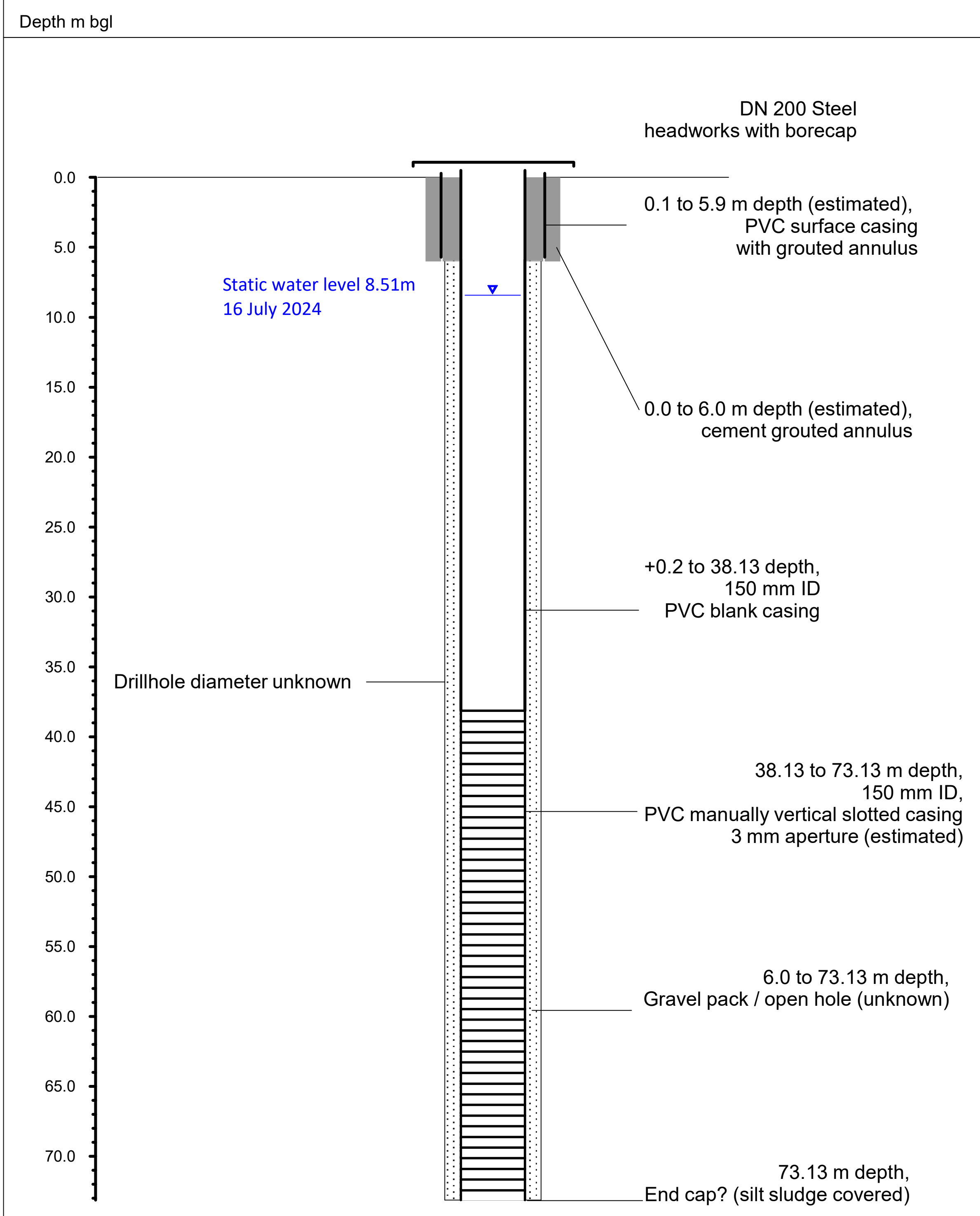
GDA2020 / MGA zone 50

Project	Crown Prince Deposit Hydrological & Hydrogeological Assessment
Client	Ora Gold Limited
Date	September 2024
Figure Number	586-0/24-02/01

LOCATION PLAN

Figure 2

Bore Construction Details



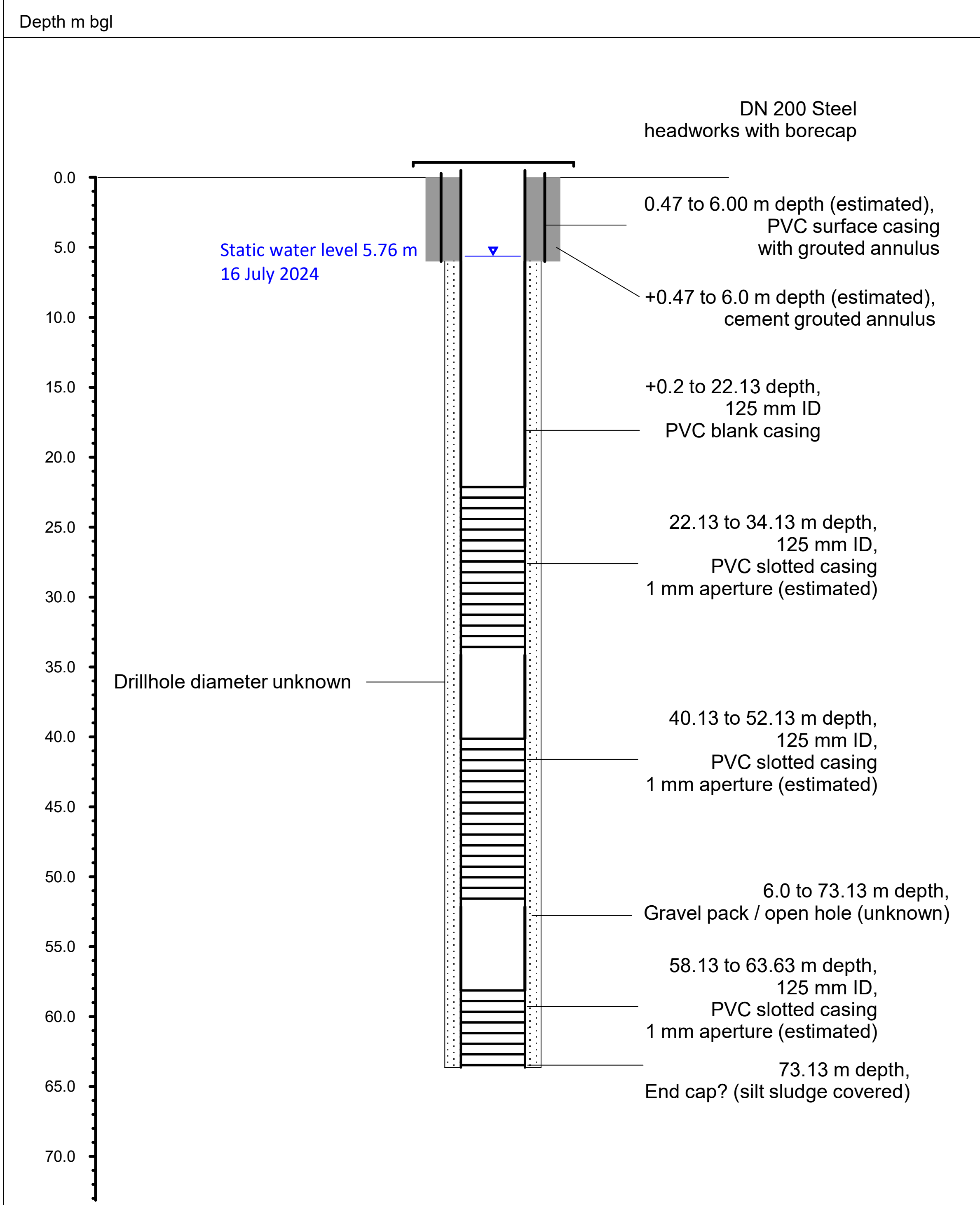
CLIENT:	Ora Gold Limited
PROJECT:	Crown Prince Deposit Hydrological and Hydrogeological Assessment
DATE:	October 2024
FIG No.:	586-0/24-02/02

BORE CP
CAMERA AND FIELD
SURVEY DIAGRAM

Figure 3

Rockwater
CONSULTANT HYDROGEOLOGISTS

Bore Construction Details

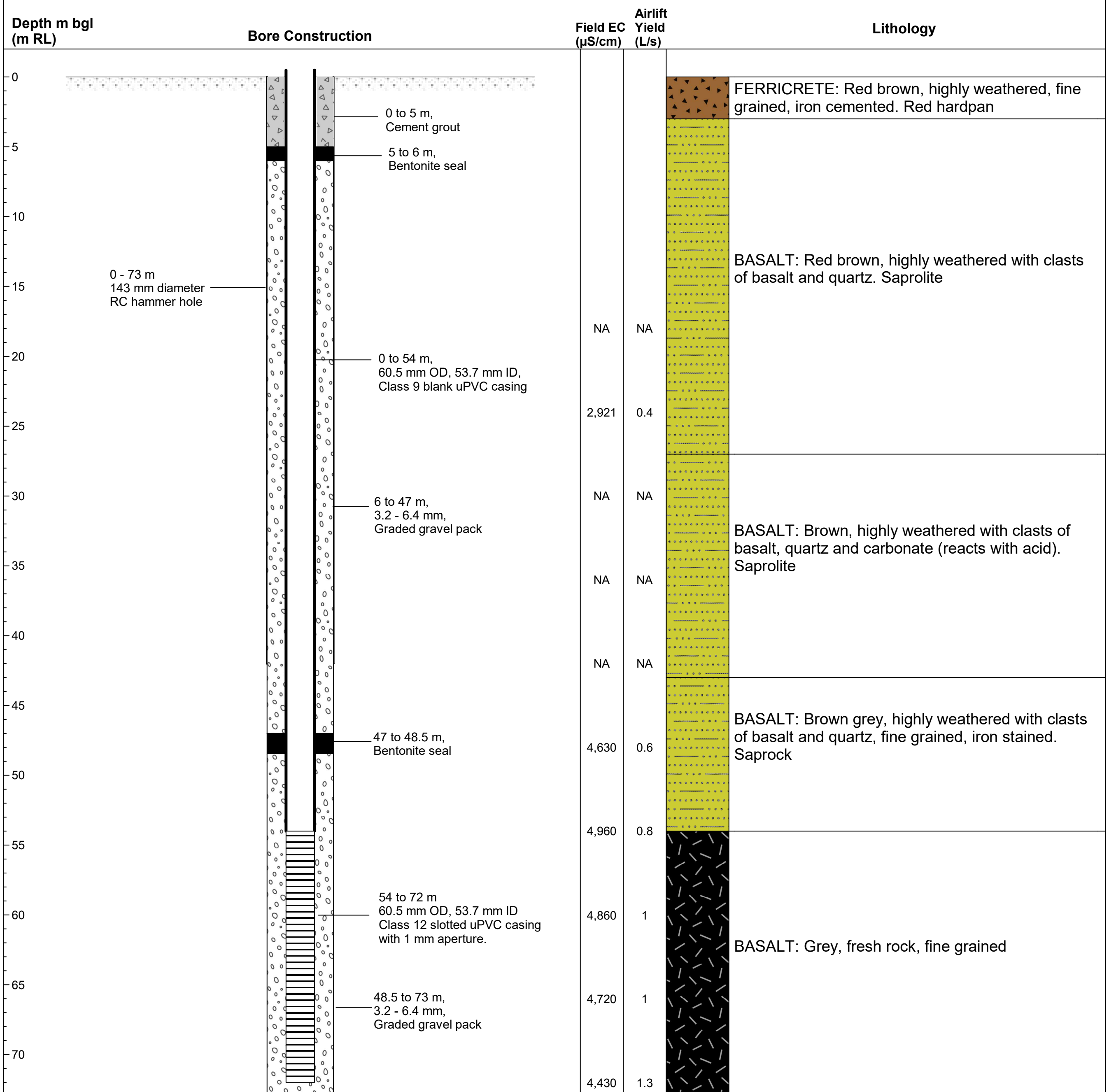


CLIENT:	Ora Gold Limited
PROJECT:	Crown Prince Deposit Hydrological and Hydrogeological Assessment
DATE:	October 2024
FIG No.:	586-0/24-02/03

MAIN ROADS BORE CAMERA AND FIELD SURVEY DIAGRAM

Rockwater

Figure 4



Construction Date: 27-08-2024
Easting: 645,918
Northing: 7,073,758

Depth Drilled (m bgl): 73.00
Top of Casing (m agl): +0.50
Cased Depth (m bgl): 72.00
Screened Interval (m bgl): 54.00 to 72.00

SWL m bgl: 9.92
Water Chemistry: 4,300 µS/cm, 8.18 pH
Final Airlift Yield (L/s): 0.7

Client: Ora Gold Limited

Project: Crown Prince Deposit Hydrological and Hydrogeological Assessment

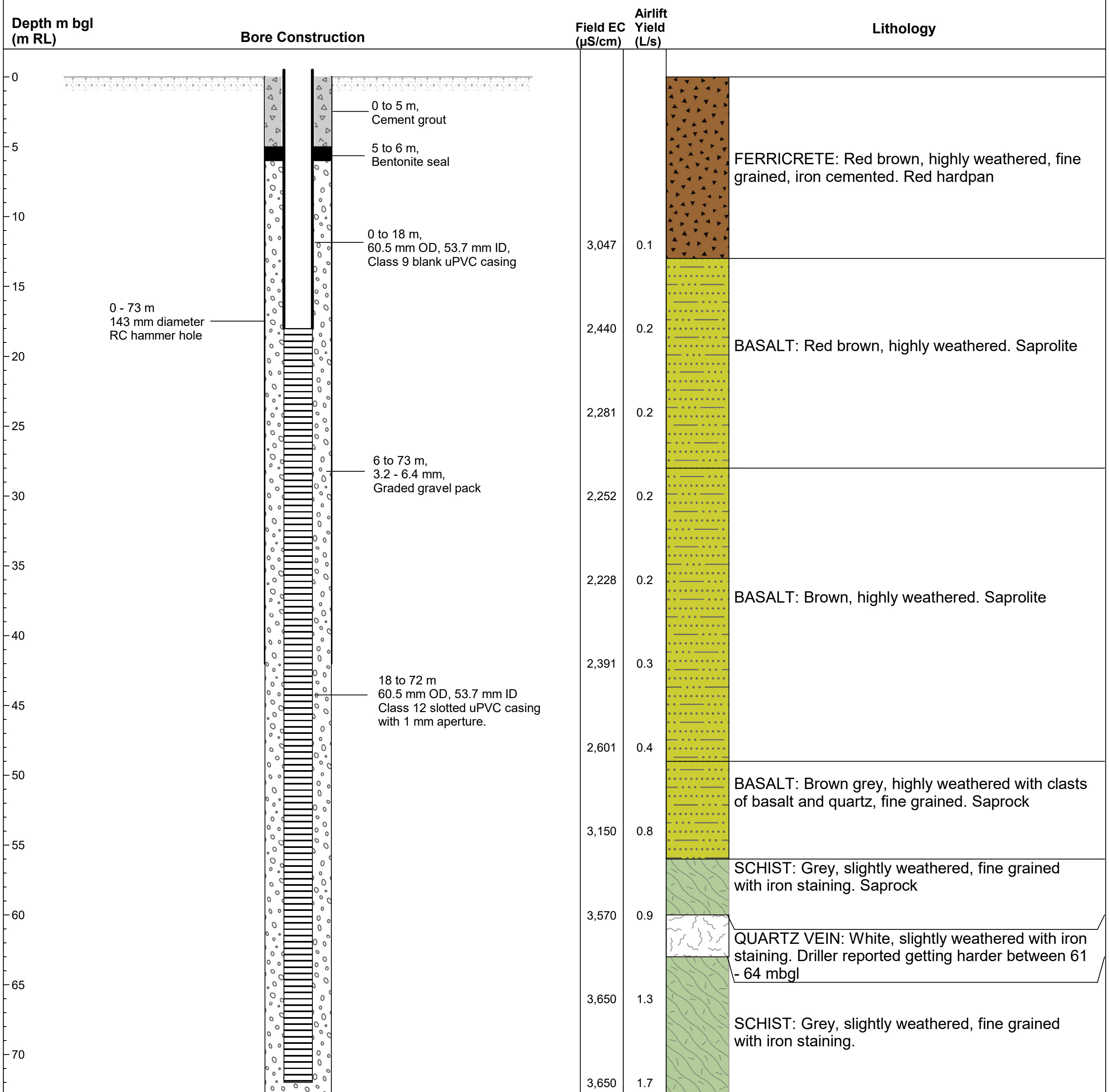
Date: October 2024

Dwg. No: 586-0/24-02/04

OGGMB856
MONITORING BORE
CONSTRUCTION DIAGRAM

Rockwater
CONSULTANT HYDROGEOLOGISTS

Figure 5



Construction Date:	28-08-2024	Depth Drilled (m bgl):	73.0	SWL m bgl:	7.58
Easting:	645,925	Top of Casing (m agl):	+0.50	Water Chemistry:	3,930 µS/cm, 8.20 pH
Northing:	7,073,871	Cased Depth (m bgl):	72.00	Final Airlift Yield (L/s):	1.0
		Screened Interval (m bgl):	18.00 to 72.00		

Client: Ora Gold Limited

Project: Crown Prince Deposit Hydrological and Hydrogeological Assessment

Date: October 2024

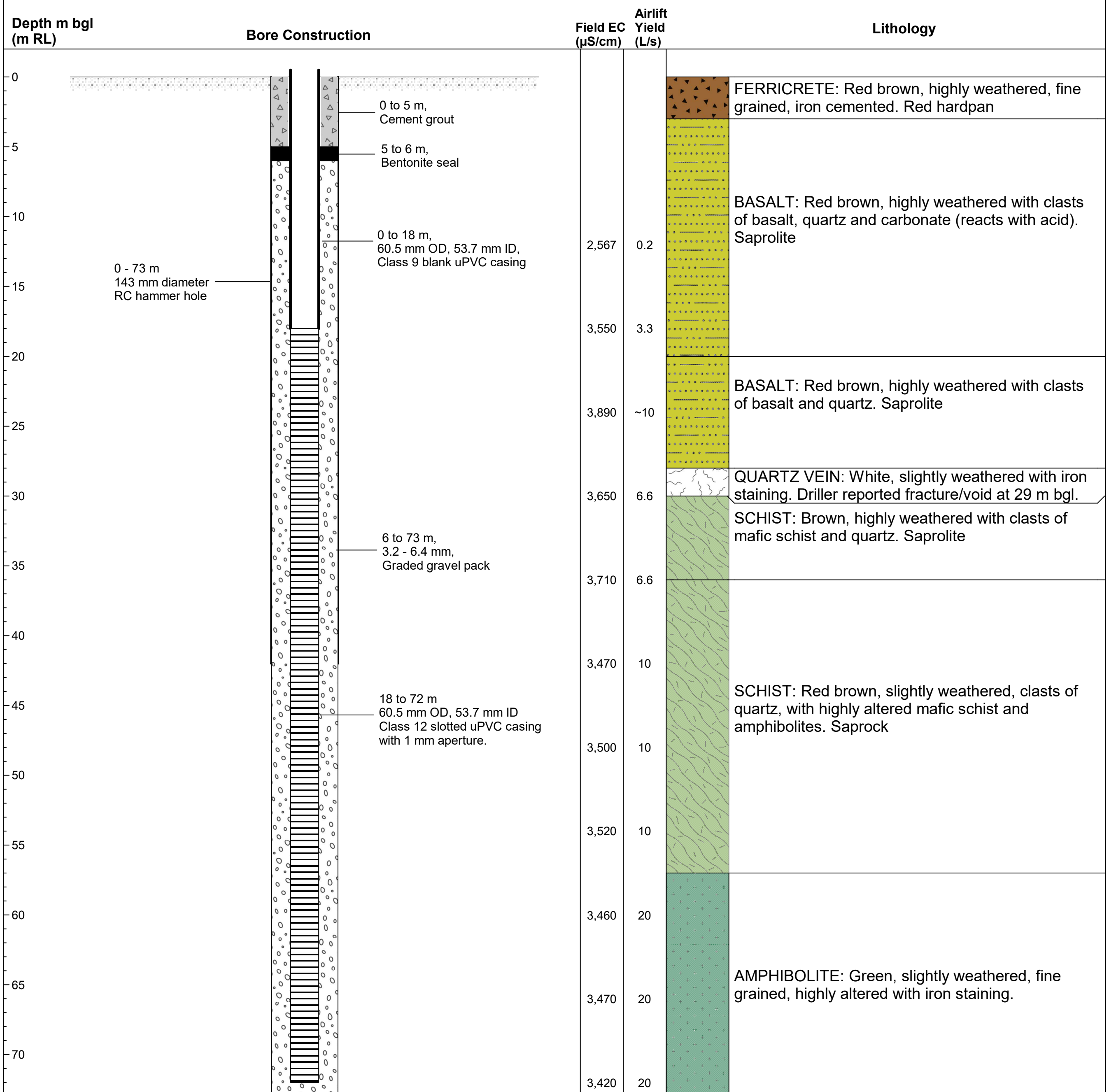
Dwg. No: 586-0/24-02/05

OGGMB857
MONITORING BORE
CONSTRUCTION DIAGRAM

Rockwater
PROPRIETARY LIMITED

Figure 6

Rockwater
CONSULTANT HYDROGEOLOGISTS



Water spurting from nearby RC hole during drilling (hear / feel air from second nearby RC hole). Water disappearing in void/cavity beneath sump during drilling and development.

Airlift yields measured are will have surface seepage returns

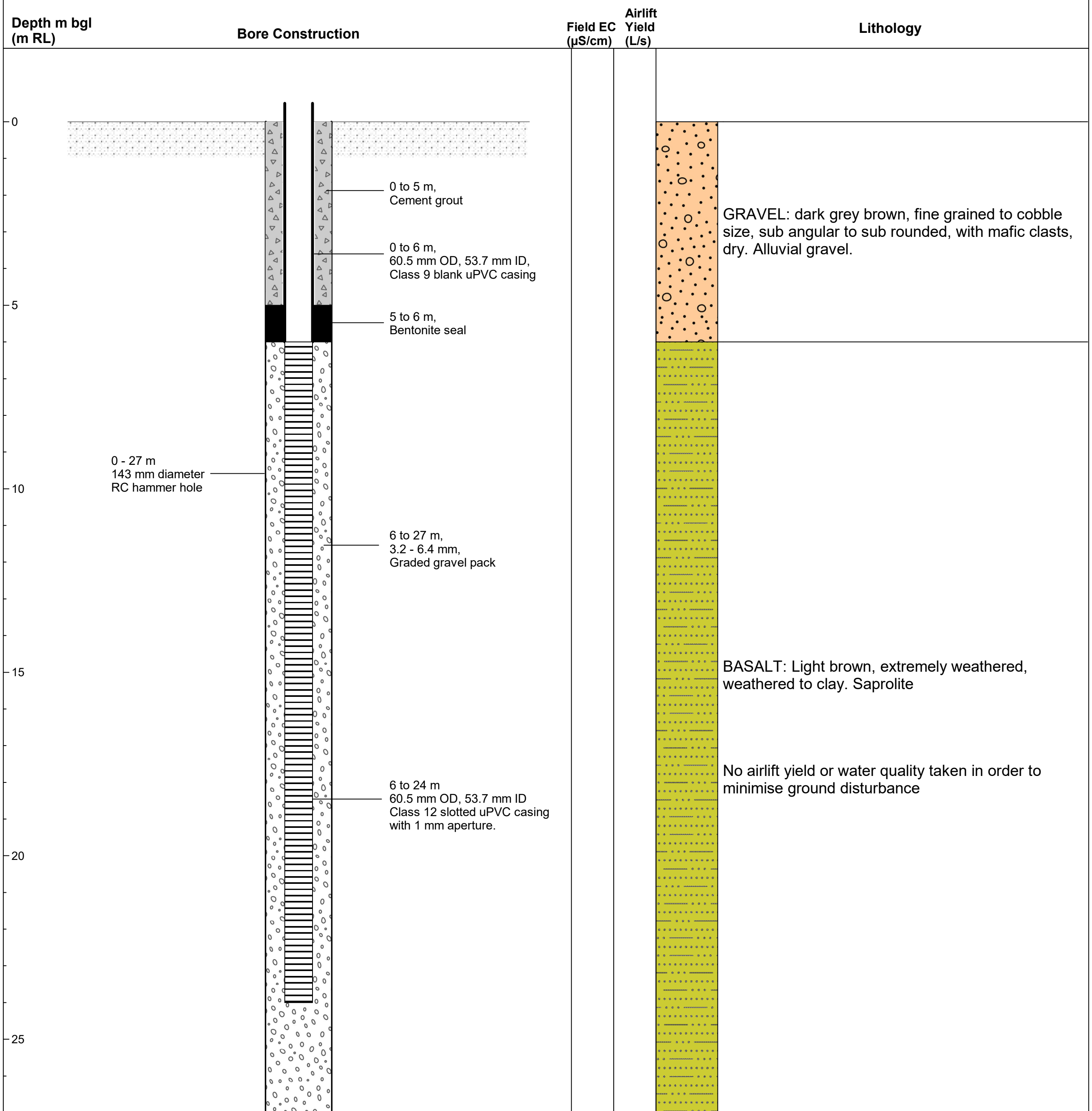
Construction Date:	29-08-2024	Depth Drilled (m bgl):	73.0	SWL m bgl:	9.6
Easting:	645,946	Top of Casing (m agl):	+0.50	Water Chemistry:	3,460 µS/cm, 8.01 pH
Northing:	7,073,788	Cased Depth (m bgl):	72.00	Final Airlift Yield (L/s):	Unknown due to recycled surface seepage
		Screened Interval (m bgl):	18.00 to 72.00		

Client:	Ora Gold Limited
Project:	Crown Prince Deposit Hydrological and Hydrogeological Assessment
Date:	October 2024
Dwg. No:	586-0/24-02/06

OGGMB858
MONITORING BORE
CONSTRUCTION DIAGRAM

Rockwater PROPRIETARY LIMITED

Figure 7



Construction Date:	30-08-2024	Depth Drilled (m bgl):	27.0	SWL m bgl:	5.83
Easting:	645,123	Top of Casing (m agl):	+0.50	Water Chemistry:	1,954 µS/cm, 7.60pH
Northing:	7,073,650	Cased Depth (m bgl):	24.00	Final Airlift Yield (L/s):	0.2
		Screened Interval (m bgl):	6.00 to 24.00		

Client: Ora Gold Limited

Project: Crown Prince Deposit Hydrological and Hydrogeological Assessment

Date: October 2024

Dwg. No: 586-0/24-02/07

OGGMB859
MONITORING BORE
CONSTRUCTION DIAGRAM

Rockwater	**DRILLING, CONSTRUCTION DATA and LITHOLOGICAL LOG** **MONITORING BORE: OGGMB056**

STATUS:	Monitoring Bore MB01
MGA COORDINATES (GPS):	Zone 50, 645,919 mE 7,073,758 mN
DRILLING CONTRACTOR:	Caswell Drilling
DRILL RIG:	Rig 1
DATE CONSTRUCTED:	27 August 2024
DRILLING DETAILS:	0 to 73 m, 5 5/8” hammer bit
CASING:	+0.5 to 54 m, 50 mm ND, Class 9 blank uPVC casing
SLOTTED CASING:	54 to 72 m, 50 mm ND, slotted uPVC casing, 1 mm aperture, including uPVC end cap
GRAVEL PACK:	6 to 47 and 48.5 to 73 m, grade +1.6 – 3.2 mm (bentonite 47 to 48.5 m bgl)
BOREHEAD ANNULAR SEAL:	0 to 5 m cement grout, 5 to 6 m bentonite
HEADWORKS:	TBD
STATIC WATER LEVEL	9.92 mbgl
SALINITY/TEMPERATURE/pH:	4,300 µS/cm @ 30.7 °C, pH 8.18

LITHOLOGY:

Depth (m)		Lithology	Description
From	To		
0	2	Duricrust	Fine grained. Red brown.
2	27	Saprolite	Red brown. Clasts of mafic material and quartz. Highly weathered.
27	43	Saprolite	Brown. Clasts of mafic material, quartz and carbonate (reacts with HCL). Highly weathered.
43	54	Saprock	Fine grained. Brown grey. Clasts of basalt and quartz. Slightly weathered with iron staining present.
54	73	Basalt	Fine grained. Grey. Becoming fresher with depth.

Driller reported groundwater encountered at 14 m bgl

DRILLING AIRLIFT DATA:

Depth (m)	Yield (L/s)	EC (µS/cm)	pH	Temperature (°C)	Comments
25	0.4	2,921	7.34	21.3	Brown
31	NA	NA	NA	NA	NA
37	NA	NA	NA	NA	NA
43	NA	NA	NA	NA	NA
49	0.6	4,630	7.67	27	Brown
61	1	4,860	7.96	24.7	Brown
67	1	4,720	8.05	27.8	Brown
73	1.3	4,430	8.11	32.3	Cloudy

NA – Insufficient water encountered to sample

Yields estimated by bucket test

Rockwater	**DRILLING, CONSTRUCTION DATA and LITHOLOGICAL LOG** **MONITORING BORE: OGGMB857**

STATUS:	Monitoring Bore MB02
MGA COORDINATES (GPS):	Zone 50, 645,925 mE 7,073,871 mN
DRILLING CONTRACTOR:	Caswell Drilling
DRILL RIG:	Rig 1
DATE CONSTRUCTED:	28 August 2024
DRILLING DETAILS:	0 to 73 m, 5 5/8” hammer bit
CASING:	+0.5 to 18 m, 50 mm ND, Class 9 blank uPVC casing
SLOTTED CASING:	18 to 72 m, 50 mm ND, slotted uPVC casing, 1 mm aperture, including uPVC end cap
GRAVEL PACK:	6 to 73 m, grade +1.6 – 3.2 mm
BOREHEAD ANNULAR SEAL:	0 to 5 m cement grout, 5 to 6 m bentonite
HEADWORKS:	TBD
STATIC WATER LEVEL	7.58 mbgl
SALINITY/TEMPERATURE/pH:	3,930 µS/cm @ 30.9 °C, pH 8.20

LITHOLOGY:

Depth (m)		Lithology	Description
From	To		
0	13	Duricrust	Fine grained. Red brown.
13	28	Saprolite	Red brown clay.
28	49	Saprolite	Brown clay.
49	56	Saprock	Fine grained. Brown grey. Clasts of basalt and quartz. Highly weathered.
56	60	Mafic Schist	Fine grained. Grey. Slightly weathered with iron staining present.
60	63	Quartz vein	White. Slightly weathered with iron staining present. Driller reported getting harder 61 to 63 m bgl.
63	73	Mafic Schist	Fine grained. Grey. Slightly weathered with iron staining present. Driller reported getting harder 63 to 64 m bgl.

Driller reported groundwater encountered at 13 m bgl

DRILLING AIRLIFT DATA:

Depth (m)	Yield (L/s)	EC (µS/cm)	pH	Temperature (°C)	Comments
13	0.1	3,047	7.36	22	Brown
19	0.2	2,440	7.61	25.8	Brown
25	0.2	2,281	7.57	26	Brown
31	0.2	2,252	7.63	27.7	Brown
37	0.2	2,228	7.70	26.8	Brown
43	0.3	2,391	7.58	27.8	Brown
49	0.4	2,601	7.58	28.8	Brown
55	0.8	3,150	7.76	29.1	Brown
61	0.9	3,570	7.85	27.9	Brown
67	1.25	3,650	7.93	29.3	Brown
73	1.7	3,650	7.94	30.4	Cloudy

Yields estimated by bucket test

Rockwater	**DRILLING, CONSTRUCTION DATA and LITHOLOGICAL LOG** **MONITORING BORE: OGGMB858**

STATUS:	Monitoring Bore MB03
MGA COORDINATES (GPS):	Zone 50, 645,939 mE 7,073,788 mN
DRILLING CONTRACTOR:	Caswell Drilling
DRILL RIG:	Rig 1
DATE CONSTRUCTED:	29 August 2024
DRILLING DETAILS:	0 to 73 m, 5 5/8" hammer bit
CASING:	+0.5 to 18 m, 50 mm ND, Class 9 blank uPVC casing
SLOTTED CASING:	18 to 72 m, 50 mm ND, slotted uPVC casing, 1 mm aperture, including uPVC end cap
GRAVEL PACK:	6 to 73 m, grade +3.2 – 6.4 mm
BOREHEAD ANNULAR SEAL:	0 to 5 m cement grout, 5 to 6 m bentonite
HEADWORKS:	TBD
STATIC WATER LEVEL	9.60 mbgl
SALINITY/TEMPERATURE/pH:	3,460 µS/cm @ 31.3 °C, pH 8.01

LITHOLOGY:

Depth (m)		Lithology	Description
From	To		
0	3	Duricrust	Fine grained. Red brown.
3	20	Saprolite	Red brown. Clasts of mafic material, quartz and carbonate (reacts with HCL). Highly weathered.
20	28	Saprolite	Red brown. Clasts of mafic schist and quartz. Highly weathered.
28	30	Quartz vein	White. Slightly weathered with iron staining present. Driller reported fracture/void at 29 m bgl.
30	36	Saprolite	Brown. Clasts of quartz and schist. Highly weathered.
36	57	Saprock	Red brown. Clasts of quartz, highly altered mafic schist and amphibolite (highly altered). Slightly weathered with iron staining.
57	73	Amphibolite	Fine grained. Green. Highly altered. Slightly weathered with iron staining.

Driller reported groundwater encountered at 8 m bgl

40 m bgl water spouting out of nearby RC hole (hear/feel air from second nearby RC hole)

Water draining from sump into void/cavity during drilling

DRILLING AIRLIFT DATA:

Depth (m)	Yield (L/s)	EC (µS/cm)	pH	Temperature (°C)	Comments
13	0.2	2,567	7.58	23.4	Brown
19	3.3	3,550	7.79	26.9	Brown
25	10	3,890	7.90	22.6	Brown
31	7	3,650	7.95	26.0	Brown
37	7	3,710	7.98	26.0	Cloudy
43	10	3,470	7.99	27.1	Cloudy
49	10	3,500	8.03	27.8	Cloudy
55	10	3,520	8.05	27.8	Cloudy
61	20	3,460	8.05	29.0	Cloudy
67	20	3,470	8.04	29.3	Cloudy
73	20	3,420	8.03	30.2	Cloudy

Water draining from sump into void/cavity during development

Yields estimated by bucket test

Rockwater	**DRILLING, CONSTRUCTION DATA and LITHOLOGICAL LOG** **MONITORING BORE: OGGMB859**

STATUS:	Monitoring Bore MB04
MGA COORDINATES (GPS):	Zone 50, 645,123 mE 7,073,650 mN
DRILLING CONTRACTOR:	Caswell Drilling
DRILL RIG:	Rig 1
DATE CONSTRUCTED:	30 August 2024
DRILLING DETAILS:	0 to 27 m, 5 5/8" hammer bit
CASING:	+0.5 to 6 m, 50 mm ND, Class 9 blank uPVC casing
SLOTTED CASING:	6 to 24 m, 50 mm ND, slotted uPVC casing, 1 mm aperture, including uPVC end cap
GRAVEL PACK:	6 to 27 m, grade +1.6 – 3.2 mm
BOREHEAD ANNULAR SEAL:	0 to 5 m cement grout, 5 to 6 m bentonite
HEADWORKS:	TBD
STATIC WATER LEVEL	5.83 mbgl
SALINITY/TEMPERATURE/pH:	NA

NA - Did not develop OGGMB859 due to concerns about impacting streamline

LITHOLOGY:

Depth (m)		Lithology	Description
From	To		
0	6	Conglomerate	Sand to conglomerate size, dark grey, stained brown, sub angular to sub rounded mafic clasts. Slightly weathered.
6	27	Saprolite	Light brown.

Driller reported groundwater encountered at 18 m bgl

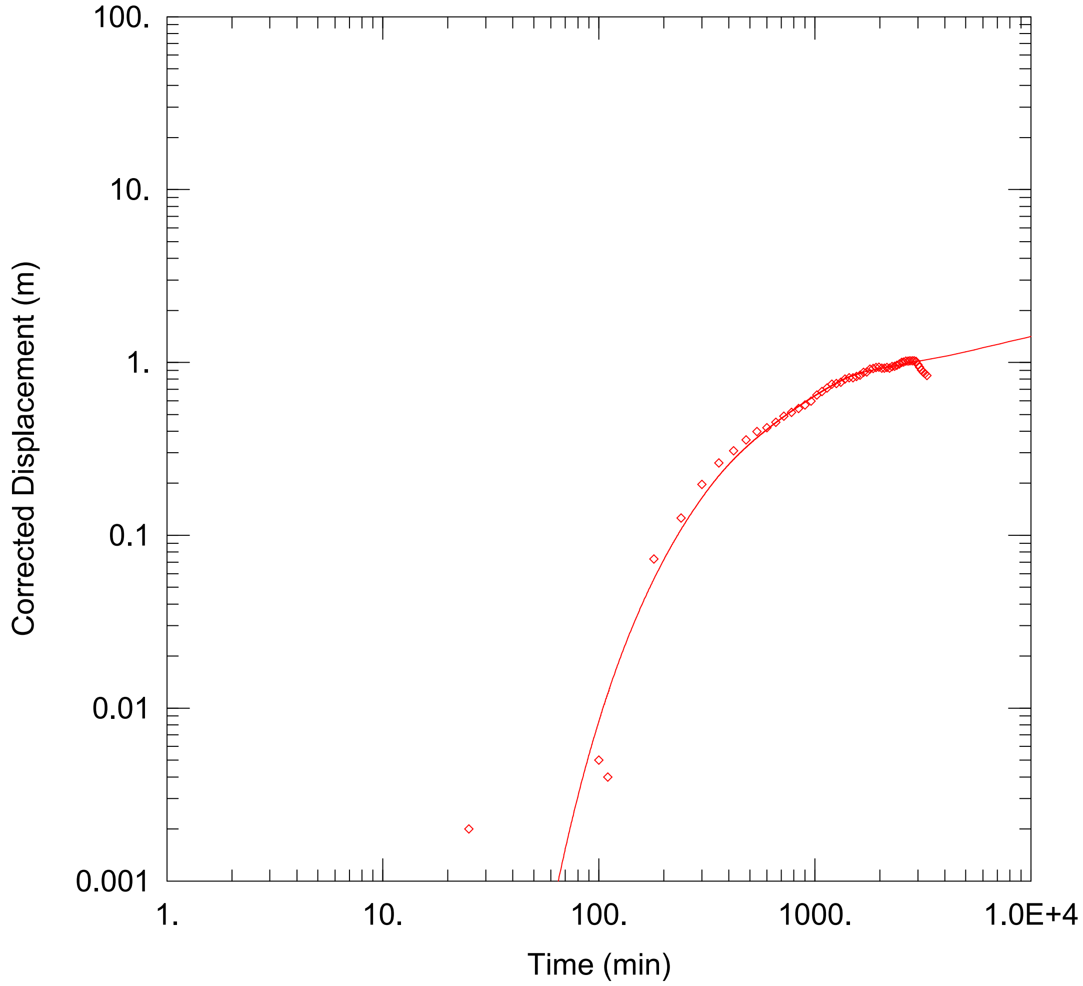
DRILLING AIRLIFT DATA:

Depth (m)	Yield (L/s)	EC (µS/cm)	pH	Temperature (°C)	Comments
NA	NA	NA	NA	NA	NA

NA - Did not sample/measure yields at OGGMB859 due to concerns about impacting streamline

APPENDIX III

PUMPING TEST ANALYSES



WELL TEST ANALYSIS

Data Set: I:\586-0\Data\Pump test\Bore CP_MB02.aqt
Date: 09/19/24 Time: 11:05:50

PROJECT INFORMATION

Company: Rockwater
Client: Ora Gold Ltd
Project: 586-0
Location: Meekatharra
Test Well: Bore CP
Test Date: 6/9/2024

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Bore CP	645918	7073789

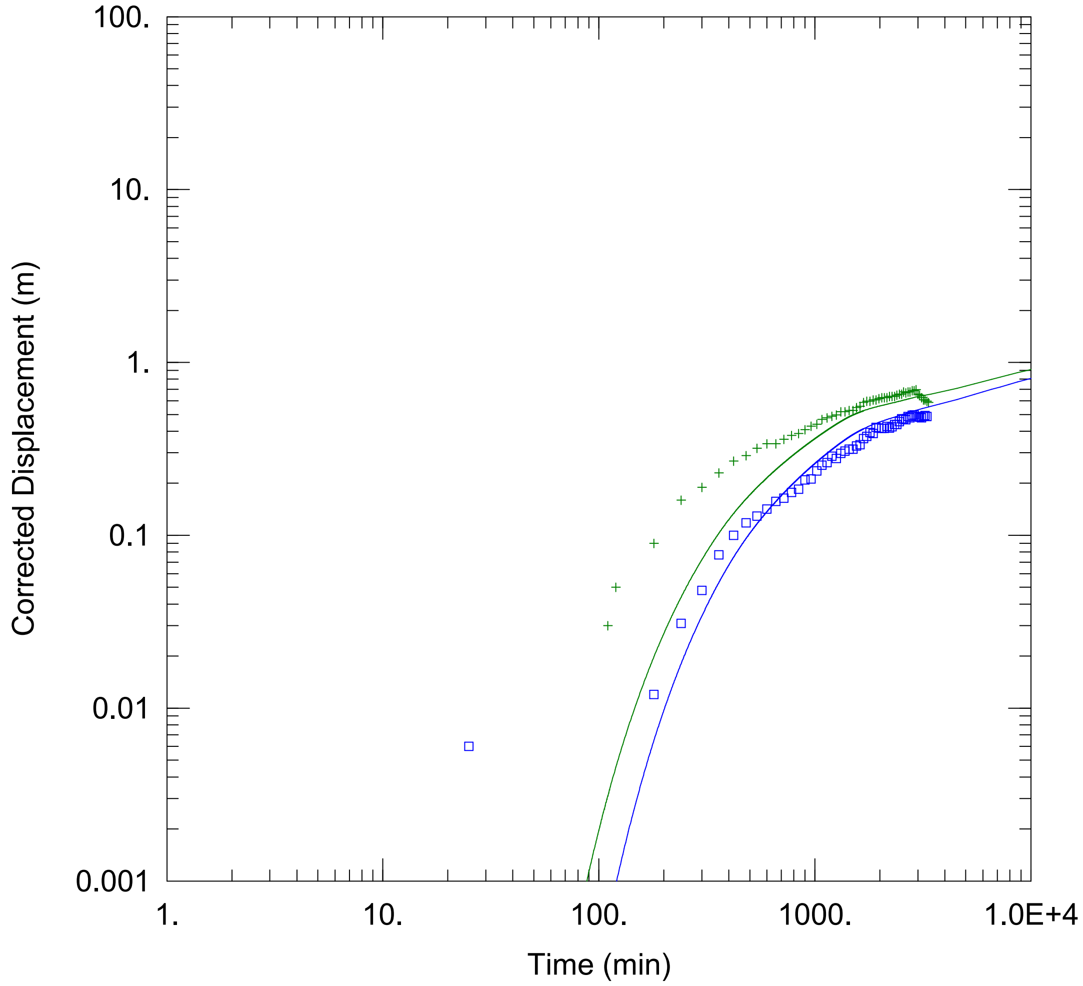
Observation Wells

Well Name	X (m)	Y (m)
MB02	645925	7073871

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 33.74 m^2/day
S = 0.004385
Kz/Kr = 1.
b = 64.62 m



WELL TEST ANALYSIS

Data Set: I:\586-0\Data\Pump test\Bore CP_MB01_MB02.aqt
Date: 09/19/24 Time: 11:02:45

PROJECT INFORMATION

Company: Rockwater
Client: Ora Gold Ltd
Project: 586-0
Location: Meekatharra
Test Well: Bore CP
Test Date: 6/9/2024

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Bore CP	645918	7073789

Observation Wells

Well Name	X (m)	Y (m)
+ MB03	645946	7073788
□ MB01	645929	7073758

SOLUTION

Aquifer Model: Unconfined
Solution Method: Theis

T = 48.15 m^2/day
S = 0.06901
Kz/Kr = 1.
b = 64.62 m

APPENDIX IV
WATER QUALITY ANALYSES CERTIFICATES

CERTIFICATE OF ANALYSIS

Work Order	: **EP2413125**	Page	: 1 of 5
Client	: **ROCKWATER PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: Peter Khor	Contact	: Customer Services EP
Address	: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: ----	Telephone	: +61-8-9406 1301
Project	: Garden Gully Dewatering Study	Date Samples Received	: 11-Sep-2024 12:30
Order number	: ----	Date Analysis Commenced	: 12-Sep-2024
C-O-C number	: ----	Issue Date	: 19-Sep-2024 15:17
Sampler	: Darren McMillan		
Site	:		
Quote number	: EP23ROCWAT0002_V3		
No. of samples received	: 1		
No. of samples analysed	: 1		

NATA

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
[redacted]	Laboratory Manager (Perth) Inorganics Analyst	Perth Inorganics, Wangara, WA Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	Crown Prince (Bore CP)	----	----	----	----
			Sampling date / time	08-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2413125-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.77**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2730**	----	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**1620**	----	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**680**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**399**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**399**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**189**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**647**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**104**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**102**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**380**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**29**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.128**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	Crown Prince (Bore CP)	----	----	----	----
			Sampling date / time	08-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EP2413125-001	--------	--------	--------	--------
				Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Manganese	7439-96-5	0.001	mg/L	**0.050**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.012**	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**55.2**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**1.83**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**1.83**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.3**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**2.1**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.04**	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.03**	----	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**30.2**	----	----	----	----
ø Total Cations	----	0.01	meq/L	**30.8**	----	----	----	----
ø Ionic Balance	----	0.01	%	**1.14**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EP2414636**	Page	: 1 of 8
Client	: **ROCKWATER PTY LTD**	Laboratory	: Environmental Division Perth
Contact	: [redacted]	Contact	: Customer Services EP
Address	: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 9284 0222	Telephone	: +61-8-9406 1301
Project	: Garden Gully	Date Samples Received	: 08-Oct-2024 12:30
Order number	: 586-0	Date Analysis Commenced	: 08-Oct-2024
C-O-C number	: ----	Issue Date	: 16-Oct-2024 11:29
Sampler	: [redacted]		
Site	:		
Quote number	: EP23ROCWAT0002_V3		
No. of samples received	: 8		
No. of samples analysed	: 8		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
[redacted]	Inorganics Supervisor	Perth Inorganics, Wangara, WA
	Laboratory Manager (Perth)	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- It is recognised that Total Phosphorus (EK067G) is less than Reactive Phosphorus (EK071G) for sample #3. However, the difference is within experimental variation of the methods.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - ammonia as N, calcium, magnesium, potassium and sodium for sample #3.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	CPMB004	Kyarra shaft	OGGV1	OGGDD842R	OGGDD927
			Sampling date / time	04-Oct-2024 14:30	04-Oct-2024 14:40	04-Oct-2024 15:45	04-Oct-2024 15:55	04-Oct-2024 15:15
Compound	CAS Number	LOR	Unit	EP2414636-001	EP2414636-002	EP2414636-003	EP2414636-004	EP2414636-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.71**	**8.04**	**7.86**	**7.89**	**7.90**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2240**	**2790**	**4360**	**4160**	**4610**
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**1340**	**1640**	**2350**	**2640**	**3000**
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**595**	**630**	**852**	**834**	**1110**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**417**	**400**	**765**	**257**	**212**
Total Alkalinity as CaCO3	----	1	mg/L	**417**	**400**	**765**	**257**	**212**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**181**	**194**	**181**	**259**	**419**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**432**	**618**	**1000**	**1020**	**1180**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**98**	**94**	**117**	**131**	**161**
Magnesium	7439-95-4	1	mg/L	**85**	**96**	**136**	**123**	**171**
Sodium	7440-23-5	1	mg/L	**236**	**338**	**484**	**377**	**537**
Potassium	7440-09-7	1	mg/L	**19**	**26**	**47**	**230**	**44**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.01**	<0.01	<0.01	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	**0.002**	**0.106**	**0.093**	**0.012**	**0.070**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	**0.001**	<0.001	**0.006**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	CPMB004	Kyarra shaft	OGGV1	OGGDD842R	OGGDD927
			Sampling date / time	04-Oct-2024 14:30	04-Oct-2024 14:40	04-Oct-2024 15:45	04-Oct-2024 15:55	04-Oct-2024 15:15
Compound	CAS Number	LOR	Unit	EP2414636-001	EP2414636-002	EP2414636-003	EP2414636-004	EP2414636-005
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued								
Manganese	7439-96-5	0.001	mg/L	**0.011**	**0.084**	**0.241**	**0.046**	**0.109**
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	**0.006**	<0.005	<0.005	**0.129**	**0.023**
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**82.5**	**47.5**	**41.7**	**50.4**	**47.2**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.04**	**0.12**	**81.8**	**1.95**	**0.10**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	**0.07**	<0.01	<0.01	**0.04**	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**5.07**	**0.66**	**0.05**	**7.04**	**10.7**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**5.14**	**0.66**	**0.05**	**7.08**	**10.7**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.6**	**0.2**	**93.2**	**2.2**	**1.1**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**5.7**	**0.9**	**93.2**	**9.3**	**11.8**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.04**	**0.05**	**6.28**	**0.04**	**0.03**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.04**	**0.02**	**6.85**	**0.03**	**0.01**
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**24.3**	**29.5**	**47.3**	**39.3**	**46.2**
ø Total Cations	----	0.01	meq/L	----	----	**46.0**	----	----
ø Total Cations	----	0.01	meq/L	**22.6**	**28.0**	----	**38.9**	**46.6**

Analytical Results

Sub-Matrix: WATER
(Matrix: WATER)

			Sample ID	CPMB004	Kyarra shaft	OGGV1	OGGDD842R	OGGDD927
			Sampling date / time	04-Oct-2024 14:30	04-Oct-2024 14:40	04-Oct-2024 15:45	04-Oct-2024 15:55	04-Oct-2024 15:15
Compound	CAS Number	LOR	Unit	EP2414636-001	EP2414636-002	EP2414636-003	EP2414636-004	EP2414636-005
				Result	Result	Result	Result	Result
EN055: Ionic Balance - Continued								
ø Ionic Balance	----	0.01	%	----	----	**1.34**	----	----
ø Ionic Balance	----	0.01	%	**3.51**	**2.62**	----	**0.46**	**0.37**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	OGGDD846	OGGDD844	OGGDD847	----	----
			Sampling date / time	04-Oct-2024 15:20	04-Oct-2024 15:35	04-Oct-2024 16:15	----	----
Compound	CAS Number	LOR	Unit	EP2414636-006	EP2414636-007	EP2414636-008	--------	--------
				Result	Result	Result	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.86**	**7.85**	**8.04**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**6120**	**2950**	**3900**	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Total Dissolved Solids @180°C	----	10	mg/L	**4070**	**1770**	**2500**	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	**1320**	**618**	**896**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**209**	**339**	**320**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**209**	**339**	**320**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**394**	**166**	**514**	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1610**	**696**	**839**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**194**	**94**	**128**	----	----
Magnesium	7439-95-4	1	mg/L	**204**	**93**	**140**	----	----
Sodium	7440-23-5	1	mg/L	**585**	**341**	**481**	----	----
Potassium	7440-09-7	1	mg/L	**256**	**58**	**33**	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.044**	**0.012**	**0.021**	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	OGGDD846	OGGDD844	OGGDD847	----	----
			Sampling date / time	04-Oct-2024 15:20	04-Oct-2024 15:35	04-Oct-2024 16:15	----	----
Compound	CAS Number	LOR	Unit	EP2414636-006	EP2414636-007	EP2414636-008	--------	--------
				Result	Result	Result	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Manganese	7439-96-5	0.001	mg/L	**0.104**	**0.271**	**0.103**	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	**0.190**	**0.024**	**0.030**	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	**0.69**	<0.05	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**55.2**	**38.4**	**46.6**	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.19**	**0.82**	**0.05**	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	**0.02**	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**11.8**	**0.04**	**5.58**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**11.8**	**0.04**	**5.58**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.0**	**0.9**	**0.7**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**12.8**	**0.9**	**6.3**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.04**	**0.03**	**0.02**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.01**	<0.01	<0.01	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**57.8**	**29.9**	**40.8**	----	----
ø Total Cations	----	0.01	meq/L	**58.5**	**28.7**	**39.7**	----	----
ø Ionic Balance	----	0.01	%	**0.58**	**2.05**	**1.35**	----	----

Appendix 6: Subterranean Fauna Assessment

GARDEN GULLY PROJECT

SUBTERRANEAN FAUNA ASSESSMENT

CROWN PRINCE DEPOSIT

REPORT FOR
ORA GOLD LIMITED

NOVEMBER 2024

Report No. 586.1/24/01

Rockwater
HYDROGEOLOGICAL AND ENVIRONMENTAL CONSULTANTS

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TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 SUBTERRANEAN FAUNA POLICY AND GUIDANCE 1
2 EXISTING ENVIRONMENT 2
2.1 CLIMATE 2
2.2 TOPOGRAPHY AND DRAINAGE 2
2.3 IBRA SUBREGIONS 2
2.4 GEOLOGY AND HYDROGEOLOGY 3
3 SUBTERRANEAN FAUNA DESKTOP STUDY 4
3.1 PREVIOUS SURVEYS AT GARDEN GULLY 4
3.2 SUBTERRANEAN FAUNA OF THE REGION 4
3.2.1 DATABASE SEARCHES 4
3.3 LITERATURE REVIEW 5
3.4 HABITAT AND DISTRIBUTION 8
3.4.1 ASSESSMENT OF POTENTIAL TROGLOFAUNA HABITAT 9
3.4.2 ASSESSMENT OF POTENTIAL STYGOFAUNA HABITAT 13
3.5 POTENTIAL IMPACTS OF MINING AT CROWN PRINCE DEPOSIT 15
3.5.1 CUMULATIVE IMPACTS 16
4 SAMPLING METHODOLOGY 17
4.1 SITE SELECTION 17
5 RESULTS AND DISCUSSION 18
6 CONCLUSIONS 20
REFERENCES 22

Tables

Table 1: Average rainfalls and Dam Evaporation, Meekatharra (mm) 2
Table 2: Defined Search Parameters of Database and Internet Sources 4
Table 3: Subterranean Fauna Projects in the vicinity of Garden Gully 6
Table 4: Potential Direct and Indirect Impacts to Subterranean Fauna 16
Table 5: Number of Stygofauna Samples Collected at the Garden Gully Project – October 2024 17
Table 6: Results of stygofauna sampling at Garden Gully 19

Plate

Plate 1: Unsaturated geological sequence at site OGGDD524 (0 to 10.3 m below ground level), located in the central part of the deposit. 9
Plate 2: Unsaturated geological sequence at site OGGDD536 (0 to 10.3 m below ground level), located in the central part of the deposit. 10
Plate 3: Unsaturated geological sequence at site OGGDD537 (3.8 to 14.1 m below ground level), located in the south-eastern part of the deposit. 11
Plate 4: Unsaturated geological sequence at site OGGDD538 (0 to 13.2 m below ground level), located in the south-western part of the deposit. 12
Plate 5: Saturated geological sequence at site OGGDD524 (52.2 to 57 m below ground level), located in the central part of the deposit. 13
Plate 6: Representative core photograph at site OGGDD536 (31 to 38.7 m below ground level), located in the central part of the deposit. 14
Plate 7: Representative core photograph at site OGGDD537 (20 to 20.3 m below ground level), located in the south-eastern part of the deposit. 14
Plate 8: Saturated geological sequence at site OGGDD538 (57.3 to 67.7 m below ground level), located in the south-western part of the deposit. 15

TABLE OF CONTENTS

(Continued)

Figures

1 Site Locality
2 Regional Geology
3 Site Layout
4 Database Searches
5 Stygofauna Sampled Sites
6 Stygofauna Sampling Results

Appendix

I Stygofauna Site Details and Field Water Quality Data Crown Prince

REVISION	AUTHOR	REVIEW	AUTHORISED	ISSUED
Rev 0	DS/NE	NE	NE	17/10/2024
Rev 1	DS/NE	PW	NE	26/11/2024

DISCLAIMER

1 INTRODUCTION

Ora Gold Limited is planning to mine gold at its Crown Prince deposit at Garden Gully, about 16 km north-north-west of Meekatharra (Figure 1). The Garden Gully Project (the Project), comprises a tenement package of several gold prospects covering the Abbots greenstone belt. There has been a long mining history at Garden Gully, with historical disturbance and groundwater extraction from several mining campaigns dating back to 1897.

Mining of the Crown Prince gold deposit has the potential to impact substrates that may provide habitat for subterranean fauna (stygofauna and troglofauna) in the vicinity of the Project. As such, Ora Gold engaged Rockwater to undertake a subterranean fauna investigation for the Project, to inform permitting applications and environmental approvals.

Subterranean fauna are defined as fauna which live their entire lives (obligate) below the surface of the earth (EPA 2016). Stygofauna are aquatic and inhabit the groundwater environment, whereas troglofauna are air-breathing and occur in suitable cavities of the unsaturated vadose zone (i.e. above the water table).

This report presents the findings of an initial subterranean fauna desktop study undertaken for the Project, to provide contextual information on the project setting, and to assess the potential for subterranean fauna in areas likely to be impacted by mining. The report also outlines the scope and findings of a basic stygofauna survey at Garden Gully, undertaken in accordance with EPA guidelines following the desktop study.

1.1 SUBTERRANEAN FAUNA POLICY AND GUIDANCE

The EPA's framework for consideration of subterranean fauna during EIA is outlined in its *Technical Guidance - Subterranean fauna surveys for environmental impact assessment* (EPA 2021). The document provides guidance on the level of survey required for proponents and the information required to understand impacts. Also relevant is the EPA's *Environmental Factor Guideline – Subterranean Fauna* (EPA 2016). The following report considers relevant guidance for assessment of subterranean fauna.

2 EXISTING ENVIRONMENT

2.1 CLIMATE

Garden Gully is located within the Arid Region as delineated in Australian Rainfall and Runoff 1987. The nearest Bureau of Meteorology (BoM) station with a long data record is at Meekatharra Airport (Stn. 007045), located 19 km south-east of the project site.

Rainfall at Meekatharra Airport has been recorded since 1944. Annual rainfall is highly variable, ranging from 66 mm to 573 mm over the period of record. The long-term mean annual rainfall is 234 mm, with the month of February having the highest monthly average of 36.1 mm and September the lowest at 5.0 mm (Table 1). Rainfall over the winter months is generally associated with the passage of cold fronts from May through to August. Summer rainfall is highly erratic, and generally results from thunderstorms or cyclonic weather activity in the north.

Table 1: Average rainfalls and Dam Evaporation, Meekatharra (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall	29.2	36.1	30.8	18.8	21.6	28.5	20.0	10.6	5.0	6.0	11.7	14.4	234.0
Dam Evap.	380	314	267	190	131	87	92	121	170	259	293	333	2,637

Average dam evaporation (Luke, Burke, and O'Brien, 1988) is also given in Table 1. It exceeds average rainfall in all months, and by a factor of 11 overall.

Monthly mean maximum temperatures at Meekatharra range from 19.3 ^{o}C in July to 38.4 ^{o}C in January; and monthly mean minimum temperatures range from 7.5 ^{o}C in July to 24.4 ^{o}C in January.

2.2 TOPOGRAPHY AND DRAINAGE

The Murchison bioregion has low hills and mesas separated by flat colluvium and alluvial plains (DCCEEW 2024a). The land surface of the alluvial plain in the vicinity of Garden Gully is bisected by a minor drainage known as Garden Gully. Garden Gully drains a moderately-large catchment that lies to the north and east of Garden Gully (Rockwater 2024). It drains to the south-west, towards Hope River, a palaeodrainage (located 35 km from the project site) that is a zone of groundwater (and surface water) discharge.

2.3 IBRA SUBREGIONS

The Interim Biogeographic Regionalisation for Australia (IBRA) is a biogeographic regionalisation of Australia developed by the Australian government's Department of Climate Change, Energy, the Environment and Water. The bioregions and subregions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The Garden Gully Project lies within the Murchison bioregion in the southern rangelands of Western Australia, and is described as:

Mulga low woodlands, often rich in ephemerals, on outcrop and fine-textured Quaternary alluvial and eluvial surfaces mantling granitic and greenstone strata of the northern part of the Yilgarn Craton. Surfaces associated with the occluded drainage occur throughout with hummock grasslands on Quaternary sandplains, saltbush shrublands on calcareous soils and Halosarcia low shrublands on saline alluvia. Areas of red sandplains with mallee-mulga parkland over hummock grasslands occur in the east (DCCEEW 2024b).

The Murchison IBRA area has a 6.9% protection level; that is less than 7 % of the area is represented in the National Reserve System.

2.4 GEOLOGY AND HYDROGEOLOGY

The Tieraco 1:100,000 Geological map for the area (Chen and Ivanic, 2009) shows that the Garden Gully gold deposits are situated in an area of colluvial footslope (including ferruginous gravel and duricrust) with a northerly-trending, Proterozoic dolerite dyke. The Project location and regional geology are shown in Figure 2.

A description of the Archaean geology in the area of the Kyarra workings at Garden Gully, close to the Meekatharra Mount Clere Road is taken from St Barbara (1994). The mineralised area is underlain by undifferentiated felsic sedimentary rocks to the west, sheared felsic volcanic and volcaniclastic rocks to the east, with some local mafic to ultramafic units. Further east there is a thin unit of Stockyard Basalt, and then granitic intrusives. Geological interpretation by Boddington (2015) shows the host rock to be mainly a mafic volcanic (dolerite or basalt) with some ultramafic units (talc-chlorite and sericite schists).

Gold mineralization is associated with steeply dipping quartz veins within a series of anastomosing ductile shear zones. The linear drainage of Garden Gully is interpreted to follow a cross-cutting, north-easterly trending fault (Garden Gully Shear Zone) which truncates rock units to the south. Three other north-north-easterly trending faults are shown truncating mineralised zones on a plan in the Ora Gold October 2023 Investor Presentation. Aeromagnetic survey results for the area (MagSpec, 2016) show a complex structure for the area, including apparent northerly faults trending west of north, and east – west faults.

Photographs from four diamond-cored drillholes at Garden Gully, cored from ground surface, indicate that the main permeable broken zones are weathered, sheared mafics (generally dolerite) or ultramafics; or altered quartz mineralised zones (Rockwater 2024). Locations of the strongly-jointed core zones are shown in Figure 3. Most of the rocks below 90 m downhole (at 60^{o} dip) appear to be weakly jointed and of relatively low permeability, although locally some open fractures extend down to about 140 m depth (downhole).

Many drillholes were recorded as having intersected water during drilling, commonly from depths below about 12 to 30 m (downhole) in completely oxidised or transition-zone rocks. Five drillhole logs recorded faults or shears along a north-north-easterly line. A number of drillholes intersected high water flows from strongly fractured rocks or stopes. The locations of the high-flow zones, faults and shears are shown in Figure 3. Three faults that are within the envelope of the planned western pit are reported to have yielded high airlift water rates (up to 20 L/s in some drilled holes).

A tributary palaeochannel of Tertiary age follows the Garden Gully drainage on its northern side (Fig. 3) and has been defined by a passive-seismic survey (Resource Potentials, 2024). The survey results suggest that the palaeochannel is about 70 m deep. The palaeochannel is likely to contain basal sands (Werillup Formation). One drillhole north of the drainage is reported to have intersected about 100 m of sand; and the Main Roads bore probably intersects the southern edge of the channel. The palaeochannel that has been delineated by the passive seismic survey is likely to contain basal sands of moderate permeability.

3 SUBTERRANEAN FAUNA DESKTOP STUDY

3.1 PREVIOUS SURVEYS AT GARDEN GULLY

There are few records of subterranean fauna in the Murchison region of Western Australia, and no publicly available records that indicate surveys for stygofauna or troglofauna have been undertaken in the Garden Gully area.

3.2 SUBTERRANEAN FAUNA OF THE REGION

3.2.1 DATABASE SEARCHES

A number of database searches were undertaken to detail any stygofauna or troglofauna previously recorded near to the Project area, and to identify if any threatened/priority ecological communities (TEC's/PEC's) relating to subterranean fauna or threatened fauna species occur in the vicinity of the Project. The database search areas are specified in Table 2.

Database sources included:

- Dandjoo Database of Western Australia;
- Department of Biodiversity, Conservation and Attractions (DBCA) Threatened Fauna and TEC/PEC databases; and
- Atlas of Living Australia (ALA).

Table 2: Defined Search Parameters of Database and Internet Sources

Data Source	Search Area	No of records (un-screened)	No of records (screened for subterranean habitats)
DBCA TEC/PEC	100 km radius	9	4
DBCA Dandjoo Database		3,171	91
ALA	200 by 150 km rectangle	5,278	19

DBCA Threatened and Priority Ecological Community (TEC/PEC) database search

Results of a Threatened and Priority Ecological Community (TEC/PEC) database search confirmed that there are no TECs relating to subterranean fauna within a 100 km radius of the Project. The search returned several Priority Ecological Communities (PEC) pertaining to stygofauna communities in calcrete habitats, with all five communities listed occurring (at least partially) within a 50 km radius of the project (Figure 4). The nearest of these PECs is the (Priority 1) Belele calcrete groundwater assemblage, with its spatial buffer being approximately 34 km to the west of Garden Gully Project (Figure 4).

DBCA Threatened and Priority Fauna

A search of DBCA's Threatened and Priority Fauna database was screened for subterranean records within a 100 km radius of the Project. No subterranean fauna species were listed in the search results.

3.3 LITERATURE REVIEW

A literature review was conducted to gather existing information on subterranean fauna near to the Project area, using publicly available technical reports. The results of the closest of these reported studies are presented in Table 3, and locations of the projects are shown in Figure 1.

The closest record of subterranean fauna to Garden Gully is at Andy Well, 29 km to the north-north-east, within the Meekatharra-Wydgee greenstone belt. Andy Well sits in the Murchison Mineral Field of the Yilgarn Craton, in a sequence of granite and granodiorite intrusions of basalt and porphyry rocks. Superficial cover includes degraded laterite profiles and ferruginised rubble and colluvium over areas of subdued relief. This grades into sheetwash deposits 5 to 8 metres thick, and alluvium in surrounding watercourses related to northwesterly flowing tributaries to the Yalgar drainage system. Alluvial cover over the Yalgar drainage system ranges up to 30 metres thick overlying channel clays up to 100 metres thick.

A subterranean fauna assessment for the Andy Well Project recorded 21 stygofauna species, including Nematoda, Rotifera, Aphanoneura, Oligochaeta, Ostracoda, Copepoda, Syncarida and Amphipoda (Bennelongia 2011). All but two species were recorded from both the mine footprint “impact area” and reference sites, which included nearby calcretes with known significant stygofauna assemblages (Karalundi and Killara North Calcretes). The two remaining species were known to be widespread species. Consequently, development of the Project was not considered to be a significant risk to conservation of stygofauna of detrital aquifers (alluvium and colluvium) at Andy Well. Two troglofauna species were also recorded; an isopod and a polyxenid. Neither species of troglofauna was restricted to the mine footprint “impact area”.

Results of a survey of the adjacent Gnaweeda gold project (Bennelongia 2017) demonstrated a depauperate stygofauna community and absence of troglofauna in subterranean habitats including fractured rock and overlying colluvium. Two stygofauna species were recorded, with both species found to be widespread across Australia. The survey, combined with results of a desktop review suggested that the Project would not significantly threaten species or communities of subterranean fauna.

Stygofauna has also been found from fractured rock habitats at three other projects within 100 km of Garden Gully (Table 3, Figure 1). In addition, sampling for subterranean fauna in granite and granodiorite habitats at the Yangibana Rare Earths Project in the Gascoyne region (~350 km northwest of Garden Gully) yielded several species of both stygofauna and troglofauna (Bennelongia 2018). All stygofauna species from the project area were found to be widespread, and also occurred in samples from nearby calcrete aquifers, which were considerably more diverse than habitats of the project area.

In other parts of the Yilgarn Craton, fractured rock aquifers have yielded few records of stygofauna, and where present, stygofauna communities have generally been found to be depauperate. Surveys in greenstone belts from Ravensthorpe to north of Southern Cross have recorded occasional records of stygofauna (e.g. Rockwater 2009 a, b, c, d; Bennelongia 2009a; GHD 2009). Where surveys of fractured rock aquifers have recorded stygofauna, cyclopoid and harpacticoid copepods appear to be the most common groups found in these habitats; however, these are typically in very low numbers.

Surveys of fractured rock habitats in the Yilgarn have also yielded occasional records of troglofauna. These studies have typically been associated with banded ironstone geology, or calcretes. Surveys of BIF habitats in the Yilgarn at Koolyanobbing, Mt Jackson, Mt Dimer, Lake Giles, Mt Caudan and the Watt and Yendilberin Hills have yielded depauperate to moderately rich troglofauna communities (Bennelongia 2008a, b, 2009a,b; Rockwater 2009a, 2010, 2011). Sampling of other fractured rock habitats comprising mafic units (amphibolites, basalt, dolerite and gabbro) have also yielded occasional records (e.g. Rockwater 2009d, 2010) indicating that troglofauna habitat is present across a range of geological units that are typically found in greenstones of the Yilgarn Craton.

Table 3: Subterranean Fauna Projects in the vicinity of Garden Gully

Site	Distance to GG	Reference / Year	Geological Setting	Studied for	Results
Andy Well	32 km north-north east	Bennelongia, 2011	Surface covering of colluvial deposits up to 11 m thick, which overlie basement rock (metabasalt) weathered to form saprolite and saprock, with the rock freshening with depth. All stygofauna recorded from sites with the surficial colluvium (and alluvium in reference sites)	Stygofauna	The survey recorded 21 stygofauna species from 71 samples in the Andy Well Project Survey; comprising Nematoda, Rotifera, Aphanoneura, Oligochaeta, Ostracoda, Copepoda, Syncarida and Amphipoda. Six of the 21 species were recorded from the impact footprint of the Andy Well Project. The study confirmed no stygofauna species were restricted to the detrital aquifers of the Andy Well Project, and the integrity of the nearby Priority 1 PECs at Karalundi and Killara North calcretes would not be threatened by the proposed mining. It was concluded that the proposed mining at Andy Well would not threaten stygofauna conservation values or the persistence of any stygofauna species.
				Troglofauna	A desktop assessment concluded that the risk to troglofauna from mining at Andy Well Project was low to very low. A field survey of 25 samples yielded a depauperate troglofauna community of two species (1 isopod and 1 polyxenid). Neither species was recorded within the Andy Well impact footprint and mining activities at the Project were not considered to be a threat to their persistence.
Gnaweeda	34 km north-east	Bennelongia, 2017	Alluvial and colluvial (detrital) deposits overlying deeply-weathered volcanic and sedimentary rocks	Stygofauna Desktop and Level 1 Sampling	A desktop assessment recorded three stygal specimens from three species within 10 km of the project. Targeted sampling of the mine impact areas (10 samples) recorded three specimens from two stygofauna species, the cyclopoid copepod *Mesocyclops notius* and the ostracod *Cypretta seurati*. Both species are widespread and have been recorded across Australia. Survey results were consistent with the desktop review and demonstrated a depauperate stygofauna community
				Troglofauna Desktop and Level 1 Sampling	A desktop assessment compiled nearby troglofauna records and revealed four troglofauna species collected within 10 km of the project (taken as part of the Andy Well sampling programme). These included at least two isopod species, a millipede and a symphylan. Targeted sampling of the Gnaweeda impact area returned no troglofauna. The study concluded that troglofauna at the Project will be depauperate.

Site	Distance to GG	Reference / Year	Geological Setting	Studied for	Results
Murchison Gold Project – St Annes	34 km north-east			Desktop Assessment and Baseline Level 1 Survey	Twelve sites were sampled and five stygofauna species were collected, with most species determined to be widespread. The exception being one Ostracod species, which has not been collected elsewhere.
					Twelve sites were sampled for troglofauna, yielding three species; two millipede (Diplopoda) species and a slater (Isopoda: Oniscridea). No species were restricted to the impact area and the study concluded that troglofauna at the Project is be depauperate.
Gabanintha Vanadium Project (Australian Vanadium Project)	52 km south-east	Biologic 2021	Alluvial and colluvial deposits, ferruginous duricrust and felsic volcanic rock overlaying magnetite banded gabbro units	Stygofauna Desktop and Level 2 Sampling	A total of 1,460 stygofaunal and amphibious specimens were collected representing 34 unique taxa belonging to Nematoda, Aphanoneura, Oligochaeta, Syncarida, Copepoda and Ostracoda. Of these, nine species comprised regionally widespread, cosmopolitan, and higher order taxa. The remaining twenty-five species were recorded for the first time during the surveys and are currently only known from the Study Area. Eleven of the 25 species unique to the Study Area are amphibious enchytraeid worms that are not regarded as SREs. The remaining species comprise stygobites and potential stygobites.
				Troglofauna Desktop and Level 2 Sampling	Eleven troglofauna species were recorded, belonging to nine taxonomic groups: Pseudoscorpiones, Isopoda, Diplura, Zygentoma, Geophilida, Scolopendrida, Polyxenida, Pauropoda and Symphyla. Seven taxa were recorded from the Mining Area, two from the Water Supply Area and two from regional sites.
Gidgee Gold Project	90 km south-east	MBS 2013	Fractured Rock	Stygofauna – Level 1	Sixteen stygofauna species were recorded from 10 of the 20 sites sampled. Nine of these are considered common and widespread within the region and Western Australia. One juvenile Anzcyclops sp. was collected and could not be identified to species level but is likely to be Anzcyclops sp. B04. The remaining six are new undescribed species based on morphological differences.
				Troglofauna – Desktop only	A desktop review of potential habitat determined that the geology and hydrogeology of Gidgee was not suitable to support significant or unique troglofaunal habitat

3.4 HABITAT AND DISTRIBUTION

The probability that a site contains a diverse subterranean fauna community is largely determined by the region in which a site occurs, and biophysical attributes such as local geology. Geological, topographical and hydrological features influence subterranean faunal assemblages by allowing, or restricting, dispersal between populations. For stygofauna, karstic limestone and calcrete aquifers, alluvial formations and fractured rock habitats have historically been shown to provide stygofauna habitat in other parts of the Yilgarn Craton.

For troglofauna, the EPA notes that the probability of rich troglofauna assemblages in the Gascoyne and Murchison regions of Western Australia is typically only high where local geology includes calcrete, alluvium or banded ironstone (EPA 2007).

In the vicinity of the Crown Prince deposit, there are three geological formations that may provide habitat for subterranean fauna. These are;

- Ferruginous gravel and duricrust in the colluvial footslope;
- Fractured rock; and
- Calcrete associated with a tributary palaeochannel to the north of Garden Gully drainage.

The suitability of local geological formations as habitat for subterranean fauna can further be assessed by the presence of suitable voids within the rock type, which provide habitat spaces, and conduits for infiltration of oxygen and nutrients from the surface. Features such as fractures, vugs, and other voids in suitable lithologies facilitate fauna dispersal and infiltration of nutrients and organic material. These characteristics are considered essential for subterranean fauna habitat. Other important features include depth to surface, adjacent strata, geomorphology, vegetation types and presence of tree roots.

Locally, Ora Gold geologists have not encountered any cavities or vuggy sections of the surface duricrust layer within any drill holes at Crown Prince. The specific lithologies of the Crown Prince gold deposit at Garden Gully, combined with very shallow groundwater levels, suggests that potential troglofauna habitat is not widespread in the Project area.

Measured groundwater levels in the vicinity of the planned Crown Prince open pits are typically <10 m below ground level (bgl), with measured water levels ranging between 5 and 11 m bgl in drill holes and bores across the Project area. Initial hydrogeological studies indicate that the groundwater has a salinity of 690-3,500 mg/L TDS, and is circumneutral to slightly alkaline (pH 7.05-8.20, Rockwater 2024). These groundwater conditions appear to be conducive to stygofauna habitat, based on measured water quality ranges for groundwaters containing stygofauna in other parts of Western Australia.

The potential for the presence of subterranean habitats at the Crown Prince deposit was assessed using photos of diamond drill core at 4 holes across the Project area. These were inspected in detail and cross-referenced with lithological codes. Drill core photos were reviewed for any characteristic features such as vugs, fractures, holes, or pore spaces, pre-existing fractures (those show staining from groundwater, rather than fresh mechanical fractures from drilling), coarse gravel layers, or areas of significant core loss, which might indicate a subterranean cavity. The data was also inspected for key lithologies which, when sufficiently weathered or porous, are known to provide habitat for subterranean fauna in other parts of the Yilgarn Craton. Results of the assessment of diamond drill core are presented in section 3.4.1 (for troglofauna) and section 3.4.2 (for stygofauna).

3.4.1 ASSESSMENT OF POTENTIAL TROGLOFAUNA HABITAT

Four diamond core holes drilled from or near surface at Garden Gully provide insitu profiles of the geological sequence above the water table. Groundwater occurs at approximately 5 to 11 metres below ground level (bgl) at the deposit, and the unsaturated overburden consists of clay-rich duricrust. No vugs or cavities have been observed in diamond drill cores, or noted by site geologists in other drilling. Any voids formed in the weathering process have been filled with clay and are unlikely to support troglofauna.

Core photographs for the unsaturated sections of four diamond holes are presented in Plates 1 to 4 and the locations of the diamond holes are shown in Figure 5. The clay-rich profiles associated with surface detritals above the shallow water table at Crown Prince deposit are unlikely to support troglofauna.

Plate 1: Unsaturated geological sequence at site OGGDD524 (0 to 10.3 m below ground level), located in the central part of the deposit.

Plate 2: Unsaturated geological sequence at site OGGDD536 (0 to 10.3 m below ground level), located in the central part of the deposit.

Plate 3: Unsaturated geological sequence at site OGGDD537 (3.8 to 14.1 m below ground level), located in the south-eastern part of the deposit.

Plate 4: Unsaturated geological sequence at site OGGDD538 (0 to 13.2 m below ground level), located in the south-western part of the deposit.

3.4.2 ASSESSMENT OF POTENTIAL STYGOFAUNA HABITAT

Selected diamond core photographs from the four holes shown in Figure 5 outline the geological sequences of saturated sections of the deposit within the planned Crown Prince pits. All holes were drilled at -60° and depths discussed herein have been converted to vertical depth below ground level (bgl). Groundwater occurs at approximately 5 to 11 m bgl at the deposit. A clay-rich duricrust extends to approximately 13 to 40 m vertical depth at the deposit, below which weathered dolerite occurs to about 30 to 100 m bgl. Broken and fractured sections of this unit may provide potential habitat for stygofauna. Plates 58 show sections of broken/fractured ground below the water table that indicates areas of higher permeability within the Crown Prince gold deposit. The most prospective areas appear to be at top of the weathered dolerite, and considerably more fracturing is noted for holes intersecting faults (as mapped on Figure 3).

Plate 5: Saturated geological sequence at site OGGDD524 (52.2 to 57 m below ground level), located in the central part of the deposit.

Plate 6: Representative core photograph at site OGGDD536 (31 to 38.7 m below ground level), located in the central part of the deposit.

Plate 7: Representative core photograph at site OGGDD537 (20 to 20.3 m below ground level), located in the south-eastern part of the deposit.

Plate 8: Saturated geological sequence at site OGGDD538 (57.3 to 67.7 m below ground level), located in the south-western part of the deposit.

3.5 POTENTIAL IMPACTS OF MINING AT CROWN PRINCE DEPOSIT

Impacts to subterranean fauna are defined by the EPA's *Environmental Factor Guideline: Subterranean Fauna* (EPA 2016). These impacts may be direct or indirect.

Direct impacts include the removal or destruction of habitat by drawdown of water levels, inundation, or water quality changes. The main threats include excavation of rock types/habitat known to support subterranean fauna; groundwater extraction for process or domestic purposes; dewatering to facilitate mining below the water table, and groundwater reinjection of waste or excess water.

Indirect impacts include changes to hydrology, siltation, void collapse, alteration to nutrient balance and contamination. The main threats include changed surface topography due to compaction or creation of hard surfaces resulting in altered groundwater flow paths, increased runoff, and reduced infiltration and aquifer recharge; clearing of surface vegetation leading to sedimentation and changed nutrient inputs;

potential leaks or leaching including tailings and waste water resulting in alterations to ground water chemistry and quality, and introduction of toxins or radiation; and salinisation due to intrusion of saline water into freshwater aquifers and leaching from pit voids.

The potential impacts to stygofauna and troglofauna associated with mining are summarised in Table 4.

Table 4: Potential Direct and Indirect Impacts to Subterranean Fauna

Impact Type	Description
Direct Impacts (open pit and groundwater drawdown)	Direct impacts to subterranean fauna habitat due to mine development, excavation of open pit (stygofauna and troglofauna) and groundwater drawdown (for stygofauna) due to pit dewatering.
Indirect Impacts (open pit and other mining infrastructure)	Impacts that may modify subterranean habitats, such as clearing and/or modifying landform, and activities associated with construction of infrastructure where such activities cause siltation, void collapse, alteration to nutrient balance and contamination.
Cumulative Impacts	Impacts of Mining Proposal with consideration of other projects/users potentially impacting subterranean fauna. These include: 1. Pit Dewatering (nearby mines) 2. Other groundwater users

Two pits are planned to be mined at Crown Prince, to depths of about 136 m and 53 m, respectively, on the southern side of the Garden Gully drainage (Figure 3), over a three-year period. Model-calculated groundwater-level drawdowns (Rockwater 2024) suggest that the largest drawdowns will occur at the end of mining of the deeper (western pit); and that at the end of mining of both pits, the 0.5 m drawdown contour could extend up to 6.4 km north-south by 3.1 km east-west. The modelled drawdown is shown for the end of mining and dewatering in Figure 5.

The post mining landscape will include pit lakes from the final mine voids, which will be groundwater sinks. Water-balance calculations for the planned pits show that the final, post-mining pit lake levels will be slightly lower than current groundwater levels (Rockwater 2024). In the case of the (shallower) eastern pit, the pre-mining groundwater level and predicted post-mining lake level are so close that it may be a flow through feature. The modelling and water balances also suggest that there will be no seepage from the pit lakes back into the surrounding groundwater.

There will be no direct impacts to troglofauna habitat as a result of the Garden Gully Proposal as the water level is shallow (typically < 10 m below ground surface) and there is limited prospective habitat in the clay-rich detrital profile between the ground surface and water table.

Indirect impacts from clearing and related risks to subterranean habitats such as siltation, void collapse, alteration to nutrient balance and contamination are considered unlikely, given the local geology and small scale of the project.

3.5.1 CUMULATIVE IMPACTS

Cumulative impacts of drawdown from the other mining operations are not considered relevant to the Crown Prince proposal, as there will be no interactions between mine pit dewatering and drawdown associated with any current projects. There are no other significant groundwater users in the area that could impact the aquifers of the Project Area. The Meekatharra Water Reserve, which includes the Sherwood Borefield that provides water for the town, is about 2.5 km from Crown Prince at its closest point (Rockwater 2024). However, the nearest Sherwood Borefield production bore is about 9 km from Crown Prince deposit.

4 SAMPLING METHODOLOGY

The stygofauna sampling methodology implemented for the Garden Gully Project was prepared in accordance with relevant EPA guidance statement (EPA 2021). The investigation constitutes a basic survey following on from the desktop study and the sampling effort complies with the requirements of the EPA.

Sampling was undertaken by Daisy Scott, Senior Environmental Scientist and Nick Evelegh, Principal Environmental Scientist (both of Rockwater Pty Ltd) in October 2024 in accordance with Regulation 27 Permit No. BA 27 001 173 (Fauna Taking (Biological Assessment) Licence), issued by DBCA.

Prior to stygofauna sampling at each bore, water quality was measured on a bailed sample using a multi-parameter probe. Representative samples were also taken from a selection of open RC and diamond drill holes. Water quality parameter readings (including conductivity, pH, dissolved oxygen, and temperature) were recorded. Measurements of total depth, collar height, diameter and other bore details were also recorded.

Stygofauna sampling was undertaken using modified plankton nets. Each site was sampled using sampling nets with a diameter approximately two-thirds of the bore casing and filter mesh sizes 50 µm and 150 µm. Net samples were obtained by lowering sampling nets into each bore using a reel of braid until they reached the bottom of the bore where they were agitated to disturb sediment and any animals that may be present. Each biological sample was taken using three net-hauls of the 50 µm stygofauna sampling net and three net-hauls of the 150 µm sampling net, which were combined and stored in 120 mL polycarbonate vials. Samples from several reference sites and one impact site were pumped using existing installed pumps. Samples were preserved using 100% (absolute) ethanol.

To avoid contamination between sites, the sampling nets were thoroughly washed with a decontaminant solution (Decon 90) and then rinsed with distilled water. All samples were transported to Perth and forwarded to specialist stygofauna biologists for sorting and identification.

4.1 SITE SELECTION

The 2024 stygofauna sampling programme surveyed a combination of existing monitoring bores at the site, open reverse circulation (RC) exploration holes and diamond drill core holes across the proposed mine pit area and pastoral bores/wells in the immediate surrounds (Fig. 5). Table 5 outlines numbers of stygofauna samples collected by the Garden Gully stygofauna survey.

Eighteen stygofauna samples were collected from Project area impact sites, defined by the modelled 0.5 m drawdown contour of Rockwater (2024). Six additional reference sites were taken from regional bores and wells.

Table 5: Number of Stygofauna Samples Collected at the Garden Gully Project – October 2024

	Number of Samples			Total Samples
	Net	Pump	Total	
Project Area	17	1	18	24
Reference	3	3	6	

5 RESULTS AND DISCUSSION

Surveys of other fractured rock habitats in the Murchison, Gascoyne, and wider Yilgarn Craton have yielded few records of stygofauna or troglofauna, and where present, these subterranean fauna communities have generally been found to be depauperate. Based on previous surveys of similar habitats, there appears to be low potential for significant stygofauna or troglofauna at Crown Prince deposit.

Given the very clayey surface lithology of the Crown Prince deposit and the shallow water table (typically <10 m bgl) there is a low probability that suitable troglofauna habitat exists locally. Therefore, there is a low likelihood of any impacts to troglofauna habitat or troglofauna conservation values associated with the Project.

Stygofauna has generally been found to occur in alluvial or calcrete aquifers in the region. Stygofauna communities of alluvial aquifers have generally been shown to be widespread, and are unlikely to have restricted distribution ranges (at individual project scales).

There are no calcrete or karstic formations in the Project area; however, several bores located upstream of the Ora Gold project intersected significant thicknesses of porous calcrete that have historically had moderately high groundwater yields (Rockwater 2024). In addition, several regional calcretes have been shown to provide habitat for significant stygofauna assemblages (Figure 4). The nearest of these PECs is the (Priority 1) Belele calcrete groundwater assemblage, with its spatial buffer being approximately 34 km to the west of Garden Gully Project (Figure 4). Other Priority 1 calcrete PECs within 50 km of the Project including Killara North, Karalundi, Killara and Polelle are shown on Figure 4.

There were no subterranean fauna species listed in the results of a search of DBCA's Threatened and Priority Fauna database for the Project area. Results of other database searches (see section 3.2.1) identified subterranean fauna records from groups including Insecta, Malacostraca, Maxillopoda, Arachnida, Entognatha and Oligochaeta (Figure 4). The majority of these records are associated with a 2011 survey at the Andy Well Project, which recorded 2 troglofauna species and 21 stygofauna species from surficial colluvium and alluvial habitats of the project area (Bennelongia 2011). None of the stygofauna recorded by that survey were restricted to the weathered basement rock (metabasalt).

The October 2024 stygofauna survey at the Crown Prince deposit sampled a total of 24 sites, including six regional bores and wells; some of which are located in areas of calcrete upstream of the Project (Figure 5). Sampling results are presented in Table 6. Twelve possible stygofauna species were recorded, indicating a moderately diverse stygofauna community. The stygofauna recovered from samples included copepods, ostracods, syncarids, and aquatic worms. Seven stygofauna species were recorded within the Project impact area, which is defined by the 1,580 ha area of drawdown influence on groundwater levels. Stygofauna recorded by the survey, together with the extent of drawdown resulting from pit dewatering, are shown in Figure 6.

Only one of seven species recorded from the area of drawdown influence at Garden Gully has not been recorded from regional sites. The cyclopoid copepod, *Parastenocaris* `BHA433`, is a potential new species that is currently only known from a single site approximately 1.1 km west-north-west of the Project (Figure 6). Another *Parastenocaris* specimen was recorded from bore GG2, approximately 5 km east of the Project (Figure 6). The specimen was female (males are required for species level identification) and may represent another record of *Parastenocaris* `BHA433`.

Table 6: Results of stygofauna sampling at Garden Gully

	Order	Family	Taxon	n	Project Area	Reference
CRUSTACEA						
Copepoda	Cyclopoida	Cyclopidae	Dussartcyclops uniarticulatus s.l.	5	-	CP Bore, GG2
	Cyclopoida	Cyclopidae	*Mesocyclops brooksi*	12	OGGRC555	LPGG5
	Cyclopoida	Cyclopidae	*Paracyclops chiltoni*	1	CPMB001	Widespread species
	Cyclopoida	Parastenocarididae	*Parastenocaris* \`BHA433\`	10	Main Roads Bore	-
	Cyclopoida	Parastenocarididae	Parastenocaris sp.	1		GG2
Ostracoda	Podocopida	Cyprididae	Sarscypridopsis aculeata	4	-	Pettiford Mill
	Podocopida	Cyprididae	Sarscypridopsis sp.	2	-	Joe Well
	Podocopida	Limnocytheridae	Limnocythere	1	-	Pettiford Mill
Syncarida	Bathynellacea	Parabathynellidae	Atopobathynella \`BSY387\`	12	-	GG1, LPGG5, GG2
ANNELIDA						
Polychaeta		Aeolosomatidae	Aeolosoma sp.*	20	CPMB001	-
Oligochaeta	Tubificida	Enchytraeidae	Enchytraeidae ‘2 bundle’ s.l. (long thin 2 per seg)	8	-	GG2
	Tubificida	Enchytraeidae	Enchytraeidae ‘3 bundle’ s.l. (short sclero)	61	OGGRC555, OGGDD0S1	Joe Well, GG2
	Tubificida	Phreodrilidae	Phreodrilidae sp. AP DVC s.l.	15	-	Joe Well, LPGG5, GG2
	Tubificida	Naididae	Tubificinae \`BOL106\`	2	CP Bore	GG2
			TOTAL	154		

* Denotes taxa not expected to be identified to species level (EPA, 2007)

Harpacticoid copepods of the Pilbara region have been shown to have variable ranges, with most showing at least catchment scale distributions (Halse *et al*. 2014). *Parastenocaris* \`BHA433\` is expected to have a range extending well beyond the area of groundwater drawdown associated with the Project. The Garden Gully specimens of this taxon were recorded from a 74 m deep production bore, where the aquifer has a recorded saturated thickness of at least 68 m. The maximum modelled drawdown of approximately 1.5 m at this site will not affect the conservation status of the species.

Two cyclopoid copepods (*Mesocyclops brooksi* and *Paracyclops chiltoni*) recorded from impact sites are cosmopolitan species that are also known to occur more widely, including from freshwater habitats of the Pilbara region. Most of the remaining stygofauna speciesare known to occur more widely than the Project impact area. The exception is the aquatic annelid worm Aeolosoma sp., which cannot be assessed for EIA purposes due to the lack of a suitable taxonomic framework to further identify the species. All stygofauna species recorded by the survey are expected to have distribution ranges at least an order of magnitude greater than the Project area of drawdown influence.

In the Pilbara and Murchison regions, stygofauna distributions are usually restricted by surface drainage catchments, aquifer discontinuity, geological barriers or habitat preference. There is no evidence to suggest that distribution ranges of any species are limited at the project-scale by any such factors. The habitats sampled at Garden Gully are not unique in a regional context, and there appear to be no real constraints of geological barriers or aquifer boundaries that would restrict dispersal of stygofauna more widely than the Project area. Sampling results indicate that continuous stygofauna habitat extends beyond the area of drawdown influence. Consequently, none of the recorded species are likely to have distribution ranges limited to the localised extent of dewatering impacts. Mining of the Crown Prince Prospect is unlikely to threaten the conservation of any individual stygofauna species recorded by the survey, or to impact any stygofauna conservation values of the wider Garden Gully area.

Results of groundwater sampling, undertaken in conjunction with the stygofauna field survey at Garden Gully, indicate a groundwater salinity range of 1,180 to 5,943 mg/L TDS and circumneutral to slightly alkaline pH (7.28 to 7.85) (Appendix I). Dissolved oxygen levels ranged from 1.51 to 8.25 mg/L (18.3 to 91.6 % saturation). The water quality results indicate that the groundwater conditions are within suitable ranges recorded for stygofauna habitat at other locations in Western Australia. Therefore, water quality is unlikely to be a limiting factor for stygofauna at Crown Prince deposit.

There will be no interactions between the Crown Prince mine pit dewatering and drawdown associated with groundwater extraction from the Meekatharra town water supply borefield, or from dewatering of other current mining operations in the region over the life of the mine. The Crown Prince deposit and the nearest Meekatharra borefield production bore are separated by a distance of at least 9 km. There are no other nearby developments or projects that could present a cumulative impact to stygofauna in the vicinity of the Project.

6 CONCLUSIONS

A basic stygofauna survey was undertaken over the Crown Prince deposit at Garden Gully, in conjunction with a desktop subterranean fauna study. Results of the desktop study indicate that there appears to be no suitable habitat for troglofauna, and the aquifers of the immediate Project area are unlikely to host a rich stygofauna community. Results of 24 samples from the Project area included 12 possible stygofauna species, including copepods, ostracods, syncarids, and aquatic worms. Most of the stygofauna species from the Project area were found to occur more widely. However, one cyclopoid copepod species (*Parastenocaris* \`BHA433\`) collected from the area of drawdown influence as a singleton record is currently known only from the Garden Gully area. The modelled drawdown at the site it was recorded at represents 2% of the aquifer thickness, which will not affect the conservation status of the species. Drawdown associated with the Project affects an area of approximately 1,580 ha and is unlikely to impact any stygofauna conservation values of the wider Garden Gully area.

The nearest calcrete groundwater assemblage with significant conservation values (Belele P1 Priority Ecological Community) has its spatial buffer approximately 34 km to the west of Garden Gully Project, and 33 km from any modelled drawdown impacts associated with pit dewatering at Crown Prince deposit. There appears to be no risk from the Project to any stygofauna conservation values associated with listed threatened or priority ecological communities. The localised drawdown from pit dewatering over the life of the Project is unlikely to impact any stygofauna values at Garden Gully, or the persistence of any stygofauna species recorded by the survey.

DATED: 25 November 2024 **Rockwater Pty Ltd**

[redacted]

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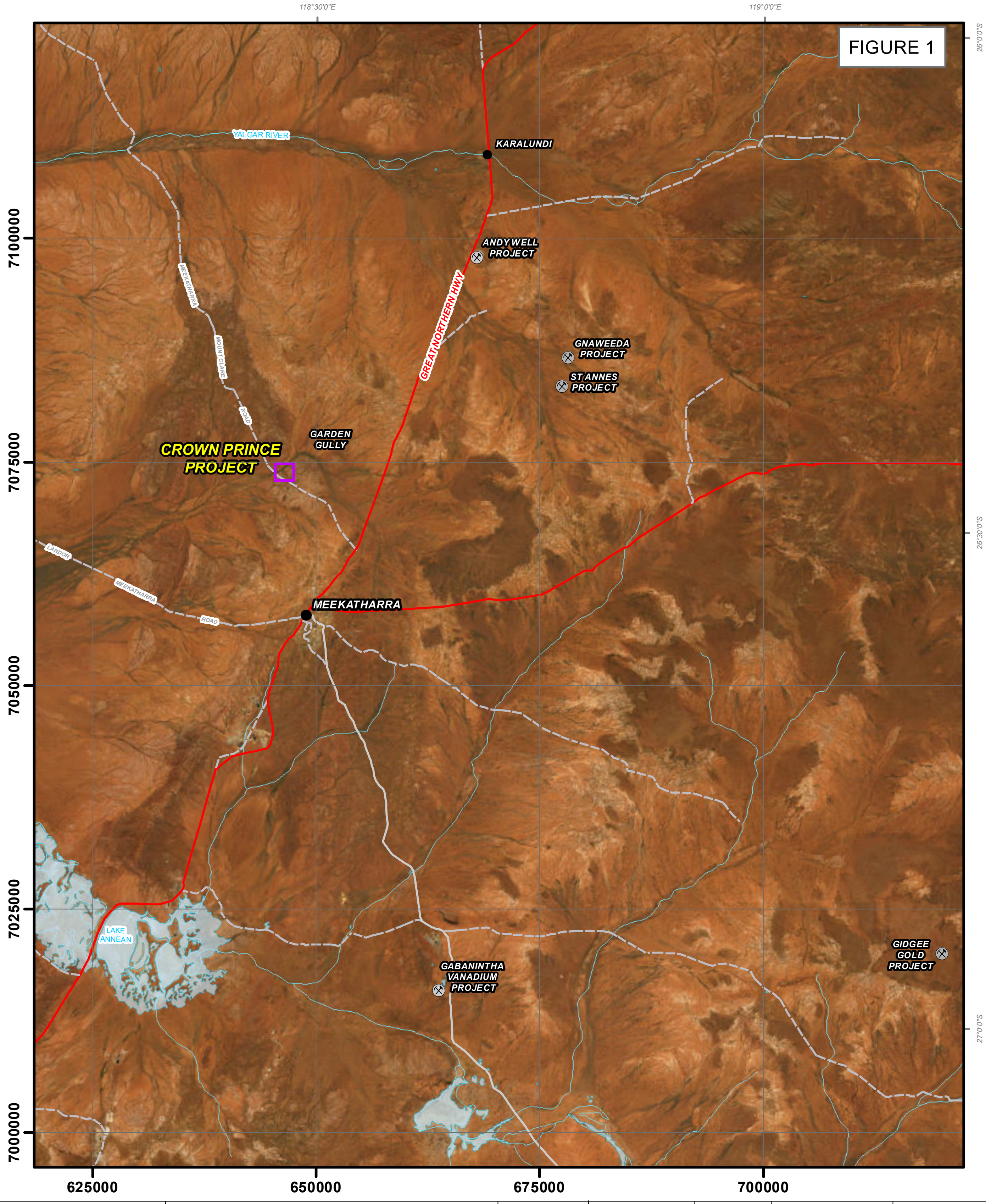
FIGURES



Data Source:

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

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Populated place
Lakes
Rivers_DoW

Roads/Tracks
Principal Road
Secondary Road
Minor Road

1:600,000
A4

Grid: MGA 1994
Zone 50

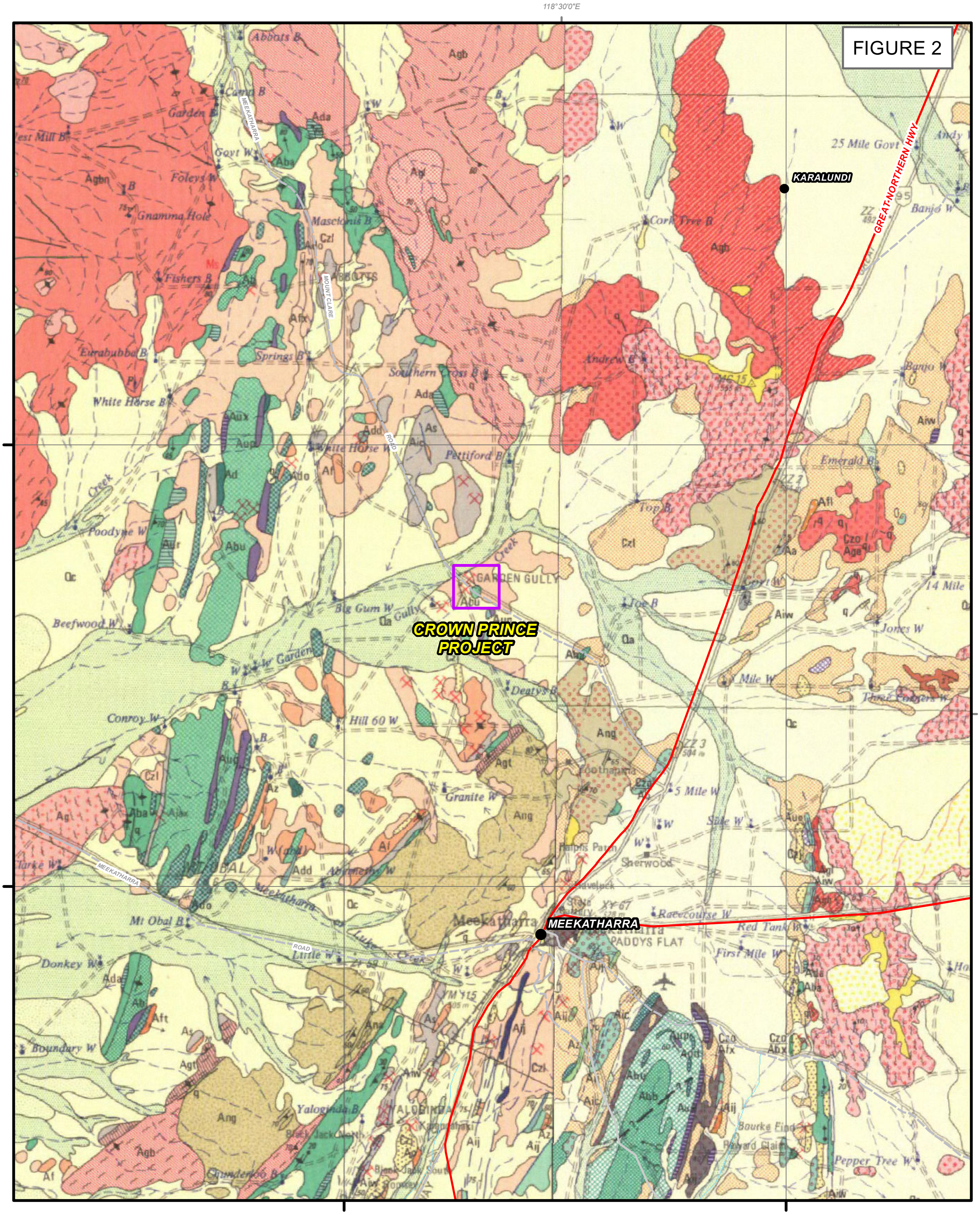
CLIENT: Ora Gold Ltd

PROJECT: Garden Gully Project
Subterranean Fauna Assessment

DATE: October 2024

DWG NO: 586-1/24/01-4

SITE LOCALITY



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Service Layer Credits:
Geological Survey of Western Australia

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Populated place
Lakes
Rivers_DoW

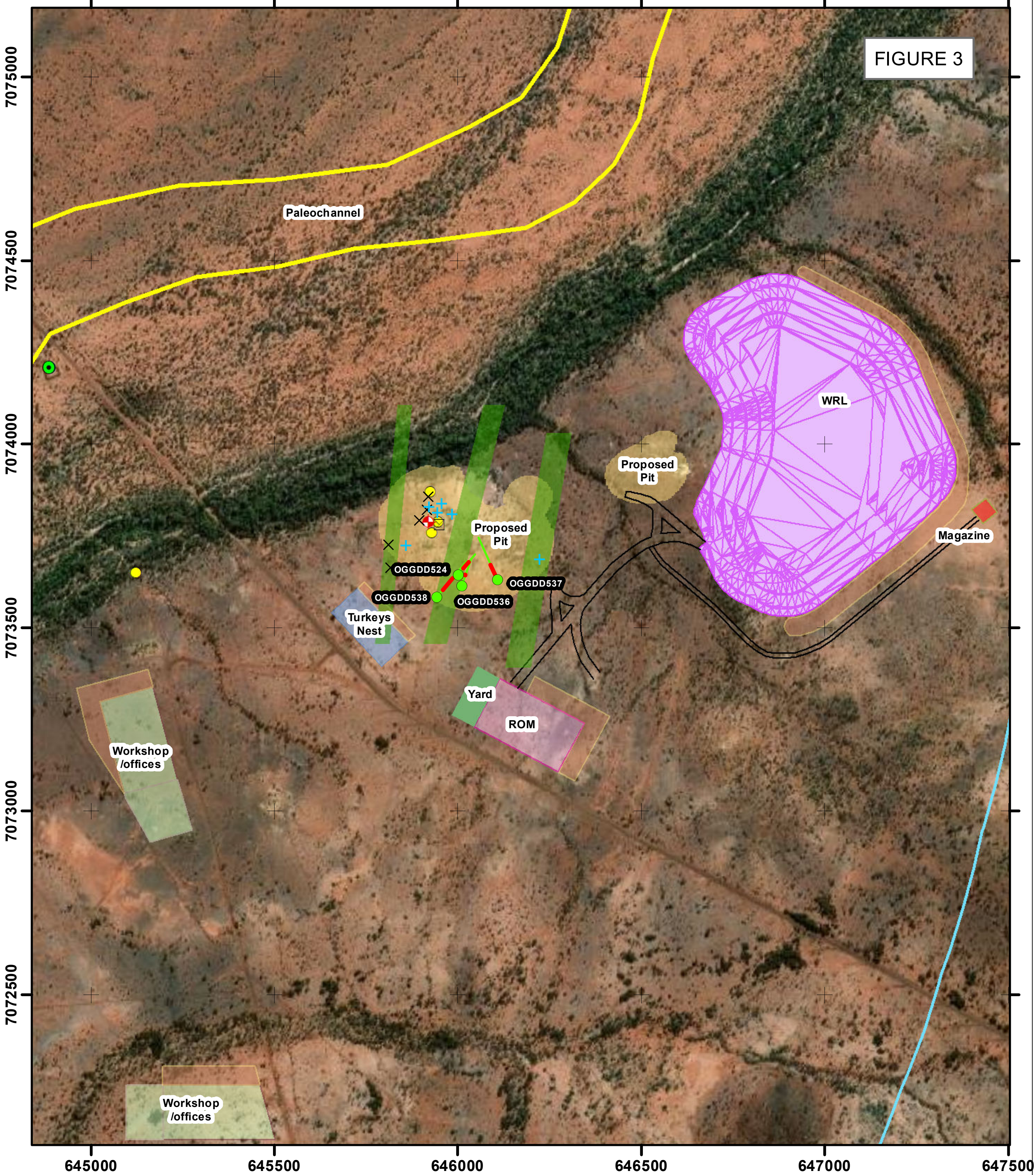
Roads/Tracks
Principal Road
Secondary Road
Minor Road

1:250,000
A4

Grid: MGA 1994
Zone 50

CLIENT: Ora Gold Ltd
PROJECT: Garden Gully Project
Subterranean Fauna Desktop Assessment
DATE: October 2024
DWG NO: 586-1/24/01-2

REGIONAL GEOLOGY



Inspected Diamond Core	CP Production Bore
0.5 m Drawdown Extent	Kyarra Shaft
Drillhole jointed zones	Main Roads Bore
Drillhole traces	Monitoring Bore
Inferred Faults	High Yielding Holes
Palaeochannel	Fault/shear, in drillholes

N

1:15,000
A4

Grid: MGA 1994
Zone 50

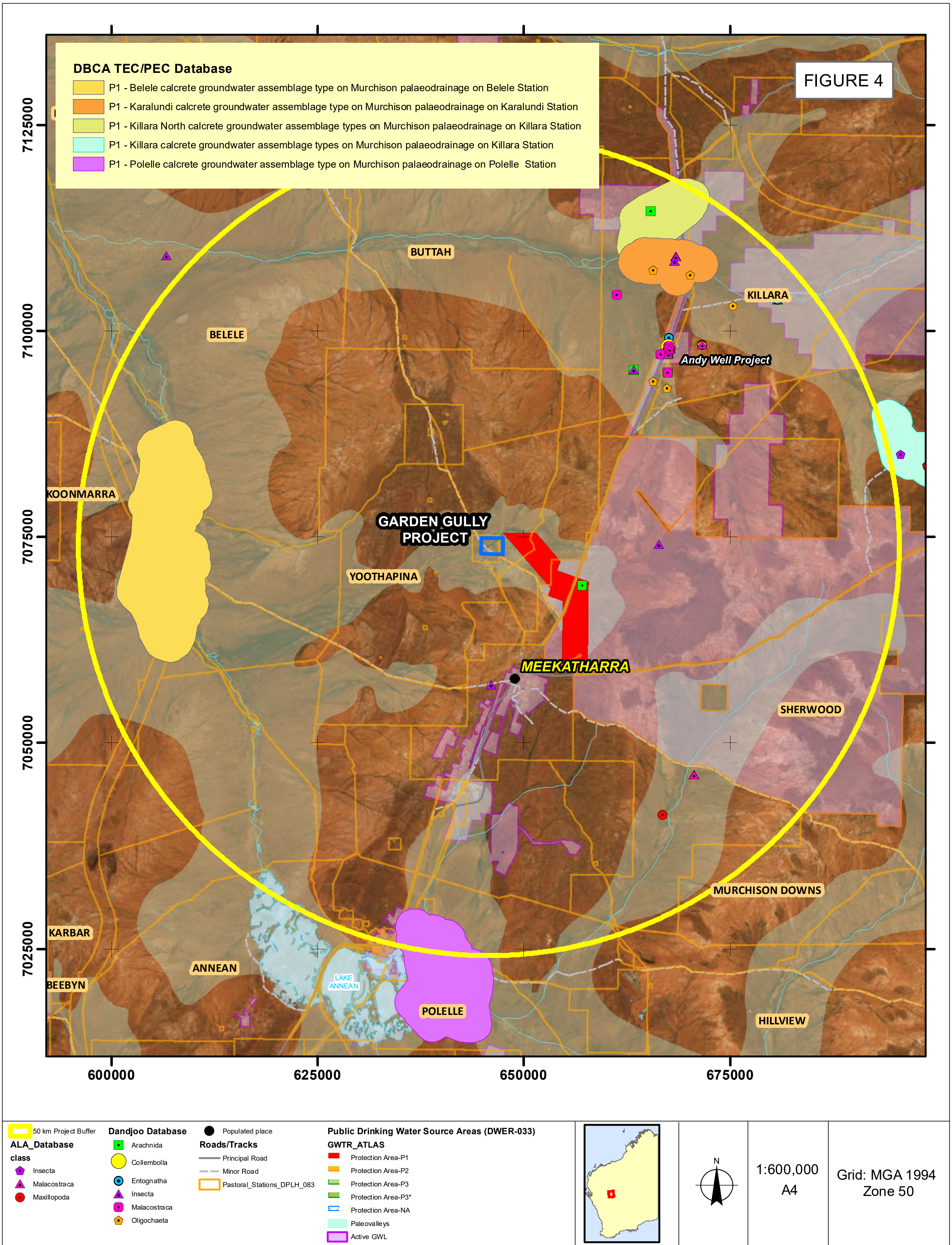
ORA GOLD LIMITED

CLIENT: Ora Gold Ltd
PROJECT: Garden Gully Project
Subterranean Fauna Assessment
DATE: October 2024
DWG NO: 586-1/24/01-3

GARDEN GULLY PROJECT

SITE LAYOUT

Rockwater



CLIENT: Ora Gold Ltd

PROJECT: Garden Gully Project

Subterranean Fauna Assessment

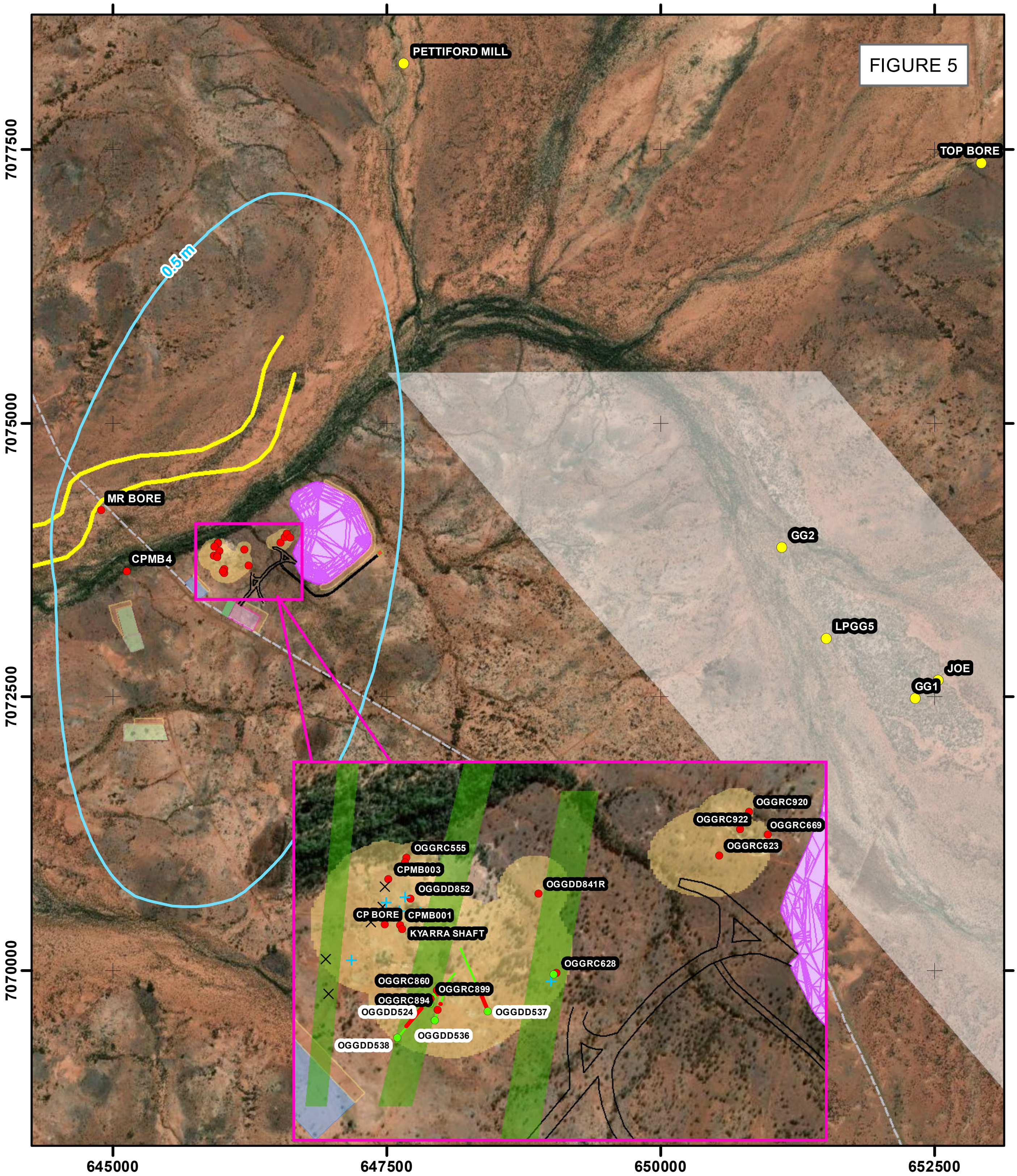
DATE: October 2024

DWG NO: 586-1/24/01-4

GARDEN GULLY PROJECT

DATABASE SEARCHES

Rockwater



Inferred Faults		Inspected Diamond Core	
Drillhole traces		High Yielding Holes	
Drillhole jointed zones		Fault/shear, in drillholes	
0.5 m Drawdown Extent		**Stygofauna Sampled_Sites**	
Water Reserve - Public Drinking Water P1		Impact	
Palaeochannel		Reference	

N

1:50,000
A4

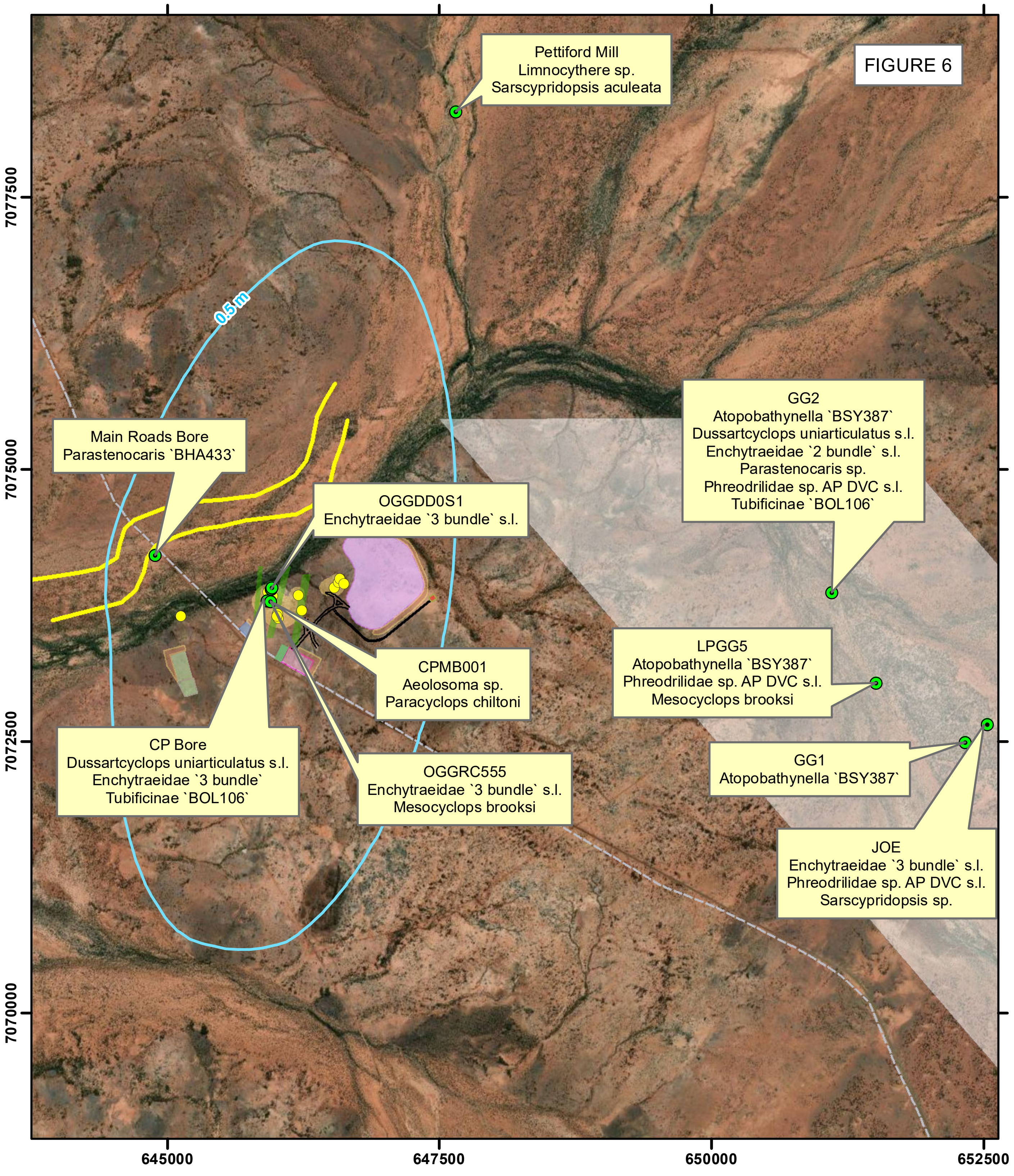
Grid: MGA 1994
Zone 50

ORA GOLD LIMITED

CLIENT: Ora Gold Ltd
PROJECT: Garden Gully Project
Subterranean Fauna Assessment
DATE: October 2024
DWG NO: 586-1/24/01-5

STYGOFAUNA SAMPLED SITES

Rockwater



Inferred Faults

0.5 m Drawdown Extent (Rockwater, 2024)

Water Reserve - Public Drinking Water P1

Palaeochannel (Rockwater, 2024)

Sampled_Sites

Sampled_Sites

Stygofauna Present

N

1:50,000

A4

Grid: MGA 1994
Zone 50

ORA GOLD LIMITED

CLIENT: Ora Gold Ltd

PROJECT: Garden Gully Project

Subterranean Fauna Assessment

DATE: October 2024

DWG NO: 586-1/24/01-6

GARDEN GULLY PROJECT

STYGOFAUNA SAMPLING RESULTS

Rockwater

APPENDIX

APP I: Site and Sampling Details, Crown Prince deposit

Site Details													Bore Construction			Sampling Details			Water Quality					
Site id	Zone	Easting	Northing	RL	Type	Prelim Status	Depth	Measured WL (m)	Collar Height	Water Level (m bgl)	Water Level (m RL)	Dip	Construction Date	Slotted Section	Diameter (mm)	Sampled Date	Sampled For	Method	Temperature (degrees)	TDS (mg/L)	EC (mS/cm)	pH	DO (mg/L)	DO (% Sat)
CP BORE	MGA94 50	645,918	7,073,789		Production Bore	Impact						-90	-	-	100	3/10/2024	S	Pumped	23.2	2036.8	3.04	7.85	5.86	68.3
CPMB001		645,946	7,073,788	490	Monitoring Bore	Impact	73	10.06	0.5	9.6	480.44	-90	2024	18-72	50	3/10/2024	S	Net	25.6	2559.4	3.82	7.35	1.83	22.2
CPMB003		645,925	7,073,871	489	Monitoring Bore	Impact	73	9.74	0.5	9.2	479.76	-90	2024	18-72	50	3/10/2024	S	Net	24.8	2056.9	3.07	7.28	7.07	85.3
GGMB4		645,123	7,073,650	486	Monitoring Bore	Impact	27	5.92	0.5	5.4	480.58	-90	2024	6-24	50	2/10/2024	S	Net	25.9	1721.9	2.57	7.25	1.51	18.3
KYARRA SHAFT		645,950	7,073,780	490	Old Shaft	Impact		9.3	0	9.3	480.7	-	-	-	-	3/10/2024	S	Net	22.9	2063.6	3.08	7.36	2.74	31.7
MAIN ROADS BORE		644,887	7,074,209	487	Production Bore	Impact		6.3		6.3	480.7	-90	-	-	-	3/10/2024	S	Net	26.4	1373.5	2.05	7.69	6.11	75.5
OGGDD0S1		645,955	7,073,902	488	Diamond Hole	Impact		5.88	0	5.9	482.12	-90	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGDD841R		646,199	7,073,845	488	Diamond Hole	Impact	80	8.75	0.2	7.4	479.45	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGDD852		645,965	7,073,836	490	Diamond Hole	Impact	99.4	8.95	0.1	7.7	481.15	-65.1	-	-	-	2/10/2024	S	Net	25.8	5942.9	8.87	7.35	2.5	30.7
OGGRC555		645,957	7,073,910	488	RC Hole	Impact	126					-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC623		646,529	7,073,914	489	RC Hole	Impact	120	9.27	0.2	7.8	479.93	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC628		646,232	7,073,700	490	RC Hole	Impact	94	10.43	0.2	8.8	479.77	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC669		646,618	7,073,953	490	RC Hole	Impact		9.52	0.45	7.8	480.93	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC860		646,013	7,073,668	490	RC Hole	Impact	71	12.3	0.3	10.4	478	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC894		646,015	7,073,632	491	RC Hole	Impact	126	13.4	0.3	11.3	477.9	-60	-	-	-	3/10/2024	S	Net	23.1	1943	2.9	7.45	6.54	78.8
OGGRC899		646,002	7,073,653	490	RC Hole	Impact	138	12.42	0.3	10.5	477.88	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC920		646,583	7,073,995	489	RC Hole	Impact	119	9.25	0.3	7.7	480.05	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
OGGRC922		646,567	7,073,963	489	RC Hole	Impact		9.23	0.3	7.7	480.07	-60	-	-	-	3/10/2024	S	Net	-	-	-	-	-	-
GG1		652,326	7,072,487	498	Water Exploration Hole	Reference	17.9	6.19	0.4	5.8	492.21	-90	-	-	-	4/10/2024	S	Net	24.4	1283.05	1.915	7.53	6.05	72.5
GG2		651,105	7,073,869	495	Water Exploration Hole	Reference	19	3.9	0.25	3.7	491.35	-90	-	Uncased	-	4/10/2024	S	Net	25.9	1269.65	1.895	7.45	5.33	65.2
JOE		652,532	7,072,652	500	Stock Bore w Windmill	Reference	5.9	5.9	0.6	5.3	494.7	-90	-	-	-	4/10/2024	S	Pumped	25.1	1339.33	1.999	7.59	6.99	85.1
LPGG5		651,511	7,073,036	499	Water Exploration Hole	Reference	16.7	4.25	0.2	4.1	494.95	-90	-	-	-	4/10/2024	S	Net	25.4	1228.78	1.834	7.64	6.2	75.6
PETTIFORD MILL		647,648	7,078,284	497	Stock Bore w Windmill	Reference		-	-	-	-	-90	-	-	-	3/10/2024	S	Pumped	24.9	1179.87	1.761	7.28	8.25	91.6
TOP BORE		652,927	7,077,377	500	Stock Bore w Windmill	Reference	-	-	-	-	-	-90	-	-	125	4/10/2024	S	Pumped	27.1	1487.4	2.22	7.38	6.35	79