Appendix 1: Ridges Iron Ore Deposit Soil Survey and Waste Characterisation (SWC 2010)

S O I L W A T E R C O N S U L T A N T S

RIDGES IRON ORE DEPOSIT SOIL SURVEY

Prepared for: **Kimberley Metals Group**

Date of Issue: 27 April 2010

Project No.: PN0149-1-1-KMG-001

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A member of the SOIL WATER GROUP

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Revision History

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A	26/04/10	Internal review of report	ASP	AJH	ASP
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A - Report issued for internal SWC review	1 - First Revision
B - Draft report issued for client for review	2 - Second Revision
C - Final report issued to	3 - Third Revision

LIMITATIONS

The sole purpose of this report and the associated services performed by Soil Water Consultants (SWC) was to undertake a Soil and Waste Characterisation for the proposed Ridges Iron Ore Project (RIOP). This work was conducted in accordance with the Scope of Work discussed with Kimberley Metals Group ('the Client').

SWC performed the services in a manner consistent with the normal level of care and expertise exercised by members of the earth sciences profession. Subject to the Scope of Work, the soil and waste characterisation was confined solely to the Ridges Iron Ore Project. No extrapolation of the results and recommendations reported in this study should be made to areas external to this project area. In preparing this study, SWC has relied on published soil reports from various soil researchers and information provided by the Client. All information is presumed accurate and SWC has not attempted to verify the accuracy or completeness of such information. While normal assessments of data reliability have been made, SWC assumes no responsibility or liability for errors in this information. All conclusions and recommendations are the professional opinions of SWC personnel.

SWC is not engaged in reporting for the purpose of advertising, sales, promoting or endorsement of any client interests. No warranties, expressed or implied, are made with respect to the data reported or to the findings, observations and conclusions expressed in this report. All data, findings, observations and conclusions are based solely upon site conditions at the time of the investigation and information provided by the Client.

This report has been prepared on behalf of and for the exclusive use of the Client, its representatives and advisors. SWC accepts no liability or responsibility for the use of this report by any third party.

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1 INTRODUCTION

Soil Water Consultants (SWC) were commissioned by Kimberley Metals Group (KMG) to undertake a pre-mine soil and waste characterisation study for the proposed Ridges Iron Ore Project (RIOP). The purpose of this assessment was to identify and characterise all surficial soil and waste materials in the disturbance area and suggest management strategies for their handling and utilisation. This information provides baseline data that will be used to assist in the mining of these soils, restoration of the post-mining soil profile and the identification of potential environmental impacts that may occur in response to mining. Implementation of the waste management recommendations suggested in this report will ensure that only optimal materials are used in the rehabilitation of the backfilled mine pits and in the construction of the outer surface of the waste dumps, thus facilitating stability and revegetation.

1.1 STUDY OBJECTIVES

The objectives of this soil survey were to:

- Define the distribution of the soils in the Ridges Pre-Mine Soil Study Area (the study area);
- Characterise the physical and chemical properties of these soils;
- Identify soils that may develop adverse soil properties during mining and rehabilitation;
- Suggest management strategies for the handling and utilisation of these soils during mining and rehabilitation.

1.2 SCOPE OF WORK

The Scope of Work completed by SWC included:

- Obtain and review all of the existing exploration and production drilling data from KMG;
- Prepare geological cross-sections throughout the soil study area and identify provisional Soil Mapping Units (SMU) from these cross-sections;
- Excavate soil trenches to expose and examine the soil profile in each SMU;
- Using field and laboratory analysis, and the morphological descriptions, finalise the definition of SMU boundaries and characteristics for the soil study area;
- Preparation of this report.

2 SITE DESCRIPTION

2.1 STUDY LOCATION

The RIOP is located with the Shire of Wyndham - East Kimberley, approximately 78 km from the Northern Territory border and 120 km SSW of Kununurra (Figure 2.1). The deposit is located along a major north-south trending escarpment, approximately 6 km east of the Great Northern Highway (Figure 2.2).

2.2 PROJECT BACKGROUND

The RIOP consists principally of two deposits named Sam and Tony Pits (Figure 2.3). Two orebody outlines have currently been identified consisting of a high-grade hematite-rich deposit and a larger low-grade more magnetite-rich deposit. Areas of the proposed pits are provided in Table 2.1. The iron ore deposits have formed by supergene alteration and iron enrichment of the previous sandstone formation, and subsequently it is relatively shallow with a maximum depth of only 24 m. The orebody occurs close to surface over most of the area, and therefore there is minimal requirement for waste dumps, with backfilling of the mine void being considered as a possible option to further reduce the requirement of permanent waste dumps.

Additional infrastructure associated with the RIOP includes: Run-Of-Mine (ROM) Pad, crusher, workshop, laydown area, site offices and carparks. These ancillary facilities will be located on the flatter plain area to the west of the escarpment (Figure 2.3).

Table 2.1: Areas of proposed mine areas at the RIOP.

	High grade area (m^2)	Low grade area (m^2)
Sam Pit	186,295	522,691
Tony Pit	73,641	140,421

Given the shallow elongate nature of the deposits, surface miners are likely to be used. Mined ore will be excavated and trucked to the ROM Boxcut located between the two pits (Figure 2.3). From there the ore will be trucked to the ROM Pad, down the escarpment, and then crushed for transport by road to Wyndham where it will be shipped to overseas clients.

2.3 CLIMATE

The study area experiences a tropical climate with warm, dry winters and hot, wet summers. The average long-term (1889 - 2009) annual rainfall for the area is 624 mm, with 80% of the total rainfall falling between the months of December and March. During the wet season (Dec - Mar) daily rainfalls of > 100 mm have been recorded, with these associated with large cyclonic events (for example, on the 17th March 2005 a total of 209 mm of rain was recorded at the Lissadell weather station associated with Cyclone Ingrid, whilst close to 100 mm fell on the 11th December 2000, associated with Cyclone Sam).

The average long-term (1889 - 2009) annual pan evaporation is approximately 2850 mm (Table 2.2), with a monthly average of 242 mm. Potential evaporation exceeds rainfall for all months of the year, and subsequently the environment exists in a water deficit condition.

Table 2.2: Average monthly rainfall (mm) and pan evaporation data (mm) for the study area (Lissadell; Station number 2016; Bureau of Meteorology, 2009).

Month	Rainfall (mm) (1889 – 2009)	Pan Evaporation (mm) (1989 – 2009)
January	151.8	242.1
February	157.9	197.8
March	101.1	215.8
April	18.4	218.9
May	5.9	202.7
June	3.5	178.9
July	4.3	194.6
August	1.2	230.8
September	3.8	275.0
October	21.2	315.3
November	50.7	300.5
December	105.1	277.2
Annual	**624.5**	**2849.1**

2.4 GEOMORPHOLOGY

The landscape within the RIOP is dominated by the large north-south trending sandstone escarpment, which hosts the mineralised iron ore deposits (Plate 2.1; Figure 2.4). The escarpment rises approximately 300 m from the surrounding granitic plain and reaches a maximum elevation of 668 m AHD (Figure 2.5). East of the escarpment the plateau landsurface gently slopes towards Lake Argyle, located approximately 40 km east-northeast of the RIOP.

At a local-scale within the RIOP the geomorphology of the plateau surface is strongly controlled by a series of north-south trending structural surfaces or geological contacts, resulting in a steeply dipping east-west landsurface (Figures 2.6 and 2.7). Within the proposed Sam Pit area the landsurface steeply dips from a maximum elevation of 668 m on the western side of the deposit to around 580 m to the east (Figure 2.6), with slopes of between 15 - 20° over most of the deposit (Plates 2.2 and 2.4). At the base of the slope there is a broad alluvial valley, approximately 250 m wide (Plate 2.5), with a centralised drainage line. Surface water within this drainage system flows predominately to the north, becoming March Fly Creek.

In the Tony Pit area the landsurface dips from 650 m west of the proposed pit to 550 m in the east (Figure 2.7). Slopes vary from 15 - 20° (Plate 2.6), and unlike in the Sam Pit area there is no broad valley at the base of the slope (Plate 2.7). At the Tony Pit the linear slope abuts the structural contact with the adjoining unweathered Hensman Sandstone and Golden Gate Siltstone (Plate 2.8). The contact between the steep slope and the unweathered basement rocks creates a defined drainage line which flows south over the edge of the escarpment.

Plate 2.1: Dominant sandstone escarpment which hosts mineralised deposits.

Plate 2.2: Approximate location of the Sam Pit showing the considerable relief of the area.

Plate 2.3: Characteristic steep vegetated slope within the Sam Pit area.

Plate 2.4: Very steeply dipping portion (20° slope) of the landsurface in the Sam Pit area.

Plate 2.5: Broad alluvial valley at the base of the slope in the Sam Pit area.

Plate 2.6: Steep linear slope within the Tony Pit area.

Plate 2.7: Steep linear slope within the Tony Pit area looking east.

Plate 2.8: Abrupt contact between the steeply dipping landsurface of the Tony Pit area and the remnant structural surface of the Hensman Sandstone and Golden Gate Siltstone.

2.5 GEOLOGY

The regional geology covering the RIOP is shown in Figure 2.8, whilst a schematic cross-section is provided in Figure 2.9. The RIOP occurs within the metasediments of the once extensive Carr Boyd Basin, which consists of interbedded sandstone, siltstone and mudstone sequences deposited under a shallow-water environment (Xploray, 2006). These basin sediments were deposited onto the existing Proterozoic granite - gneiss terrane of the Lamboo Complex, which forms the relatively flat granitic plain area surrounding the RIOP.

The basal portion of the Carr Boyd Basin consists predominately of a sandstone end-member, labelled the Hensman Sandstone. Unconformably overlying the sandstone is the Golden Gate Siltstone, which was subsequently covered by the Lissadel Formation. Uplifting of the basin sediments and subsequent erosion during the Mesozoic - Paleozoic Periods exposed the basal Hensman Sandstone along the western edge of the basin. Extensive lateritic weathering of the exposed Hensman Sandstone during the Tertiary Period and subsequent supergene mineralisation of iron resulted in the formation of the iron-ore deposits to be mined at the RIOP. The eastern extent of the magnetite-hematite deposit is constrained by the presence of the remnant Golden Gate Siltstone overlying the Hensman Sandstone; the presence of the fine-textured siltstone would have limited the extent of lateritic weathering of the underlying sandstone and the enrichment of iron.

2.6 REGIONAL SOILS

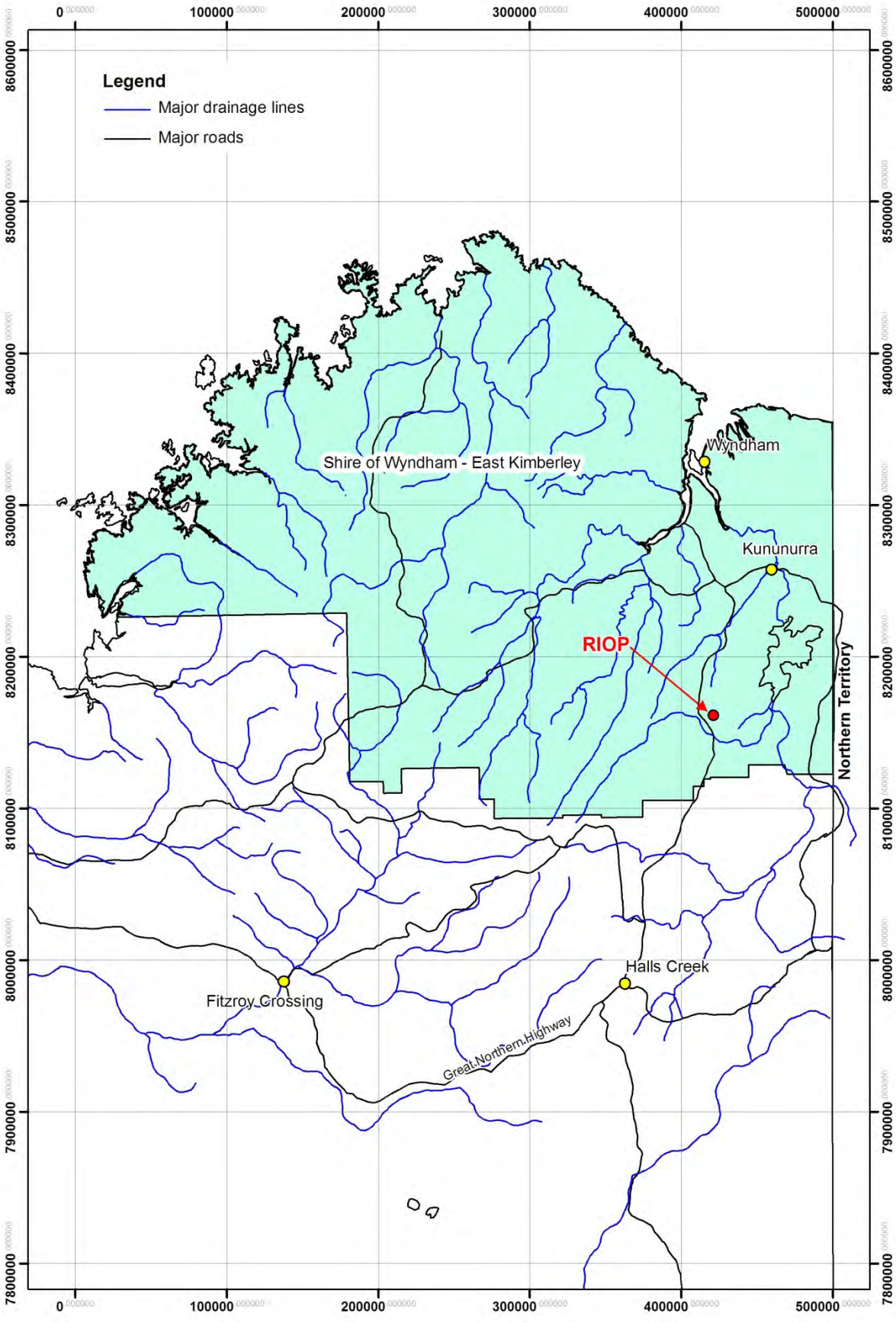
The soils within the RIOP have been mapped at a regional scale by the Department of Agriculture as part of the Rangelands and Arid Interior Soil - Landscape Survey (Tille, 2006). A map showing the regional distribution of soils is provided in Figure 2.10.

Soils on the escarpment and associated sandstone plateau consist of shallow sands, often gravelly, overlying a consolidated laterite, sandstone, siltstone or mudstone basement. The soils have formed primarily by *in situ* weathering of the parent rocks, and subsequently their properties reflect the characteristics of the parent materials. In lower slope positions the depth of the surface soil cover increases and becomes more silty with a dominated loamy texture.

Soils within the surrounding plain consist of shallow granitic detritus overlying unweathered granite (Plate 2.9). Granitic outcrops are common through the area creating a gently undulation relief, with the depth of soil cover varying according to slope position. The surface soils are primarily gritty yellow sands with neutral to alkaline pH. Drainage lines within the area consist of weathered, well rounded fragments of granite in a loss sand matrix.

Plate 2.9: Shallow, predominately sandy soils overlying unweathered granitic bedrock within the plain surrounding the escarpment.

Plate 2.10: Sandy soils within drainage lines in the granite plain area surrounding the escarpment.



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Prep. by	ASP	04/02/10	
Rev'd. by	MH	04/02/10	
Revision No.		0	

Figure 2.1

soilwater

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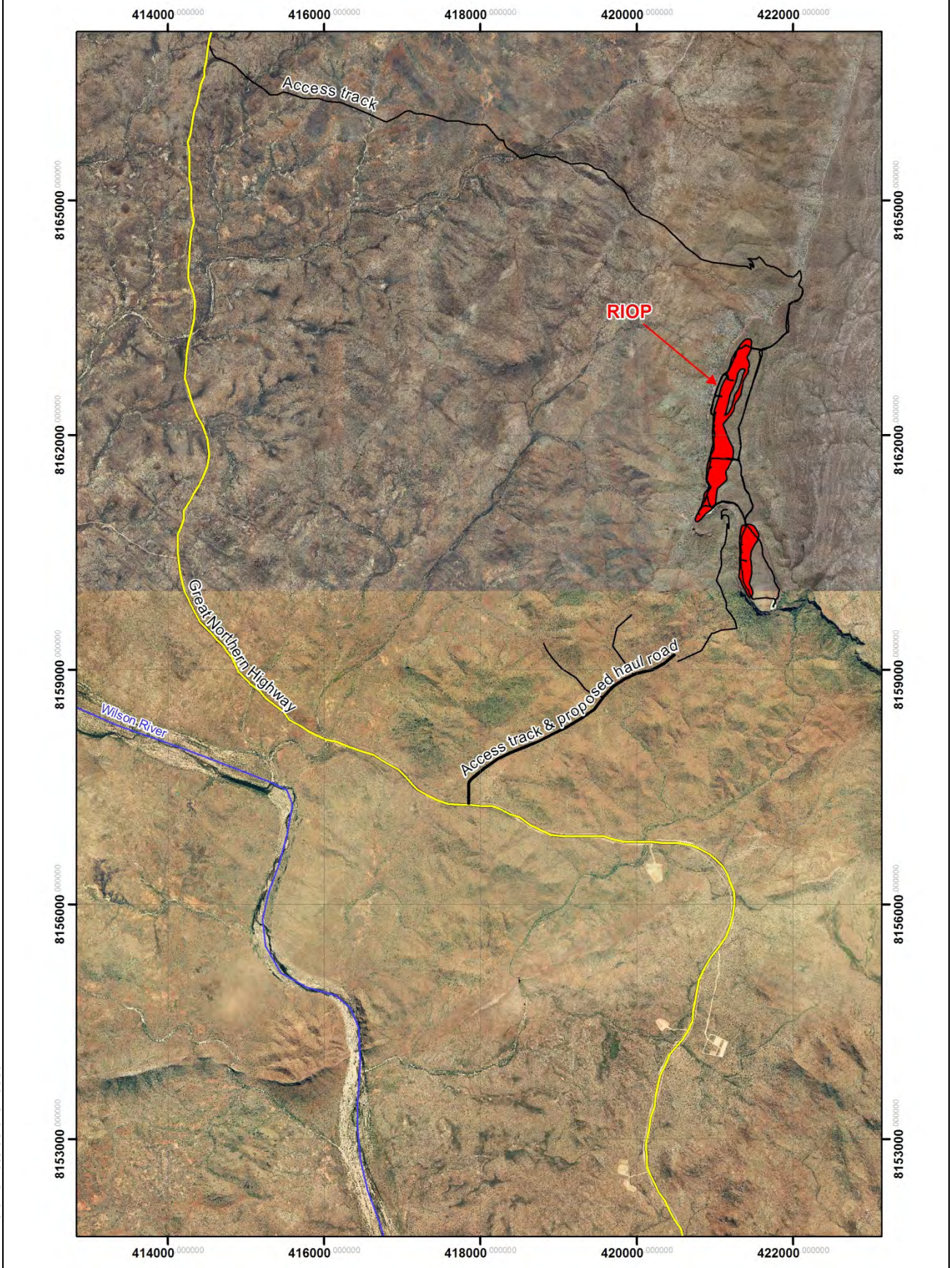

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Revision No.		0	

Figure 2.2

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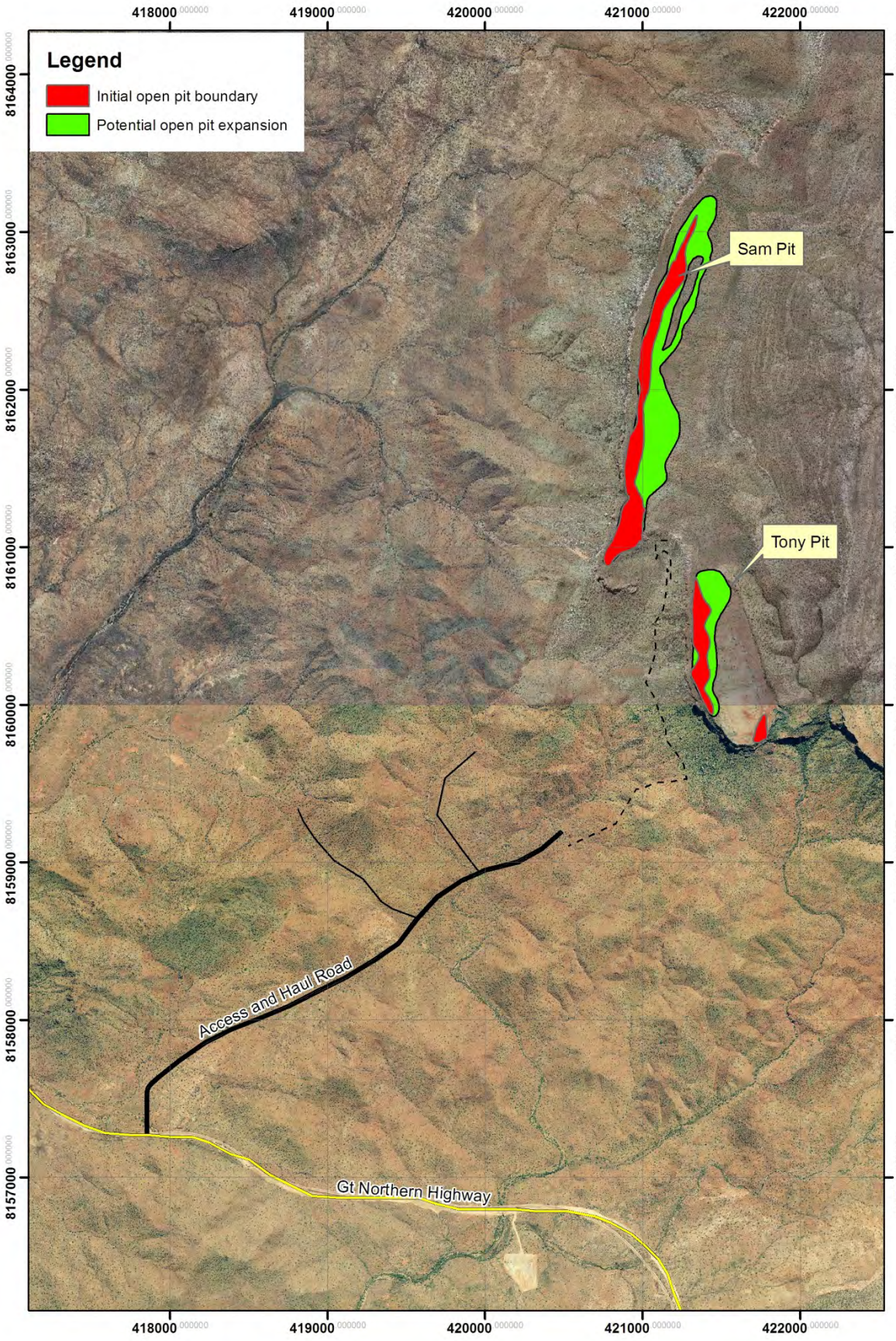

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Figure 2.3

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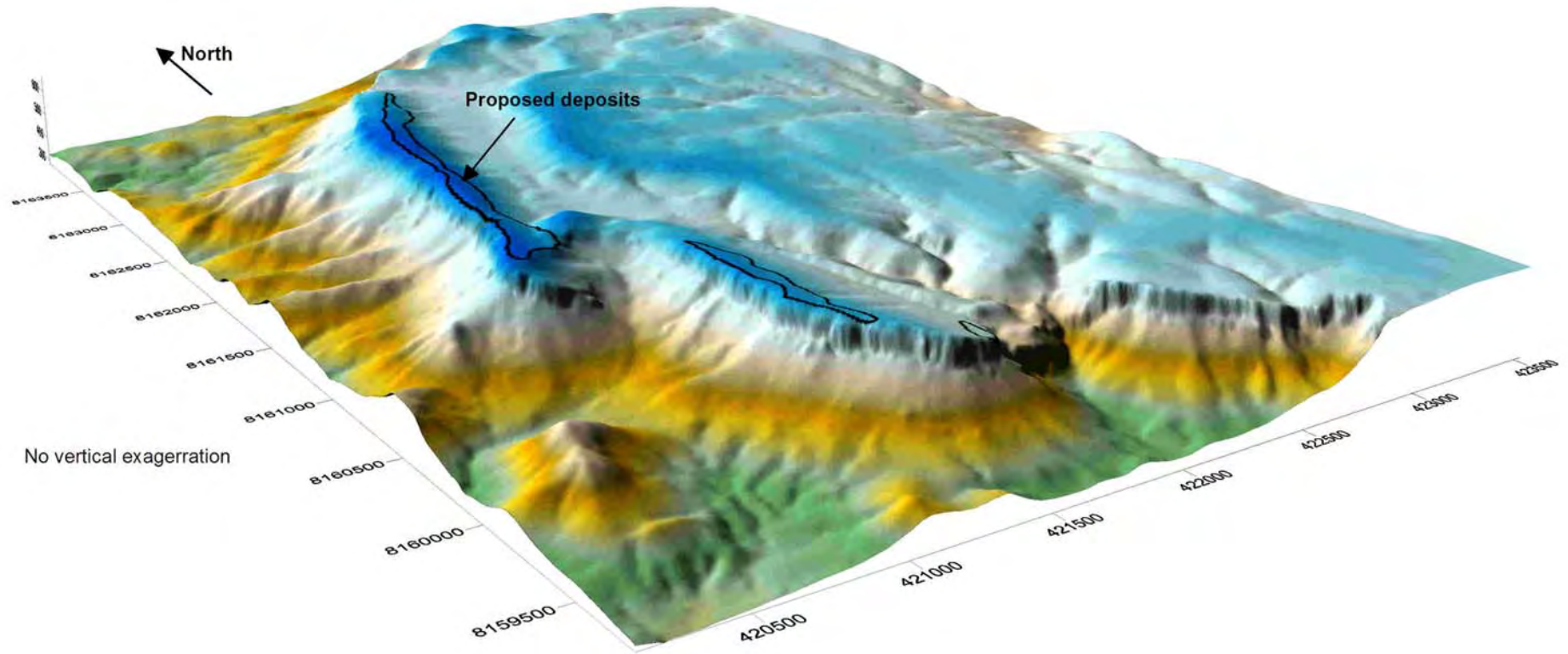

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RIOP SOIL AND WASTE CHARACTERISATION
REGIONAL GEOMORPHOLOGY

Figure 2.4

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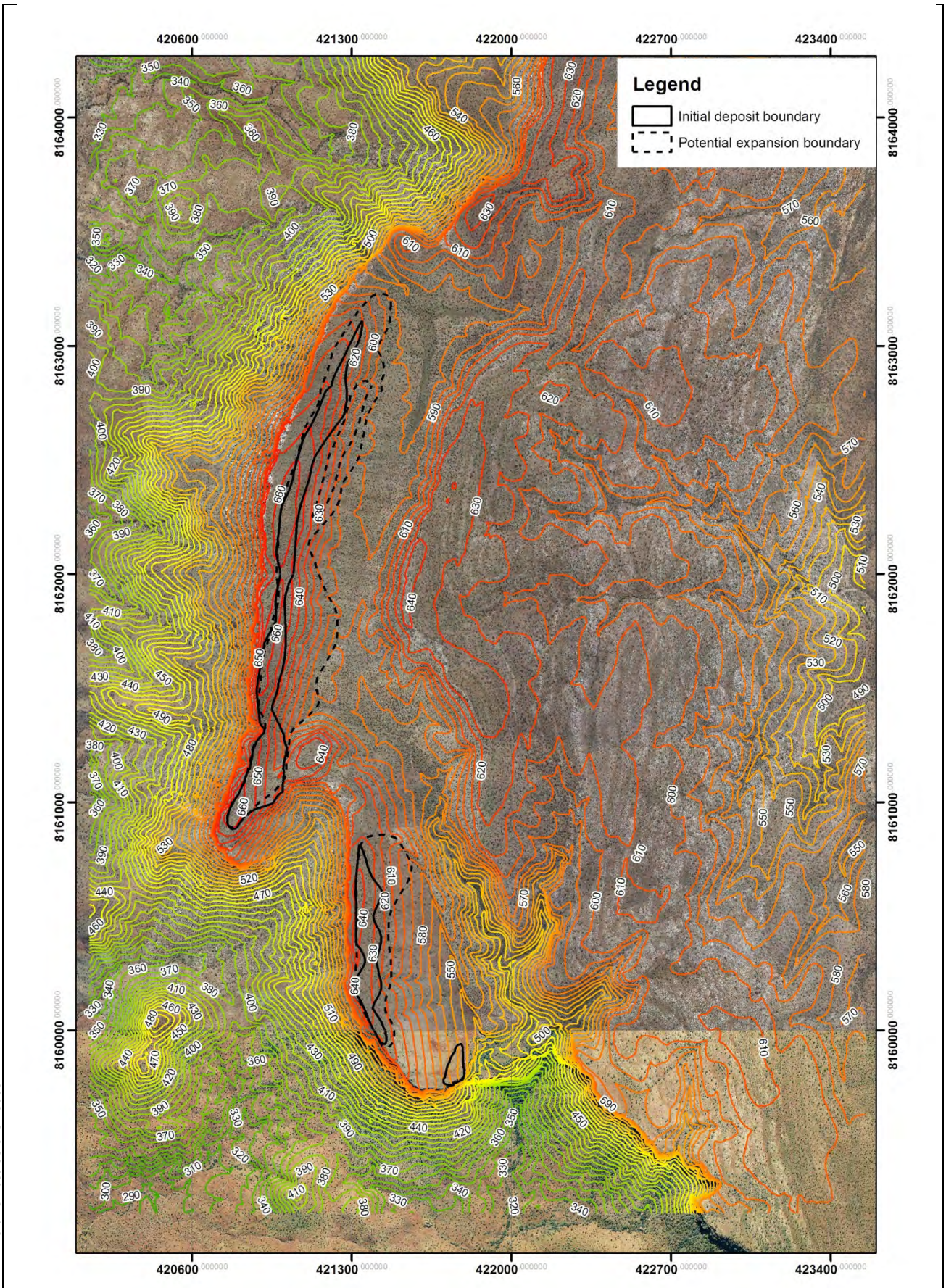

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RIOP SOIL AND WASTE CHARACTERISATION
SURFACE CONTOURS

Figure 2.5

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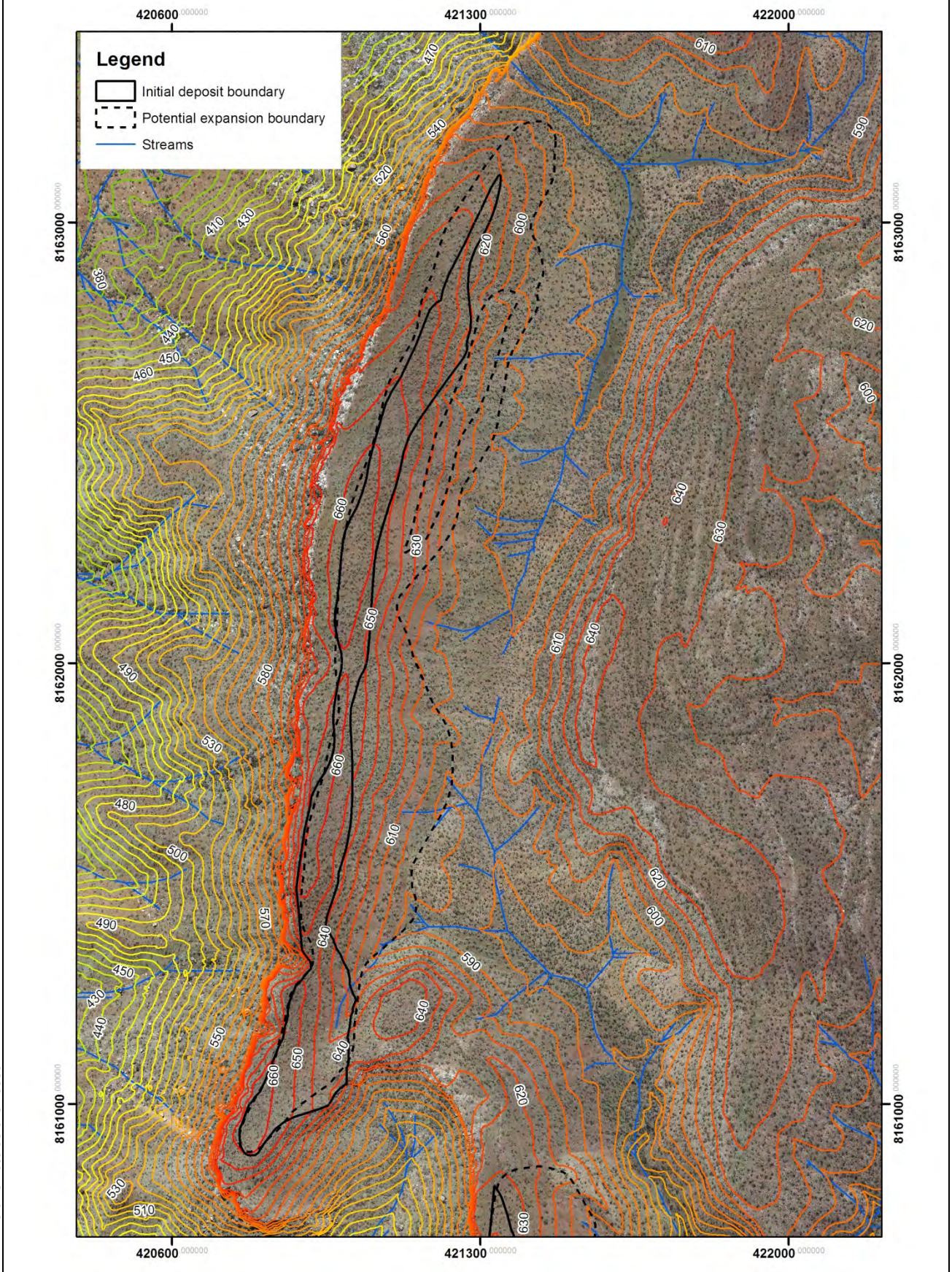

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RIOP SOIL AND WASTE CHARACTERISATION
SAM PIT LANDSURFACE

Figure 2.6

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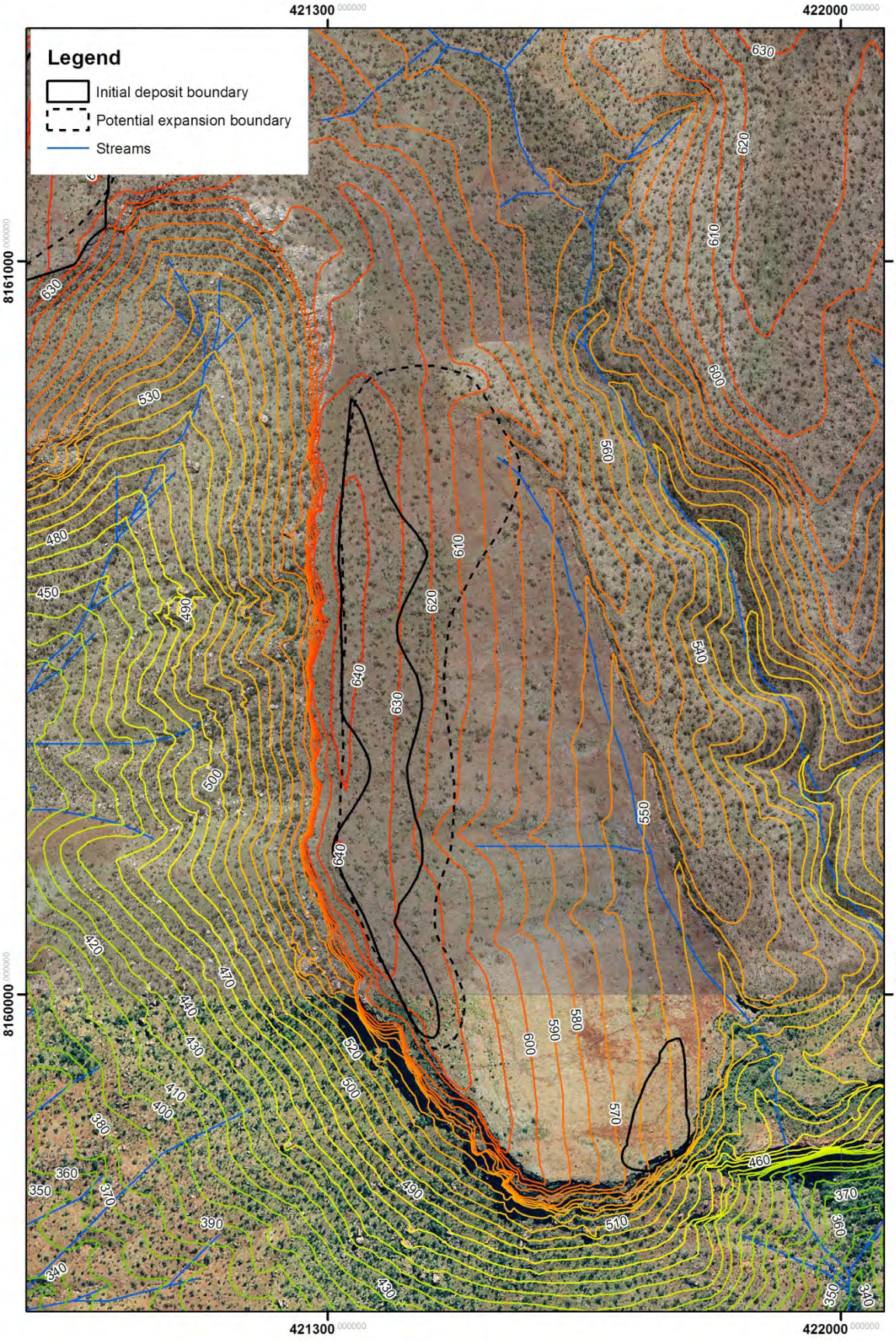

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RIOP SOIL AND WASTE CHARACTERISATION
TONY PIT LANDSURFACE

Figure 2.7

soilwater

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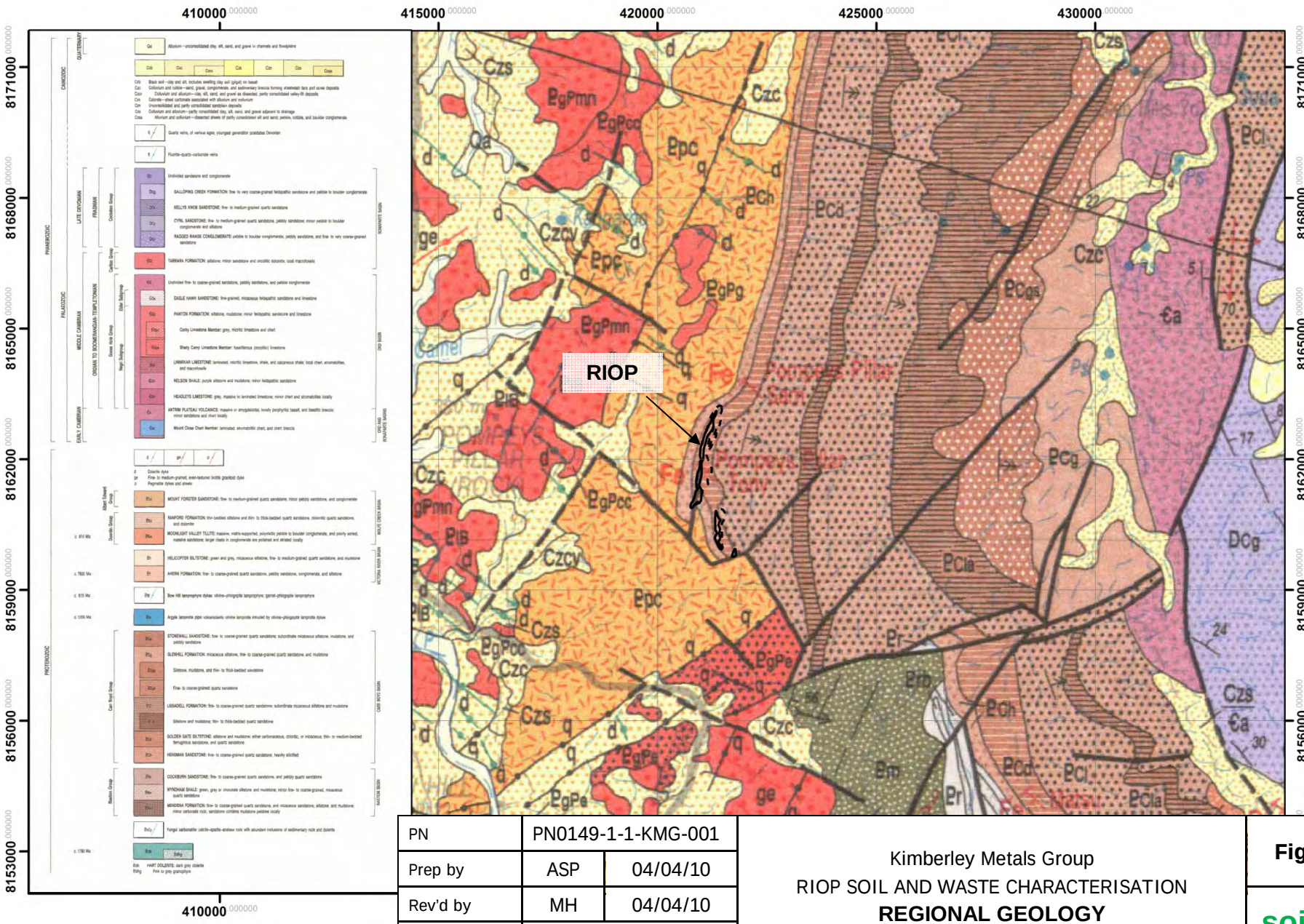

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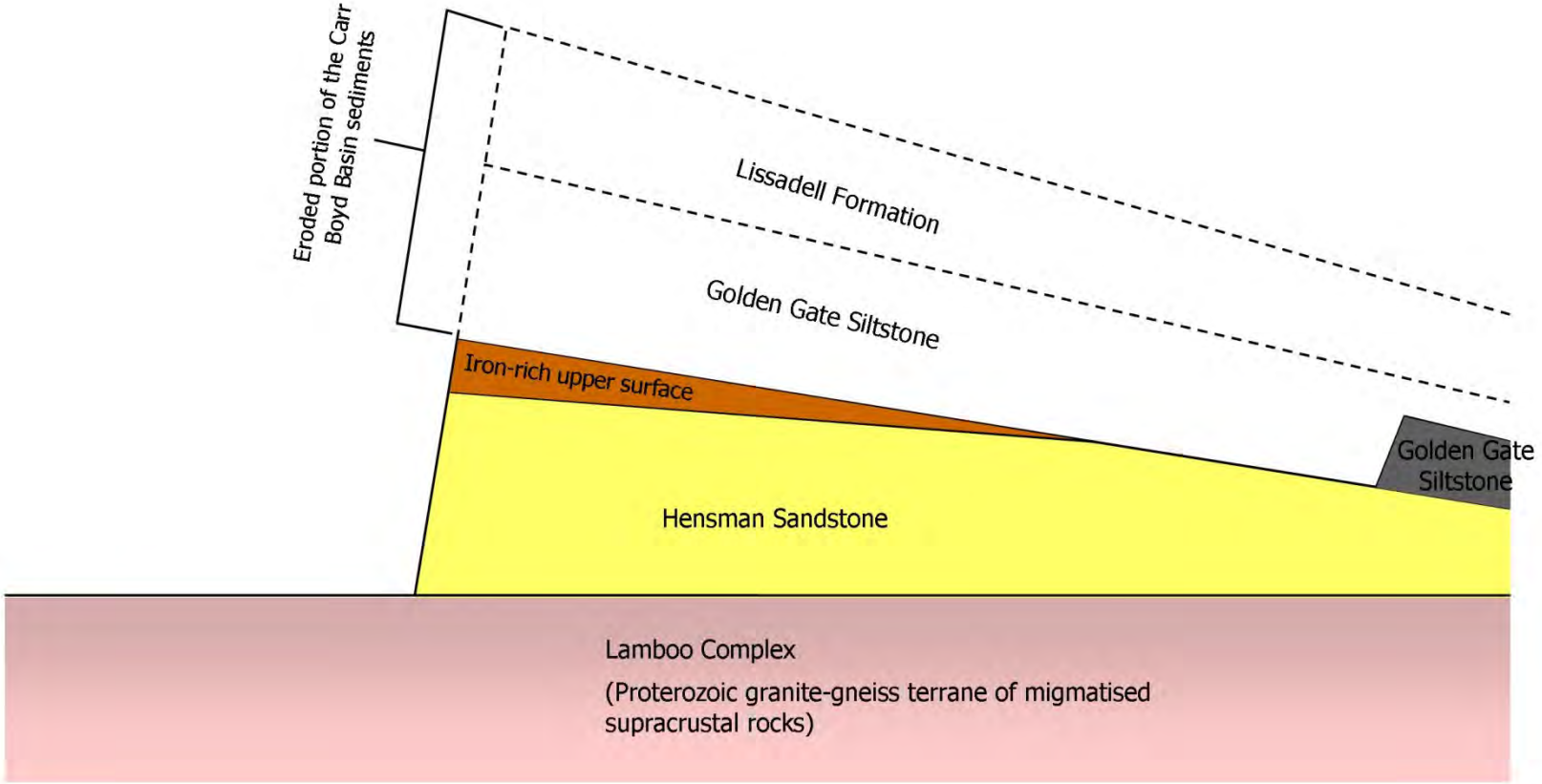
RIOP SOIL AND WASTE CHARACTERISATION
REGIONAL GEOLOGY

Figure 2.8

soilwater



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RIOP SOIL AND WASTE CHARACTERISATION
SCHEMATIC GEOLOGICAL CROSS SECTION

Figure 2.9

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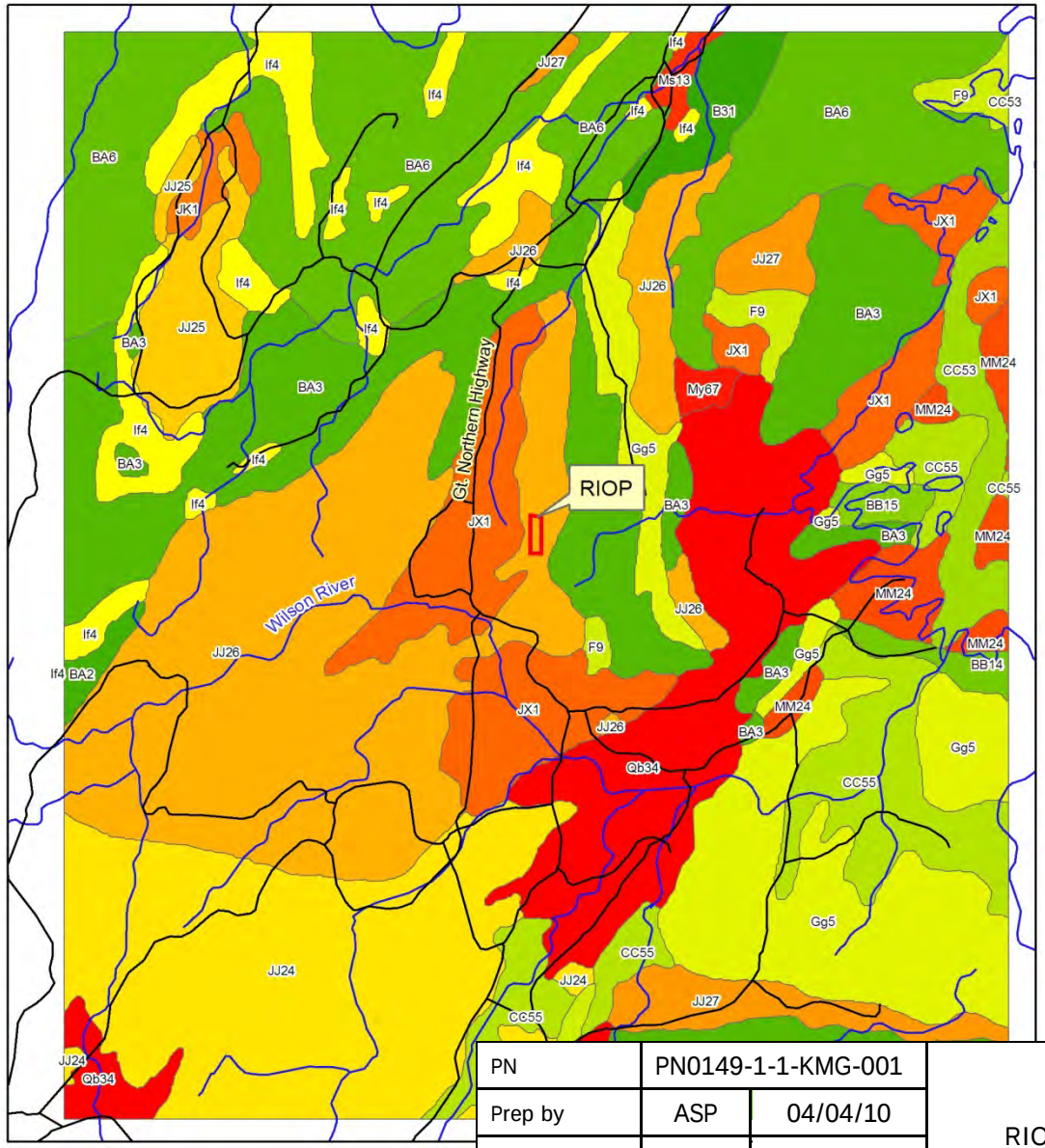

Legend

Major Roads

Major Drainage Lines

Soil - Landscape Unit

- B31 — *Gently undulating sandy plains with small areas of low bouldery sandstone hills. Soils are typicall deep red and yellow siliceous sands.*
- BA2 — *Mountains sandstone country with narrow valleys cut into basalt. Soils are typically shallow sands with rock outcrop in elevated areas.*
- BA3 — *Rugged stony country - ridges, cuestas and plateau formed in sandstone, quartzite, shale and some limestone. Soils are typically shallow, often stony, sands and sandy loams.*
- BA6 — *Rugged stony country - ridges, cuestas and plateau with some sloping or low hilly dissected areas on sandstone, quartzite, shale and some limestone. Typical soils are shallow sands, often stony together with shallow stony loams.*
- BB14 — *Low hilly to undulating dissected limestone country with some steep low hills and ridges separated by deeply incised stream channels. Soils are typically shallow calcareous loams and shallow red loams.*
- BB15 — *Undulating to low hilly limestone country with scattered outcrops and boulders of limestone. Soils are typically shallow calcareous loams with minor grey and brown cracking clays.*
- CC53 — *Flat to gently sloping flood plains. Soils are typically grey and brown clays.*
- CC55 — *Gently sloping and undulating plains derived from intermediate and basic igneous rocks and mantled with stones. Soils are typically grey and brown clays with minor gilgai.*
- F9 — *Mountains and rocky ridges of metamorphic rocks (phyllites, schists and gneiss). Soils are typically shallow dense loamy soils and neutral red soils along valley plains.*
- Gg5 — *Remnant flat to gently undulting sandy laterite country. Soils are typically shallow leached sands, often gravelly, overlying solid laterite.*
- If4 — *Hilly country with mesas and buttes on basic igneous rocks. Soils are typically shallow dark pedal clays.*
- JJ24 — *Mountainous country developed from granitic rocks. Soils are typically shallow stony sands with considerable rock outcrop on crests and upper slopes.*
- JJ25 — *Granite domes with intervening alluvial plains. Soils are typically shallow gritty sandy soils.*
- JJ26 — *Rocky sandstone plateau and hills with minor lower slopes and deeply incised valleys. Soils are typically shallow sands with loams on lower slopes and valley floors.*
- JJ27 — *Undulating to hilly shaly country with some rock outcrops. Soils are typically shallow, often stony, sandy soils with minor shallow loams.*
- JK1 — *Rocky sandstone plateau and hills. Soils are typically shallow sands with minor shallow loams.*
- JX1 — *Valleys of undulating relief developed in granitic detritus with common granitic outcrops. Soils are typically shallow gritty yellow sands and gritty alkaline to neutral yellow mottled soils on lower slopes.*
- MM24 — *Gently undulating plain derived from limestone and shales with occasional limestone outcrops. Soils are typically brown and grey clays with gilgai microrelief.*
- Ms13 — *Low-lying alluvial plains. Soils are typically acid yellow earths with minor ironstone gravels.*
- My67 — *Gently undulating country derived from limestone and shales. Soils are typically neutral to alkaline red earths.*
- Qb34 — *Stony undulating country with scattered granitic residuals. Soils are typically neutral hard red earths and minor alkaline yellow mottled earths.*

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Kimberley Metals Group
RIOP SOIL AND WASTE CHARACTERISATION
REGIONAL SOILS

Figure 2.10

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3 STUDY METHODOLOGY

3.1 SOIL CHARACTERISATION

3.1.1 SOIL SAMPLE COLLECTION

Soil materials within the proposed Sam and Tony Pits and the waste dump areas were investigated by shallow trench excavation. Sampling was undertaken in August 2009 and the locations of the sampling sites are shown in Figure 3.1. Shallow trenches were excavated by hand to a maximum depth of 0.6 m (Plate 3.1), with 24 sites investigated across the proposed mining disturbance area.

Soil samples were collected at regular intervals down the surficial profile to ensure that any pedologic organisation or horizonation was identified and that each of the major soil materials was sampled. Approximately 3 kg of soil was collected for each material for detailed laboratory analysis (Section 3.1.2).

Plate 3.1: Sampling of the surficial soil materials in the proposed disturbance area

3.1.2 LABORATORY ANALYSIS

The physical and chemical properties of the various soil materials collected in the field were assessed in the laboratory. The properties listed in Table 3.1 were assessed for representative soil materials. Analysis of the physical properties was undertaken at Soil Water Analysis (SWA) Laboratories, whilst the chemical properties were assessed at CSBP Laboratories.

Table 3.1: Physical and chemical properties examined in the laboratory

Physical properties	Chemical properties
• Soil structure • Bulk density • Particle size distribution • Gravel content • Saturated hydraulic conductivity • Unsaturated hydraulic conductivity • Water retention properties	• Nutrients (Mineralised Nitrogen, Colwell Phosphorus and Potassium, and extractable Sulfur) • Organic carbon • pH • Electrical conductivity (salinity, EC) • Exchangeable cations (Calcium, Magnesium, Sodium and Potassium) • Cation exchange capacity (CEC) • Sodicity (Exchangeable sodium percentage – ESP)

All physical and chemical properties were assessed against standard Australian soil property criteria.

3.2 WASTE CHARACTERISATION

Waste materials at the RIOP are generally regarded as the uneconomic portion of the consolidated lateritic profile underlying the surface friable soils. Although the mine pits are planned to be backfilled with excavated waste materials, a proportion of this material will need to be stored in permanent above-ground waste dumps. In order to determine how these materials will behave during the construction and rehabilitation of the waste dumps, and whether they represent a risk to the surrounding environment, detailed laboratory investigation was undertaken to quantify the geochemical characteristics of these materials.

Representative samples of waste material likely to be stored in the waste dumps were selected following a review of the geological data and observation of intact drill cores. A total of 15 samples of waste material were selected for analysis (Table 3.2) and the properties assessed included:

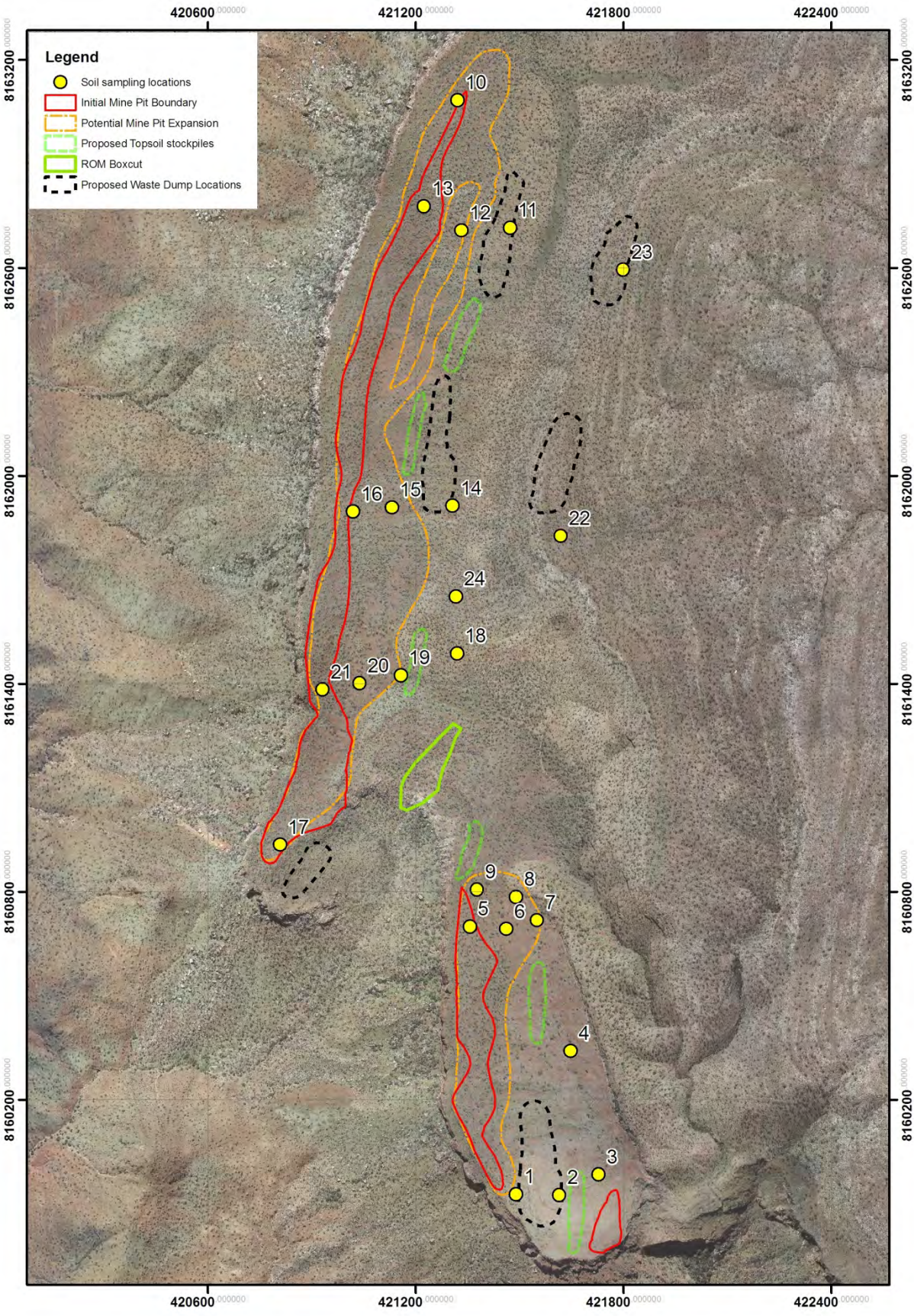
- pH
- EC
- Dispersion (structural stability)
- Sodicity (ESP)
- Metals content (metals assessed - As, Ba, Cd, Co, Cr, Cu, Mn, Ni, Pb and Zn)
- Bioavailability or leachability of metals (using the Australian Standard Leaching Procedure - AS4439.3 - 1997, under both a neutral and a highly acidic leach environment)

The presence of potential acid forming (PAF) or acid rock drainage (ARD) materials was not tested as the redoximorphic conditions in which the waste materials exist is unlikely to facilitate sulfide formation or hosting of sulfide minerals. The lateritic profile exists in a highly weathered oxidising environment, and subsequently any PAF

materials would have previously oxidised resulting in an acidic material. Measurement of the pH of the waste materials will identify if such oxidation of sulfides has occurred in the past.

Table 3.2: Waste materials selected for detailed laboratory analysis.

Drillhole ID	Depth (m)
RIDD 006	0 - 1
	1 - 2
	2 - 3
	3 - 4
	4 - 5
RIDD 007	0 - 1
	1 - 2
	2 - 3
RIDD 011	0 - 1
	1 - 2
	2 - 3
	3 - 4
RIDD 018	0 - 1
	1 - 2
	2 - 3



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SOIL SAMPLING LOCATIONS**
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Revision No.		0	

Figure 3.1

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4 SOIL & WASTE CHARACTERISATION

4.1 SOILS CHARACTERISATION

4.1.1 SOIL MAPPING UNITS

Based on the evolutionary history of the project area and the morphological characteristics of the soil profiles exposed by trench excavation, three distinct Soil Mapping Units (SMU) were identified in the RIOP:

- SMU 1: Deep gravelly duplex
- SMU 2: Shallow gravel over ironstone
- SMU 3: Shallow gravel over siltstone.

The relationship between these SMU and the major soil groups of Western Australia (Schoknecht, 2001) and the Australia Soil Classification (Isbell, 1996) are presented in Table 4.1.

Table 4.1: Relationship between the SMU identified in this study and the major soil groups of Western Australian and the Australian Soil Classification.

SMU (Present study)	Major soil group, WA (Schoknecht, 2001)	Australian Soil Classification (Isbell, 1996)
1. Deep gravelly duplex	Deep sandy gravel	Ferric Chromosol
2. Shallow gravel over ironstone	Shallow gravel	Ferric - Petroferric Tenosol
3. Shallow gravel over siltstone	Shallow gravel	Ferric - Petroferric Tenosol

A detailed description of each SMU identified in this study is provided below, whilst their distribution across the study area is shown in Figure 4.1.

4.1.2 SMU 1: DEEP GRAVELLY DUPLEX

This soil type or SMU occurs over the majority of the proposed mining disturbance area (Figure 4.1). A characteristic soil profile showing the physical and chemical properties of the soils is shown in Figure 4.2. It has negligible pedogeneic organisation and consists of 30 to 60+ cm of reddish brown gravelly loamy sand to gravelly sandy loam overlying a solid siltstone or ironstone base (Plate 4.1). The surface soils typically have gravel contents > 60 %, with the gravel fraction loosely set in the finer textured matrix. The particle size distribution within SMU 1 exhibits a defined toposequence, with the gravel fraction and gravel size decreasing with distance downslope and a corresponding increase in the silt and clay content (Table 4.2). This transition in particle size distribution with distance downslope is shown in Plate 4.2.

The high gravel fraction of the surface soils results in them having a high permeability (> 2 m/day). Subsequently, rainfall rapidly infiltrates the soil surface and recharges the soil moisture content, with minimal surface runoff. Any runoff that does occur (i.e. during high intensity storm events) is unlikely to cause significant erosion as the abundance of gravels and ironstone fragments on the surface (Plate 4.3) reduce the slope length and

corresponding flow velocity; hence there is insufficient energy to detach the surface soil particles causing erosion; during the site visit no evidence of erosion of any surfaces was observed.

Plate 4.1: Typical soil profile in SMU 1.

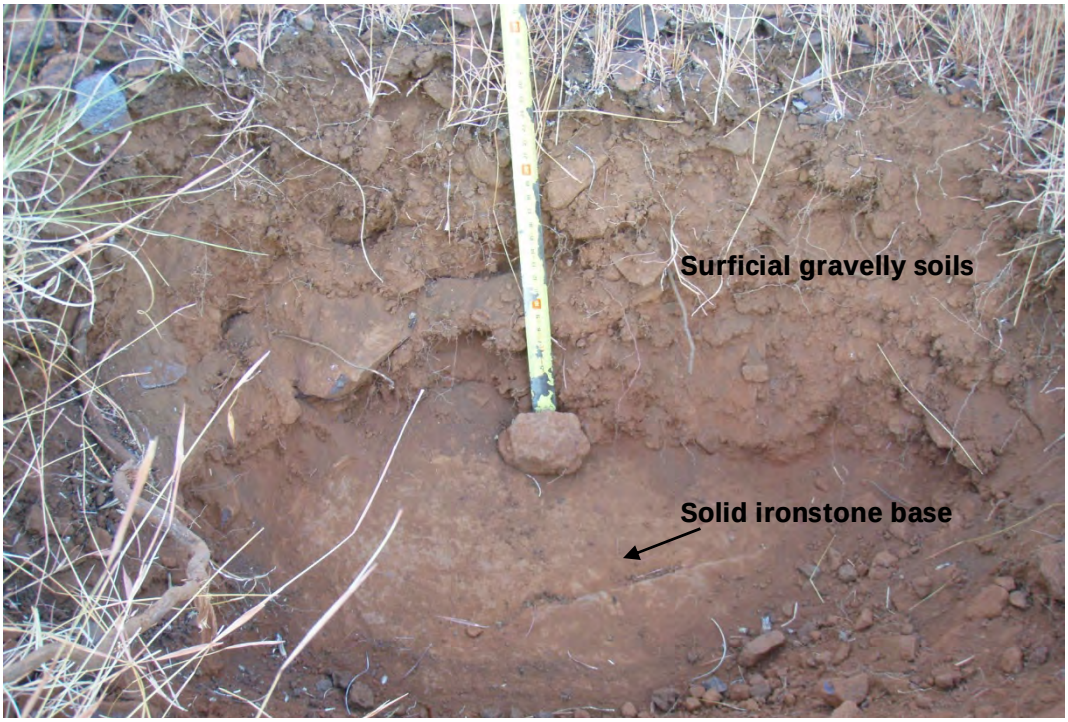


Plate 4.2: Nature of the surficial soils in SMU 1 with distance downslope.

Table 4.2: Variation in particle size distribution with distance downslope in SMU 1.

Slope location	Depth (cm)	Gravel fraction size distribution (%)				Gravel fraction (%)	Particle size distribution (< 2 mm soil fraction)		
		> 100 mm	100 - 60 mm	60 - 20 mm	20 - 2 mm		% Sand	% Silt	% Clay
Upper slope	0 - 10	10	30	40	20	80.4	77.9	10.7	11.4
	10 - 20	6	25	50	19	76.7	81.4	10.4	8.2
	20 - 30	-	-	-	-	77.3	-	-	-
	30 - 40	2	40	40	18	88.2	75.5	5.8	18.7
	40 - 50	-	-	-	-	75.9	-	-	-
Mid slope	0 - 10	1	20	18	60	71.5	64.8	16.5	18.7
	10 - 20	1	20	19	60	64.3	65.8	10.4	8.2
	20 - 30	-	-	-	-	66.2	-	-	-
	30 - 40	-	-	-	-	59.8	-	-	-
	40 - 50	1	15	44	40	53.2	64.4	9.0	26.7
Lower slope/valley floor	0 - 10	0	1	30	69	2.6	50.5	18.3	31.2
	10 - 20	0	1	20	79	2.3	45.2	21.0	33.8
	20 - 30	-	-	-	-	3.7	-	-	-
	30 - 40	0	1	25	74	4.2	40.9	25.6	33.5
	40 -50	-	-	-	-	4.6	-	-	-

The presence of the surface gravels also protects the surface soils from wind erosion. These soils, however, are highly susceptible to wind erosion once disturbed, as shown in Plate 4.4. This susceptibility is due to the relatively high fine silt and clay content in the finer fraction, which is highly mobile and easily dispersed by wind action. Dust control measures, such as spraying with non-saline water or use of chemical binding agents, will need to be applied during mining at this site to prevent the loss of this valuable soil resource and potential impact to surrounding vegetation (i.e. by coating their leaves and thus impacting on photosynthesis and transpiration).

Plate 4.3: Abundance of surface gravels protecting the soils from wind and water erosion.

The surficial gravelly soils in SMU 1 are slightly to very strongly acidic with pH values between 4 and 6 (Figures 4.3 and 4.4). This acidity is to be expected given the highly weathered nature of the soils and the dominance of iron oxides (i.e. ferrolysis results in the release of H^+ ions which cause the pH of the materials to be become acidic). All salts have been leached from the surface soils, resulting in EC values < 10 mS/m and sodicity values typically < 6 % (i.e. non-sodic soils; Figure 4.3 and 4.4). The surface soils are therefore structurally stable and non-dispersive.

As the surface soils in SMU 1 exhibit little pedogenic organisation no defined topsoil, as represented by a build-up of organic matter, is present. In the surface 10 cm of the profile there is an abundance of large to fine roots, and a slight accumulation of nutrients; although the soils generally have very low levels of mineralised N (< 8 mg/kg), plant available P (Colwell P: < 5 mg/kg), plant available K (Colwell K: 36 - 278 mg/kg) and extractable S (1.5 - 4 mg/kg).

Plate 4.4: High wind erosion potential of the surface soils in SMU 1.

4.1.3 SMU 2: SHALLOW GRAVEL OVER IRONSTONE

This soil type represents a truncated version of SMU 1, with the surface gravelly soils having a depth of < 30 cm (Plate 4.5). This SMU occurs in areas of considerable relief (i.e. > 20 ° slope; Plate 4.6), and subsequently the majority of the surface soil profile has been eroded.

The physical and chemical properties of the surface gravelly soils in SMU 2 are equivalent to those in SMU 1, emphasizing their common origin. The surface soils are friable, highly permeable and have a low hardsetting potential. They are also slightly to strongly acidic, non-saline, non-sodic and non-dispersive (Figure 4.5); these soils therefore exhibit optimal physical and chemical limitations for handling and utilisation.

The presence of the solid ironstone base close to the soil surface strongly influences the nature of the vegetation in SMU 2. The downward extension of roots is restricted by the ironstone and the roots of the vegetation are constrained to the shallow surface soils, developing a dominant lateral root system. This root distribution significantly limits the availability of soil moisture as the surface soils remain in a water deficit condition for the majority of the years as a result of their low water holding capacity. Consequently, the vegetation in SMU 2 is dominated by shallow-rooted, low transpiring grasses with trees only occurring in regions where the underlying ironstone is fractured, thus allowing roots to access moisture stored deeper in the soil profile.

Plate 4.5: Characteristic soil profile in SMU 2.

Plate 4.6: Location of SMU 2 on very steep slopes in SMU 1.

Plate 4.7: Transition from SMU 1 to SMU 2, marked by the change in vegetation structure from woodland to grassland.

4.1.4 SMU 3: SHALLOW GRAVEL OVER SILTSTONE

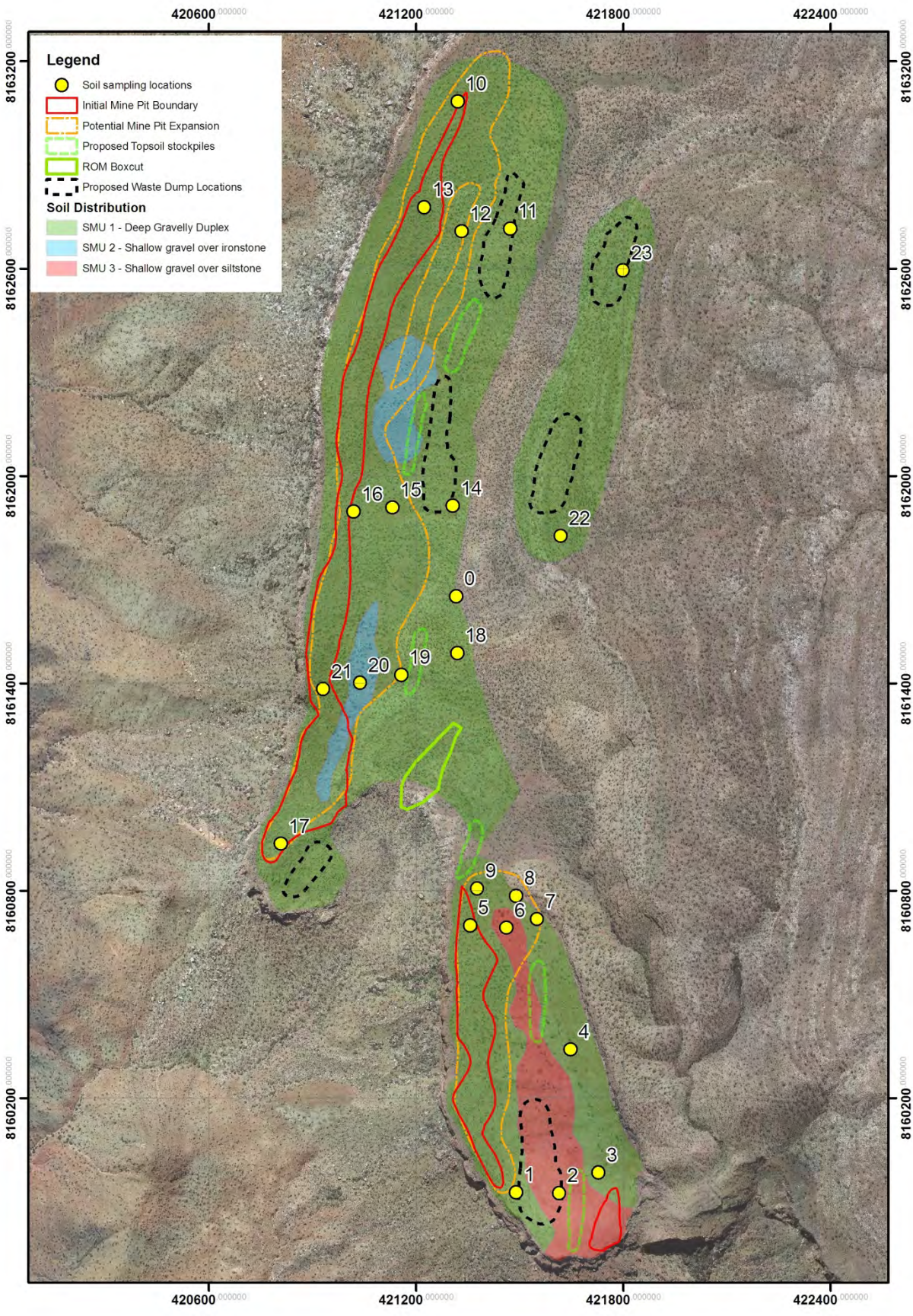
This soil type is restricted to the Tony Pit and corresponds to areas where unweathered remnant portions of the Golden Gate Siltstone (Section 2.5) occur at (Plate 4.8) or close to (i.e. < 10 cm of depth; Plate 4.9) the soil surface. The properties of the surficial gravelly soils are similar to those exhibited in SMU 1 and 2, and are slightly to strongly acidic, non-saline, non-sodic, structurally stable and non-erosive (Figure 4.5).

As with SMU 2, the thin surface soil cover restricts the distribution of trees and larger shrubs, and subsequently the vegetation in SMU 3 is dominated by grasses (Plate 4.10).

Plate 4.8: Presence of unweathered siltstone at the surface in SMU 3.

Plate 4.9: Presence of unweathered siltstone within the surface 10 cm of the profile in SMU 3.

Plate 4.10: Grass species dominating the surface in SMU 3.



PN	PN0149-1-1-KMG-001		Kimberley Metals Group RIOP SOIL AND WASTE CHARACTERISATION **SMU DISTRIBUTION**
Prep. by	ASP	04/02/10	
Rev'd. by	MH	04/02/10	
Revision No.		0	

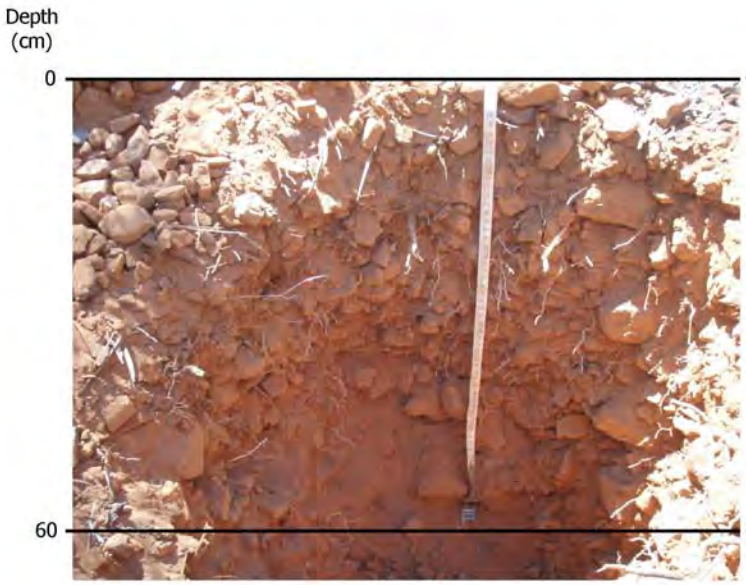
Figure 4.1

soilwater

Soil Water Consultants PTY LTD Perth Offices 08 9434 5836

Figure #: 4.2- Characteristic soil profile for SMU 1 - Deep gravelly duplex	**Easting:** 421,021	**Northing:** 8,161,900	**Trench No.:** Trench 16

Morphological description:



Horizon	Soil Material	Description
A	Red gravelly sandy loam	Reddish brown sandy loam with abundant (50 - 80 %) coarse (2 - 4 cm) angular gravel, single grain structured with very weak coherence, no pedologic organization, common roots growing through matrix, abrupt boundary to
B	Ironstone	Massive ironstone

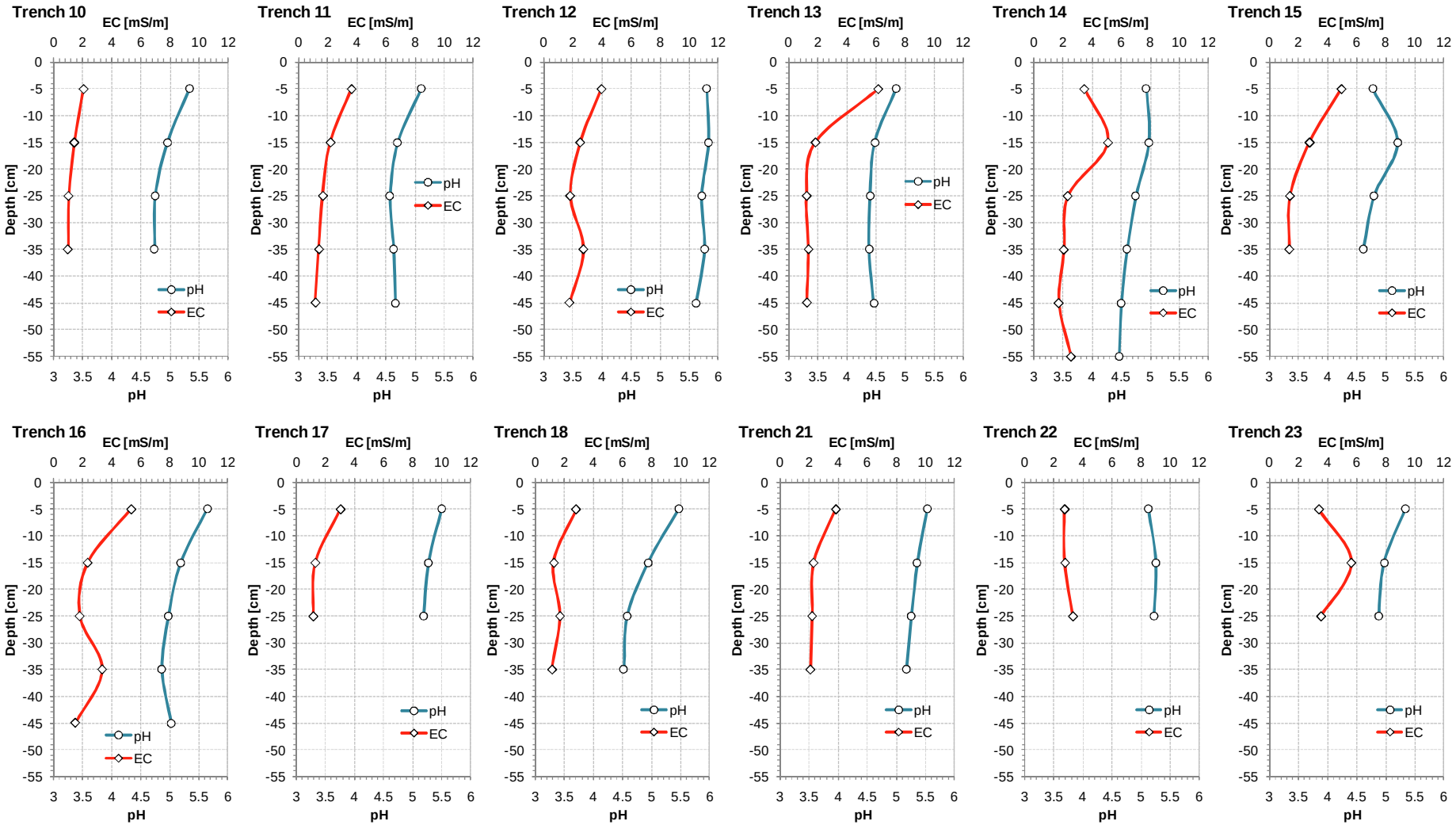
Soil properties:

Physical properties

Depth (m)	Soil material	Structure	Particle size distribution				Bulk Density (g/cm^3)	Total porosity (%)	Soil Strength (MPa)	Saturated Hydraulic Conductivity (m/day)	Structural Stability		Hardsetting potential
			Sand (%)	Silt (%)	Clay (%)	Texture					Macro (slaking)	Micro (dispersive)	
0 - 10	Gravelly sandy loam	Single grain	83.57	10.79	5.64	Loamy sand	-	-	< 0.5	5.92	Very poor	Good	Very low
10 - 20		Single grain	82.25	10.94	6.81	Loamy sand	-	-	< 0.5	-	Very poor	Good	Very low
20 - 30		Single grain	79.35	7.13	13.52	Sandy loam	-	-	< 0.5	> 20	Very poor	Good	Very low
30 - 40		Single grain	77.17	7.45	15.39	Sandy loam	-	-	< 0.5	-	Very Poor	Good	Very low

Chemical Properties

Depth (m)	Soil material	Nutrients (mg/kg)					OrgC (%)	EC (mS/m)	pH_w	pH_{Ca}	PRI	Exchangeable Cations (meq/100g)					ESP
		NO_3^- -N	NH_4^+ -N	Colwell		Extr S						Ca	Mg	Na	K	CEC	
				P	K												
0 - 10	Gravelly sandy loam	1	1	2	165	3.7	1.76	1.7	5.9	4.9	-	1.87	0.44	0.06	0.35	2.72	2.21
10 - 20		1	1	3	165	10.5	1.26	1.7	5.2	4.2	-	1.33	0.29	0.07	0.29	1.98	3.54
30 - 40		1	1	4	124	11.9	0.45	2.7	5.1	4.2	-	1.73	0.34	0.11	0.21	2.39	4.60
40 - 50		1	2	2	78	14.5	0.54	3.6	5.4	4.5	-	3.70	0.51	0.15	0.16	4.52	3.32

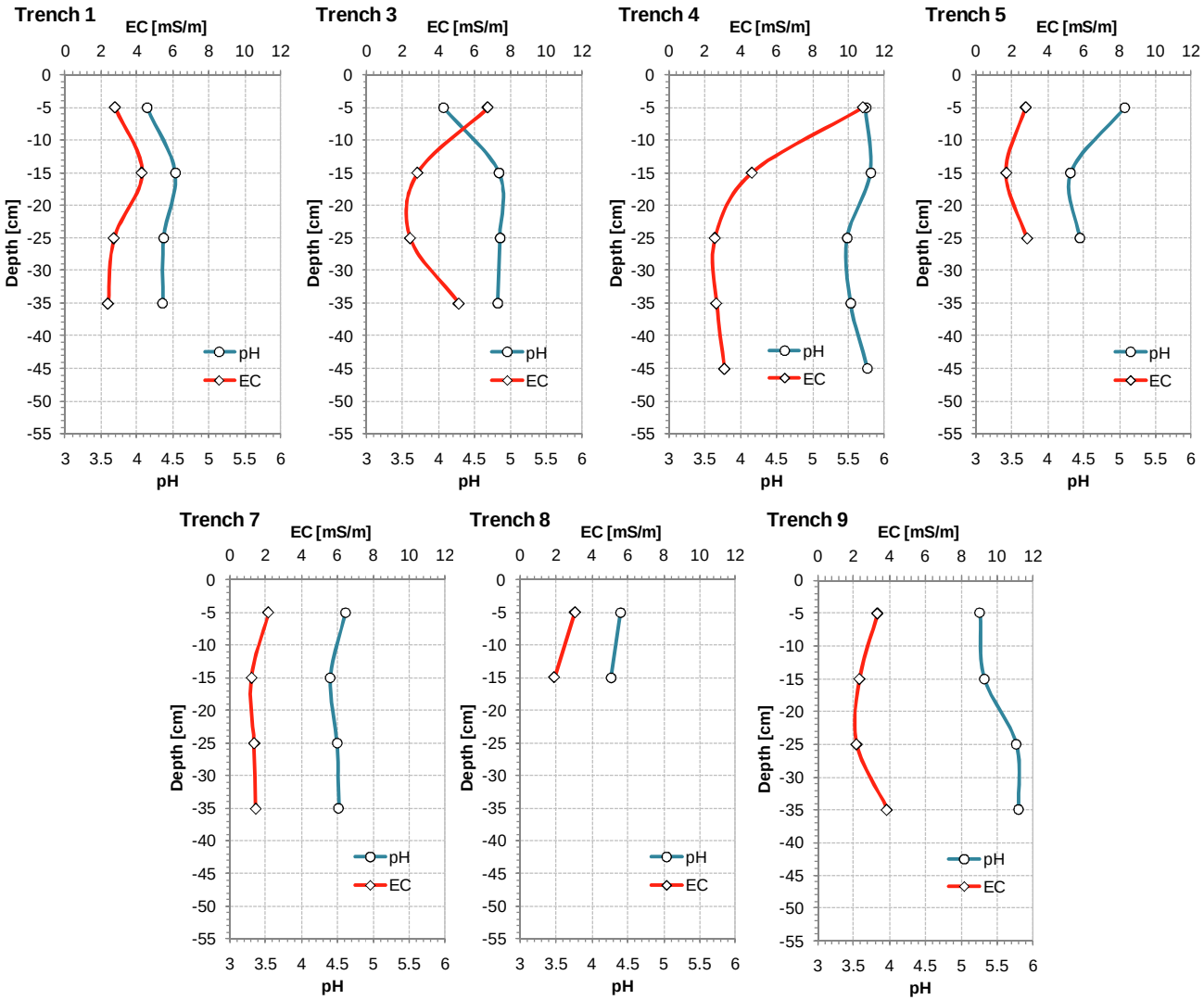


PN	PN0149-1-1-KMG-001	
Prep by	ASP	04/04/10
Rev'd by	MH	04/04/10
Revision No.	0	

Kimberley Metals Group
RIOP SOIL AND WASTE CHARACTERISATION
pH AND EC DATA FOR SMU 1 SOILS - SAM PIT

Figure 4.3

soilwater



PN	PN0149-1-1-KMG-001	
Prep by	ASP	04/04/10
Rev'd by	MH	04/04/10
Revision No.	0	

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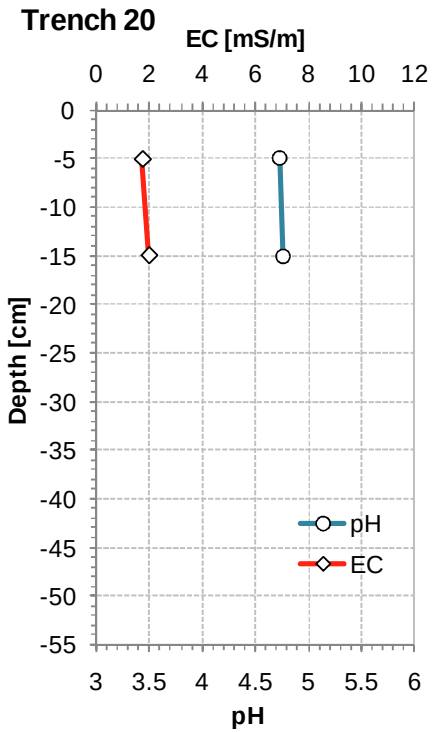
RIOP SOIL AND WASTE CHARACTERISATION
pH AND EC DATA FOR SMU 1 SOILS - TONY PIT

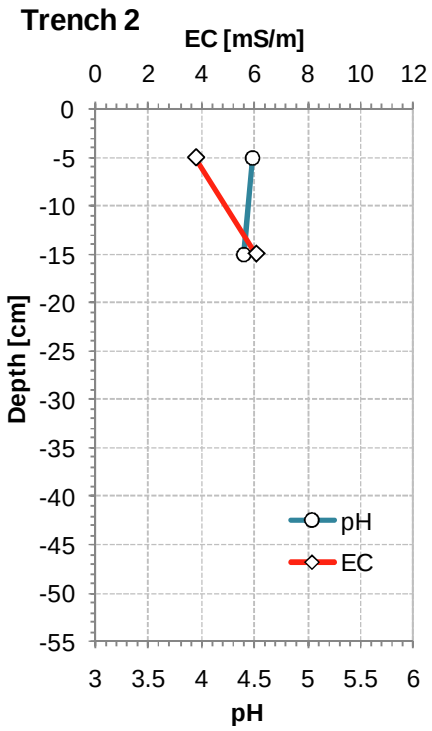
Figure 4.4

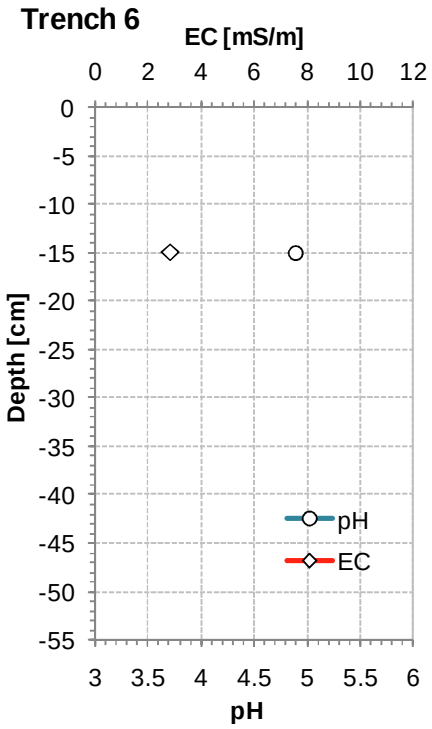
soilwater

SMU 2 Surface Soils



SMU 3 Surface Soils





PN	PN0149-1-1-KMG-001	
Prep by	ASP	04/04/10
Rev'd by	MH	04/04/10
Revision No.	0	

Kimberley Metals Group
RIOP SOIL AND WASTE CHARACTERISATION
pH AND EC DATA FOR SMU 2 & 3 SOILS

Figure 4.5

soilwater

4.2 WASTE CHARACTERISATION

The results of the waste characterisation are provided in Tables 4.3 - 4.5.

The lateritic waste materials are typically slightly to strongly acidic, in response to their high iron content (i.e. ferrolysis releases H^+ into the soil solution), non-saline, non-sodic (ESP < 6 %) and non-dispersive (Emerson Dispersion Class 6). These materials are highly weathered and subsequently nearly all salts (including exchangeable Na^+) have been removed. The structural stability of these materials occurs in response to the low sodicity and aggregation by iron oxides. Even when excavated and fractured, the lateritised waste materials will remain structurally stable as negligible silt and clay contents occur; hence the < 2 mm size fraction rapidly settles out of solution, with no mobilisation or slaking of finer particles.

Table 4.3: Chemical properties of waste materials in the RIOP.

Drillhole ID	Depth (m)	pH	EC (mS/m)	Emerson Dispersion Class*	Exchangeable cation content (meg/100g)				CEC (meq/100g)	ESP (%)
					Ca	Mg	Na	K		
RIDD 006	0 - 1	6.65	30.3	Class 6	0.38	0.48	0.08	0.09	1.03	7.77
	1 - 2	6.11	4.96	Class 6	0.94	0.54	0.10	0.22	1.80	5.56
	2 - 3	5.04	1.60	Class 6	1.69	0.48	0.09	0.32	2.58	3.49
	3 - 4	4.73	1.68	Class 6	4.96	1.30	0.14	0.56	6.69	2.01
	4 - 5	5.16	57.9	Class 6	3.32	1.70	0.07	0.29	5.38	1.30
RIDD 007	0 - 1	7.23	6.59	Class 6	2.76	1.44	0.15	0.28	4.66	3.22
	1 - 2	6.73	29.7	Class 6	0.54	0.69	0.04	0.16	1.43	2.80
	2 - 3	5.69	2.15	Class 6	0.61	2.38	0.1	0.16	3.24	3.08
RIDD 011	0 - 1	5.98	2.35	Class 6	4.92	1.53	0.03	0.32	6.80	0.44
	1 - 2	6.24	3.36	Class 6	1.76	1.02	0.03	0.11	1.91	1.57
	2 - 3	6.15	2.96	Class 6	14.14	7.88	0.04	0.65	22.71	0.18
	3 - 4	6.37	2.76	Class 6	1.54	2.15	0.03	0.31	4.03	0.74
RIDD 018	0 - 1	6.86	8.21	Class 6	4.05	1.00	0.03	0.23	5.31	0.56
	1 - 2	6.27	2.98	Class 6	1.27	0.63	0.02	0.20	2.12	0.94
	2 - 3	5.62	2.35	Class 6	1.30	0.59	0.02	0.19	2.10	0.95

* Emerson Dispersion Class: Class 6 - Non dispersive (flocculated) in both a undisturbed and disturbed condition.

The metals content of the waste materials is shown in Table 4.4. In these materials only As is elevated. But although As is enriched, the bioavailability results shown in Table 4.5 indicate that it is not mobile, either under a neutral or highly acidic leaching environment. It is therefore likely that the high As concentration represents structural elements in the iron-rich materials (i.e. through isomorphic substitution), and is not readily exchangeable or released into the environment.

Table 4.4: Metals content and relative enrichment for the various waste materials tested. Values highlighted in Red are significant enrichment, whilst those in Green represent slight enrichments.

	Element	As		Ba		Cd		Co		Cr		Cu		Mn		Ni		Pb		Zn	
	ACA*	1.5		500		0.11		20		100		50		950		130		14		75	
Sample #	Depth (m)	Metal content	GAI†	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI	Metal content	GAI
		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
RIDD 006	0 - 1	24	3	137.7	0	0.3	1	4.1	0	41	0	141	1	78	0	12	0	22	0	10	0
	1 - 2	18	3	86	0	0.4	1	3.1	0	145	0	119	1	83	0	30	0	24	0	11	0
	2 - 3	26	4	138.3	0	0.2	0	6	0	6	0	92	0	209	0	11	0	57	1	13	0
	3 - 4	27	4	31.4	0	0.2	0	20.4	0	17	0	107	1	430	0	15	0	89	2	64	0
	4 - 5	48	4	9.6	0	<0.1	0	38.7	0	7	0	85	0	1157	0	12	0	157	3	86	0
RIDD 007	0 - 1	38	4	8.4	0	<0.1	0	9.2	0	16	0	14	0	87	0	7	0	7	0	2	0
	1 - 2	36	4	16.5	0	<0.1	0	20.8	0	8	0	27	0	130	0	6	0	6	0	2	0
	2 - 3	69	5	6.2	0	<0.1	0	10.3	0	9	0	30	0	31	0	6	0	6	0	<1	0
RIDD 011	0 - 1	97	5	55.1	0	0.2	0	2.2	0	38	0	253	2	12	0	11	0	16	0	4	0
	1 - 2	93	5	55.3	0	0.2	0	2.2	0	42	0	234	2	17	0	12	0	14	0	3	0
	2 - 3	94	5	64	0	0.3	1	1.7	0	48	0	225	2	5	0	11	0	13	0	2	0
	3 - 4	92	5	5.3	0	<0.1	0	25	0	8	0	124	1	226	0	7	0	20	0	40	0
RIDD 018	0 - 1	79	5	4.6	0	<0.1	0	9.7	0	13	0	129	1	140	0	6	0	17	0	3	0
	1 - 2	212	7	6.7	0	0.2	0	5.7	0	19	0	183	1	57	0	9	0	23	0	4	0
	2 - 3	110	6	5.4	0	0.2	0	6.2	0	23	0	204	1	104	0	13	0	11	0	10	0

* ACA = Average Crustal Abundance

† GAI = Global Abundance Index

Table 4.5: Bioavailability of metals within the various materials under both a neutral (pH 5.5 - 6.5) and high acidic (pH 2.5) leaching environment.

Neutral Solution (pH 5.5 - 6.5)																					
Element		As		Ba		Cd		Co		Cr		Cu		Mn		Ni		Pb		Zn	
		Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached
Sample ID	Depth (m)	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
RIDD 006	0 - 1	0.0009	0.0000016	0.0528	0.000203	<0.00002	0	0.0007	0.0000008	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	0.0008	0.0000012	0.0453	0.000173	<0.00002	0	0.0003	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	<0.0005	0	0.0477	0.000183	0.00003	0	0.0005	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	3 - 4	<0.0005	0	0.0502	0.000193	0.00004	0	0.001	0.000002	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	4 - 5	<0.0005	0	0.0504	0.000194	0.00004	0	0.0014	0.0000036	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	0.2	0.000724
RIDD 007	0 - 1	<0.0005	0	0.0411	0.000156	0.00002	0	0.0018	0.0000052	<0.1	0.000198	<0.1	0.000168	0.1	0.000398	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	<0.0005	0	0.0349	0.000132	0.00003	0	0.0009	0.0000016	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	<0.0005	0	0.0245	0.00009	<0.00002	0	0.0003	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
RIDD 011	0 - 1	<0.0005	0	0.0375	0.000142	<0.00002	0	0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	0.0006	0.0000004	0.0489	0.000188	<0.00002	0	0.0002	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	0.0008	0.0000012	0.0415	0.000158	<0.00002	0	0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	3 - 4	<0.0005	0	0.0331	0.000124	<0.00002	0	<0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
RIDD 018	0 - 1	<0.0005	0	0.0193	6.92E-05	<0.00002	0	0.0002	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	1 - 2	<0.0005	0	0.0324	0.000122	<0.00002	0	<0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124
	2 - 3	<0.0005	0	0.0309	0.000116	<0.00002	0	<0.0001	0	<0.1	0.000198	<0.1	0.000168	<0.1	0.000198	<0.1	0.000198	<0.2	0.0004	<0.1	0.000124

Table 4.5 continued...

Acidic solution (pH 2.5)																					
Element		As		Ba		Cd		Co		Cr		Cu		Mn		Ni		Pb		Zn	
		Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached	Leachate concentration	Proportion leached
Sample #	Depth (m)	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%	mg/L	%
RIDD 006	0 - 1	0.0005	0	0.1537	0.000603	0.00004	0	0.0153	0.0000592	<0.1	0.000198	<0.1	0.00014	0.5	0.001988	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	1 - 2	0.0007	0.0000008	0.0936	0.000362	0.00004	0	0.0009	0.0000016	<0.1	0.000198	<0.1	0.00014	0.2	0.000788	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	2 - 3	<0.0005	0	0.0461	0.000172	0.00003	0	0.0009	0.0000016	<0.1	0.000198	<0.1	0.00014	0.1	0.000388	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	3 - 4	0.0011	0.0000024	0.0636	0.000242	0.00002	0	0.0013	0.0000032	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	4 - 5	0.0005	0	0.0501	0.000188	0.00003	0	0.002	0.000006	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	0.2	0.000712
RIDD 007	0 - 1	<0.0005	0	0.0755	0.00029	0.00003	0	0.0065	0.000024	<0.1	0.000198	<0.1	0.00014	0.3	0.001188	<0.1	0.000198	<0.2	0.0004	0.2	0.000712
	1 - 2	<0.0005	0	0.0648	0.000247	0.00003	0	0.0026	0.0000084	<0.1	0.000198	<0.1	0.00014	0.2	0.000788	<0.1	0.000198	<0.2	0.0004	0.1	0.000312
	2 - 3	0.0007	0.0000008	0.0345	0.000126	0.00003	0	0.0005	0	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
RIDD 011	0 - 1	<0.0005	0	0.0589	0.000224	0.00033	0.0000011	0.0029	0.0000096	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	1 - 2	0.0008	0.0000012	0.0852	0.000329	0.00002	0	0.0031	0.0000104	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	2 - 3	<0.0005	0	0.0623	0.000237	0.00002	0	0.0006	0.0000004	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	3 - 4	<0.0005	0	0.0371	0.000136	<0.00002	0	0.0014	0.0000036	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
RIDD 018	0 - 1	0.001	0.000002	0.0347	0.000127	0.00003	0	0.0014	0.0000036	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	1 - 2	<0.0005	0	0.0671	0.000256	0.00004	0	0.0019	0.0000056	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112
	2 - 3	0.0006	0.0000004	0.0495	0.000186	0.00004	0	0.0008	0.0000012	<0.1	0.000198	<0.1	0.00014	<0.1	0.000188	<0.1	0.000198	<0.2	0.0004	<0.1	0.000112

5 SOIL AND WASTE MATERIAL MANAGEMENT

From the results presented in Section 4 the following soil material management units (SMMU) were identified:

- Topsoil
- Subsoil
- Waste material

Each of these materials exhibits specific physical and chemical properties that may either benefit or limit their handling and utilisation during mining, rehabilitation and closure. Careful management of these soils is therefore required to ensure rehabilitation success and subsequent closure is not impacted, and that the environmental risks to the surrounding environment are kept to a minimum.

5.1 TOPSOIL

Although there is negligible profile differentiation in surface soils across the site, topsoil has been delineated as the the surface 0 - 10 cm of the profile. This soil layer has slightly elevated nutrient and organic matter levels, compared to the deeper soil materials, and it is likely that the majority of the soil stored native vegetation seed occurs in this layer. It is therefore recommended that this soil layer be preferentially stripped and stockpiled separately from the deeper soil materials for use in rehabilitation.

Topsoils within the proposed mining area consist of a friable gravelly loamy sand to sandy loam that is non-saline, non-sodic, and structurally stable with a high permeability in response to its high gravel fraction. They therefore have optimal soil properties for use in rehabilitation and can be easily handled and utilised. All temporary topsoil stockpiles should not exceed 2 m in height to maintain the soils biological activity and native seed viability.

5.2 SUBSOIL

The morphological, physical and chemical properties of the subsoil materials are very similar to the overlying topsoils consisting of a friable, non-saline, non-sodic and structurally stable gravelly loamy sand to sandy loam. The subsoil represents a critical soil layer that facilitates the establishment of vegetation on the escarpment. The friable nature of the subsoil materials enables roots of the vegetation to expand laterally and access fracture surfaces in the underlying consolidated ironstone or siltstone. A strong correlation between depth of subsoil and vegetation composition and structure is clearly evident at this site. It is therefore recommended that all friable gravelly material beneath the topsoil (0 - 10 cm soil layer) and overlying the ironstone/siltstone basement is stripped and stockpiled as a subsoil for later use in rehabilitation. For volume calculations a subsoil depth of 10 - 40 cm can be used within SMU 1. In SMU 2 and 3 the thickness of subsoil will generally be < 10 cm.

Subsoil materials in all soil types are unlikely to contain an appreciable biological component or native seed store and subsequently there is no restriction to the height in which they can be stockpiled. Given their friable gravelly nature, these materials can easily be handled and utilised.

5.3 WASTE MATERIAL

Waste materials represent all consolidated soils below the surficial gravels, corresponding to the highly weathered ironstone and siltstone. These materials are non-saline, non-sodic, structurally stable and non-dispersive. Although these materials contain considerable enrichment of As, it is not readily available or mobile under a range of

leaching environments; hence it has a very low bioavailability and represent a low risk to the surrounding environment.

Excavation of the lateritic waste materials to access the underlying orebody will result in fracturing of this material and a subsequent reduction in particle/aggregate size (diameter). A gravel-rich material, with a minor < 2 mm soil fraction, will likely be produced and based on the testwork undertaken during this study these gravels will be structurally stable, non-dispersive and non-erosion. There is therefore no restriction on the utilisation of this material in the construction of the permanent waste dumps.

5.4 MINE PIT REHABILITATION

To reduce the volume of material to be stored in waste dumps onsite, KMG have proposed to backfill and rehabilitate the mine voids. A progressive backfill strategy will be implemented whereby excavated waste material is continuously backfilled into the advancing mined-out void. Topsoil and Subsoil materials will then be placed over the waste to rehabilitate the soil profile. To facilitate post-mine revegetation of the mine voids it is recommended that the following profile is reconstructed:

- Topsoil (0 - 10 cm): the presence of the native seed store should facilitate rapid revegetation establishment and growth. Direct seeding may be required to supplement or return recalcitrant species and to improve the species richness, plant density and foliage cover so that the closure objectives can be achieved in a timely manner.
- Subsoil (10 - 40 cm): a minimum of 30 cm of subsoil should be spread over areas where trees are to be re-established. The thickness of returned subsoil should be recorded so that areas that receive < 30 cm can easily be identified and revegetated with shallow-rooted, low transpiring revegetation species (i.e. grasses).
- Waste material (> 40 cm).

6 REFERENCES

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Appendix 2: Matsu Project Surface Water Risk Assessment (Golder 2014a)

TECHNICAL MEMORANDUM

DATE 15 July 2014 **PROJECT No.** 147646028-001-M-Rev1

TO Leon Hill
Kimberley Metals Group

CC

FROM Steven Boxall **EMAIL** sboxall@golder.com.au

MATSU PROJECT – SURFACE WATER RISK ASSESSMENT

1.0 INTRODUCTION

Kimberley Metals Group (KMG) is in the preliminary phase of preparing project plans for the development of the Matsu Project, located approximately 35 km south-west of Lake Argyle in north-eastern Western Australia. The proposed mine development area is also located approximately 10 km south-east of KMG's existing Ridges Mine operation. KMG engaged Golder Associates Pty Ltd (Golder) to undertake an assessment of the site-specific surface water risks and surface water, drainage and sediment management requirements for the Matsu Project, including proposed haul road alignments. As a separate study Golder is also providing an assessment of potential groundwater supply options near the Matsu Project for use in mining activities including camp supply, construction supply and dust suppression.

This technical memorandum provides a summary of the regional and local hydrology and surface water drainage systems surrounding the Matsu Project, including a high level assessment of the potential surface water risks and management requirements.

2.0 OBJECTIVES AND SCOPE

Based on the current understanding of the potential surface water risks and issues at the Matsu Project site, the objective of this study is to provide a high-level characterisation of regional and local surface water systems, with particular focus on the identification and assessment of potential risks and impacts to Matsu Project infrastructure and assets as well as the proposed haul road alignment. More specifically, this includes the following:

- Assessment and presentation of the historic climate patterns and derivation of rainfall intensity-frequency-duration (IFD) curves for design storms with durations up to 72 hours and average recurrence intervals (ARI) of up to 100 years.
- Characterisation of regional and local stream networks, drainage and flow paths and surface water features relative to the proposed Matsu Project site, haul road alignment and associated infrastructure.
- Assessment of potential surface water risks to site infrastructure and assets across the proposed Matsu Project site including a review of potential sources, pathways and receptors of surface runoff and drainage from the proposed development areas.

The assessments defined for this study are aimed at addressing a number of the requirements relating to surface water management as defined by the Department of Mines and Petroleum (DMP) Guidelines for Mining Proposals in Western Australia (DMP, 2006). Additionally the outcomes and findings of this assessment will be used to identify requirements for more detailed surface water, drainage and sediment management assessments aimed at defining specifications for infrastructure design.

3.0 REVIEW OF REGIONAL CLIMATIC REGIME

The climate of the study area is characterised by a distinct seasonal, tropical/sub-tropical monsoon climate with a dominant wet (hot and humid) summer season and dry winter months. The dry season is characterised by a generally stable climate with clear skies, easterly winds, warm daytime temperatures and occasional cold nights. The initial period leading into the wet season can experience rainfall can be more extreme, although generally localised and of short duration, as a consequence to convective rainfall events and thunderstorms. As the wet season progresses across northern Australia, isolated thunderstorm activity gives way to more dominant large scale, low pressure weather systems which are able to generate significant, and occasionally extreme, periods of rainfall. Cyclonic activity can also provide an additional risk of extreme weather, i.e. strong winds and heavy rainfall, across the Kimberly region during the summer period.

Surface water drainage features in the region are characterised by highly ephemeral streams, creek and drainage networks with surface water runoff events occurring in response to significant storm events during the wet season. Widespread flooding is not unusual in the Kimberley and even major highways may get cut off during extreme flood events, potentially for several days.

3.1 Rainfall

A review of available long-term Bureau of Meteorology (BoM) rainfall stations in the study region has identified two potentially useful rainfall records. The closest rainfall station is located at Argyle Aerodrome (Station No. 2026) located approximately 14 km north-east of the Matsu project with a daily rainfall record covering the period from January 1985 to May 2014). Alternatively a slightly longer rainfall record (January 1969 to May 2014) has been identified for the rainfall station at Lake Argyle Resort located approximately 78 km north-east of the Matsu Project. Following a review of these rainfall records it has been identified that both datasets contain a number of missing months of data or periods of observations which have been flagged as not being fully quality controlled, particularly for the period between 1999 and 2014. However, the collated rainfall data can be used for checking and verifying other assessments of historic rainfall.

In order to provide a comprehensive and long-term assessment of the climatic regime, particularly rainfall and evaporation distributions, SILO climate data (DSITIA, 2013) from 1900 have been downloaded for the following coordinates (considered representative of the Matsu Project site):

- Latitude: 16°.42’
- Longitude: 128°.18’.

The SILO rainfall series has been checked and verified against the available observed records for Argyle Aerodrome and Lake Argyle Resort and has been assessed to provide a good level of agreement in terms of the average and seasonal rainfall patterns and distribution of major rainfall events.

The monthly rainfall statistics presented in Table 1 and Figure 1 show that the study area experiences a distinct seasonal distribution of rainfall with a wet summer period (November to March) and a dry winter period (April to October). The available data reflect a high degree of relative variability in extreme rainfall throughout the year, with extreme maximum observed monthly rainfalls exceeding 100 mm during the dry season and from 600 mm to 800 mm during the wet season.

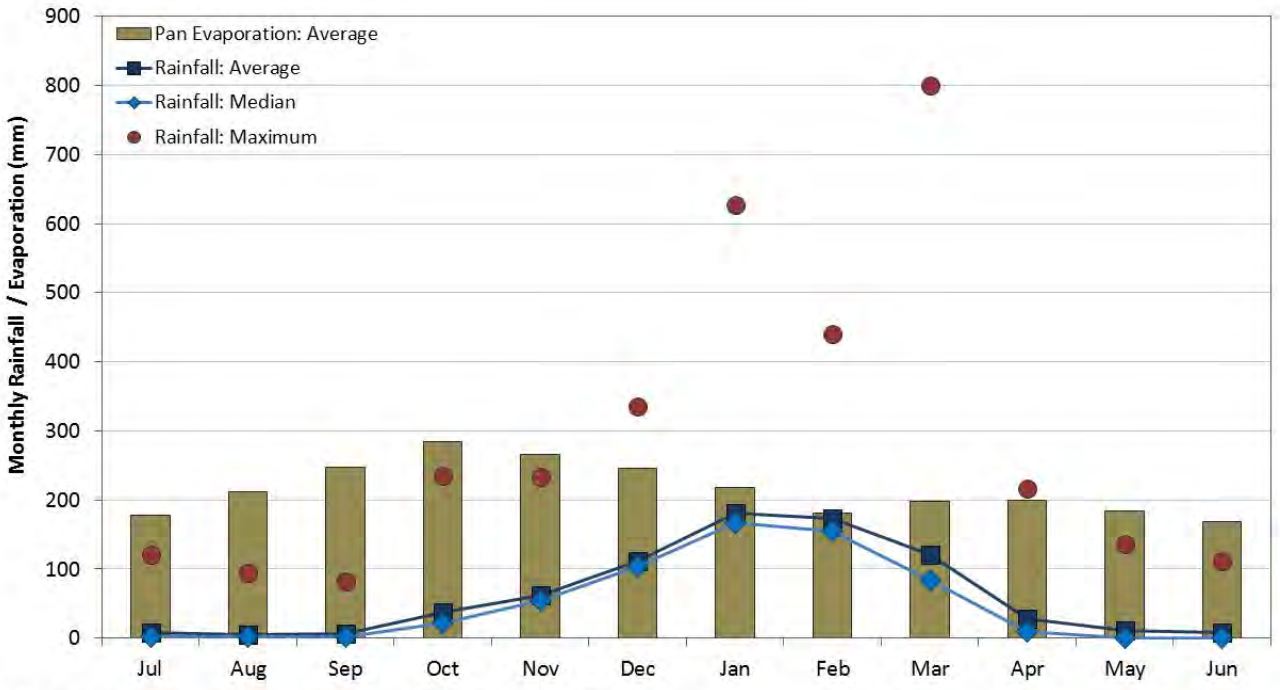
These more extreme rainfall totals are most likely to result from occasional high intensity, short term thunderstorm events, significant monsoonal low pressure systems or cyclonic, or remnant cyclonic, activity. For example, the extremely high March 2011 rainfall total (799.5 mm) was the result of an intense monsoonal event that brought significant flooding to the region and is discussed in more detail in Section 3.2.

Average annual (July-June) rainfall for the period 1900-2013 was 755 mm with annual rainfall showing a relatively high level of inter-annual variability ranging from a minimum of 301 mm (1951-52) to a maximum of 2058 mm (2010-11). Total annual rainfall (July-June) for the period of record (July 1900 to June 2014) is presented in Figure 2.

Table 1: Long-term Monthly Rainfall and Evaporation Statistics (Jan 1900- June 2014)

Month	SILO Rainfall				Pan Evaporation[1]
	Average	Median	Minimum	Maximum	Average
July	8	1	1	121	178
August	6	3	2	94	211
September	6	1	1	82	247
October	37	22	1	236	284
November	62	54	5	233	267
December	112	104	4	335	245
January	180	166	12	627	218
February	171	152	13	440	182
March	122	85	0	800	198
April	27	9	0	216	199
May	12	1	1	137	184
June	8	1	1	111	168
Annual	**755**	**700**	**301**	**2058**	**2581**

Note: [1]Pan Evaporation = Class A Pan Evaporation (used post-1970) and synthetic pan evaporation (pre-1970)



Note: All statistics derived from SILO data drill climate information (Jan 1900 - June 2014)
Pan Evaporation = Class A pan evaporation (used post -1970) and synthetic pan evaporation (pre -1970)

Figure 1: Monthly Rainfall and Evapotranspiration for the Region

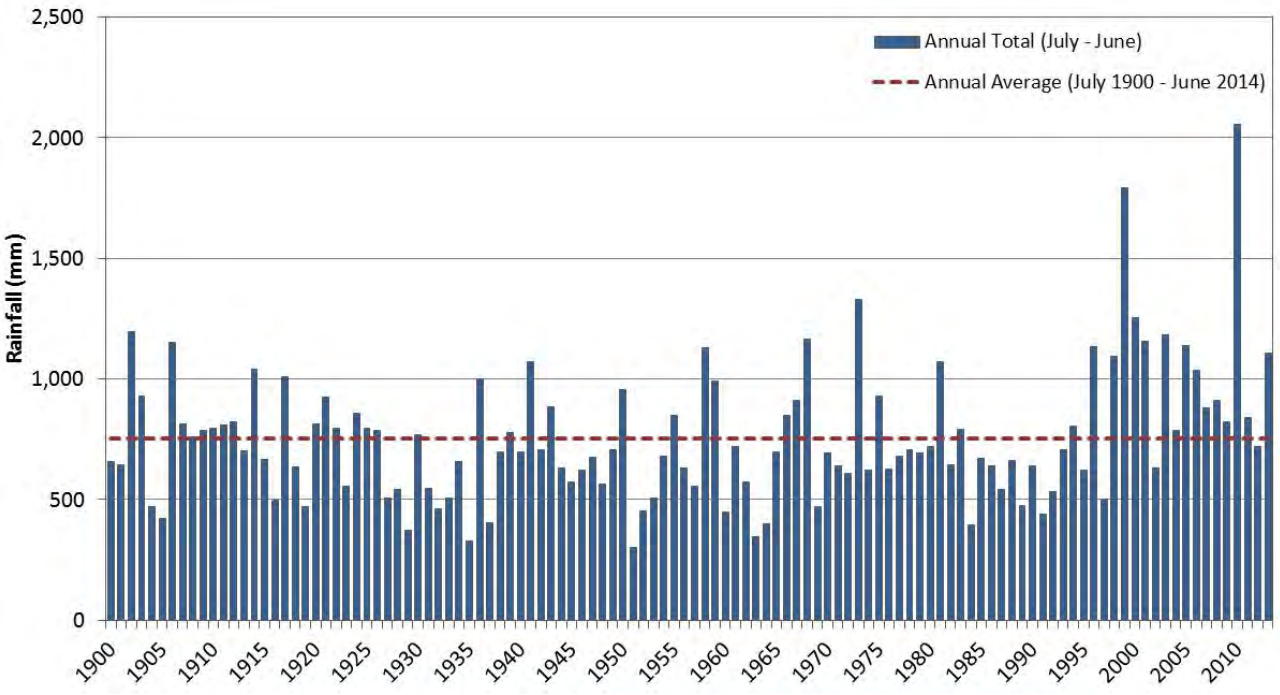


Figure 2: Annual Total and Annual Average Rainfall at the Matsu Project Study Area (July 1900 – June 2014)

3.2 Recent Extreme Rainfall

Between 10 and 14 March 2011, the central and eastern Kimberley regions of Western Australia experienced extremely heavy rainfall, with more than 700 mm falling during the month over the Kimberley Plateau, caused by an active monsoon trough. A further slow moving tropical low caused extensive flood damage to infrastructure across the Fitzroy, Ord and Pentecost River catchment areas. Total rainfall recorded at the Argyle Aerodrome rainfall station for the three day period from 12 to 14 March 2011 was 380 mm.

A number of locations in the Kimberley region broke their highest March rainfall records including Warmun, Yulmbu and Gibb River. In the east Kimberley town of Warmun up to 500 people were evacuated when the town's 76 houses were either destroyed or deemed uninhabitable through flood inundation. Within days more than 290 members of the Warmun community were evacuated to the Ord Stage II Camp (Garrjang) in Kununurra.

3.3 Design Rainfalls

Rainfall intensity-frequency-duration (IFD) data for the Matsu Project study area have been derived using the BoM's CDIRS (Computerised Design IFD Rainfall System), which allows automatic determination of a full set of IFD curves and associated data for any location in Australia. This approach is compatible with the manual procedures described in Australian Rainfall and Runoff (ARR): A Guide to Flood Estimation (Pilgrim, 1987).

Table 2 and Figure 3 provide details of rainfall intensities associated with design storms with durations up to 72 hours and ARIs up to 100 years. The data represent design rainfalls at the location of the proposed Matsu Project development (16.70°S 128.325°E) and are also valid to be applied to the surrounding local catchment areas. These IFD curves provide standard design rainfall intensities used in the estimation of design flood discharges or drainage volumes for a range for storm ARIs and durations across the study area.

Table 2: Rainfall Intensity (mm/h) for Standard Durations and Average Recurrence Intervals (ARIs)

Duration (mins)	1 Year ARI	2 Year ARI	5 Year ARI	10 Year ARI	20 Year ARI	50 Year ARI	100 Year ARI	Duration (hours)
5	99.5	128.0	163.0	184.0	213.0	251.0	281.0	**0.083**
10	77.2	99.4	126.0	142.0	164.0	193.0	216.0	**0.167**
20	59.7	76.5	95.9	108.0	123.0	145.0	161.0	**0.333**
30	49.7	63.6	79.4	88.7	102.0	119.0	132.0	**0.5**
60	33.5	42.8	53.4	59.8	68.4	80.0	88.9	**1**
120	20.3	26.0	32.9	37.1	42.7	50.2	56.1	**2**
180	14.6	18.8	24.1	27.3	31.6	37.4	42.0	**3**
360	8.2	10.6	13.9	16.0	18.7	22.4	25.3	**6**
720	4.7	6.2	8.2	9.6	11.3	13.7	15.6	**12**
1440	2.9	3.8	5.2	6.0	7.1	8.7	9.9	**24**
2880	1.8	2.4	3.3	3.8	4.5	5.5	6.3	**48**
4320	1.3	1.7	2.4	2.8	3.3	4.0	4.6	**72**

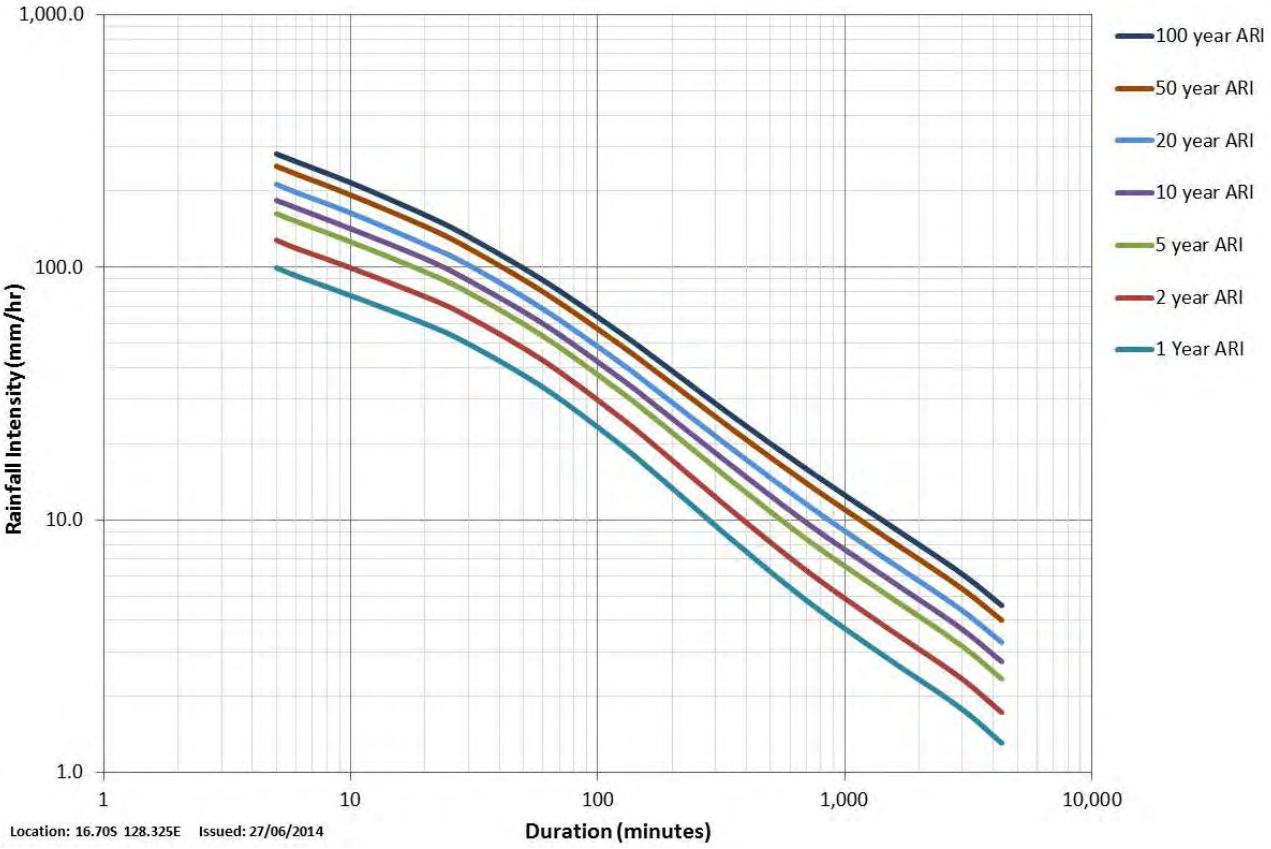


Figure 3: IFD Curves for the Matsu Project Study Area

3.4 Design Standard

Although design IFD rainfall data and subsequent estimates of peak flood discharges can be calculated for the range of ARI events, the 100 year ARI peak event is commonly adopted as the design criteria standard for projects such as the Matsu Project. This design condition provides a very high level of flood protection (e.g. 1% chance of being equalled or exceeded in any one year) and is consistent with the requirements of the DMP for the assessment of flood potential and drainage design in the preparation of mining proposals (DMP, 2006).

With respect to the design criteria for surface water and drainage management for road developments, lower magnitude design events may be adopted for the design of waterway crossings and drainage management infrastructure. Alternative design criteria may be considered where the risks can be sufficiently managed or where it is unlikely to be economically feasible to construct crossings, such as floodways and culverts, which will remain trafficable under flow conditions that could be reasonably expected. The appropriate level of serviceability for a particular waterway crossing may depend on the requirements of the entire road link and it is normal practice to design each crossing to a predetermined level of serviceability (MRWA, 2006).

3.5 Evaporation

Evaporation data recorded in the region are limited. Therefore estimated class A pan evaporation available from the SILO climate dataset has been adopted for this assessment. The SILO data provide estimates of class A pan evaporation, based on nationally interpolated surfaces developed by the BoM, from 1970 onwards. Prior to 1970 the evaporation series is based on developed synthetic pan evaporation estimates.

The profile of average monthly pan evaporation presented in Figure 1 reflects the level of seasonal variation experienced across the study area. The highest average monthly evaporation occurs through the period from September to December, peaking at approximately 285 mm in October, with slightly lower monthly evaporation rates ranging between 170 mm and 200 mm through the spring and winter months, i.e. February to July. Annual evaporation in the region is relatively high with pan evaporation averaging around 2000 mm annually. These data demonstrate that, on a monthly basis, potential evaporative losses consistently exceed monthly rainfall inputs throughout the year; therefore, notable surface water runoff events are largely associated with extreme storm and rainfall events.

4.0 REGIONAL ANALYSIS OF SURFACE WATER SYSTEMS

4.1 Catchment Delineation

Surface water drainage systems and associated sub-catchments surrounding the Matsu Project study area have been delineated using a Digital Elevation Model (DEM) generated from Shuttle Radar Topographic Mission (SRTM) data. Higher resolution LiDAR topographic survey data are not currently available for the delineation of local drainage systems surrounding the study area. However, this detailed survey information will be required for future detailed local surface water investigations and design assessments, i.e. hydraulic modelling, surface water management planning and drainage design, which are currently beyond the scope of this study.

The derived drainage paths have been validated against satellite imagery and aerial photography, where possible, to ensure that they closely align with visible drainage morphology. The drainage paths and catchment boundaries of the major surface water drainage systems surrounding the Matsu Project are shown in Figure A1 (Attachment A). The proposed haul road alignments and the Ridges Mine infrastructure are also presented.

4.2 Regional Surface Water Flow Patterns

As shown in Figure A1, the Matsu Project and Ridges mine developments lie directly along the ridge lines of the Carr Boyd Range and are surrounded by highly ephemeral drainage systems, consisting of predominantly small channels, creeks or gullies. This was confirmed during the site inspection undertaken in June 2014. These rugged upland drainage systems are characterised by steep, rocky channels flowing through intermittent deep gorges, waterfalls and pools. Hydrological responses in the upper catchment areas are likely to be characterised by intense and often short duration extreme runoff and flood events.

Across much of the areas surrounding the sites surface water flows may only occur in defined channels where there are sufficient convergence of flows and increases in flow velocities to promote scour and channel formation. Within the smaller, flatter drainage systems with less well-defined channels surface water flows are dominantly expressed as sheet flow where overland flow moves down slope as a broad shallow front in response to infiltration of excess rainfall prior to channel initiation.

The Matsu Project and Ridges Mine developments are located close to or directly along the catchment boundaries of two larger surface water systems, the Bow River and Smoke Creek, both of which ultimately drain to Lake Argyle. Lake Argyle is Australia's largest artificial lake by volume and is part of the Ord River Irrigation Scheme and is located near to the town of Kununurra. The lake is a DIWA (Directory of Important Wetlands in Australia) listed wetland and additionally Lake Argyle, along with Lake Kununurra, are recognised as Ramsar protected wetlands and were listed in 1990 as Australian Site Number 32. The lake supports a large population of the nationally listed marine species, regularly supports very large numbers of waterbirds and provides a regionally important dry-season and drought refuge for waterbirds

A brief summary of the regional drainage pattern for each of the prospects is described below:

- Surface water runoff from the project sites draining to the south and south-west forms the upper reaches of small tributaries of the Bow Rover. As shown in Figure A1 (Attachment A), the majority of proposed Matsu Project site infrastructure, such as the haul road alignment, crusher, ROM and loadout, are located in these catchments. The drainage systems flow under the Great Northern Highway and join the main channel of the Bow River approximately 10 – 15 km downstream of the Matsu Project and Ridges Mine areas. The Bow River continues flowing in an easterly direction before turning north-east and flowing into Lake Argyle at its most southerly point.

- The upper catchment area of Wesley Spring Creek drains directly south of the proposed Matsu Project Pit and forms a tributary of the Bow River close to Lissadell Hill. The pit extent is located directly along the northern catchment divide of the Wesley Spring Creek (draining south) and the Flying Fox Creek (draining north – described below). As shown in Figure A1 and Figure A2 (Attachment A), the Wesley Spring is located approximately 3.5 km southeast of the proposed Matsu Project pit and based on the Environmental Protection Agency (EPA) report, seepage from the Wesley Spring to the creek is likely to be sourced through elevated groundwater storage that is depleted during the dry season and the spring may naturally cease to flow during extreme dry spells (EPA, 2005). The Wesley Spring Management Plan, which forms part of the Argyle Underground Environmental Management Plan (Argyle Diamonds, 2005), defines the management measures that may be implemented should impacts at the Wesley Spring as a result of mining activities at the Argyle Diamond Mine be identified.

- The Smoke Creek runs 35 km from the Matsu Range to Lake Argyle and was one of the key locations where alluvial diamonds were found in a sample collected from the creek in 1979 as part of the exploration effort that led to the development of the Argyle Diamond Mine. As shown in Figure A1 (Attachment A), the proposed Matsu Pit and the final section of the road, along the top of the ridge, linking the pit to the ROM and crusher are located in the very top of the northern draining Flying Fox Creek catchment, a sub-catchment of Smoke Creek. Just to the east of the proposed Matsu Pit the upper reaches of the Smoke Creek flow towards the surface water impoundment, which has been developed as part of the Argyle mine development. However, none of the proposed Matsu Project development lies within this easterly draining catchment area.

5.0 LOCAL SURFACE WATER RISK ASSESSMENTS

The following sections provide a brief summary of the potential surface water risks relating to site infrastructure and assets associated with the proposed Matsu Project based on location with respect to local topographic features, defined drainage paths and upstream catchment areas. These high level risk assessments aim to inform and identify requirements for further, more detailed, surface water investigations, which may be required as part of the regulatory approval process for mine development and for the development of surface water management and drainage plans.

Each assessment provides a brief review of surface water management, drainage issues and potential flood risks relevant to the key development areas. Potential surface water issues relating to the proposed haul road alignment are also described. Maps showing the local hydrology and surface water drainage features for the Matsu Project are provided in Figures A2 and A3 (Attachment A).

Where possible, local catchment areas have been delineated and relevant physical catchment characteristics defined. These catchment parameters have been used to derive estimates of the design peak flood discharge for a range of design events up to the 100 year ARI using the Rational Method (as described below). These peak flood discharge estimates are aimed at providing initial estimation of relative flood magnitudes at each location and should be reviewed and reassessed in more detail if and where more detailed surface water design investigations are required.

As recommended in Volume 1 of ARR (Pilgrim, 1987), the Rational Method can be applied to generate estimates of peak flows at a given point of a drainage network in response to defined design rainfall events. These estimates of peak flows are used as initial flow variable inputs to a hydraulic model for the assessment of flood levels and flood extents under steady state conditions. The rational method provides discharge estimates based on the following general formula to give the peak flow Q_p:

$$Q_p = CIA$$

where C is the coefficient of runoff (dependent on catchment characteristics); I is the intensity of rainfall; and A is the area of the catchment. After time T_C from the commencement of a rainfall event, the whole of the catchment is taken to be contributing to runoff at a particular location and this time (T_C) is used to select the rainfall intensity (I) for application of the Rational Method.

5.1 Matsu Project Mine and Infrastructure Area

The proposed Matsu Project pit and infrastructure developments and local surface water drainage features are presented in Figure A2. The proposed pit site is located almost directly along the ridge line which forms a catchment divide of the northerly and southerly draining sub-catchments. Based on the topographic data and proposed pit extent there are no clearly defined risks to the pit from upslope surface water runoff.

Until mining occurs to a depth below the ground surface sufficient for incident rain to drain internally to pit sumps, incident rainfall falling on the Matsu pit area, or areas surrounding the pit, will preferentially drain directly away from the site in a northerly direction. Local drainage and sediment management measures, i.e. bunds, cut-off drains and sediment traps, should be considered in the mine plan and layout in order to mitigate any potential impacts on the downstream environment. The relatively steep local topography and potentially high rainfall intensity associated with storms events can lead to risk of sediment impacted surface runoff leaving cleared and developed mine areas. Surface water systems directly downstream of the pit area are characterised by steep gullies, intermittent gorges, waterholes and pools, which may be detrimentally impacted by the interception of sediment laden runoff.

As indicated in Figure A2, local drainage and sediment management options should also be considered for the southern and northern extents of the proposed pit development in order to mitigate any potential surface water impacts to the upper reaches of the Wesley Spring Creek and Flying Fox Creek, respectively. The proximity of the pit development extent to the catchment divide of the Wesley Spring Creek, and the requirements for local drainage management along this alignment should be assessed in more detail based on higher resolution topographic data (when available) and the finalised pit development extent.

Appropriate cross road and longitudinal drainage management, i.e. swales and cut-off drains, and sediment management controls are recommended to be incorporated in design and construction of the proposed haul road linking the proposed pit and crusher sites (Haul road drainage recommendations are outlined in more detail in Section 5.2).

Based on the available topographic data and delineated drainage paths, it appears that the proposed site infrastructure (crusher, ROM and loadout) development area is located directly adjacent to, or partially crosses, the confluence of three small surface water drainage systems. The delineated upstream areas of these small catchments (MP A, MP B, and MP C) are indicated in Figure A2. The drainage areas range from approximately 2.8 km^2 to 15.2 km^2. The derived catchment characteristics and estimated peak flood discharges up to the 100 year ARI event are presented in Table 3.

Table 3: Catchment Characteristics and Estimated Peak Design Flood Discharge for the Matsu Project Infrastructure Development Area

Catchment	Area (km^2)[1]	Main Stream Length (km)[1]	Estimated Peak Discharge (m^3/s)[2]					
			2 Year ARI	5 Year ARI	10 Year ARI	20 Year ARI	50 Year ARI	100 Year ARI
MP A	15.2	6.3	49	73	94	122	164	210
MP B	3.9	3.1	22	32	40	51	67	83
MP C	2.8	3.0	17	25	31	40	52	64

Notes: [1]Estimated based on coarse resolution SRTM topographic data
[2]Estimated using the Rational Method as recommended in Volume 1 of ARR (Pilgrim, 1987)

Consideration of surface water management and flood mitigation measures for the proposed site development, i.e. such flood protection bunds, channel diversion or raising local ground levels above flood elevations, may be required to reduce the potential surface water impacts to the site and modifications to downstream flows.

Based on the review of local topography and drainage paths, the surface water risks and issues identified for the Matsu Project Mine and Infrastructure Area can be summarised as follows:

- There are no clearly defined drainage paths in the vicinity of the Matsu pit; however, the small drainage path to the north of the pit could potentially be at risk of impacted surface water runoff. Appropriate surface water and sediment management measures should be incorporated in the design of the mine pit development and associated access/haul road.
- Surface water management requirements for the Matsu pit would be limited to the management of drainage and sediment movement generated by incident rainfall falling directly on the site rather than inflows from surrounding catchments.
- The Matsu Project infrastructure area is located directly on or adjacent to a number of local drainage systems. Appropriate flood protection, surface water and drainage management requirements should be assessed in more detail as part of the design of the proposed infrastructure area.
- Sediment ponds and local drainage management should be considered for developed, cleared and disturbed areas to minimise the risk of sediment discharge to the environment, particularly for the areas surrounding the proposed Matsu Project pit development.
- The design and development of the road leading from the crusher to the Matsu pit should incorporate appropriate levels of drainage and sediment management infrastructure to mitigate any potential impacts on downslope surface water systems.

5.2 Matsu Project Haul Road Alignment

The proposed Matsu Project haul road alignment and local surface water drainage features are presented in Figure A3. Surface water and drainage risks and impacts relevant to the proposed Matsu Project haul road alignment linking the mine infrastructure area to the Great Northern Highway have been assessed with respect to potential crossing of surface water drainage systems and the potential requirements for the management of local surface runoff.

Based on the drainage system delineation there are a number of sections along the proposed road alignment where the road potentially crosses local surface water drainage paths. At these locations it is recommended that appropriate waterway crossing or cross-road drainage options are considered in the future development of the haul road infrastructure design, i.e. flood ways or culverts. The approximate locations of waterway crossings and associated upslope catchment areas are indicated in Figure A3. The drainage areas range from approximately 0.9 km^2 to 7.2 km^2. The derived catchment characteristics and estimated peak flood discharges up to the 100 year ARI event are presented in Table 4. Although the contributing catchment areas are relatively small, the physical catchment characteristics combined with the nature of storm events in this region can generate relatively high peak flood discharges, although of generally short duration.

In line with the DMP guidance requirements (DMP, 2006), as well as best practice in road design and engineering, appropriate cross road, longitudinal drainage management, i.e. swales and cut-off drains, and sediment management controls are recommended to be incorporated in design and construction of the proposed haul road. This will minimise the risk of up gradient ponding and thereby minimise alterations and impacts on the natural surface water runoff regime. Due consideration of surface water and drainage management as part of the road design can also provide benefits with respect to maintaining the stability, integrity and safety of the road over the life of the asset.

Table 4: Catchment Characteristics and Estimated Peak Design Flood Discharge for the Matsu Project Haul Road Alignment

Catchment	Area (km^2)[1]	Main Stream Length (km)[1]	Estimated Peak Discharge (m^3/s)[2]					
			2 Year ARI	5 Year ARI	10 Year ARI	20 Year ARI	50 Year ARI	100 Year ARI
HR A	1.2	1.0	13	17	21	26	33	40
HR B	0.9	0.9	11	14	17	21	27	32
HR C	3.3	2.9	20	28	35	45	59	73
HR D	7.2	3.2	35	50	63	80	106	132
HR E	3.9	2.9	22	32	40	51	67	83

Notes: [1]Estimated based on coarse resolution SRTM topographic data
[2]Estimated using the Rational Method as recommended in Volume 1 of ARR (Pilgrim, 1987)

Based on the review of local topography and drainage paths, the surface water risks and issues identified for the Matsu Project haul road alignments can be summarised as follows:

- The existing topographic data and drainage system delineation indicates that the proposed haul road alignment may cross a number of small surface water drainage systems. However, during significant storm events, local surface water discharges at these crossing locations may be relatively high.
- Appropriate waterway crossing or cross road drainage options should be considered in the haul road infrastructure design, i.e. flood ways or culverts. The sizing and design specifications for cross-road drainage infrastructure should be defined based on detailed assessments of hydrological responses of upslope areas and consideration of the serviceability requirements for the road alignment.
- Longitudinal drainage management controls are recommended to be incorporated in design and construction of the proposed haul road. These should also consider sediment management measures and sediment traps to minimise the risk of discharge of sediment impacted runoff from the road alignment or associated cleared and disturbed areas.

6.0 DISCUSSION AND RECOMMENDATIONS

This report provides a high level review of local and regional hydrology around KMG's proposed Matsu Project mine development (and adjacent Ridges Mine area) and describes the potential surface water risks and issues which may require further detailed assessment as part of the mine development process. The assessment focuses on the key mine infrastructure developments (pit, crusher, ROM, etc.) and also considers potential surface water issues relating to nearby related road developments. Based on the results of this assessment the following comments and recommendations are made:

- The Matsu Project (and Ridges Mine) developments are located close to or directly along the catchment boundaries of two larger surface water systems, the Bow River and Smoke Creek, both of which ultimately drain to Lake Argyle. Local hydrological responses in the small catchment areas surrounding the project site are likely to be characterised by intense and often short duration extreme runoff and flood events
- The currently proposed extent and footprint of the Matsu Project infrastructure area (crusher, ROM, etc.) is located directly on, or adjacent to, a series of local drainage systems. Flood protection, surface water and drainage management requirements should be assessed in more detail as part of the design of the proposed infrastructure area and as part of any future mine planning and mining proposal submissions.
- Until mining in the Matsu pit occurs to a depth below the ground surface sufficient for incident rain to drain internally to pit sumps, surface water management requirements for the Matsu pit would be limited to the management of drainage and sediment movement generated by incident rainfall falling directly on the site rather than inflows from surrounding catchments. However, effective drainage and sediment management designs should be incorporated to minimise the potential impact on local surface water systems and downstream environments.

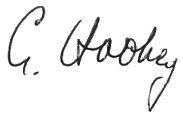
- Requirements for surface water and sediment management options for the proposed Matsu pit area should be assessed in more detail based on higher resolution topographic data (i.e. LiDAR) and the finalised pit development extent to ensure that potential impacts to the Wesley Spring Creek and Flying Fox Creek are effectively defined and managed.
- The haul road alignment linking the Matsu Project to the Great Northern Highway has been identified to cross a number of surface water drainage systems and it is recommended that surface water and drainage management requirements, particularly for potential waterway crossings, should be considered in more detail as part of the design, construction and operation of the haul road.
- Sediment ponds and effective drainage management should be considered for all developed, cleared and disturbed areas (i.e. haul road alignments, proposed pit development, crusher and ROM pad etc.) to minimise the risk of sediment discharge to the environment.
- All derived drainage and surface water flow paths presented in this assessment are derived from relatively coarse topographic data and should therefore be reviewed and reassessed using more detailed survey data (i.e. LiDAR), when available.
- Requirements for surface water, drainage and sediment management infrastructure, including locations, alignments and sizing, should be assessed in more detail when designs and footprints of proposed site developments are further defined or agreed.
- Further assessments of design flood discharge events for site-specific surface water or drainage management infrastructure should be carried out using detailed topographic data (i.e. LiDAR) and more physically based rainfall-runoff modelling approaches (i.e. RORB or XPRAFTS).
- Design specifications for surface water management infrastructure should be based on an agreed design condition based on the life of mine, life of asset or assessed level of risk and impact to the mine operation and/or directly related to the design requirements for particular infrastructure, i.e. haul road design conditions

7.0 LIMITATIONS

The analysis and assessments presented in this document are limited to the proposed Matsu Project development areas defined in the scope of services (outlined in P47646034-001-L-Rev1). Please refer to the ‘Limitations’ document included as Appendix B to this report. This document aims to identify and define the inherent limitations associated with a study of this nature in order to ensure that your expectations of the outcomes and recommendations of this study are realistic and appropriate. If you are uncertain as to whether this report is appropriate for any purpose, please feel free to discuss any issues with us directly.

GOLDER ASSOCIATES PTY LTD

Steven Boxall
Hydrologist



Greg Hookey
Principal Hydrologist

SB/GRH/hsl

Attachments: A – Figures
B – Limitations

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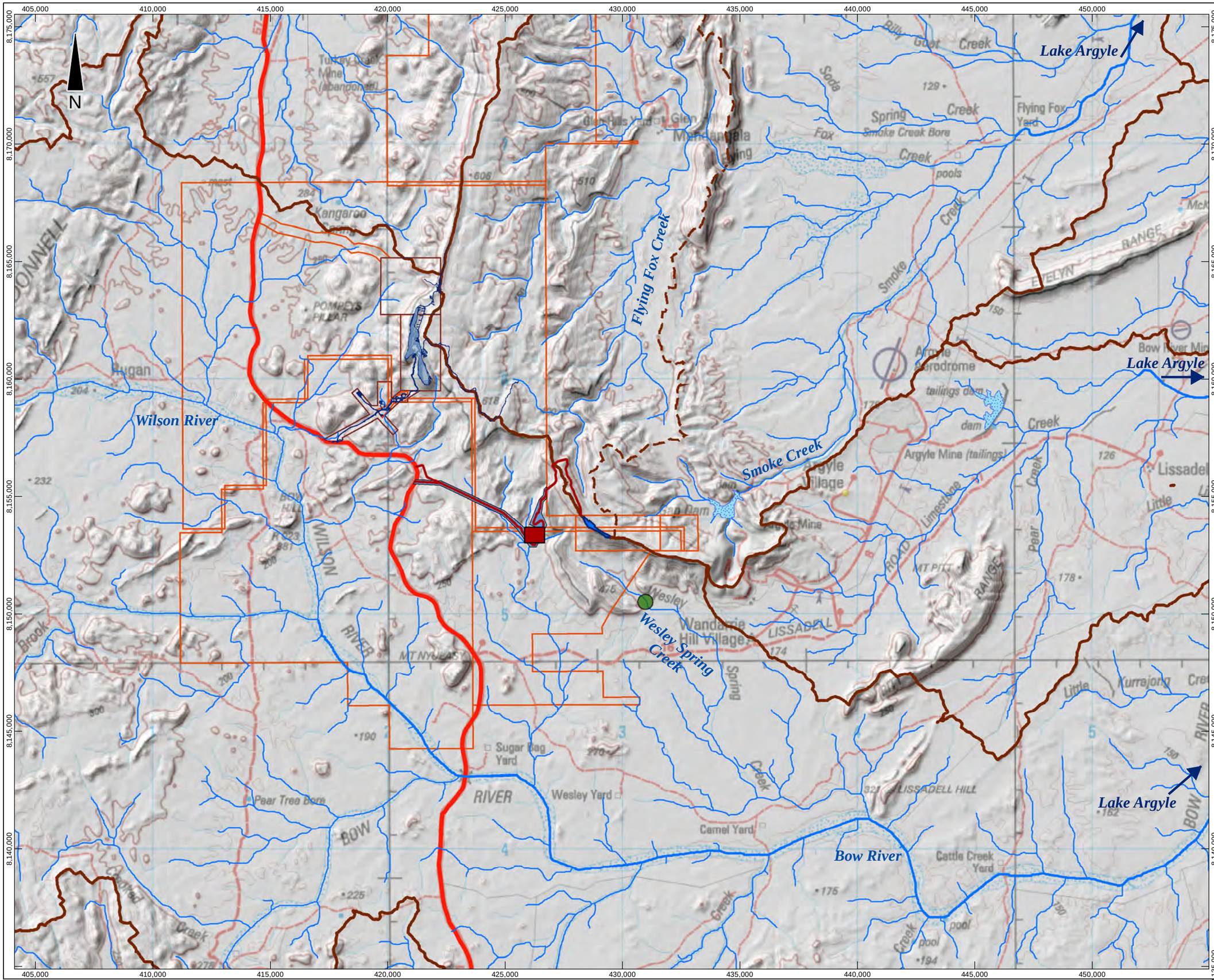
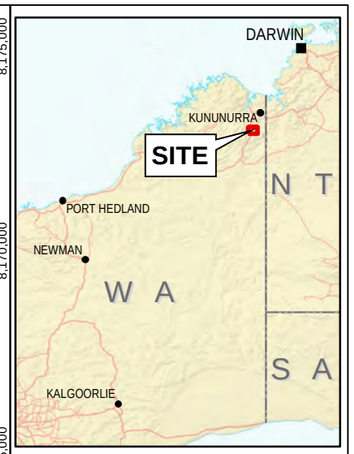
ATTACHMENT A
Figures





LEGEND

- Proposed Matsu Project Pit
- Proposed Crusher Location
- Proposed Haul Road
- Haul Road Alignment
- Ridges Mine Pit
- Existing Ridges Mine Infrastructure
- River / Creek / Drainage Line (SRTM Derived)
- Catchment Boundary
- Waterbodies
- Great Northern Highway
- KMG Tenement Boundaries
- Wesley Spring

NOTES

Coordinate System: GDA 1994 MGA Zone 52

COPYRIGHT

1 second SRTM Derived Hydrological Digital Elevation Model (DEM-H) version 1.0 (ANZLIC identifier:ANZCW0703014615) sourced from Geoscience Australia

Mine areas, site infrastructure, road alignments and tenement boundaries provided by KMG

0 1.5 3 4.5 6 7.5
km

SCALE (at A3) 1:150,000

Golder Associates

CLIENT	KMG
DOCUMENT	147646028-001-R-REV1
DATE	11 Jul 2014
COMPILED	SB
APPROVED	DRAFT

KMG
Matsu Project

REGIONAL SURFACE WATER DRAINAGE SYSTEMS

Figure A1

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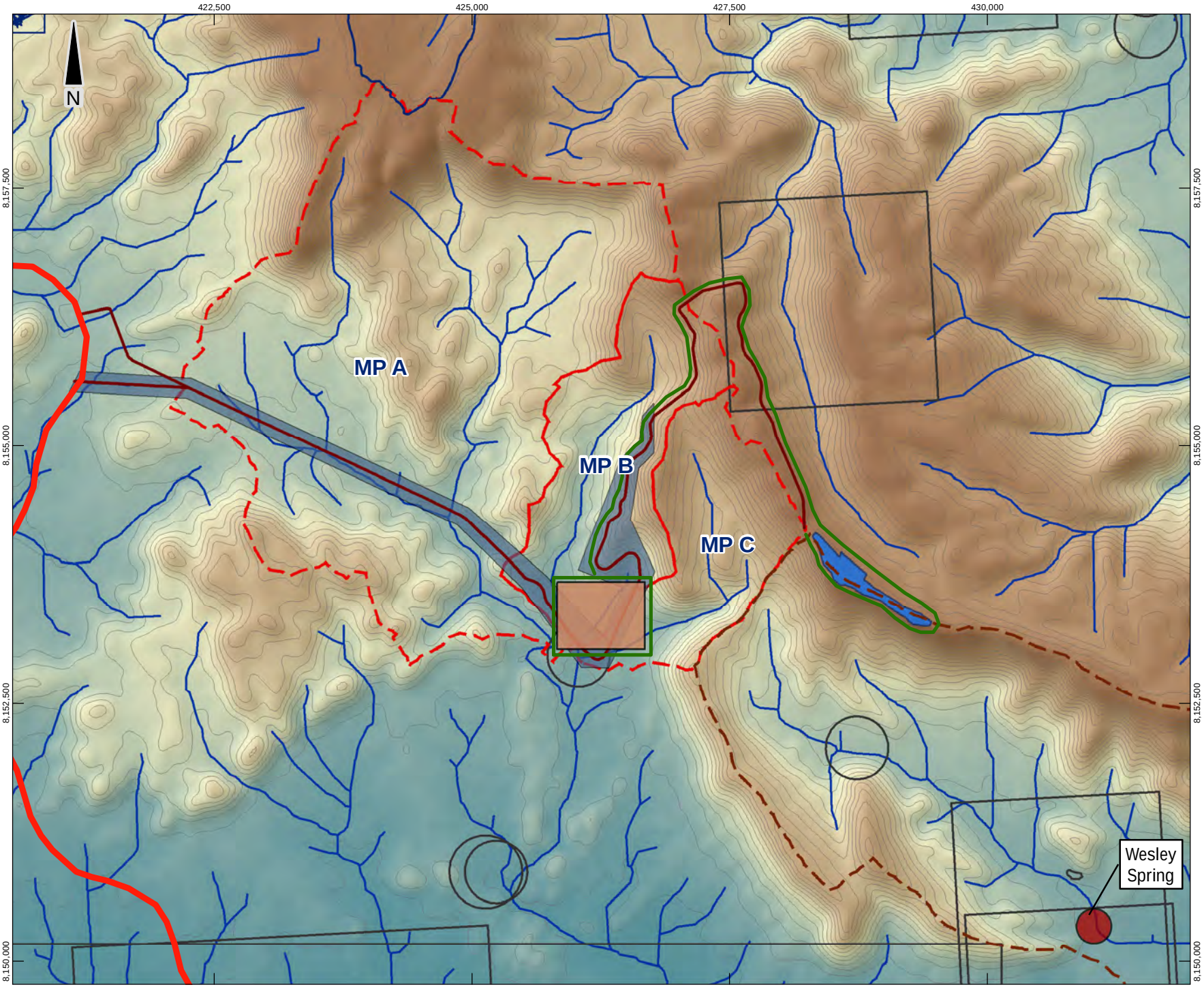

LEGEND

- Surface Water, Drainage & Sediment Management Areas
- Proposed Crusher Location
- Proposed Matsu Project Pit
- Proposed Haul Road
- Haul Road
- Crusher & ROM Catchments
- Wesley Spring
- Wesley Spring Catchment
- Great Northern Highway
- Drainage Paths (SRTM Derived)
- DAA Registered Sites
- Contours (20 m)

Value

- High : 640 m
- Low : 185 m

NOTES
Coordinate System: GDA 1994 MGA Zone 52

0 0.5 1 1.5 2
km

SCALE (at A4) 1:50,000

Golder Associates

CLIENT KMG
DOCUMENT 147646028-001-M-Rev1
DATE 15 Jul 2014
COMPILED SB
APPROVED GRH

KMG
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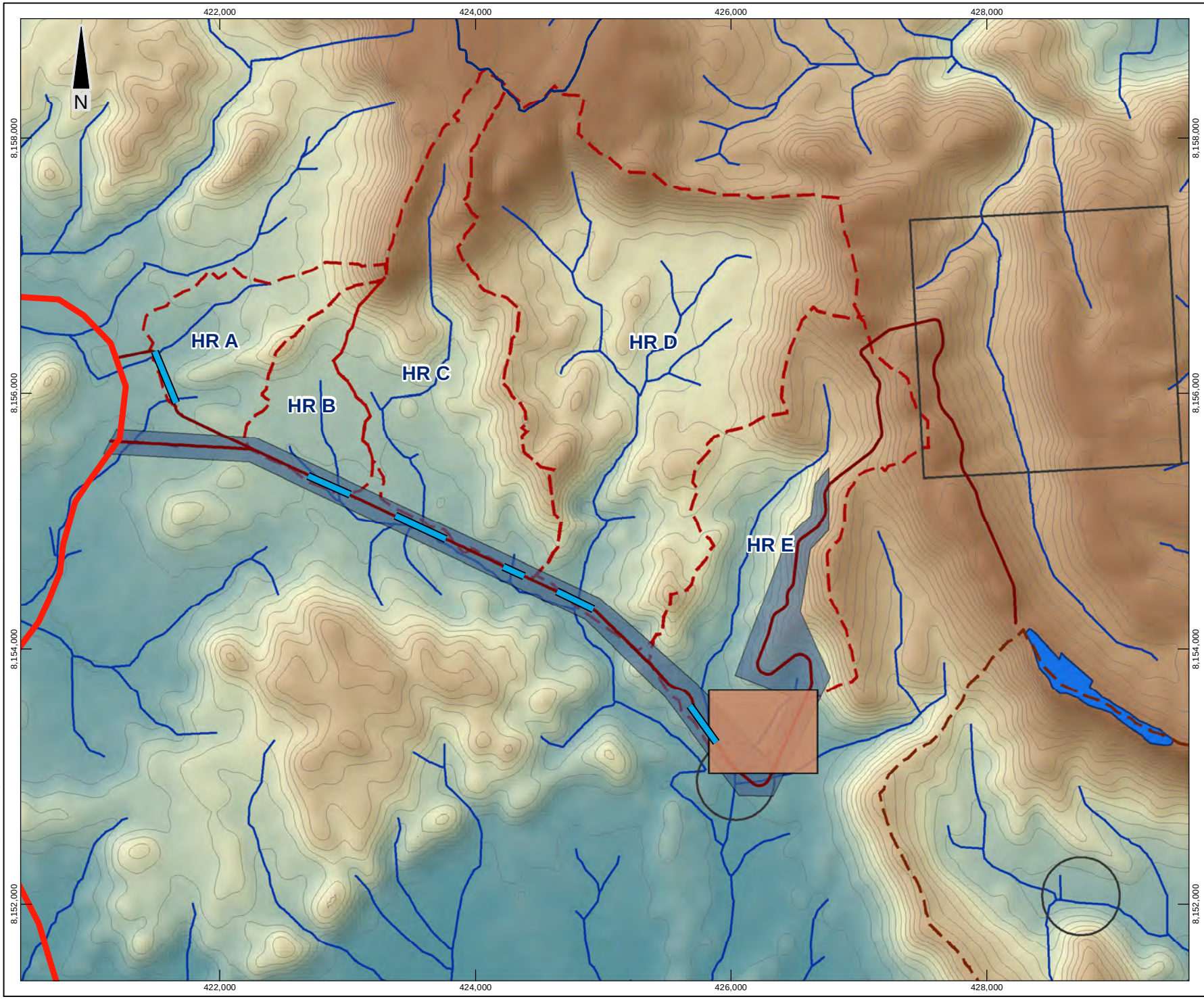
SURFACE WATER MANAGEMENT MATSU PROJECT INFRASTRUCTURE AREAS

FIGURE A2

File Location: J:\Hydro\2014\147646028 - KMG Water Supply Matsu\Analysis\GIS\Mapping\Surface Water\Rev1\147646028-001-M-F00A2-Rev1 A4_Local.mxd



LEGEND

- Waterway Crossing Locations (Approximate)
- Proposed Haul Road
- Haul Road
- Drainage Paths (SRTM
- Haul Raod Catchments
- Wesley Spring Catchment
- Proposed Crusher Location
- Proposed Matsu Project Pit
- Great Northern Highway
- DAA Registered Sites
- Contours (20 m)

Value

- High : 640 m
- Low : 200 m

NOTES
Coordinate System: GDA 1994 MGA Zone 52

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1 second SRTM Derived Hydrological Digital Elevation Model (DEM-H) version 1.0 (ANZLIC identifier:ANZCW0703014615) sourced from Geoscience Australia

Mine areas, site infrastructure, road alignments and tenement boundaries provided by KMG

0 0.5 1 1.5
km

SCALE (at A4) 1:40,000

Golder Associates

CLIENT KMG
DOCUMENT 147646028-001-M-Rev1
DATE 15 Jul 2014
COMPILED SB
APPROVED GRH

KMG
Matsu Project

WATERWAY CROSSINGS MATSU PROJECT HAUL ROAD ALIGNMENT

FIGURE A3

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ATTACHMENT B
Limitations

LIMITATIONS

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Appendix 3: Matsu Project Hydrogeology Desktop Study (Golder 2014b)

July 2014

MATSU MINE PROJECT, KIMBERLEY WESTERN AUSTRALIA

Hydrogeological Desktop Study to Identify Groundwater Supply Targets

Submitted to:
Kimberley Metals Group
Suite 4, Ground Floor
610 Murray Street
WEST PERTH WA 6005

REPORT

Report Number. 147646028-002-R-RevA-DRAFT

Distribution:

1 Electronic Copy – Kimberley Metals Group
1 Electronic Copy – Golder Associates Pty Ltd

Golder Associates

Table of Contents

TABLES

FIGURES (FOLLOWING TEXT)

APPENDICES

1.0 INTRODUCTION

Golder Associates Pty Ltd (Golder) was engaged by Leon Hill from the Kimberley Metals Group (KMG) to carry out a hydrogeological desktop study for the Matsu Mine Project (MMP), located approximately 110 km south – south-west of the township of Kununurra in north-eastern Western Australia (Figure 1), and about 4.5 km south-east of KMG's currently operating Ridges Mine Project (Ridges). The Argyle Diamond mine is located approximately 6 km due east of MMP.

The work requested by KMG was for Golder to assist with locating a water supply for use in mining activities including camp supply, processing water supply and dust suppression. The current mining operation at Ridges has an estimated water demand of 350 kL/day (approximately 130 000 kL/annum) or around 4 L/s (Aquaterra 2009), although water requirements are reported to be met by abstraction from a water supply bore capable of pumping 3 L/s sustainably, located approximately 250 m to the east of the Sam Pit at Ridges. Water demand at MMP should be similar to usage at Ridges.

Golder has also recently undertaken a desktop surface water risk assessment (Golder 2014) as part of the current desktop study project for which this current report presents the findings of the hydrogeological component.

1.1 Scope of services

The scope of services for the hydrogeological component of the study comprised selecting groundwater target options and ranking the selected targets based on a number of factors including:

- Tenement consideration
- Likely groundwater salinity
- Aquifer storage characteristics
- Likely yields from production wells (i.e. how many wells will be required)
- Distance from site and topography (pipeline costs)
- Investigation costs (geophysics (if necessary) and drilling)
- Potential impacts on the environment or third-party groundwater users which may result in a higher degree of regulatory scrutiny.

The deliverable (this report) for this work will contain:

- The outcome of the hydrogeological desktop study (including a discussion on the identified risks and uncertainties associated with the groundwater supply options).
- The proposed groundwater targets and proposed field program; which will be suitable for submission to regulators.

1.2 Information Sources and Previous Work

The following previous work and online geological/hydrogeological databases were referenced to conduct the hydrogeological desktop study:

- Aquaterra, 2009a. Ridges Groundwater Investigation Report, Ref. 1080C/C1/016a, 30 September 2009
- Aquaterra, 2009b. Ridges Iron Ore Project – Water Supply Drilling Programme Summary Report, Job No. 1080C, Doc No. 27a, 27 November 2009
- Golder Associates, 2014. Surface water risk assessment. Golder Technical Memorandum 147646028-001-M-Rev1, dated 15 July 2014.

- Sheppard, S., Thorne, A.M. and Tyler, I.M., 1999: Geology of the Bow 1:100 000 sheet: Western Australian Geological Survey, 1:100 000 Geological Series Explanatory Notes, Sheet SE52-2, 4564
- Online Water Information Reporting (WIR) database, Department of Water
- Online Hydrogeological Atlas, Department of Water
- Rockwater, 2010. Groundwater Assessment, Ridges Project, East Kimberley (Rockwater Pty Ltd, Report No. 382.0/10/1, November 2010)

The desktop study included a search for, and review of the following:

- Available groundwater information held by KMG
- Available geological information for the MMP (including from drilling databases and models)
- Available environmental information held by KMG, to assist with the identification of groundwater dependent ecosystems in the region
- Publically available groundwater studies in the area
- Publically available geological and hydrogeological maps of the area
- Department of Water (DoW) databases
- Topographic maps and data held by KMG
- Any airborne geophysical imagery or other geophysical information of the area from public domain (Department of Mines and Petroleum)
- Tenement boundary information (supplied by KMG), and
- Heritage or cultural protected areas (information supplied by KMG).

1.3 Regulatory Framework

Under the *Rights in Water and Irrigation Act 1914,* administered by the Department of Water (DoW), it is illegal in proclaimed areas (applies to the project area), to take water from a watercourse or groundwater aquifer without a licence. The licences required from the DoW for drilling wells and utilising groundwater are:

- Licence to Construct (or alter) a Well – Section 26D
- Licence to Take Water – Section 5C.

2.0 REGIONAL SETTING

2.1 Climate

The climate of the study area is characterised by a distinct seasonal, tropical/sub-tropical monsoon climate with a dominant wet (hot and humid) summer season and dry winter months. The dry season is characterised by a generally stable climate with clear skies, easterly winds, warm daytime temperatures and occasional cold nights. The initial period leading into the wet season can experience rainfall can be more extreme, although generally localised and of short duration, as a consequence to convective rainfall events and thunderstorms. As the wet season progresses across northern Australia, isolated thunderstorm activity gives way to more dominant large scale, low pressure weather systems which are able to generate significant, and occasionally extreme, periods of rainfall. Cyclonic activity can also provide an additional risk of extreme weather, i.e. strong winds and heavy rainfall, across the Kimberly region during the summer period.

Average annual rainfall in the region ranges from 550 mm to about 700 mm. Average daily maximum temperatures range from 38° during the (hot) wet season, to about 27° in July, the coolest month. For a detailed review on the climate in the vicinity of the MMP area, refer to our recent Golder Technical Memorandum Report (147646028-001-M-Rev1, dated 15 July 2014)

2.2 Topography, Drainage and Surface Water

The topography of the MMP area is defined by a complex system of ridges and drainage channels where local surface water primarily drains into an extensive catchment basin area to the south of the MMP area, and eventually drains from two larger surface water systems (the Bow River and Smoke Creek) to Lake Argyle. For a detailed review on the drainage and surface water in the vicinity of the MMP area, refer to our recent Golder Technical Memorandum Report (147646028-001-M-Rev1, dated 15 July 2014).

2.3 Geology

The MMP site is located on the Bow 1:100 000 Geological Series map (Sheppard, S., Thorne, A.M. and Tyler, I.M., 1999), which provides the basis for this geological setting section. The site is located within Palaeoproterozoic to Phanerozoic rocks of the Halls Creek Orogen, a major north – north-easterly trending orogenic belt developed in the east Kimberley region of Western Australia. The Halls Creek Orogen initially formed in the Palaeoproterozoic, between the Kimberley Craton to the north-east and the North Australian Craton to the east.

In the vicinity of the MMP, metamorphosed sediments and volcanics, and granitic rocks of the Palaeoproterozoic Lamboo Complex outcrop to the south-west of the site. Mesoproterozoic siliciclastic rocks of the Carr Boyd Group that host the MMP, unconformably overly the Lamboo Complex and Revolver Creek Basin.

The area has undergone numerous episodes of deformation and metamorphism. Faulting and extensive quartz veining is present throughout the area (refer to Figures 2 to 4). A geological legend is also provided as Figure 2A. The general local stratigraphy at the MMP area can be summarised as:

- PROTEROZOIC
  - Mount Nyulasy Granite: massive, coarse-grained, porphyritic biotite monzogranite and syenogranite with a rapakivi-like texture; subordinate medium- to coarse-grained, even-textured monzogranite.
  - Marboo Formation: low-grade, turbiditic metasandstone and quartz-plagioclase-muscovite-biotite phyllite; quartz-muscovite-biotite (-cordierite) hornfels adjacent to granitoid intrusions,
  - Revolver Creek Formation: fine- to coarse-grained quartz sandstone, lithic quartz sandstone, feldspathic quartz sandstone, and carbonaceous siltstone and mudstone; minor conglomerate (with dolerite, basalt, and basaltic breccia; minor lithic sandstone, siltstone, and mudstone),
  - Hensman Sandstone: heavily silicified fine- to coarse-grained quartz sandstone,

- Golden Gate Siltstone: (carbonaceous,chloritic, or micaceous) siltstone and mudstone; thin- to medium-interbedded ferriginous sandstone, and quartz sandstone,
- Lissadell Formation: fine to coarse-grained quartz sandstone; subordinate micaceous siltstone and mudstone.

- CAINOZOIC
  - Colluvium and rubble – sand, gravel, conglomerate, and sedimentary breccia forming sheetwash fans and scree deposits
  - Colluvium and alluvium – partly consolidated clay, silt and sand; pebble, cobble, and boulder conglomerate

2.4 Hydrogeological Setting

The hydrogeological setting in the vicinity of the MMP is likely to be predominantly a fractured rock setting with groundwater movement and storage occurring in faults, fractures, bedding plane partings and weathered zones within:

- metamorphic and granitic rocks of the Lamboo Complex
- volcanic (mafic) and sedimentary rocks of the Revolver Creek Formation, and
- siliciclastic rocks of the Carr Boyd Group

Additionally, there is extensive colluvium and alluvium within the Bow River catchment, although thicknesses are not known and it is likely useful sources may be too far from the MMP to warrant evaluation.

3.0 FINDINGS

3.1 Existing Groundwater Boreholes

A review of Rockwater's Groundwater Assessment Report (Rockwater, 2010) shows that an existing water supply bore is located in the Ridges Iron Ore Mine area. Details of the bore ID, construction, water quality and yield etc., is not available. However, review of Aquaterra's Ridges Groundwater Investigation report (Aquaterra, 2009a and b) showed that a water supply bore (RWB01) exists at almost the same location as the water supply bore reported by Rockwater and is likely the same bore. RWB01 was reported at that time to provide temporary water supply for both camp and drilling purposes. Static water level for RWB01 was at 3.8 metres below ground level (m bgl); total drill depth was 28.0 m bgl with the sandstone member of the Golden Gate Siltstone as the primary geology. Following pump testing and sustainable supply analysis, the bore was reported capable to supply a sustainable yield of 3 L/s.

3.1.1 Department of Water Records

A search of the DoW's Water Information Reporting (WIR) database was undertaken for existing groundwater boreholes over an area of approximately 1 500 km^2 within the vicinity of the MMP. The extent of the search was chosen due to the likely limited amount of borehole data available in the study area.

The search identified 21 existing Water Information Network (WIN) groundwater boreholes, 15 are in close proximity to a diversity of heritage sites, and six boreholes are located directly within heritage sites (Figures 1 to 2). All boreholes are located in the Ord River basin (18 boreholes in the upper Ord River catchment and three boreholes in the lower Ord River catchment). Twelve of the upper catchment boreholes and all of the lower catchment boreholes are located in the Halls Creek Groundwater Province, and the remaining six upper catchment boreholes are in the Ord-Victoria Groundwater Province of the Canning-Kimberley Groundwater Area. Review of borehole data showed that these boreholes have 'limited to no' information with respect to bore construction, groundwater chemistry and aquifers encountered.

However, 14 of the 21 boreholes reported static water level (SWL) ranging between 1.8 m bgl and 167.6 m bgl, and 12 of the 21 boreholes reported yields ranging between 0.01 L/s (20082132) and 6.02 L/s (20082110). Borehole 20082110 is the only bore that recorded sufficient yield to meet the MMP water supply demand of 150 000 kL/annum (about 4.8 L/s); screened in possible fractured Proterozoic amphibolite to a depth of 96.0 m bgl; with SWL at 7.3 m bgl.

A summary of available details of the WIN boreholes are presented in Table 1. Full details of the borehole information provided by the DoW are presented in the Appendix A.

3.1.2 Aquaterra Exploration Boreholes

Aquaterra drilled some exploration boreholes (Aquaterra, 2009) along the Ridges haul road for the purpose of supplementing the existing water supply from RWB01. The borehole showed that static water levels (SWL's) were encountered in seven of the eight exploration boreholes at shallow depths. The SWL's ranged between 2.4 m bgl (REX03) and 11.0 m bgl (RMB07). Yields between the eight exploration boreholes (screened predominantly in clay bound fractured granite) ranged between <0.1 L/s and 0.2 L/s. These yields were also reported as insufficient for water supply for the Ridges project at that time.

3.1.3 Matsu Water Borehole Information

KMG undertook a search of their borehole drilling database, looking for any indications of groundwater. The search identified eight boreholes where water was reported during drilling but there is no indication of substantial amounts of water in the boreholes to warrant reopening them for testing. Three of the eight boreholes (MATC038, MATC018 and PD11) recorded SWL's ranging between 7.4 m bgl (MATC038) and 15.0 m bgl (MATC018). Review of the borehole locations and the (BOW) geological series map show that these boreholes are likely to be drilled in the Golden Gate Siltstone with total drill depths ranging between 11.6 m bgl (PD11) and 17.0 m bgl (MATC018).

Table 1: Summary of Existing WIN Groundwater Borehole Details

WIN[1] Site ID	AWRC[2] Reference	Default Site Name	Coordinates[3]		Date	Purpose	Depth (m bgl)	SWL (m bgl)	Yield (L/s)	Comments[4]
			Easting	Northing						
11386854	80919380	CHARLES BORE NO1.	413194	8134918	22/08/1994	Production	Unknown	Unknown	Unknown	From SWRIS database: [production; total depth 34.5 m of 150 mm pvc]; toc above gl = 0.4 m.
11386857	80919381	GATE BORE NO2.	413026	8134731	23/08/1994	Production	Unknown	Unknown	Unknown	Total length of casing in the bore 10.5 m (WRC history file).
20082089	80910131	FLYING FOX BORE NO 9	442992	8169491	30/06/1961	Unknown	91.44	7.32	1.26	Water struck at 29 ft. Visited by URANERZ AUST geologist 1978, 1330 MG/L, and 7.0 ph.
20082090	80910132	LISSADELL NO 10 BORE	439859	8162103	30/06/1956	Livestock	92.96	17.07	0.73	URANERZ geologist sample taken from pump 1978, 420 MG/L, ph 7.7. Smoke creek bore.
20082091	80910449	UNNAMED SPRING	434213	8171001	2/01/1900	Unknown	Unknown	Unknown	Unknown	CHEM ANAL no: 54514, vol 72, flying fox gorge?? TDS originally recorded as: 0.23 msm/cm.
20082092	80910133	LISSADELL NO 3 WELL	446093	8151843	30/06/1933	Livestock	3.35	Unknown	0.3	PWD 238/51 records 2 wells 11 ft × 5 ft & 1 ft × 6 ft in some position.
20082104	80910144	S12 STRAT ARGYLE PROJECT	434664	8155735	15/07/1980	Observation	158	21.2	2.5	(see Appendix A for more details on comments)
20082110	80910150	PB6 (P3B) ARGYLE PROJECT	438651	8155555	15/05/1980	Production	96	7.3	6.02	Supplies were intersected at a shallow depth in carbonate rock and amphibolite. (see Appendix A for more details on comments)
20082117	80910157	CAMEL YARD BORE 1	436217	8141001	30/06/1962	Unknown	18.59	Unknown	0.13	Abandoned, very little water at 30 ft, second water at 42 ft.
20082119	80910159	LISSADELL NO 2 BORE BULLOCK PADDOCK	445744	8146854	30/06/1940	Livestock	207.57	167.64	1.26	PWD STN plan says 560ft sunk before 1939.
20082120	80910160	H006-3009.85-0.15R-A	423742	8143629	4/09/1988	Unknown	60	3.2	0.4	Abandoned. Insufficient flow: 1.50 klh. Drilled: 2-4/9/88.
20082121	80910161	LISSADELL NO 3 BORE BLACKFELLOW CREEK	434666	8131417	30/06/1941	Livestock	31.39	27.43	Unknown	PWD 238/51 recs depth 150 ft. sunk before 1939.
20082125	80910165	BOW RIVER H-S BORE (NO 1)	413577	8134521	30/06/1953	Domestic/Household; Livestock	15.24	6.1	Unknown	River sand
20082126	80910166	7 MILE BORE	414240	8141802	15/06/1966	Unknown	39.62	25.91	0.48	7" bore hard seam diorite 120-130 ft. Cased off overburden. 22 ft of casing. Rest of hole is standing rock.
20082130	80910451	MCPHEES CREEK BORE (STOCK ROUTE NO 5)	414872	8174553	2/01/1900	Unknown	20.73	Unknown	Unknown	Not equipped. see card 4565-3-x-8.
20082131	80910170	H006 - 3043 6-1.0L-A	414369	8169916	6/12/1989	Unknown	60	Unknown	-	Abandoned, dry hole.
20082132	80910171	H006-3047.20-1.30 R-A	415534	8174551	10/10/1988	Unknown	28.5	12	0.01	Abandoned, seepage only. Supply: 20 L/hr.
20082134	80910172	H006-3031.63-0.015L-A	415381	8158218	8/09/1990	Unknown	90.5	7	1.25	Abandoned hole. Insufficient flow 4.5 klh. Drilled: 4-8/9/90
20082393	80910257	LISSADELL NO 4: MCKENNA SPRINGS	452607	8167067	30/06/1936	Livestock	3.66	1.83	0.88	Timbered
20082395	80910259	LISSADELL NO 1 BORE: NEW HOMESTEAD	450569	8157273	30/06/1939	Livestock	92.35	73.15	Unknown	-
20082396	80910260	DRY BORE 2 (NO 7 BORE)	455765	8151549	30/06/1961	Livestock	49.07	20.42	2.02	Water first struck at 86ft, second at 177ft (small supplies), main supply 155-160, tested from 180 for 18 hours. drawdown to 108ft.

Notes: [1]Water Information Network.
[2]Australian Water Resources Council.
[3]Zone 52 (GDA94 datum).

3.2 Groundwater Quality

There is only limited data available for groundwater quality in the vivinity of the site.

3.2.1 Department of Water Boreholes

Available groundwater quality data for five of the 21 existing boreholes in the study area are provided in Appendix A.

Limited groundwater quality data were available, and review of the data showed that only 3 samples collected in May 1980, for TDS and pH were collected in the vicinity of the MMP historically (Win ID's 20082089, 20082090, 20082110) with another more comprehensive suite of sampling occurring at the Juwalipanyi Community about 25 km to the south west; too distant to have any relevance in the current study. (Win ID's 11386854 and 11386857).

For boreholes 20082089, 20082090 and 20082110, only *in situ* total dissolved solids (TDS) was measured and the results ranged between 420 and 1330 mg/l.

Review of the DoW Hydrogeological Atlas database showed that groundwater salinity in the study area is less than 500 to 1000 mg/L, which is considered to be fresh to marginal.

3.2.2 Aquaterra Exploration Boreholes

Review of the field water quality results from seven of the eight Aquaterra exploration boreholes showed that water was fresh with EC ranging between 0.53 mS/cm (approx. TDS = 265 ppm) at REX06 and 0.83 mS/cm (approx. TDS = 415 ppm) at RMB07. pH was slightly alkaline and ranged between 8.23 (RMB05) and 8.80 (REX06). It was noted that further chemical analysis of the water quality was limited due to the low yields of the boreholes.

3.2.3 Existing Ridges Water Supply Bore

Aquaterra hydraulically tested the existing water supply bore (RWB01) at Ridges plus another drill hole located north of the current workings (RIDD020). The RWB01 sample returning indications of apparently very good water quality in terms of TDS (Total Dissolved Solid), of 48 mg/L, but iron concentrations were extremely high. The RIDD020 water sample returned a TDS of 374 mg/L which is fresh, but again the iron concentrations were excessively high.

3.3 Remote Sensing and Geophysical Data

Readily available remote sensing and geophysical was sought from the Department of Mines and Petroleum, however, only regional magnetic and gravity data plus some high resolution topographic data was identified. The data added little to our understanding of the geology of the region, with the magnetic data only identifying the Ridges and MMP orebodies, and gravity data failing to indicate any features of interest such as palaeovalley settings.

4.0 EXPLORATION TARGETS

In a region that has generally low groundwater supply potential, sixteen areas of interest have been identified (Figures 3 to 4) and Table 2.

Targets have been ranked using the following priority convention:

- High – indicating a relatively high likelihood of intercepting groundwater where a number of favourable hydrogeolological characteristics may be present (low topography, structural or lithological nature etc.) coupled with reasonable proximity to the areas where water is needed, such as the mill or near the pit. Indeed, in the absence of concrete information otherwise, a good place to drill a groundwater exploration well in in the most convenient location for the use of the water. Additionally, the target locations would also be located some distance away from existing heritage, archaeological or environmentally sensitive sites, such as groundwater dependant ecosystems.
- Moderate – indicating prospective hydrogeological characteristics but priority being lessened because of the presence of existing heritage, archaeological or environmentally sensitive sites, or distance from the point of use (pumping considerations).
- Low – indicating less favourable hydrogeological characteristics coupled with the proximity of existing heritage, archaeological or environmentally sensitive sites, or distance from the point of use (pumping considerations). Low priority targets are also more likely to require geophysics to identify collar locations on the ground.

At this stage the use of geophysical techniques is not assumed and all sites need to be ground-truthed and then reprioritised through discussions with KMG personnel. Additionally, the identified sites may warrant more than one exploration bore in their vicinity, though this is a matter for evaluation once the sites have been examined/mapped.

4.1 Preliminary High and Moderate Priority Exploration Targets

Five high and four moderate priority targets have been selected as potential exploration locations (Figures 3 to 4) and are summarised in Table 2.

All target locations and coordinates are based on a desktop study assessment and therefore may not be the exact coordinates for exploratory holes. It is recommended that a site visit be carried out to inspect the exploration targets at the MMP area to ground-truth each of the targets in order to:

- obtain firsthand appreciation of the rock hydrogeological characteristics, generally
- validate the individual target areas and potentially find other ones
- assess site access for any subsequent drilling (which is expected to be limited in some areas)
- assess requirements for further targeting effort through geophysical surveying and/or exploratory holes.

The sole use of visual inspection on site may not be sufficient to validate these targets, in which case the use of geophysical prospecting techniques may be recommended prior to confirming the exploratory hole location.

At this point, and based on the limited information available, the yield cannot be estimated and it is unclear how deep the water table will be in the fracture bedrock. Therefore Golder has assumed a generic and realistic depth of drilling of at least 150 m per borehole. Shallow groundwater may be encountered but might not have sufficient yield for the requirements of the MMP as seen from the existing Aquaterra and DoW WIN borehole data.

Table 2: Summary of Preliminary Exploration Targets (see Figures 3 to 4 for location)

Target Zone	Priority	Coordinates**		Description	Comments
		Easting	Northing		
1	High	425758	8153572	Convenient location close to the end of a large fault mapped Marboo Formation (low grade metamorphics) but terminating in the proposed haul road alignment/mill location.	Convenient location for mill supply and dust suppression on haul road
2	High	425053	8153732	Regional extensive/persistent quartz vein terminating in vicinity of proposed mill location	Convenient location for mill supply and dust suppression on haul road
3	High	427709	8153622	Structural: potential drainage slope intersected by Revolver Creek Formation mafic volcanics and a near N-S trending fault	Mapping of fault and mafics required
4	High	429076	8154235	Lithological: east of Matsu water intercepts area in Golden Gate Siltstone and possibly into Lissadell Formation.	Convenient source for pit water, avoids pumping uphill
5	High	428003	8152497	Structural: inclined mafic volcanics of the Revolver Creek Formation adjacent to a fault trending near N-S with Cainozoic colluvium and alluvium to the southern end of the fault.	Mapping of fault and mafics required. Proximity to heritage site needs evaluation
6	Moderate	426988	8155734	Structural: potential lateral displacement of Revolver Creek Formation mafics by a NE-SW trending fault intersected by a near N-S trending fault.	Mapping of faults and mafics required. Topographically high, near heritage site
7	Moderate	429234	8151677	Structural: mafics of the Revolver Creek Formation below Cainozoic colluvium and alluvium.	Mapping of mafic and alluvium required. Assess heritage site.
8	Moderate	431042	8152547	Structural and lithological: fault trending E-W showing displacement of Lissadell Formation, Hensman Sandstone and Golden Gate Siltstone.	Mapping of fault required, topographical elevated
9	Moderate to low	426083	8157694	Structural: intersecting faults in a fault bounded zone trending E-W and NE-SW at intersecting point, defining lithological boundaries between Lissadell Formation, Revolver Creek Formation and Marboo Formation.	Mapping of faults required
10	Low	423015	8156764	Structural: ENE-WSW trending and outcropping quartz vein intersected by a NE-SW trending fault, defining lithological boundaries between Lissadell Formation, Marboo Formation and Mount Nyulasy Granite.	Mapping of faults and outcrop required,
11	Low	428857	8158299	Structural: Cluster of intersecting faults trending in various directions in a potential fault zone defining lithological boundaries between Lissadell Formation and Glenhill Formation.	May not be accessible, mapping of faults required,
12	Low	420841	8156386	Structural: NE-SW trending and outcropping quartz vein laterally displaced by an intersecting an inferred fault trending NW-SE, surrounded by CAINOZOIC colluvium unit.	Mapping of fault and outcrop required
13	Low*	431117	8155075	Structural: potential shearing/lateral displacement of Lissadell Formation by an E-W trending fault.	May not be accessible, mapping of fault required
14	Low*	421784	8157825	Structural: off-set/lateral displacement of NE-SW trending and outcropping quartz vein by a NW-SE trending fault; also lateral displacement of Mount Nyulasy Granite and Castlereagh Hill Porphyry contact.	Mapping of faults and outcrop required
15	Low*	419273	8155801	Structural: two parallel dolerite dykes trending NW-SE surrounded by CAINOZOIC colluvium between NE-SW trending and regionally extensive quartz veins.	Mapping of dykes and outcrop required
16	Low*	419988	8156886	Structural: inferred fault trending NW-SE which laterally displaced NE-SW trending quartz veins, within the vicinity of Cainozoic colluvium	Accessible, mapping of fault and outcrop required

Notes: *Based on distance that might be less feasible.
**Centre coordinates (MGA, Zone 52)

5.0 RECOMMENDATIONS

It is recommended that a field verification of the targets identified in this desktop study be undertaken. The emphasis of the field verification should be towards the targets ranked higher, while lower priority target areas should also be examined in the field to gain greater insight on the hydrogeological character in the vicinity of the sites.

Structural and lithological targets require at least reconnaissance mapping in order to identify appropriate borehole locations and consideration of the requirement for geophysical surveying for accurate targeting for deep intersection of water bearing features. All prospective borehole locations should be marked, specifically surveyed using a hand held GPS unit, and pegged at the proposed borehole location.

Permission to access and explore the various proposed drilling target areas outlined above should be obtained from the traditional owners of the land, prior to any further works.

The actual nature of individual heritage sites located near exploration target areas should be clarified to allow for an assessment of the risks from groundwater abstraction in the context of each individual site.

All groundwater exploration and well construction should be appropriately licenced in accordance with regulatory requirements.

REFERENCES

Groundwater Assessment, Ridges Project, East Kimberley (Rockwater Pty Ltd, November 2010).

Ridges Groundwater Investigation Report, Ref. 1080C/C1/016a (Aquaterra, 30 September 2009).

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Report Signature Page

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400,000 410,000 420,000 430,000 440,000 450,000 460,000

8,170,000 8,160,000 8,150,000 8,140,000 8,130,000

20082130 20082132 20082131 20082091 20082089 20082393 20082090 20082104 20082110 20082395 20082092 20082396 20082119 20082120 20082126 20082117 20082125 20082121 11386854 11386857 20082134

Existing Ridges Mine Pit

Site 6 Ridges water Supply Bore Site 3 Site 4 Site 2 Site 1 Site 5

RMB07 REX08 Site 7 RMB05 REX06 REX01 REX02 REX03 REX04

Existing Ridges Mine Infrastructure

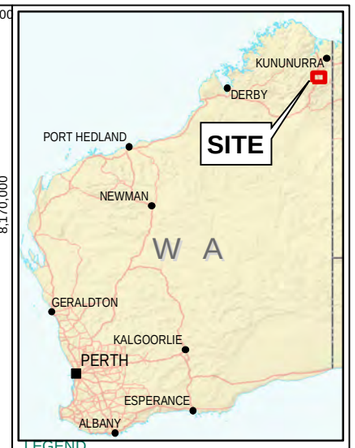
Proposed Crusher Location

PD40 MATC018 MATC029 MATC027 PD20 MATC028 MATC038 PD11

Matsu Mine Pit Prospect

1309082 1501229 1309089 1309086 1309087 1501228 1501231 1309083 1501230 1309084 1309088 1309085

Great Northern Hwy



LEGEND

- Ridges water supply bore
- Matsu drillhole water intercepts
- Aquaterra exploration drillhole
- Mineral exploration drillhole
- Rockwater target
- DoW WIN site
- Existing Ridges Matsu exploration track
- Proposed route via magazine
- Proposed haul road
- Proposed crusher location
- Existing Ridges mine infrastructure
- KMG tenement
- Live tenement
- Pending tenement
- Possible State Lease S79
- Proposed Matsu Project Pit
- Haul Road Alignment
- Matsu mineralisation
- Heritage site

NOTES

Coordinate System: GDA 1994 MGA Zone 52

0 1,750 3,500 5,250 7,000 8,750
metres

SCALE (at A3) 1:200,000

Golder Associates

CLIENT	KMG
DOCUMENT	147646028-002-R-REVA
DATE	29 Jul 2014
COMPILED	SAR
APPROVED	DRAFT

KMG Matsu Project

LOCATION PLAN

FIGURE 1

File Location: C:\Users\jberrio\Desktop\147646028\147646028-002-R-F001-RevA-Location_Plan.mxd

410,000 420,000 430,000 440,000

8,170,000 8,160,000 8,150,000

N

20082131 20082134 20082090 20082104 20082110

Existing Ridges Mine Pit

Site 6 Site 3 Site 4 Site 2 Site 1 Site 5 Site 7

Ridges water Supply Bore

RMB07 REX08 RMB05 REX06 REX01 REX02 REX04 REX03

PD40 MATC018 MATC029 MATC027 PD20 MATC028 MATC038 PD11

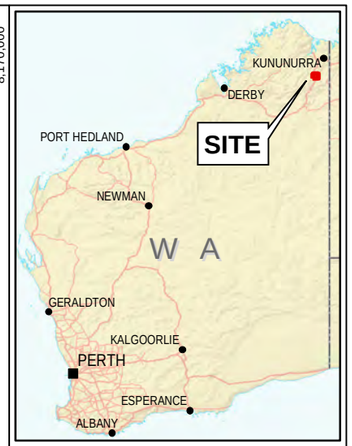
Existing Ridges Mine Infrastructure

Proposed Crusher Location

Great Northern Highway

B

KIMBERLEY MINERAL FIELD



LEGEND

- Ridges water supply bore
- Matsu water intercept
- Aquaterra exploration drillhole
- Mineral exploration drillhole
- DoW WIN site
- Existing Ridges Matsu exploration track
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- Possible_State_Lease_s79
- Proposed Matsu Project Pit
- Haul Road Alignment
- Matsu mineralisation
- Heritage site

NOTES

Coordinate System: GDA 1994 MGA Zone 52

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Mine design,Matsu water intercepts and KMG tenements supplied by KMG
Mineral exploration drillholes sourced from the Department of Mines and Petroleum
Winsites sourced from the Department of Water.
Great Northen Highway © Western Australian Land Information Authority trading as Landgate (2011)
1:100,000 Geology, Bow sheet 4564 (1997),and 1:250,0000 adjoining Geology Lissadell SE52-2 (1998), Geological Survey of Western Australia sourced from the Department of Minerals and Petroleum.

0 870 1,740 2,610 3,480 4,350
metres

SCALE (at A3) 1:98,656

Golder Associates

CLIENT	KMG
DOCUMENT	147646028-002-R-REVA
DATE	29 Jul 2014
COMPILED	SAR
APPROVED	DRAFT

KMG Matsu Project

DRAFT

GEOLOGY MAP

FIGURE 2

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Qa Alluvium—unconsolidated clay, silt, sand, and gravel in channels and floodplains
Qc Colluvium—unconsolidated rock fragments in soil; scree deposits

Czb Block soil—clay and silt
Czc Colluvium and rubble—sand, gravel, conglomerate, and sedimentary breccia forming sheetwash fans and scree deposits
Czcv Colluvium and alluvium—clay, silt, sand, and gravel as dissected, partly consolidated valley-fill deposits
Czcn Unconsolidated and partly consolidated sandplain deposits
Czs Colluvium and alluvium—partly consolidated clay, silt, sand, and gravel adjacent to drainage
Czsa Alluvium and colluvium—dissected sheets of partly consolidated silt and sand; pebble, cobble, and boulder conglomerate

q Quartz veins, of various ages; youngest generation postdates Devonian

DCg GALLOPING CREEK FORMATION: fine- to very coarse-grained feldspathic sandstone, and pebble to boulder conglomerate

DG Undivided, fine- to coarse-grained sandstone, pebbly sandstone, and pebble conglomerate

DGn NELSON SHALE: purple siltstone and mudstone; minor sandstone (section only)

DGh HEADLEYS LIMESTONE: grey, massive to laminated limestone; minor chert and stromatolites locally

Ca ANTRIM PLATEAU VOLCANICS: massive or amygdaloidal, locally porphyritic basalt, and basaltic breccia

Cas Medium-grained quartz sandstone

d Dolerite dyke
ge Fine- to medium-grained, even-textured biotite granitoid dyke
p Pegmatite dykes and sheets

PEo MOUNT FORSTER SANDSTONE: fine- to medium-grained quartz sandstone; minor pebbly sandstone and conglomerate

PEo RANFORD FORMATION: thin-bedded siltstone and thin- to thick-bedded quartz sandstone, dolomitic quartz sandstone, and dolomite

PEm MOONLIGHT VALLEY TILLITE: massive, matrix-supported, polymictic pebble to boulder conglomerate, and poorly sorted, massive sandstone; larger clasts in conglomerate are polished and striated locally

Ph HELICOPTER SILTSTONE: green and grey, micaceous siltstone, fine- to medium-grained quartz sandstone, and mudstone

Pt AHERN FORMATION: fine- to coarse-grained quartz sandstone, pebbly sandstone, conglomerate, and siltstone

PlB Bow Hill lamprophyre dykes: olivine-phlogopite lamprophyre; garnet-phlogopite lamprophyre

Argyle lamproite pipe: volcaniclastic olivine lamproite intruded by olivine-phlogopite lamproite dykes

PCg GLENHILL FORMATION: micaceous siltstone, fine- to coarse-grained quartz sandstone, and mudstone

PCgs Fine- to coarse-grained quartz sandstone

PCl LISSADELL FORMATION: fine- to coarse-grained quartz sandstone; subordinate micaceous siltstone and mudstone

PCls Siltstone and mudstone; thin- to thick-bedded quartz sandstone

PCd GOLDEN GATE SILTSTONE: siltstone and mudstone; either carbonaceous, chloritic, or micaceous; thin- to medium-bedded ferruginous sandstone, and quartz sandstone

PCh HENSMAN SANDSTONE: fine- to coarse-grained quartz sandstone; heavily silicified

PCh HART DOLERITE: dark grey dolerite

Pr REVOLVER CREEK FORMATION: fine- to coarse-grained quartz sandstone, lithic quartz sandstone, feldspathic quartz sandstone, and carbonaceous siltstone and mudstone; minor conglomerate

Prb Dolerite, basalt, and basaltic breccia; minor lithic sandstone, siltstone, and mudstone

Px TEXAS DOWNS FORMATION: fine- to coarse-grained lithic quartz sandstone, pebbly sandstone, conglomerate, siltstone, mudstone, basalt, and basaltic breccia

Pxs Mudstone and siltstone; thin- to thick-bedded quartz sandstone

PEw LANSDOWNE ARKOSE: thin- to thick-bedded feldspathic quartz sandstone; minor micaceous siltstone and mudstone

PEv VALENTINE SILTSTONE: siltstone and mudstone; commonly micaceous or chloritic; minor thin-bedded feldspathic quartz sandstone and rhyolitic volcaniclastic sandstone

PEt TUNGANARY FORMATION: quartz sandstone, feldspathic quartz sandstone, and subordinate siltstone and mudstone

PEO O'DONNELL FORMATION: fine- to coarse-grained quartz sandstone and lithic quartz sandstone, pebbly sandstone, chloritic siltstone and mudstone, and granule to pebble conglomerate

Ea Undivided layered mafic-ultramafic intrusions; includes olivine norite, gabbronorite, and minor anorthosite

EgSg Undivided granitoid rock
EgSmd **MABEL DOWNS TONALITE:** medium- to fine-grained, foliated, hornblende-biotite tonalite; extensively recrystallized; abundant flattened inclusions of mafic rock
EgSms **MAGOTTY SPRINGS MONZOGRANITE:** medium- to coarse-grained, porphyritic biotite monzogranite; medium-grained, even-textured hornblende-biotite granodiorite
EgSvv **VIOLET VALLEY TONALITE:** fine- to medium-grained, weakly porphyritic biotite granodiorite and biotite-hornblende tonalite; weakly to moderately foliated
EgSvm Medium-grained, weakly porphyritic biotite granodiorite and biotite-hornblende tonalite; weakly to moderately foliated
EgSwy **WESLEY YARD MONZOGRANITE:** massive, medium- to coarse-grained, porphyritic biotite monzogranite; minor granodiorite
EgSp Medium- to coarse-grained, porphyritic monzogranite and syenogranite
EgSob Biotite-bearing norite, gabbronorite, and minor gabbro
EgSog Biotite-bearing norite, gabbronorite, and minor gabbro with veins of intermediate hybrid rock; mafic and intermediate hybrid rock cut by abundant veins of coarse-grained porphyritic tonalite and granodiorite

EgPg Undivided granitoid rock
EgPby **BEEFWOOD YARD GRANITE:** medium- and coarse-grained, porphyritic biotite monzogranite
EgPcc **CROOKED CREEK GRANITE:** medium-grained, plagioclase-phyric, biotite granodiorite and monzogranite
EgPdc **DINNER CREEK TONALITE:** fine- to medium-grained, massive or weakly foliated hypersthene-biotite-amphibole tonalite; abundant inclusions of fine-grained biotite-amphibole tonalite; commonly extensively recrystallized
EgPgg **GORDONS GORGE GRANITE:** massive, coarse-grained, porphyritic biotite(-hornblende) monzogranite and syenogranite with a rapakivi-like texture
EgPmn **MOUNT NYULASY GRANITE:** massive, coarse-grained, porphyritic biotite monzogranite and syenogranite with a rapakivi-like texture; subordinate medium- to coarse-grained, even-textured monzogranite
EgPe Medium-grained, even-textured biotite monzogranite
EgPob Biotite gabbro

Epg **GREENVALE PORPHYRY:** massive, dark grey quartz-feldspar micromonzogranite porphyry; medium to coarse phenocrysts of quartz, K-feldspar, and plagioclase
Epc **CASTLEREAGH HILL PORPHYRY:** dark grey, massive, fine-grained feldspar microgranodiorite porphyry; medium phenocrysts of plagioclase, commonly strongly recrystallized

Pw WHITEWATER VOLCANICS: thick-bedded, massive, fine- to medium-grained quartz-feldspar rhyolite to dacite porphyry and welded ignimbrite; minor agglomerate, lapilli tuff, and volcaniclastic sedimentary rocks

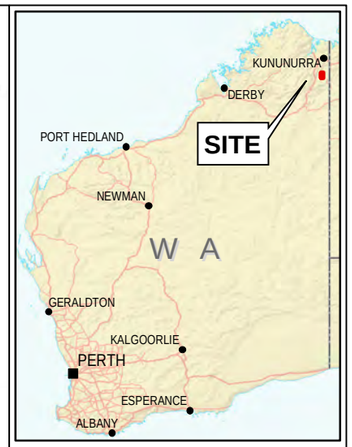
Pm **MARBOO FORMATION:** low-grade, turbiditic metasandstone and quartz-plagioclase-muscovite-biotite phyllite; quartz-muscovite-biotite(-cordierite) hornfels adjacent to granitoid intrusions
Pmh Quartz-K-feldspar-plagioclase-muscovite-biotite-cordierite-andalusite hornfels and hornfelsic schollen (raft) migmatite

PmTt Quartz-K-feldspar-plagioclase-biotite-cordierite-andalusite(-muscovite) hornfels and hornfelsic schollen (raft) migmatite

EmTgd **DOUGALLS TONALITE:** foliated and metamorphosed hypersthene-hornblende-biotite tonalite; abundant pyroxene amphibolite inclusions, and inclusions of country rock
EmTgk **CORKWOOD TONALITE:** foliated and metamorphosed biotite-(hornblende) tonalite and granodiorite; locally garnet-bearing

EmTa Amphibolite; relict gabbroic textures
EmTpn Clinopyroxene-orthopyroxene-plagioclase-quartz(-hornblende-biotite) mafic granulite; local relict gabbroic textures

EmTa Amphibolite; interlayered with pelite and psammite, banded iron-formation, calc-silicate rock, and marble
EmTpc Calc-silicate rock and marble; minor banded iron-formation, quartzite, and amphibolite
EmTpn Biotite-plagioclase-quartz(-K-feldspar-sillimanite-garnet-cordierite-spinel) migmatitic pelitic gneiss; numerous layers, pods, and angular to rounded schollen (rafts) of mafic granulite, psammitic gneiss, and calc-silicate rock; intruded by discontinuous syn- to post-metamorphic mafic to intermediate dykes



DRAFT

NOTES
Coordinate System: GDA 1994 MGA Zone 52

COPYRIGHT
Legend sourced from Bow sheet 4564, Geological Survey of Western Australia (1997), sourced from the Department of Minerals and Petroleum.

Golder Associates

CLIENT	KMG
DOCUMENT	147646028-002-R-REVA
DATE	15 Jul 2014
COMPILED	SAR
APPROVED	DRAFT

KMG Matsu Project

GEOLOGY LEGEND

FIGURE 2A

File Location: G:\Spatial_Information_Group\GIS_WORKSPACE_AUSTRALIA\01_WA\SE5202_LISSADELL\147646028\Projects\002-R\RevA\147646028-002-R-F002A-RevA-GeologyLegend.mxd

420,000

430,000

8,160,000

N

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Site 6

Ridges water Supply Bore

Site 4

Site 3

Site 2

Site 1

Site 5

RMB07

REX08

RMB05

Site 7

REX03

REX06

REX04

REX02

REX01

14

9

11

16

10

12

15

6

13

Great Northern Hwy

MATC028

PD40

MATC029

4

MATC018

MATC027

PD20

2

1

3

MATC038

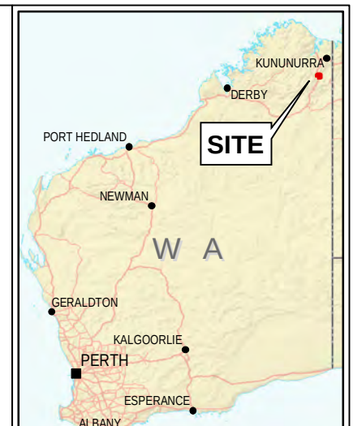
PD11

Proposed Crusher Location

5

8

7



LEGEND

- Ridges water supply bore
- Rockwater target
- Matsu water intercept
- Aquaterra exploration drillhole
- Existing Ridges Matsu exploration track
- Proposed route via magazine
- Proposed haul road
- Proposed crusher location
- Existing Ridges mine infrastructure
- KMG tenement
- Live tenement
- Pending tenement
- Possible_State_Lease_s79
- Proposed Matsu Project Pit
- Haul Road Alignment
- Matsu mineralisation
- Heritage site
- Proposed exploration target

NOTES

Coordinate System: GDA 1994 MGA Zone 52

COPYRIGHT

Mine design,Matsu water intercepts and KMG tenements supplied by KMG
Mineral exploration drillholes sourced from the Department of Mines and Petroleum
Winsites sourced from the Department of Water.
Great Northen Highway © Western Australian Land Information Authority trading as Landgate (2011)

0 440 880 1,320 1,760 2,200
metres

SCALE (at A3) 1:50,000

Golder Associates

CLIENT	KMG
DOCUMENT	147646028-002-R-REVA
DATE	29 Jul 2014
COMPILED	SAR
APPROVED	DRAFT

KMG Matsu Project

PROPOSED EXPLORATION TARGETS

FIGURE 3

File Location: C:\Users\jberrio\Desktop\147646028\147646028-002-R-F003-RevA-Exploration_Targets.mxd

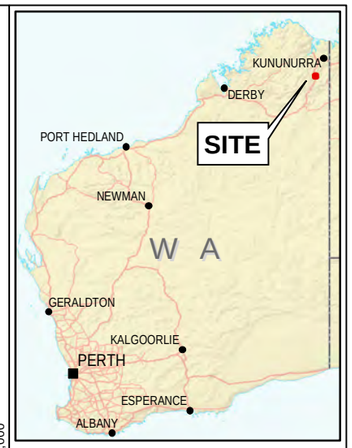
420,000 430,000

8,160,000

N

DRAFT

Site 6
Ridges Water Supply Bore
Site 4
Site 3
Site 2
Site 1
Site 5
RMB07
REX08
RMB05
Site 7
REX03
REX06
REX04
REX02
REX01
Great Northern Hwy
Proposed Crusher Location
MATC028
PD40
MATC029
MATC018
MATC027
PD20
MATC038
PD11



LEGEND

- Ridges water supply bore
- Rockwater target
- Matsu water intercept
- Aquaterra exploration drillhole
- Existing Ridges Matsu exploration track
- Proposed route via magazine
- Proposed haul road
- Proposed crusher location
- Existing Ridges mine infrastructure
- KMG tenement
- Live tenement
- Pending tenement
- Possible_State_Lease_s79
- Proposed Matsu Project Pit
- Haul Road Alignment
- Matsu mineralisation
- Heritage site
- Proposed exploration target

NOTES
Coordinate System: GDA 1994 MGA Zone 52

COPYRIGHT
Mine design,Matsu water intercepts and KMG tenements supplied by KMG
Mineral exploration drillholes sourced from the Department of Mines and Petroleum
Winsites sourced from the Department of Water.
Great Northen Highway © Western Australian Land Information Authority trading as Landgate (2011)
1:100,000 Geology, Bow sheet 4564 (1997), Geological Survey of Western Australia sourced from the Department of Minerals and Petroleum.

0 400 800 1,200 1,600 2,000
metres

SCALE (at A3) 1:45,685

Golder Associates

CLIENT	KMG
DOCUMENT	147646028-002-R-REVA
DATE	29 Jul 2014
COMPILED	SAR
APPROVED	DRAFT

KMG Matsu Project

PROPOSED EXPLORATION TARGETS WITH GEOLOGY

FIGURE 4

File Location: C:\Users\jberrio\Desktop\147646028\147646028-002-R-F004-RevA-Exploration_Targets_Geol.mxd

APPENDIX A

WIN Sites Search

Government of Western Australia
Department of Water

Date: 20/06/2014

Advanced Site Data Availability Summary

Site ID	Default Site Ref	Project Name	Site Category Name	Data Category	Variable Type	First Measurement	Last Measurement	No of Readings
11386854	80919380	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Inorganic metals	23/08/1994	23/08/1994	10
11386854	80919380	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Physical	23/08/1994	23/08/1994	16
11386854	80919380	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Nutrients	23/08/1994	23/08/1994	2
11386854	80919380	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Organics	23/08/1994	23/08/1994	2
11386854	80919380	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Inorganic non-metals	23/08/1994	23/08/1994	22
11386854	80919380	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	(none)	23/08/1994	23/08/1994	4
11386857	80919381	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Inorganic metals	23/08/1994	23/08/1994	10
11386857	80919381	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Physical	23/08/1994	23/08/1994	16
11386857	80919381	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Nutrients	23/08/1994	23/08/1994	2
11386857	80919381	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Organics	23/08/1994	23/08/1994	2
11386857	80919381	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	Inorganic non-metals	23/08/1994	23/08/1994	22
11386857	80919381	Historical Data from the SWRIS Database	Groundwater	Water quality indicators - discrete	(none)	23/08/1994	23/08/1994	4
20082089	80910131	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1961	30/06/1961	3
20082089	80910131	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1961	30/06/1978	2
20082090	80910132	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1956	30/06/1956	3
20082090	80910132	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1956	30/06/1978	2

Government of Western Australia
Department of Water

Date: 20/06/2014

Advanced Site Data Availability Summary

Site ID	Default Site Ref	Project Name	Site Category Name	Data Category	Variable Type	First Measurement	Last Measurement	No of Readings
20082091	80910449	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	01/01/1900	01/01/1900	1
20082092	80910133	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1933	30/06/1933	1
20082104	80910144	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	15/07/1980	15/07/1980	3
20082104	80910144	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	15/07/1980	15/07/1980	1
20082110	80910150	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	15/05/1980	15/05/1980	3
20082110	80910150	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	15/05/1980	25/05/1980	2
20082117	80910157	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1962	30/06/1962	1
20082119	80910159	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1940	30/06/1940	3
20082119	80910159	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1940	30/06/1940	1
20082120	80910160	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	04/09/1988	04/09/1988	3
20082120	80910160	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	04/09/1988	04/09/1988	1
20082121	80910161	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1941	30/06/1941	3
20082121	80910161	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1941	30/06/1941	1
20082125	80910165	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1953	30/06/1953	3
20082125	80910165	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1953	30/06/1953	1
20082126	80910166	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	15/06/1966	15/06/1966	3

Government of Western Australia
Department of Water

Date: 20/06/2014

Advanced Site Data Availability Summary

Site ID	Default Site Ref	Project Name	Site Category Name	Data Category	Variable Type	First Measurement	Last Measurement	No of Readings
20082126	80910166	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	15/06/1966	15/06/1966	2
20082130	80910451	Misc Data from GW Investigations for AQWABase	Groundwater	Water quality indicators - discrete	Physical	01/01/1900	01/01/1900	1
20082131	80910170	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	06/12/1989	06/12/1989	1
20082132	80910171	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	10/10/1988	10/10/1988	3
20082132	80910171	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	10/10/1988	10/10/1988	1
20082134	80910172	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	08/09/1990	08/09/1990	3
20082134	80910172	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	08/09/1990	08/09/1990	1
20082393	80910257	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1936	30/06/1936	3
20082393	80910257	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1936	30/06/1936	1
20082395	80910259	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1939	30/06/1939	3
20082396	80910260	<1996 AQWABase Data Capture	Groundwater	Water levels - discrete	Water Level (discrete)	30/06/1961	30/06/1961	3
20082396	80910260	<1996 AQWABase Data Capture	Groundwater	Water quality indicators - discrete	Physical	30/06/1961	30/06/1961	1

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80919380 - JUWULIPANYI COMMUNITY - CHARLES BORE NO1. **WIN Site ID: 11386854**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80919380	JUWULIPANYI COMMUNITY	CHARLES BORE NO1.

General Details *(Site reference: 80919380 WIN Site ID: 11386854)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8134918	**Easting**	413194	**Zone**	52
Latitude	-16.867552920	**Longitude**	128.185082650	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	From SWRIS database:: [PRODUCTION ; TOTAL DEPTH 34.5M of 150MM PVC]; TOC above GL = 0.4m				

Fixed Infrastructure Status *(Site reference: 80919380 WIN Site ID: 11386854)*

Start Date	End Date	Status	Comments
23/08/1994	24/08/1994	Operational	G2#REG READ G/W#G1#LEV+QUAL G/W#PRODUCTION TOTAL DEPTH 34.5M 150MM PVC
24/08/1994		Unknown	

Stakeholders *(Site reference: 80919380, WIN Site ID 11386854)*

Start Date	End Date	Role	Stakeholder
23/08/1994		Establishing authority	Water Authority Hydrology Branch
23/08/1994		Operating authority	Water Corporation
23/08/1994		Owning authority	Aboriginal And Torres Strait Island Commission

Depth Reference Points (*Site reference: 80919380 WIN Site ID: 11386854)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
(none)	~ 0 (mNA)	(none)	23/08/1994 (Unknown)	Depth Reference Point added to cater for historical samples with Depth Reference Point of ()
Top of casing	100 (mSLE)	(none)	22/08/1994 (Unknown)	Depth recorded as 34.5 m, WRC History file

Construction Events - No Data Available

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80919380 WIN Site ID: 11386854)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80919380	WA-S-SWRISHIST	Historical Data from the SWRIS Database	23/08/1994	23/08/1994	56

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80919380	Water quality indicators - discrete	23/08/1994	23/08/1994	56

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80919380	(none)	23/08/1994	23/08/1994	4
80919380	Inorganic metals	23/08/1994	23/08/1994	10
80919380	Inorganic non-metals	23/08/1994	23/08/1994	22
80919380	Nutrients	23/08/1994	23/08/1994	2
80919380	Organics	23/08/1994	23/08/1994	2
80919380	Physical	23/08/1994	23/08/1994	16

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80919381 - JUWULIPANYI COMMUNITY - GATE BORE NO2. **WIN Site ID: 11386857**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80919381	JUWULIPANYI COMMUNITY	GATE BORE NO2.

General Details *(Site reference: 80919381 WIN Site ID: 11386857)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8134731	**Easting**	413026	**Zone**	52
Latitude	-16.869236900	**Longitude**	128.183498310	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	Total length of casing in the Bore 10.5m (WRC History file)				

Fixed Infrastructure Status *(Site reference: 80919381 WIN Site ID: 11386857)*

Start Date	End Date	Status	Comments
23/08/1994	24/08/1994	Operational	G2#REG READ G/W#G1#LEV+QUAL G/W#PRODUCTION THIS IS A WELL
24/08/1994		Unknown	

Stakeholders *(Site reference: 80919381, WIN Site ID 11386857)*

Start Date	End Date	Role	Stakeholder
23/08/1994		Establishing authority	Water Authority Hydrology Branch
23/08/1994		Operating authority	Water Corporation
23/08/1994		Owning authority	Aboriginal And Torres Strait Island Commission

Depth Reference Points (*Site reference: 80919381 WIN Site ID: 11386857)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
(none)	~ 0 (mNA)	(none)	23/08/1994 (Unknown)	Depth Reference Point added to cater for historical samples with Depth Reference Point of ()

Construction Events - No Data Available

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80919381 WIN Site ID: 11386857)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80919381	WA-S-SWRISHIST	Historical Data from the SWRIS Database	23/08/1994	23/08/1994	56

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80919381	Water quality indicators - discrete	23/08/1994	23/08/1994	56

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80919381	(none)	23/08/1994	23/08/1994	4
80919381	Inorganic metals	23/08/1994	23/08/1994	10
80919381	Inorganic non-metals	23/08/1994	23/08/1994	22
80919381	Nutrients	23/08/1994	23/08/1994	2
80919381	Organics	23/08/1994	23/08/1994	2
80919381	Physical	23/08/1994	23/08/1994	16

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910131 - 809 - ORD RIVER BASIN - FLYING FOX BORE NO 9 **WIN Site ID: 20082089**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910131	809 - ORD RIVER BASIN	FLYING FOX BORE NO 9
AQWAB	4564-1-NE-0001	809 - ORD RIVER BASIN	FLYING FOX BORE NO 9

General Details *(Site reference: 80910131 WIN Site ID: 20082089)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8169491	**Easting**	442992	**Zone**	52
Latitude	-16.555955534	**Longitude**	128.465681420	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	WATER STRUCK AT 29FT. VISITED BY URANERZ AUST GEOLOGIST 1978, 1330 MG/L, 7.0PH.				

Fixed Infrastructure Status *(Site reference: 80910131 WIN Site ID: 20082089)*

Start Date	End Date	Status	Comments
30/06/1961		Unknown	

Stakeholders *(Site reference: 80910131, WIN Site ID 20082089)*

Start Date	End Date	Role	Stakeholder
30/06/1961	01/07/1961	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910131 WIN Site ID: 20082089)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1961 (Unknown)	

Construction (*Site reference: 80910131 WIN Site ID: 20082089)*

Events

Completed Date	1961 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Gorey & Cole			**Total Drilled Depth (m)**	91.440
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910131 WIN Site ID: 20082089)*

Logged By	Authority Not Known	**Log Date**	1961 (Known year)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	3.350	VOLCANIC SMALL BOULDERS
3.350	4.570	BROWN CLAY
4.570	6.400	DECOMPOSED GRANITE
6.400	7.010	BROWN CLAY
7.010	9.750	RED BROWN SANDSTONE WITH PYRITES
9.750	14.940	BLUE GREY SANDSTONE WITH PYRITES
14.940	90.220	RED BROWN & BLU-GREY SANDSTONE INTERBEDDED CONTAINING PYRITES & OCCASIONAL LAYERS OF BROWN & BLUE CLAY.
90.220	91.440	DECOMPOSED GRANITE QUARTZ DOMINANT FAIRLY HARD.

Log Event - Summary *(Site reference: 80910131 WIN Site: 20082089)*

Logged By	Authority Not Known	**Log Date**	1961 (Known year)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	7.010	Cainozoic	boulders	granite	clay
7.010	90.220	Ragged Range Conglomerate Member	sandstone	pyrite	clay
90.220	91.440	Possible Weathered Proterozoic	quartz	granite	

Advanced Data Summary (*Site reference: 80910131 WIN Site ID: 20082089)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910131	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1961	30/06/1978	5

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910131	Water levels - discrete	30/06/1961	30/06/1961	3
80910131	Water quality indicators - discrete	30/06/1961	30/06/1978	2

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910131	Physical	30/06/1961	30/06/1978	2
80910131	Water Level (discrete)	30/06/1961	30/06/1961	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910132 - 809 - ORD RIVER BASIN - LISSADELL NO 10 BORE **WIN Site ID: 20082090**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910132	809 - ORD RIVER BASIN	LISSADELL NO 10 BORE
AQWAB	4564-1-NE-0002	809 - ORD RIVER BASIN	LISSADELL NO 10 BORE

General Details *(Site reference: 80910132 WIN Site ID: 20082090)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8162103	**Easting**	439859	**Zone**	52
Latitude	-16.622661529	**Longitude**	128.436122755	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	URANERZ GEOLOGIST SAMPLE TAKEN FROM PUMP 1978, 420 MG/L, PH 7.7. SMOKE CREEK BORE .				

Fixed Infrastructure Status *(Site reference: 80910132 WIN Site ID: 20082090)*

Start Date	End Date	Status	Comments
30/06/1956		Unknown	

Stakeholders *(Site reference: 80910132, WIN Site ID 20082090)*

Start Date	End Date	Role	Stakeholder
30/06/1956	01/07/1956	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910132 WIN Site ID: 20082090)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1956 (Unknown)	

Construction (*Site reference: 80910132 WIN Site ID: 20082090)*

Events

Completed Date	1956 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	92.960
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910132 WIN Site ID: 20082090)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910132	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1956	30/06/1978	5

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910132	Water levels - discrete	30/06/1956	30/06/1956	3
80910132	Water quality indicators - discrete	30/06/1956	30/06/1978	2

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910132	Physical	30/06/1956	30/06/1978	2
80910132	Water Level (discrete)	30/06/1956	30/06/1956	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910449 - 809 - ORD RIVER BASIN - UNNAMED SPRING **WIN Site ID: 20082091**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910449	809 - ORD RIVER BASIN	UNNAMED SPRING
AQWAB	4564-1-NE-0028	809 - ORD RIVER BASIN	UNNAMED SPRING

General Details *(Site reference: 80910449 WIN Site ID: 20082091)*

Site Type	Ground	**Sub Type**	Unknown	**Site Geofeature**	Ground
Northing	8171001	**Easting**	434213	**Zone**	52
Latitude	-16.542078663	**Longitude**	128.383435392	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	CHEM ANAL NO: 54514, VOL 72, FLYING FOX GORGE?? TDS ORIGINALLY RECORDED AS: 0.23 MSM/CM.				

Fixed Infrastructure Status *(Site reference: 80910449 WIN Site ID: 20082091)*

Start Date	End Date	Status	Comments
28/08/1981		Unknown	

Stakeholders *(Site reference: 80910449, WIN Site ID 20082091)*

Start Date	End Date	Role	Stakeholder
01/01/1900		Data source	Private Owner

Depth Reference Points (*Site reference: 80910449 WIN Site ID: 20082091)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	01/01/1900 (Unknown)	

Construction Events - No Data Available

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910449 WIN Site ID: 20082091)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910449	<1996AQWADATA	<1996 AQWABase Data Capture	1/01/1900	1/01/1900	1

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910449	Water quality indicators - discrete	1/01/1900	1/01/1900	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910449	Physical	1/01/1900	1/01/1900	1

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910133 - 809 - ORD RIVER BASIN - LISSADELL NO 3 WELL **WIN Site ID: 20082092**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910133	809 - ORD RIVER BASIN	LISSADELL NO 3 WELL
AQWAB	4564-1-SE-0003	809 - ORD RIVER BASIN	LISSADELL NO 3 WELL

General Details *(Site reference: 80910133 WIN Site ID: 20082092)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8151843	**Easting**	446093	**Zone**	52
Latitude	-16.715557229	**Longitude**	128.494326893	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Ord-Victoria
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	PWD 238/51 RECORDS 2 WELLS 11FT X 5FT & 1FT X 6FT IN SOME POSITION.				

Fixed Infrastructure Status *(Site reference: 80910133 WIN Site ID: 20082092)*

Start Date	End Date	Status	Comments
30/06/1933	01/07/1933	Operational	
01/07/1933		Unknown	

Stakeholders *(Site reference: 80910133, WIN Site ID 20082092)*

Start Date	End Date	Role	Stakeholder
30/06/1933	01/07/1933	Owning authority	Lissadell Pastoral Co

Depth Reference Points (*Site reference: 80910133 WIN Site ID: 20082092)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1933 (Unknown)	

Construction (*Site reference: 80910133 WIN Site ID: 20082092)*

Events

Completed Date	1933 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	3.350
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910133 WIN Site ID: 20082092)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910133	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1933	30/06/1933	1

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910133	Water quality indicators - discrete	30/06/1933	30/06/1933	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910133	Physical	30/06/1933	30/06/1933	1

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910144 - 809 - ORD RIVER BASIN - S12 STRAT ARGYLE PROJECT **WIN Site ID: 20082104**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910144	809 - ORD RIVER BASIN	S12 STRAT ARGYLE PROJECT
AQWAB	4564-1-SE-0015	809 - ORD RIVER BASIN	S12 STRAT ARGYLE PROJECT

General Details *(Site reference: 80910144 WIN Site ID: 20082104)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8155735	**Easting**	434664	**Zone**	52
Latitude	-16.680085850	**Longitude**	128.387233263	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	Unknown
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	Geophysical log supplied. SWL ORIGINALLY RECORDED AS: 21.2M B/C. AIRLIFT SUPPLY OF 217 M3/D WAS FORM THE QUARTZITE WITH THE RATE GRADUALLY INCREASING THROUGH THE 38M SECTION. THE GR LOG INDICATED A CLEANER QUARTZITE ZONE 122-128M, THIS ZONE YIELDING 1/2 THE TOTAL SUPPLY.				

Fixed Infrastructure Status *(Site reference: 80910144 WIN Site ID: 20082104)*

Start Date	End Date	Status	Comments
15/07/1980		Unknown	

Stakeholders *(Site reference: 80910144, WIN Site ID 20082104)*

Start Date	End Date	Role	Stakeholder
15/07/1980	16/07/1980	Owning authority	CRA Exploration
30/06/1983		Data entry operator	Private Owner
15/07/1980		Data source	Rockwater Pty Ltd

Depth Reference Points (*Site reference: 80910144 WIN Site ID: 20082104)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	15/07/1980 (Unknown)	

Construction (*Site reference: 80910144 WIN Site ID: 20082104)*

Events

Completed Date	15/07/1980 (Known day)	**Pump Test Occured**		**Pumping Details**	AIRLIFT
Driller	Whitsed Drilling Resources Pty Ltd			**Total Drilled Depth (m)**	158.000
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							+0.35M - 5.85M X 225M; 5.85M - 158.0M X 220MM

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910144 WIN Site ID: 20082104)*

Logged By	Authority Not Known	**Log Date**	15/07/1980 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	120.000	BASALT, DARK BLUE, FINE GRAINED. WEATHERED 0-27M. MINOR QUARTZ 27-39M, 63-78M.
120.000	126.000	BASALT & QUARTZITE, BASALT AS ABOVE. QUARTZITE, GREY BROWN, FINE GRAINED.
126.000	141.000	QUARTZITE, GREY BROWN, FINE GRAINED.
141.000	153.000	QUARTZITE, BROWN, FINE GRAINED, CLAYEY
153.000	158.000	QUARTZITE & SHALE BANDS. QUARTZITE AS ABOVE. SHALE, BROWN TO GREEN, FISSILE.

Log Event - Summary *(Site reference: 80910144 WIN Site: 20082104)*

Logged By	Authority Not Known	**Log Date**	15/07/1980 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	158.000	Antrum Plateau Volcanics	basalt	quartzite	

Advanced Data Summary (*Site reference: 80910144 WIN Site ID: 20082104)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910144	<1996AQWADATA	<1996 AQWABase Data Capture	15/07/1980	15/07/1980	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910144	Water levels - discrete	15/07/1980	15/07/1980	3
80910144	Water quality indicators - discrete	15/07/1980	15/07/1980	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910144	Physical	15/07/1980	15/07/1980	1
80910144	Water Level (discrete)	15/07/1980	15/07/1980	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910150 - 809 - ORD RIVER BASIN - PB6 (P3B) ARGYLE PROJECT **WIN Site ID: 20082110**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910150	809 - ORD RIVER BASIN	PB6 (P3B) ARGYLE PROJECT
AQWAB	4564-1-SE-0021	809 - ORD RIVER BASIN	PB6 (P3B) ARGYLE PROJECT

General Details *(Site reference: 80910150 WIN Site ID: 20082110)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8155555	**Easting**	438651	**Zone**	52
Latitude	-16.681820298	**Longitude**	128.424620064	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	Unknown
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	Geophysical log supplied. SWL ORIGINALLY RECORDED AS: 7.3M B/C. DRILLED INTO AN OUTCROP OF CACAREOUS SIMILAR TO P1. SUPPLIES WERE INTERSECTED AT A SHALLOW DEPTH IN CARBONATE ROCK AND AMPHIBOLITE. PUMPED 96 HOURS AT 520 M3/D FINAL DRAWDOWN 3.01M. D/D OBS BORE 1.175M. CHEM ANAL: BORE=PB6, SUMMATION TDS: 773.2, PH 7.4, DATE: 21/5/80; BORE=PB6, SUMMATION TDS: 798.1, PH 7.1, DATE: 25/5/80				

Fixed Infrastructure Status *(Site reference: 80910150 WIN Site ID: 20082110)*

Start Date	End Date	Status	Comments
15/05/1980		Unknown	

Stakeholders *(Site reference: 80910150, WIN Site ID 20082110)*

Start Date	End Date	Role	Stakeholder
15/05/1980	16/05/1980	Owning authority	CRA Exploration
30/06/1983		Data entry operator	Private Owner
15/05/1980		Data source	Rockwater Pty Ltd

Depth Reference Points (*Site reference: 80910150 WIN Site ID: 20082110)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	15/05/1980 (Unknown)	

Construction (*Site reference: 80910150 WIN Site ID: 20082110)*

Events

Completed Date	15/05/1980 (Known day)	**Pump Test Occured**	Yes	**Pumping Details**	PUMPED
Driller	Rural Drilling Company			**Total Drilled Depth (m)**	96.000
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							0-5.0M X 254MM STEEL; 0-9.0M X 201MM FRP; 0-33.0M X 152MM PVC
5.000	31.000	Inlet - Slotted	Unknown							

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910150 WIN Site ID: 20082110)*

Logged By	Authority Not Known	**Log Date**	15/05/1980 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	6.000	AMPHIBOLITE, GREY BLACK, VERY FINE GRAINED.
6.000	21.000	AMPHIBOLITE AND CALC-SILICATE INTERBEDDED. AMPHIBOLITE BLACK, VERY FINE GRAINED, SCHISTOSE. CALC-SILICATE, WHITE, AMORPHOUS
21.000	96.000	AMPHIBOLITE, BLACK, VERY FINE TO MEDIUM GRAINED SCHISTOSE. AMPHIBOLE-QUARTZ-CHLORIDE-GARNET-MUSCOVITE-SULPHIDE.

Log Event - Summary *(Site reference: 80910150 WIN Site: 20082110)*

Logged By	Authority Not Known	**Log Date**	15/05/1980 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	96.000	Proterozoic	amphibolite		

Advanced Data Summary (*Site reference: 80910150 WIN Site ID: 20082110)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910150	<1996AQWADATA	<1996 AQWABase Data Capture	15/05/1980	25/05/1980	5

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910150	Water levels - discrete	15/05/1980	15/05/1980	3
80910150	Water quality indicators - discrete	15/05/1980	25/05/1980	2

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910150	Physical	15/05/1980	25/05/1980	2
80910150	Water Level (discrete)	15/05/1980	15/05/1980	3

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910157 - 809 - ORD RIVER BASIN - CAMEL YARD BORE 1 **WIN Site ID: 20082117**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910157	809 - ORD RIVER BASIN	CAMEL YARD BORE 1
AQWAB	4564-2-NE-0001	809 - ORD RIVER BASIN	CAMEL YARD BORE 1

General Details *(Site reference: 80910157 WIN Site ID: 20082117)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8141001	**Easting**	436217	**Zone**	52
Latitude	-16.813312789	**Longitude**	128.401381289	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Ord-Victoria
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	ABANDONED, VERY LITTLE WATER AT 30FT, SECOND WATER AT 42FT.				

Fixed Infrastructure Status *(Site reference: 80910157 WIN Site ID: 20082117)*

Start Date	End Date	Status	Comments
30/06/1962		Unknown	

Stakeholders *(Site reference: 80910157, WIN Site ID 20082117)*

Start Date	End Date	Role	Stakeholder
30/06/1962	01/07/1962	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910157 WIN Site ID: 20082117)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1962 (Unknown)	

Construction (*Site reference: 80910157 WIN Site ID: 20082117)*

Events

Completed Date	1962 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Gorey & Cole			**Total Drilled Depth (m)**	18.590
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910157 WIN Site ID: 20082117)*

Logged By	Authority Not Known	**Log Date**	1962 (Known year)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	1.220	BLACK SOIL
1.220	3.960	DECOMPOSED GRANITE WITH RED LOAM
3.960	8.530	DECOMPOSED GRANITE & QUARTZ
8.530	16.150	DECOMPOSED GRANITE, QUARTZ DOMINANT
16.150	17.370	LAYER OF BROWNISH COARSE GRANITE
17.370	18.590	BLUE GRANITE

Log Event - Summary *(Site reference: 80910157 WIN Site: 20082117)*

Logged By	Authority Not Known	**Log Date**	1962 (Known year)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	1.220	Quaternary	soil		
1.220	18.590	Proterozoic	granite	quartz	weathered

Advanced Data Summary (*Site reference: 80910157 WIN Site ID: 20082117)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910157	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1962	30/06/1962	1

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910157	Water quality indicators - discrete	30/06/1962	30/06/1962	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910157	Physical	30/06/1962	30/06/1962	1

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910159 - 809 - ORD RIVER BASIN - LISSADELL NO 2 BORE BULLOCK PADDOCK **WIN Site ID: 20082119**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910159	809 - ORD RIVER BASIN	LISSADELL NO 2 BORE BULLOCK PADDOCK
AQWAB	4564-2-NE-0006	809 - ORD RIVER BASIN	LISSADELL NO 2 BORE BULLOCK PADDOCK

General Details *(Site reference: 80910159 WIN Site ID: 20082119)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8146854	**Easting**	445744	**Zone**	52
Latitude	-16.760646607	**Longitude**	128.490933176	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Ord-Victoria
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	PWD STN PLAN SAYS 560FT SUNK BEFORE 1939				

Fixed Infrastructure Status *(Site reference: 80910159 WIN Site ID: 20082119)*

Start Date	End Date	Status	Comments
30/06/1940		Unknown	

Stakeholders *(Site reference: 80910159, WIN Site ID 20082119)*

Start Date	End Date	Role	Stakeholder
30/06/1940	01/07/1940	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910159 WIN Site ID: 20082119)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1940 (Unknown)	

Construction (*Site reference: 80910159 WIN Site ID: 20082119)*

Events

Completed Date	1940 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	207.570
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							5"

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910159 WIN Site ID: 20082119)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910159	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1940	30/06/1940	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910159	Water levels - discrete	30/06/1940	30/06/1940	3
80910159	Water quality indicators - discrete	30/06/1940	30/06/1940	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910159	Physical	30/06/1940	30/06/1940	1
80910159	Water Level (discrete)	30/06/1940	30/06/1940	3

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910160 - 809 - ORD RIVER BASIN - H006-3009.85-0.15R-A **WIN Site ID: 20082120**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910160	809 - ORD RIVER BASIN	H006-3009.85-0.15R-A
AQWAB	4564-2-NW-0007	809 - ORD RIVER BASIN	H006-3009.85-0.15R-A

General Details *(Site reference: 80910160 WIN Site ID: 20082120)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8143629	**Easting**	423742	**Zone**	52
Latitude	-16.789184205	**Longitude**	128.284395220	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	ABANDONED. INSUFFICIENT FLOW: 1.50 KLH. DRILLED: 2-4/9/88.				

Fixed Infrastructure Status *(Site reference: 80910160 WIN Site ID: 20082120)*

Start Date	End Date	Status	Comments
04/09/1988		Unknown	

Stakeholders *(Site reference: 80910160, WIN Site ID 20082120)*

Start Date	End Date	Role	Stakeholder
04/09/1988	05/09/1988	Owning authority	Department Of Main Roads
02/04/1990		Data entry operator	Private Owner
04/09/1988		Data source	Department Of Main Roads

Depth Reference Points (*Site reference: 80910160 WIN Site ID: 20082120)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	04/09/1988 (Unknown)	

Construction (*Site reference: 80910160 WIN Site ID: 20082120)*

Events

Completed Date	04/09/1988 (Known day)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	60.000
Depth Reference Point	Ground level			**Drill Method**	Rotary drill
Construction Method	GEMCO				
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							COLLAR: 195 PVC

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910160 WIN Site ID: 20082120)*

Logged By	Authority Not Known	**Log Date**	04/09/1988 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	2.000	SAND
2.000	32.000	GRANITE, SOME FRACTURES & WEATHERING
32.000	60.000	GRANITE FRESH

Log Event - Summary *(Site reference: 80910160 WIN Site: 20082120)*

Logged By	Authority Not Known	**Log Date**	04/09/1988 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	2.000	Cainozoic	sand		
2.000	60.000	Proterozoic	granite	fractured	weathered

Advanced Data Summary (*Site reference: 80910160 WIN Site ID: 20082120)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910160	<1996AQWADATA	<1996 AQWABase Data Capture	4/09/1988	4/09/1988	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910160	Water levels - discrete	4/09/1988	4/09/1988	3
80910160	Water quality indicators - discrete	4/09/1988	4/09/1988	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910160	Physical	4/09/1988	4/09/1988	1
80910160	Water Level (discrete)	4/09/1988	4/09/1988	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910161 - 809 - ORD RIVER BASIN - LISSADELL NO 3 BORE BLACKFELLOW CREEK **WIN Site ID: 20082121**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910161	809 - ORD RIVER BASIN	LISSADELL NO 3 BORE BLACKFELLOW CREEK
AQWAB	4564-2-SE-0003	809 - ORD RIVER BASIN	LISSADELL NO 3 BORE BLACKFELLOW CREEK

General Details *(Site reference: 80910161 WIN Site ID: 20082121)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8131417	**Easting**	434666	**Zone**	52
Latitude	-16.899900801	**Longitude**	128.386546061	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Ord-Victoria
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	PWD 238/51 RECS DEPTH 150FT. SUNK BEFORE 1939				

Fixed Infrastructure Status *(Site reference: 80910161 WIN Site ID: 20082121)*

Start Date	End Date	Status	Comments
30/06/1941	01/07/1941	Operational	
01/07/1941		Unknown	

Stakeholders *(Site reference: 80910161, WIN Site ID 20082121)*

Start Date	End Date	Role	Stakeholder
30/06/1941	01/07/1941	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910161 WIN Site ID: 20082121)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1941 (Unknown)	

Construction (*Site reference: 80910161 WIN Site ID: 20082121)*

Events

Completed Date	1941 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	31.390
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							6"

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910161 WIN Site ID: 20082121)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910161	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1941	30/06/1941	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910161	Water levels - discrete	30/06/1941	30/06/1941	3
80910161	Water quality indicators - discrete	30/06/1941	30/06/1941	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910161	Physical	30/06/1941	30/06/1941	1
80910161	Water Level (discrete)	30/06/1941	30/06/1941	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910165 - 809 - ORD RIVER BASIN - BOW RIVER H-S BORE (NO 1) **WIN Site ID: 20082125**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910165	809 - ORD RIVER BASIN	BOW RIVER H-S BORE (NO 1)
AQWAB	4564-3-NE-0002	809 - ORD RIVER BASIN	BOW RIVER H-S BORE (NO 1)

General Details *(Site reference: 80910165 WIN Site ID: 20082125)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8134521	**Easting**	413577	**Zone**	52
Latitude	-16.871155553	**Longitude**	128.188662627	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	RIVER SAND				

Fixed Infrastructure Status *(Site reference: 80910165 WIN Site ID: 20082125)*

Start Date	End Date	Status	Comments
30/06/1953		Unknown	

Stakeholders *(Site reference: 80910165, WIN Site ID 20082125)*

Start Date	End Date	Role	Stakeholder
30/06/1953	01/07/1953	Owning authority	Private Owner
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910165 WIN Site ID: 20082125)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1953 (Unknown)	

Construction (*Site reference: 80910165 WIN Site ID: 20082125)*

Events

Completed Date	1953 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	15.240
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910165 WIN Site ID: 20082125)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910165	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1953	30/06/1953	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910165	Water levels - discrete	30/06/1953	30/06/1953	3
80910165	Water quality indicators - discrete	30/06/1953	30/06/1953	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910165	Physical	30/06/1953	30/06/1953	1
80910165	Water Level (discrete)	30/06/1953	30/06/1953	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910166 - 809 - ORD RIVER BASIN - 7 MILE BORE **WIN Site ID: 20082126**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910166	809 - ORD RIVER BASIN	7 MILE BORE
AQWAB	4564-3-NE-0006	809 - ORD RIVER BASIN	7 MILE BORE

General Details *(Site reference: 80910166 WIN Site ID: 20082126)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8141802	**Easting**	414240	**Zone**	52
Latitude	-16.805368809	**Longitude**	128.195164748	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	7" BORE. YIELD AT 85FT 100 GPH INCREASED TO 800GPH AT 100FT. HARD SEAM DIORITE 120FT - 130FT. CASED OFF OVERBURDEN. 22FT OF CASING. REST OF HOLE STANDING ROCK.				

Fixed Infrastructure Status *(Site reference: 80910166 WIN Site ID: 20082126)*

Start Date	End Date	Status	Comments
15/06/1966	16/06/1966	Operational	
16/06/1966		Unknown	

Stakeholders *(Site reference: 80910166, WIN Site ID 20082126)*

Start Date	End Date	Role	Stakeholder
15/06/1966	16/06/1966	Owning authority	Private Owner

Depth Reference Points (*Site reference: 80910166 WIN Site ID: 20082126)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	15/06/1966 (Unknown)	

Construction (*Site reference: 80910166 WIN Site ID: 20082126)*

Events

Completed Date	15/06/1966 (Known day)	**Pump Test Occured**		**Pumping Details**	
Driller	Drillwell			**Total Drilled Depth (m)**	39.620
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							0-22' X 6'

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910166 WIN Site ID: 20082126)*

Logged By	Authority Not Known	**Log Date**	15/06/1966 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	6.100	CLAY & GRANITE RUBBLE
6.100	39.620	GRANITE & DIORITE SEAMS

Log Event - Summary *(Site reference: 80910166 WIN Site: 20082126)*

Logged By	Authority Not Known	**Log Date**	15/06/1966 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	6.100	Possible Cz	clay	rubble	granite
6.100	39.620	Proterozoic	granite		

Advanced Data Summary (*Site reference: 80910166 WIN Site ID: 20082126)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910166	<1996AQWADATA	<1996 AQWABase Data Capture	15/06/1966	15/06/1966	5

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910166	Water levels - discrete	15/06/1966	15/06/1966	3
80910166	Water quality indicators - discrete	15/06/1966	15/06/1966	2

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910166	Physical	15/06/1966	15/06/1966	2
80910166	Water Level (discrete)	15/06/1966	15/06/1966	3

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Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910451 - 809 - ORD RIVER BASIN - MCPHEES CREEK BORE (STOCK ROUTE NO 5) **WIN Site ID: 20082130**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910451	809 - ORD RIVER BASIN	MCPHEES CREEK BORE (STOCK ROUTE NO 5)
AQWAB	4564-4-NE-0001	809 - ORD RIVER BASIN	MCPHEES CREEK BORE (STOCK ROUTE NO 5)

General Details *(Site reference: 80910451 WIN Site ID: 20082130)*

Site Type	Ground	**Sub Type**	Unknown	**Site Geofeature**	Ground
Northing	8174553	**Easting**	414872	**Zone**	52
Latitude	-16.509357510	**Longitude**	128.202322109	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Lower	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Dunham River		
Site Comment	NOT EQUIPPED. SEE CARD 4565-3-X-8				

Fixed Infrastructure Status *(Site reference: 80910451 WIN Site ID: 20082130)*

Start Date	End Date	Status	Comments
04/12/2000		Unknown	

Stakeholders *(Site reference: 80910451, WIN Site ID 20082130)*

Start Date	End Date	Role	Stakeholder
01/01/1900	02/01/1900	Owning authority	WA Government
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910451 WIN Site ID: 20082130)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	01/01/1900 (Unknown)	

Construction (*Site reference: 80910451 WIN Site ID: 20082130)*

Events

Completed Date	01/01/1900 (Unknown)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	20.730
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910451 WIN Site ID: 20082130)*

Logged By	Authority Not Known	**Log Date**	01/01/1900 (Unknown)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	3.050	CLAY
3.050	6.100	GRAVELLY CLAY
6.100	11.280	GRAVELLY CLAY WITH SEAMS HARD ROCK
11.280	16.460	GRAVELLY CLAY WITH SEAMS HARD ROCK APPROX 200 GH WATER
16.460	20.730	HARD ROCK, NO WATER

Log Event - Summary *(Site reference: 80910451 WIN Site: 20082130)*

Logged By	Authority Not Known	**Log Date**	01/01/1900 (Unknown)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	16.460	Possible Cz	clay	gravel	rock
16.460	20.730	Proterozoic	rock		

Site Details Report

Date: 20/06/2014

Advanced Data Summary (*Site reference: 80910451 WIN Site ID: 20082130)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910451	WA-G-UNKNOWN	Misc Data from GW Investigations for AQWABase	1/01/1900	1/01/1900	1

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910451	Water quality indicators - discrete	1/01/1900	1/01/1900	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910451	Physical	1/01/1900	1/01/1900	1

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910170 - 809 - ORD RIVER BASIN - H006 - 3043 6-1.0L-A **WIN Site ID: 20082131**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910170	809 - ORD RIVER BASIN	H006 - 3043 6-1.0L-A
AQWAB	4564-4-NE-0003	809 - ORD RIVER BASIN	H006 - 3043 6-1.0L-A

General Details *(Site reference: 80910170 WIN Site ID: 20082131)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8169916	**Easting**	414369	**Zone**	52
Latitude	-16.551253494	**Longitude**	128.197435943	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Lower	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Dunham River		
Site Comment	ABANDONED, DRY HOLE.				

Fixed Infrastructure Status *(Site reference: 80910170 WIN Site ID: 20082131)*

Start Date	End Date	Status	Comments
06/12/1989		Unknown	

Stakeholders *(Site reference: 80910170, WIN Site ID 20082131)*

Start Date	End Date	Role	Stakeholder
06/12/1989	07/12/1989	Owning authority	Department Of Main Roads
02/04/1990		Data entry operator	Private Owner
06/12/1989		Data source	Department Of Main Roads

Depth Reference Points (*Site reference: 80910170 WIN Site ID: 20082131)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	06/12/1989 (Unknown)	

Construction (*Site reference: 80910170 WIN Site ID: 20082131)*

Events

Completed Date	06/12/1989 (Known day)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	60.000
Depth Reference Point	Ground level			**Drill Method**	Rotary drill
Construction Method	GEMCO				
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							COLLAR 195MM PVC

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910170 WIN Site ID: 20082131)*

Logged By	Authority Not Known	**Log Date**	06/12/1989 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	1.500	SAND & LOOSE ROCKS
1.500	12.000	CALCRETE & GRANITE, WEATHERED
12.000	14.000	GRANITE, WEATHERED
14.000	32.000	GRANITE, SLIGHTLY WEATHERED
32.000	42.000	GRANITE, FRACTURED
42.000	60.000	GRANITE, FRESH

Log Event - Summary *(Site reference: 80910170 WIN Site: 20082131)*

Logged By	Authority Not Known	**Log Date**	06/12/1989 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	1.500	Possible Cz	sand	rock	
1.500	32.000	Weathered Proterozoic	granite	weathered	calcrete
32.000	60.000	Proterozoic	granite	fractured	

Advanced Data Summary (*Site reference: 80910170 WIN Site ID: 20082131)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910170	<1996AQWADATA	<1996 AQWABase Data Capture	6/12/1989	6/12/1989	1

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910170	Water quality indicators - discrete	6/12/1989	6/12/1989	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910170	Physical	6/12/1989	6/12/1989	1

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910171 - 809 - ORD RIVER BASIN - H006-3047.20-1.30 R-A **WIN Site ID: 20082132**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910171	809 - ORD RIVER BASIN	H006-3047.20-1.30 R-A
AQWAB	4564-4-NE-0004	809 - ORD RIVER BASIN	H006-3047.20-1.30 R-A

General Details *(Site reference: 80910171 WIN Site ID: 20082132)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8174551	**Easting**	415534	**Zone**	52
Latitude	-16.509399205	**Longitude**	128.208524814	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Lower	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Dunham River		
Site Comment	ABANDONED - SEEPAGE ONLY. SUPPLY: 20 LITRES/HOUR.				

Fixed Infrastructure Status *(Site reference: 80910171 WIN Site ID: 20082132)*

Start Date	End Date	Status	Comments
10/10/1988		Unknown	

Stakeholders *(Site reference: 80910171, WIN Site ID 20082132)*

Start Date	End Date	Role	Stakeholder
10/10/1988	11/10/1988	Owning authority	Department Of Main Roads
02/04/1990		Data entry operator	Private Owner
10/10/1988		Data source	Department Of Main Roads

Depth Reference Points (*Site reference: 80910171 WIN Site ID: 20082132)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	10/10/1988 (Unknown)	

Construction (*Site reference: 80910171 WIN Site ID: 20082132)*

Events

Completed Date	10/10/1988 (Known day)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	28.500
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							COLLAR: 195MM PVC

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910171 WIN Site ID: 20082132)*

Logged By	Authority Not Known	**Log Date**	10/10/1988 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	6.500	CLAY
6.500	13.000	STONEY CLAY
13.000	28.500	GRANITE, FRESH

Log Event - Summary *(Site reference: 80910171 WIN Site: 20082132)*

Logged By	Authority Not Known	**Log Date**	10/10/1988 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	12/09/1997 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	13.000	Possible Cz	clay	stones	
13.000	28.500	Proterozoic	granite		

Advanced Data Summary (*Site reference: 80910171 WIN Site ID: 20082132)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910171	<1996AQWADATA	<1996 AQWABase Data Capture	10/10/1988	10/10/1988	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910171	Water levels - discrete	10/10/1988	10/10/1988	3
80910171	Water quality indicators - discrete	10/10/1988	10/10/1988	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910171	Physical	10/10/1988	10/10/1988	1
80910171	Water Level (discrete)	10/10/1988	10/10/1988	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910172 - 809 - ORD RIVER BASIN - H006-3031.63-0.015L-A **WIN Site ID: 20082134**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910172	809 - ORD RIVER BASIN	H006-3031.63-0.015L-A
AQWAB	4564-4-SE-0005	809 - ORD RIVER BASIN	H006-3031.63-0.015L-A

General Details *(Site reference: 80910172 WIN Site ID: 20082134)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8158218	**Easting**	415381	**Zone**	52
Latitude	-16.657028036	**Longitude**	128.206486171	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	DURACK	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	ABANDONED HOLE. INSUFFICIENT FLOW 4.5 KLH. DRILLED: 4-8/9/90				

Fixed Infrastructure Status *(Site reference: 80910172 WIN Site ID: 20082134)*

Start Date	End Date	Status	Comments
08/09/1990		Unknown	

Stakeholders *(Site reference: 80910172, WIN Site ID 20082134)*

Start Date	End Date	Role	Stakeholder
08/09/1990	09/09/1990	Owning authority	Department Of Main Roads
03/04/1990		Data entry operator	Private Owner
08/09/1990		Data source	Department Of Main Roads

Depth Reference Points (*Site reference: 80910172 WIN Site ID: 20082134)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	08/09/1990 (Unknown)	

Construction (*Site reference: 80910172 WIN Site ID: 20082134)*

Events

Completed Date	08/09/1990 (Known day)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	90.500
Depth Reference Point	Ground level			**Drill Method**	Rotary drill
Construction Method	GEMCO				
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							COLLAR 195 PVC

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910172 WIN Site ID: 20082134)*

Logged By	Authority Not Known	**Log Date**	08/09/1990 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	2.500	SAND
2.500	60.000	GRANITE, SOME FRACTURES & WEATHERING
60.000	90.500	GRANITE, FRESH

Log Event - Summary *(Site reference: 80910172 WIN Site: 20082134)*

Logged By	Authority Not Known	**Log Date**	08/09/1990 (Known day)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	03/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	2.500	Possible Quaternary	sand		
2.500	90.500	Proterozoic	granite	fractured	weathered

Site Details Report

Date: 20/06/2014

Advanced Data Summary (*Site reference: 80910172 WIN Site ID: 20082134)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910172	<1996AQWADATA	<1996 AQWABase Data Capture	8/09/1990	8/09/1990	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910172	Water levels - discrete	8/09/1990	8/09/1990	3
80910172	Water quality indicators - discrete	8/09/1990	8/09/1990	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910172	Physical	8/09/1990	8/09/1990	1
80910172	Water Level (discrete)	8/09/1990	8/09/1990	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910257 - 809 - ORD RIVER BASIN - LISSADELL NO 4: MCKENNA SPRINGS **WIN Site ID: 20082393**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910257	809 - ORD RIVER BASIN	LISSADELL NO 4: MCKENNA SPRINGS
AQWAB	4664-4-NW-0004	809 - ORD RIVER BASIN	LISSADELL NO 4: MCKENNA SPRINGS

General Details *(Site reference: 80910257 WIN Site ID: 20082393)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8167067	**Easting**	452607	**Zone**	52
Latitude	-16.578079400	**Longitude**	128.555748019	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Halls Creek
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	TIMBERED				

Fixed Infrastructure Status *(Site reference: 80910257 WIN Site ID: 20082393)*

Start Date	End Date	Status	Comments
30/06/1936	01/07/1936	Operational	
01/07/1936		Unknown	

Stakeholders *(Site reference: 80910257, WIN Site ID 20082393)*

Start Date	End Date	Role	Stakeholder
30/06/1936	01/07/1936	Owning authority	Lissadell Pastoral Co

Depth Reference Points (*Site reference: 80910257 WIN Site ID: 20082393)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1936 (Unknown)	

Construction (*Site reference: 80910257 WIN Site ID: 20082393)*

Events

Completed Date	1936 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	3.660
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910257 WIN Site ID: 20082393)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910257	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1936	30/06/1936	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910257	Water levels - discrete	30/06/1936	30/06/1936	3
80910257	Water quality indicators - discrete	30/06/1936	30/06/1936	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910257	Physical	30/06/1936	30/06/1936	1
80910257	Water Level (discrete)	30/06/1936	30/06/1936	3

Site reference (AWRC): 80910259 - 809 - ORD RIVER BASIN - LISSADELL NO 1 BORE: NEW HOMESTEAD **WIN Site ID: 20082395**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910259	809 - ORD RIVER BASIN	LISSADELL NO 1 BORE: NEW HOMESTEAD
AQWAB	4664-4-SW-0006	809 - ORD RIVER BASIN	LISSADELL NO 1 BORE: NEW HOMESTEAD

General Details *(Site reference: 80910259 WIN Site ID: 20082395)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8157273	**Easting**	450569	**Zone**	52
Latitude	-16.666571263	**Longitude**	128.536431702	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Ord-Victoria
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment					

Fixed Infrastructure Status *(Site reference: 80910259 WIN Site ID: 20082395)*

Start Date	End Date	Status	Comments
30/06/1939	01/07/1939	Operational	
01/07/1939		Unknown	

Stakeholders *(Site reference: 80910259, WIN Site ID 20082395)*

Start Date	End Date	Role	Stakeholder
30/06/1939	01/07/1939	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910259 WIN Site ID: 20082395)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1939 (Unknown)	

Construction (*Site reference: 80910259 WIN Site ID: 20082395)*

Events

Completed Date	1939 (Known year)	**Pump Test Occured**		**Pumping Details**	
Driller	Authority Not Known			**Total Drilled Depth (m)**	92.350
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments

Aquifers - No Data Available

Log Event Lithology - No Data Available

Log Event Summary - No Data Available

Advanced Data Summary (*Site reference: 80910259 WIN Site ID: 20082395)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910259	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1939	30/06/1939	3

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910259	Water levels - discrete	30/06/1939	30/06/1939	3

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910259	Water Level (discrete)	30/06/1939	30/06/1939	3

Government of Western Australia
Department of Water

Site Details Report

Date: 20/06/2014

Site reference (AWRC): 80910260 - 809 - ORD RIVER BASIN - DRY BORE 2 (NO 7 BORE) **WIN Site ID: 20082396**

Alternative Site References

Numbering System	Reference Code	Context Name	Name
AWRC	80910260	809 - ORD RIVER BASIN	DRY BORE 2 (NO 7 BORE)
AQWAB	4664-4-SW-0007	809 - ORD RIVER BASIN	DRY BORE 2 (NO 7 BORE)

General Details *(Site reference: 80910260 WIN Site ID: 20082396)*

Site Type	Ground	**Sub Type**	Bore or Well	**Site Geofeature**	Ground
Northing	8151549	**Easting**	455765	**Zone**	52
Latitude	-16.718416969	**Longitude**	128.585047585	**Spheroid**	GDA94
Thou250 Map Index	SE5202	**Assessment Method**	GDA94 Conversion (Accuracy of 0.05 - 0.9m)	**Geographic Precision(+/- m)**	+/-500m
Local Govt Authority	SHIRE OF WYNDHAM-EAST KIMBERLEY	**Locality**	LAKE ARGYLE	**DOW Region**	Kimberley
Catchment	Ord River_Upper	**Estuary**		**BOM Rainfall District**	East Kimberley
Groundwater Area	Canning-Kimberley	**Groundwater Subarea**	Canning-Kimberley	**Groundwater Province**	Ord-Victoria
Surface Water Area	Ord River and Tributaries	**Surface Water SubArea**	Upper Ord		
Site Comment	WATER FIRST STRUCK AT 86FT, SECOND AT 177FT (SMALL SUPPLIES), MAIN SUPPLY 155-160, TESTED FROM 180 FOR 18 HOURS. DRAWDOWN TO 108FT.				

Fixed Infrastructure Status *(Site reference: 80910260 WIN Site ID: 20082396)*

Start Date	End Date	Status	Comments
30/06/1961		Unknown	

Stakeholders *(Site reference: 80910260, WIN Site ID 20082396)*

Start Date	End Date	Role	Stakeholder
30/06/1961	01/07/1961	Owning authority	Lissadell Pastoral Co
01/01/1900		Data entry operator	Private Owner

Depth Reference Points (*Site reference: 80910260 WIN Site ID: 20082396)*

Depth Reference Point	Elevation (m as per Datum Plane)	Measurement Method	Date	Comments
Ground level	0 (mNA)	(none)	30/06/1961 (Unknown)	

Construction (*Site reference: 80910260 WIN Site ID: 20082396)*

Events

Completed Date	1961 (Known year)	**Pump Test Occured**	Yes	**Pumping Details**	PUMPED
Driller	Gorey & Cole			**Total Drilled Depth (m)**	49.070
Depth Reference Point	Ground level			**Drill Method**	(none)
Construction Method					
Developed By					
Drill Comments					

Elements

From (m)	To (m)	Element	Material	Grain Size	Fill Vol	Min Dia. (mm)	Max Dia. (mm)	Aperture (mm)	Thickness (mm)	Comments
		Unknown	Unknown							TO 147FT X 6" PERFORATED: 19FT X 6"

Aquifers - No Data Available

Log Event - Lithology *(Site reference: 80910260 WIN Site ID: 20082396)*

Logged By	Authority Not Known	**Log Date**	1961 (Known year)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type				
Comments					

From (m)	To (m)	Lithological Description
0.000	1.830	SANDY TOP SOIL
1.830	13.110	RED LOAM
13.110	14.330	GREY LIMESTONE
14.330	20.730	YELOW SANDSTONE WITH LIME
20.730	24.080	GREY LIMESTONE
24.080	35.660	BROWN LIMESTONE
35.660	36.880	GREY BROWN LIMESTONE
36.880	46.330	BROWN LIMESTONE WITH YELLOW ROCK
46.330	46.940	RED BROWN CLAY
46.940	48.770	GREY LIMESTONE WITH RED OCHRE STONE & QUARTZ
48.770	49.070	GREY BROWN FLINT

Log Event - Summary *(Site reference: 80910260 WIN Site: 20082396)*

Logged By	Authority Not Known	**Log Date**	1961 (Known year)	**Reference Point**	Ground level
Interpreted By	Non geologist - Unknown Org Type	**Interpreted Date**	04/04/1995 (Known day)		
Comments					

From (m)	To (m)	Stratigraphy	Lithology1	Lithology2	Lithology3
0.000	13.110	Cainozoic	loam	soil	sandy
13.110	49.070	Cambrian	limestone	sandstone	clay

Advanced Data Summary (*Site reference: 80910260 WIN Site ID: 20082396)*

Readings by Project

Default Site Reference	Project Code	Project Name	First Measurement	Last Measurement	No of Measurements
80910260	<1996AQWADATA	<1996 AQWABase Data Capture	30/06/1961	30/06/1961	4

Readings by Data Category

Default Site Reference	Data Category	First Measurement	Last Measurement	No of Measurements
80910260	Water levels - discrete	30/06/1961	30/06/1961	3
80910260	Water quality indicators - discrete	30/06/1961	30/06/1961	1

Readings By Variable Type

Default Site Reference	Variable Type	First Measurement	Last Measurement	No of Measurements
80910260	Physical	30/06/1961	30/06/1961	1
80910260	Water Level (discrete)	30/06/1961	30/06/1961	3

APPENDIX B

Limitations

LIMITATIONS

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