Mount Porter Hydrogeological Recommendations.

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1. Hydrogeological Setting

1.1 Regional Setting

Mt Porter prospect is located within the Palaeoproterozoic succession of the highly mineralised Pine Creek Inlier and includes the following units which have previously been described in Goulevitch, 2004:

- Wildman Siltstone which is comprised of medium and thin bedded to laminated pyritic carbonaceous sediments with minor sandstone beds and tuffs
- Koolpin Formation which is a variable thickness (100 – 500m) unit comprised of sulphidic carbonates siltstone and mudstones along with occurrences of ferrugenised cherts, carbonates and phyllitic mudstones;
- Burrell Creek Formation which is predominately formed of greywackes, siltstones and mudstones.
- Mount Bonnie Formation is a transitional unit which contains interbedded units of both Koolpin and Burrell Creek.
- Gerowie Tuff is thick tuff, tuffaceous chert, and siltstone containing lesser Koolpin facies sediments.
- Zamu dolerite occurs as semi-conformable sills which intrude the Koolpin formation and Gerowie tuff.

These sediments, volcanics and dolerite sills have been moderately to tightly folded and metamorphosed to lower greenschist grade. These folded metasediment and metadolerites have subsequently been intruded by late Palaeoproterozoic granite batholiths and plutons.

1.2 Geology of Mt Porter Prospect

The dominate rock unit within the Mount Porter project are the metasediments of the Koolpin Formation of the South Alligator Group. These metasediments are characterised by pyrrohotitic and pyritic carbonaceous shale and siltstones. Whilst the Koolpin formation at the site has not been fully defined due to the structural complexity of the unit, it has been divided into three units (lower, middle and upper) at the site.

1) The lower part of this formation (unit KI) is comprised of interbedded dolomitic marble, chloritic cherty (nodular) iron formation and biotite-cordierite-garnet metasiltstone/hornsfels.

2) Overlying this unit commencing at the top of the upper dolomitic marble is the mineralised middle Koolpin formation (unit I). This unit is comprised of sulphidic laminated chloritic/carbonaceous "shale" with chert nodules which are ubiquitous throughout.
3) This unit finishes in the massive sulphidic carbonaceous mudstones of the upper most unit (unit C).

Intersecting the Koolpin formation at the site are three semi-conformable dolerite sills (metadolerites/amphibolites) of the Kamu dolerite. One of these sills (DL) intersects the lower unit (unit KI) with two sills (Du and Dm) subdividing the upper units.

A schematic of the basic stratigraphic order within the proposed mine site as determined by exploration drilling are presented in the following table.

- **Table 1 Schematic of geology of the Mt Porter area.**

Drilling Sub Unit	Geological Unit
C3	Upper Koolpin
DU	Upper Dolerite sill
C2	Upper Koolpin
Dm	Upper Dolerite Sill
C1	Upper Koolpin
I	Middle Koolpin
Klu	Lower Koolpin
Dl	Lower Dolerite Sill
Kll	Lower Koolpin

Intruding the mineralised sequence are thin fine grained felsic and/or mafic dykes. These have been suggested to post date most the structural development (Goulevitch, 2004).

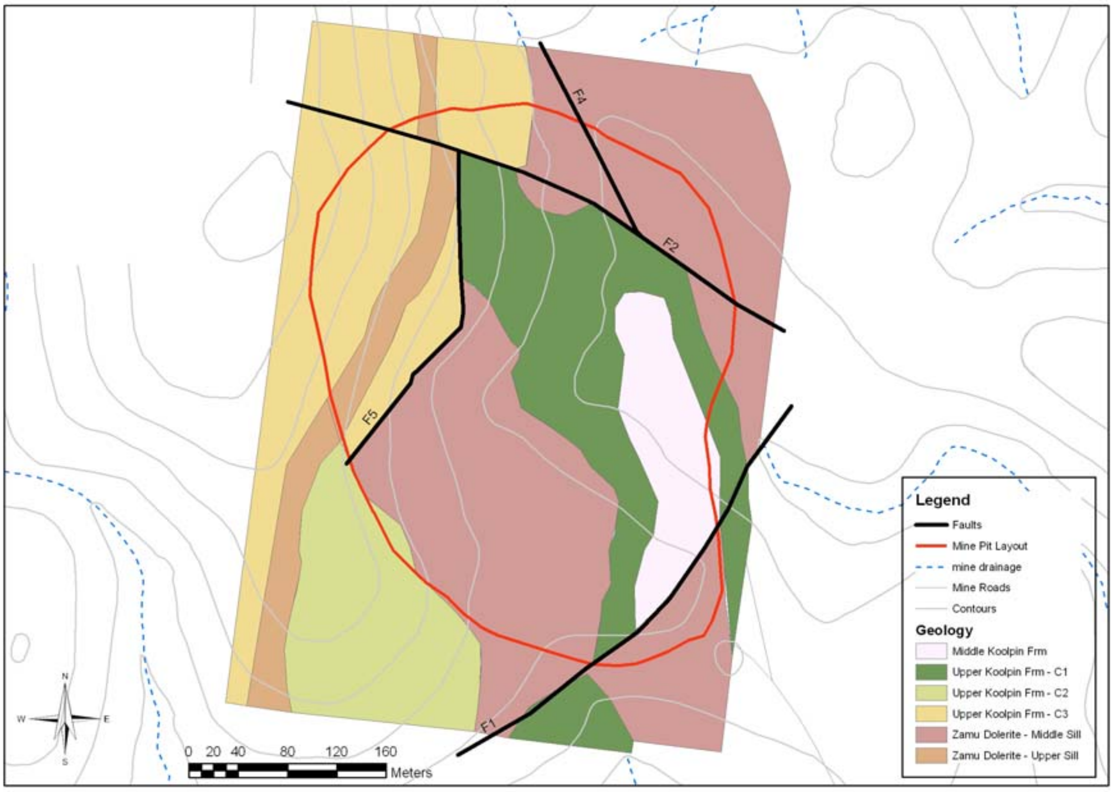
1.3 Structure

The primary structure through the prospect is the Mount Porter Anticline. This feature is predominately a NNW plunging regional structure and is similar to other structural systems within the Pine Creek Inlier (Goulevitch, 2004). It is characterised by:

- Steeply dipping to slightly overturn by generally regular limbs;

- Complex axial zones commonly with two separate antiform folds;
- Thickening of incompetent units, especially carbonaceous shale, in axial zone, and disruptions of competent units;
- Complex fault zones, frequently intruded by late basic or lamprophyric dykes and/or associated
- Quartz veining and stockworks; and,
- Evidence of massive brecciation and mineralisation.

To-date most of the mineralisation associated with the prospect has been intersected in a complex multiple hinged fold zone on and immediately to the west of the main fold axis of the anticline. This zone is bounded by a number of major faults with varying orientations. The location and direction of these features are presented in Figure 1.



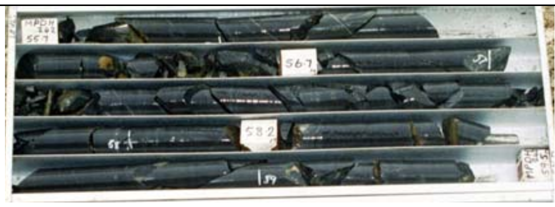
- **Figure 1 Major fault zones and geology within the Proposed Mine Area (after Goulevitch, 2004).**

2. Groundwater occurrence

Limited information is known about the occurrence of groundwater at the site with no detailed groundwater investigations having been conducted in the area to date. Review of the Northern Territory Government Groundwater Database found a number of boreholes occur within the region but not in close proximity to the mining lease. Due to the complex nature of the geology and structure of the region limited connectivity between aquifer systems is believed to existed, thus the inclusion of these government bores in understanding local groundwater conditions was dismissed.

Potential groundwater systems inferred from geological interpretations, drill cores and discussion with personnel from Arafura Resources (Goulevitch pers comm, 2006) include:

The dominate aquifer system within the proposed mining area is the metasediments of the Koolpin Formation. Permeability in this unit is largely secondary related to fractures, weathering and to a lesser extent, bedding. This unit, as evident from core descriptions, is moderately to highly fractured (Figure 2). Fracture density is believed to varying with depth (decreasing with depth) and proximity to fault zones (increasing closer to faults) across the site, suggesting yields may also decrease relative to these structures.

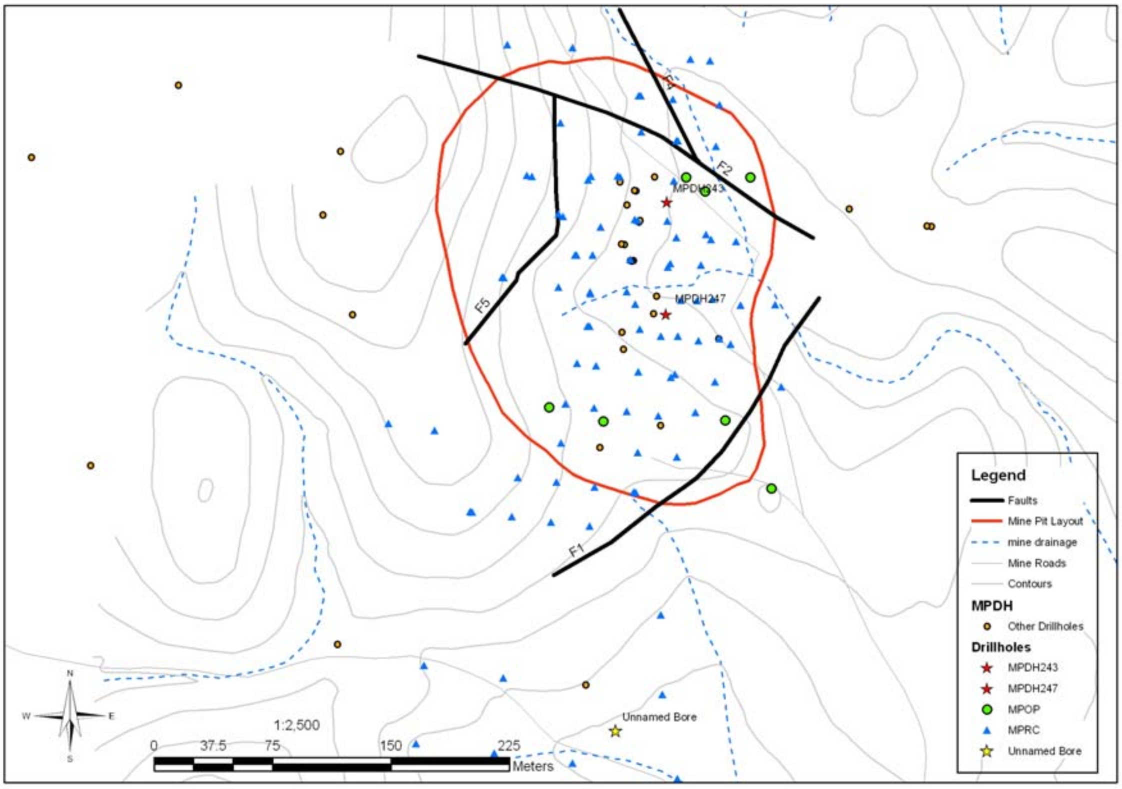
	
MPDH243	MPDH242
	
MPDH242	MPDH246

- **Figure 2 Core photos from the proposed mined pit.**

The Zamu Dolerite sills form low flow boundaries throughout the site, with groundwater seeps (springs) occurring at the contact between these intrusive units and the Koolpin metasediments (Figure 3). Whilst these concordant sills have a low porosity they are not believed to be impermeable, with spring formation the result of a difference in hydraulic conductivity resulting in a proportion of groundwater flow discharging to the ground surface. Permeability within these intrusive igneous units would once again be secondary related to fractures and joint sets.

- **Figure 3 Groundwater spring on eastern edge of the proposed mine pit.**

Water levels across the proposed pit area have been measured in inclined diamond drillholes (MBDH247 and 243) drilled during previous exploration programs (Figure 4).



▪ **Figure 4 Drillholes and Unnamed Bore in close proximity to the proposed mine pit**

These water levels have been corrected for drilling angle to obtain vertical depths to the water table. Details of measurement made in these holes are outlined in Table 2.

▪ **Table 2 Water level measurements in drillholes MBDH247 and MBDH243.**

Drillhole	Inclined water level (m)	Corrected Water level (m)	RL Water level (m)
MBDH247	16	13	509.4
MBDH243	11.7	10.8	510.7

A water level measurement and water sample were also been taken from an unnamed bore to the south of the exploration lease. This hole is believed to be an old production bore used for water supply on previous drilling programs in the area. It is unregistered and limited information is known about its construction and geology. Comparisons of water level measurements between this unnamed bore and those within the proposed pit area show a 20m difference in water level over 265m (hydraulic gradient = 0.076m). This value is extremely high and indicates that the presence of a large fault system (F1) may act as the barrier to groundwater flow and connectivity between the sites.

Water yields data for the site geology is limited, with no pumping tests or substantial airlifts during drilling having been recorded within the proposed pit area. Airlift measurements, however, are available for the unnamed bore with a discharge rate of 3 l/s, with a field pH of 6.26 and electronic conductivity of 341µS. This would equate to approximately 4 to 6 l/s if the bore was to be pumped, but no indication of sustainable long term yield is available. Although there is limited to no connectivity between the aquifer at the unnamed bore site and that within the pit, the geological setting is comparable, which may suggest yields encounter at this bore may be similar to those expected within the proposed pit.

3. Recommendations for Dewatering

Groundwater yield and aquifer parameters associated with the rocks within the proposed mining area are limited. Therefore further investigations are warranted to enable the development of a realistic dewatering strategy. In order to acquire detailed information about the aquifer and to assist in dewater design several options are outlined below. The selection of a final option will be dependant on the level of development anticipated.

1) Undertake groundwater monitoring and testing during upcoming RC drilling. This investigation would involve airlifting new RC exploration drillholes for approximately 1 hour, with discharging water being measured using v-notch weirs. During the airlift two water samples for chemical analysis should be collected after 5 minutes of airlifting and just prior to cessation of airlifting. This work will provide indicative information about aquifer yields and water chemistry. It will not provide an understanding of drawdown cone, hydrogeological boundary interactions and aquifer properties (transmissivity and storage coefficients).

2) Design and installation of a single pilot production bore and a 50mm diameter observation bores within the pit area to determine dewater requirements in the immediate vicinity of the pit. Construction for the production bore would at least a 200mm diameter hole, completed to an approximate depth of 80 to 100 m (RL 440 – 420m), so as to enable drawdown too approximately 10m below the proposed pit floor (RL 460m). The location for this bore would be along the north-eastern boundary of the pit close to the F2 fault zone (RL 520m). This work will provide sufficient information for the development of a dewater bore design. However, the bores will be lost during pit development

3) Examination of connectivity outside of the pit, this would involve installation of two 200mm diameter production bores to a depth of 80 - 100m (RL 440 - 460m) and three 50mm diameter observation bores, with two located outside the pit boundary and one within the proposed pit. The location for the production bores would be along the north-eastern boundary of the pit close to the F2 fault zone (RL 520m) and the southern boundary of the pit close to F1 fault zone (RL 530m). This work will also provide sufficient information for the design of a dewater system, with the pilot bores being available for use in future dewatering.

If either option 2 or 3 is selected a detailed pumping test program would be undertaken to establish local aquifer properties (Transmissivity and Storage Coefficients) and connectivity, boundary conditions related to local structure and to determine groundwater flow directions. This information is critical to ascertain the long-term response of the hydrogeological units to prolonged pumping. As part of this hydraulic testing a step test would also be conducted to determine the well yield and to establishing the pump setting requirements. This investigation will assist in determining the most suitable dewatering strategies, whether it is in pit pumping or construction of further production dewatering bores.

Additional to the aforementioned dewatering investigations a detailed borehole audit of existing RC and DH should be conducted. This will enable the acquisition of elevation, groundwater level, and water quality data, which will facilitate a better understanding of condition and constrains within the proposed pit area.

4. Costing

The following section outlines the indicative cost of undertaking the 3 options proposed:

Option 1

Airlift testing during exploration drilling:

- Drillers standby rate for 2 – 3 hrs per hole

Option 2

Drilling and construction of one production bore and one observation bore with one step test, a 24 hour constant rate pumping and recovery test.

Approximate cost $30,000– $50,000

Option 3

Drilling and construction of two production bores and two observation bores with two step tests, two 24 hour constant rate pumping and recover tests.

Approximate cost $50,000 – $90,000K

5. References

Goulevitch, J., 2004. Results of core drilling program November 2003, Mount Porter Gold Prospect, NT. Annual report ERL 116.

Steve Mackowski, 2006. *Pers Comm*, Arafura Resources Pty Ltd.