Beltana Mine, Beltana, SA

Mining and Rehabilitation Program, ML 4371, ML 4370 and ML 4369, and associated MPL

Prepared for

Freehold Mining Pty Limited

(a wholly-owned subsidiary of Perilya Ltd)
Level 10, 553 Hay Street
PERTH WA 6000

February 2007

Appendices

APPENDICES

Appendix A	MARP Certificate for previous operations, and associated correspondence with Department of Mines and Energy SA/PIRSA
Appendix B	Geological cross-section of the immediate area of Beltana Mine (after Rockwater (1984))
Appendix C	Bore location plan provided by PIRSA
Appendix D	NATA result sheets from October 2004 groundwater sampling program
Appendix E	Analytical techniques
Appendix F	Rockwater Report 2006
Appendix G	Native Vegetation Management Plan
Appendix H	EB Services Report
Appendix I	A3 Plans (Figure 4.1 Existing Mine Layout, Figure 4.2 Proposed Mine Layout During Operation and Figure 6.3 Layout at Mine Closure)
Appendix J	Monitoring Location Plans
Appendix K	Board HSE Committee Charter
Appendix L	Audit & Risk Management Committee Charter

PRIMARY INDUSTRIES AND RESOURCES SA

ADVICE AND INFORMATION
RESEARCH AND DEVELOPMENT
PROGRAM DELIVERY
POLICY AND REGULATION

- Agriculture
- Food
- Fisheries
- Aquaculture
- Minerals
- Petroleum
- Energy

OUR REF: MO File 6536.006

18 March 2005

Mr Tim Blyth
Level 2, 31 Ventnor Avenue
WEST PERTH WA 6005

Dear Mr Blyth

RE: MINING ACT 1971 – NOTIFICATION OF APPROVED AMENDMENT TO THE MINING AND REHABILITATION PROGRAM FOR ML's 4369, 4370 & 4371, Flinders Ranges – Beltana Mine – OOH Copley

I refer to your application pursuant to Regulation 42(b) (i) of *Mining Act, 1971*, dated 14 January 2005 to amend the Mining and Rehabilitation Program (MARP) No. ADP 48/86 for BELTANA MINE, OOH Copley.

The proposed amendment as detailed in the application dated 14 January 2005, is hereby approved.

You must comply with all lease conditions, and in the event that there is an inconsistency between the MARP and a lease condition, the lease condition prevails.

Please ensure the approved amended MARP or the new approved MARP (as the case may be) is retained for inspection at the mine site office at all times.

The amendment relates only to the requirements of the South Australia *Mining Act 1971*, however, there will or may be other legislation relevant to your application. In particular I draw your attention to the requirements of the *Native Vegetation Act*.

Should you require any further assistance, please contact Mr Serge Caplygin, Inspector of Mines, Ph: 84633056.

Yours sincerely

S. Caplygin

Serge Caplygin
A/CHIEF INSPECTOR OF MINES

MINING REGULATION & REHABILITATION BRANCH
MINERALS & ENERGY DIVISION
Level 5, 101 Grenfell Street, ADELAIDE SA 5000
GPO Box 1671, ADELAIDE SA 5001
Telephone: (08) 8463 3112 Facsimile: (08) 8463 3109
www.minerals.pir.sa.gov.au email: pirsa.miningregrehab@saugov.sa.gov.au

Government of South Australia

MW 132/5/A

ELECTROLYTIC ZINC COMPANY OF AUSTRALASIA LIMITED
(INCORPORATED IN VICTORIA)

GPO BOX 856 K,
MELBOURNE, 3001 AUSTRALIA
REGISTERED OFFICE:
390 LONSDALE STREET,
MELBOURNE, 3001 AUSTRALIA
TELEPHONE: 60 0591
TELEX: AA30463
TELEGRAMS AND CABLES:
ELECTZINC MELBOURNE
FACSIMILE: 60 0591 (BUSINESS HOURS)
FACSIMILE: 60 0599 (AFTER HOURS)

27th August, 1986

Chief Inspector of Mines
Department of Mines and Energy
P.O. BOX 151
EASTWOOD. S.A. 5063

Dear Sir,

BELTANA MINING PROGRAM

We wish to advise that a new export contract has been negotiated for the supply of 45,000/55,000 tonnes of zinc ore per year for the next 3 years from the Beltana open cut mine. This will virtually deplete the estimated remaining reserves recoverable by open-cut mining. It will involve deepening the pit a further six, 6 metre benches (from RL 268 to RL 232); the lowermost five of these benches are below the current static grounwater level.

We seek your approval of our enclosed Final Pit Outline (Drawing No. BEL 16), and proposed associated activities as follows:-

1. Groundwater

An evaluation of potential groundwater likely to affect mining was carried out by our consultants Rockwater Pty. Ltd. in 1984, in conjunction with the drilling program to re-evaluate the ore reserves.

Their report indicated that groundwater inflow could be easily controlled by up to six bores located around the pit perimeter, and proposed that disposal of the water be to the South of the mine into Deception Creek (this has the consent of Mr. R. Ragless, the pastoralist).

That creek, which is dry for almost all of the year, leads towards Lake Torrens.

The Electricity Trust of South Australia's Leigh Creek Geo-Technical Department has reviewed the Rockwater report. We shall be working with them, and also their advisers (Australian Groundwater Consultants Pty Ltd), regarding the possible transfer of potable water from Beltana Mine into their Aroona Dam catchment.

It is not possible to accurately define the scope of dewatering on a bench-by-bench basis. We therefore propose to commence using an in-pit sump with removal by water truck, progressing to pumping from the sump to the surface - or submersible pumps in dewatering bores - as required. In each case we shall liase closely with the pastoralist and ETSA.

2. Waste Rock Removal

A further approximately one million tonnes of waste removal is anticipated; it is planned to place this within the area of the existing dump, with no increase to the existing height.

We propose to break the current horizontal upper level of the dump by forming two mounds, and to spread available compatibly-coloured waste rock over the rill slopes, to minimise visual impact.

3. Completion of Mining

It is proposed to leave the workings open, when mining is complete, and have the area securely fenced off.

4. Mining Program

We proposed to retain the current contractor (Brambles Industrial Services) for the three year period, and operate on a yearly campaign basis with temporary suspensions between campaigns.

I envisage the current campaign finishing 9th September, 1986 and the next campaign commencing 14th October, 1986 to 14th September, 1987.

5. Mine Supervision

Mr. J.D. Carmichael will be our nominated Manager.

6. Departmental Liaison

These matters have been discussed in some detail with your Mr. Coates, Inspector of Mines and Quarries.

Yours faithfully,

for C.O. HASLAM
GENERAL MANAGER
MINERAL RESOURCES DIVISION

SOUTH AUSTRALIA

DEPARTMENT OF MINES AND ENERGY

APPROVED

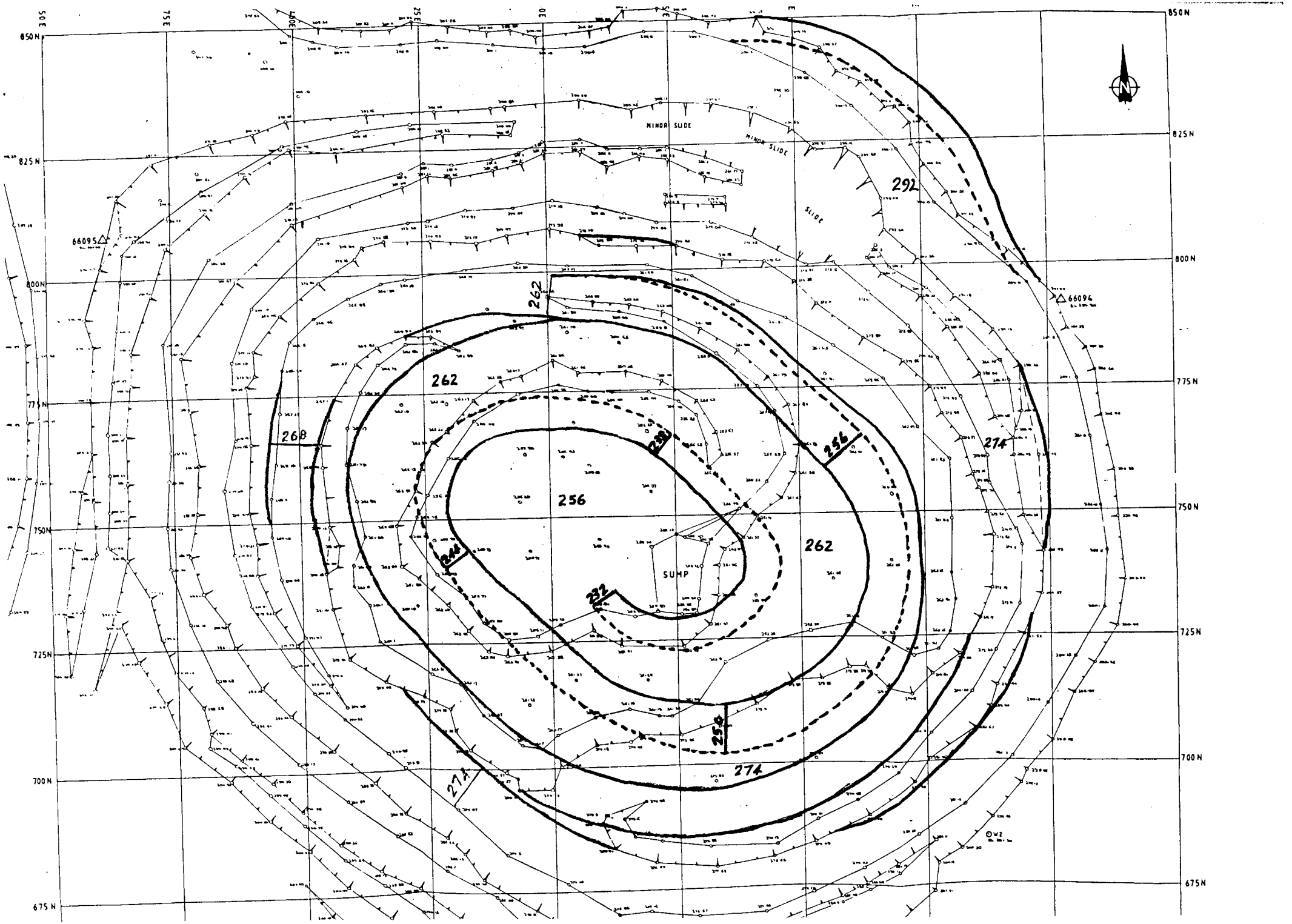
GROUND-WATER. SEE ACCOMPANYING LETTER DATED 19-9-86

CHIEF INSPECTOR OF MINES .....

DATE 19/9/86

APPROVAL No. 49/86

D.M.E. REF. 1914/32/5/9


850N
825N
800N
775N
750N
725N
700N
675N
MINOR SLIDE
SLIDE
66095
66094
292
262
262
268
256
274
256
244
SUMP
262
232
254
274
274
N

DEPARTMENT OF MINES AND ENERGY

SOUTH AUSTRALIA

191 Greenhill Road, Parkside

1836 SOUTH AUSTRALIA 1986

TELEPHONE: (08) 274 7500
TELEGRAMS: Domex
TELEX: AA88692
FACSIMILE No. 272 7597
PLEASE ADDRESS ALL CORRESPONDENCE TO:
The Director-General
PO Box 151
Eastwood, S.A., 5063

In reply, please quote

MW 132/5/A HFC:KF

19th September, 1986

The General Manager,
Mineral Resources Division,
Electrolytic Zinc Co. of A/Asia Ltd.,
G.P.O. Box 856K,
MELBOURNE, VIC., 3001

Attn.:- Mr. C. O. Haslam
Beltana Mine

Dear Sir,

The proposed programme for the final extraction of ore from the above mine as outlined in your letter of the 27th August and shown on Drawing No. BEL 16 has been approved (Approval No. 48/86) and a copy is enclosed.

Please note that the report by Rockwater Pty. Ltd. was examined by the Department's groundwater engineers and made two significant recommendations. These are:-

(1) That all water pumped from the pit should be discharged into Deception Creek. None should be allowed into the Aroona Dam catchment creeks because of heavy metal content.

(2) It would be in the operator's interest to record for future references any die-back of River Red Gums currently taking place along Deception Creek.

It was noted that other ground water users will not be affected by the pumping.

Approval to commence operations next month as planned is hereby given.

Yours faithfully,

J. H. Fenton
CHIEF INSPECTOR OF MINES

PASMINCO MINING
BELTANA

A Division of Pasminco Australia Limited
A.C.N. 004 074 962

P.O. Box 41,
Leigh Creek, S.A. 5731
C/o J D Carmichael
19 Bellevue Drive
BELLEVUE HTS.
S A 5050

20 September 1996

Mr R E MATHEWS
CHEIF INSPECTOR OF MINES
Mines & Energy S A
P O Box 151
EASTWOOD S A 5063

Dear Sir

RE:AMENDING DEVELOPMENT PROGRAMME BELTANA ZINC MINE

Further to our letter of 1/7/96 and on site discussions with Messers Mathews and Mattiazzo on 7/8/96 to review and up date our Approved Development Programme No 48/86 dated 19/9/86; we submit for your considered approval the following changes and improvements:-

1 Ground Water

Our previous approval to dewater the mine by discharging ground water off the Mining Lease into Deception Creek is no longer valid due to the introduction of the Environment Protection Act 1993. Should we wish to discharge water off the lease we will require a licence under part 6 of the EPA Act.
Following discussions with Dr J Cugley - Senior Water Quality Officer of the EPA based on preliminary water analysis, it would seem that a licence may possibly be granted for discharging water from peripheral dewatering bores out side the ore body into the Creek; although an evaporation pond would be the prefered alternative.
It was also considered that water pumped from sumps within the pit would most likely be unsuitable for Creek discharge due to high salinity and heavy metal content; requiring disposal to an evaporation pond.
EPA would be reluctant to give blanket approval for activities that may not be acted on in the near future due to ever changing environmental parameters.
It is therefore proposed to construct a 2 hectare evaporation pond on the East side of the waste dump within the Lease as shown on the attached photo map.
The Bureau of Meteorology nett average annual evaporation rate for Leigh Creek is 2.75 metres based on the 0.33 m deep open pan method.This equates to an average daily evaporation rate of 150 tonnes. (approx 300 t in summer 75 t in winter)

Pasminco Australia Limited Tel (03) 288 0333 Fax (03) 288 0406

The Pit floor is currently at RL 256 m, 7 m below the original static ground water level of 263, however the water level has stabilized at 260. Prior to temporarily suspending mining in 1987 water inflow was only 25 tonnes per day.
We would envisage the 2 ha pond would have sufficient capacity to evaporate all water generated from mining the next bench RL 250 releasing 40 000 t of ore and most likely the following bench RL 244 releasing a further 33 500 t of ore. It would also serve to evaporate the small quantity of water seeping into Pit sumps for the remaining 3 benches, while the main dewatering will most likely be by peripheral bores for which EPA approval will be sought if it is required to discharge this cleaner water off the Lease.

2 Waste Dump

On completion of mining we propose to round off the dump edge and ensure the area close to the dump edge is elevated to minimize water erosion. (Ref. section A-A on photo map)
The 2 - 7m high mounds to be formed on the dump (to break the normal horizontal line created by a dump) will be profiled to conform with the back ground hills as partially viewed from the highway some 3 km to the West.
The evaporation pond will be covered with waste having first scraped off deposited salt where practical,and placing it in the Pit. Due to a lack of available top soil and the skeletal nature of the area it is proposed to cross rip the top of the dump to induce vegetation.

3 Area General on Completion of Mining

It is proposed to leave the Pit open with the perimeter securely fenced.
In colaboration with the Pastoralist all roads and disturbed areas will be cross ripped to induce vegetation.

All other aspects of the Approved Programme will be complied with.

Enclosed is a survey plan showing the Pit current face positions with future development for the life of the mine superimposed in red; this development conforms with our previous Approved Plan BEL 16. The plan also details estimated bench tonnages remaining to be removed.
The attached photo plan also shows the current position with the proposed evaporation pond and final outline of the waste dump superimposed in red.

Yours faithfully
FOR PASMINCO AUSTRALIA LIMITED

J D CARMICHAEL
MINE MANAGER BELTANA/AROONA

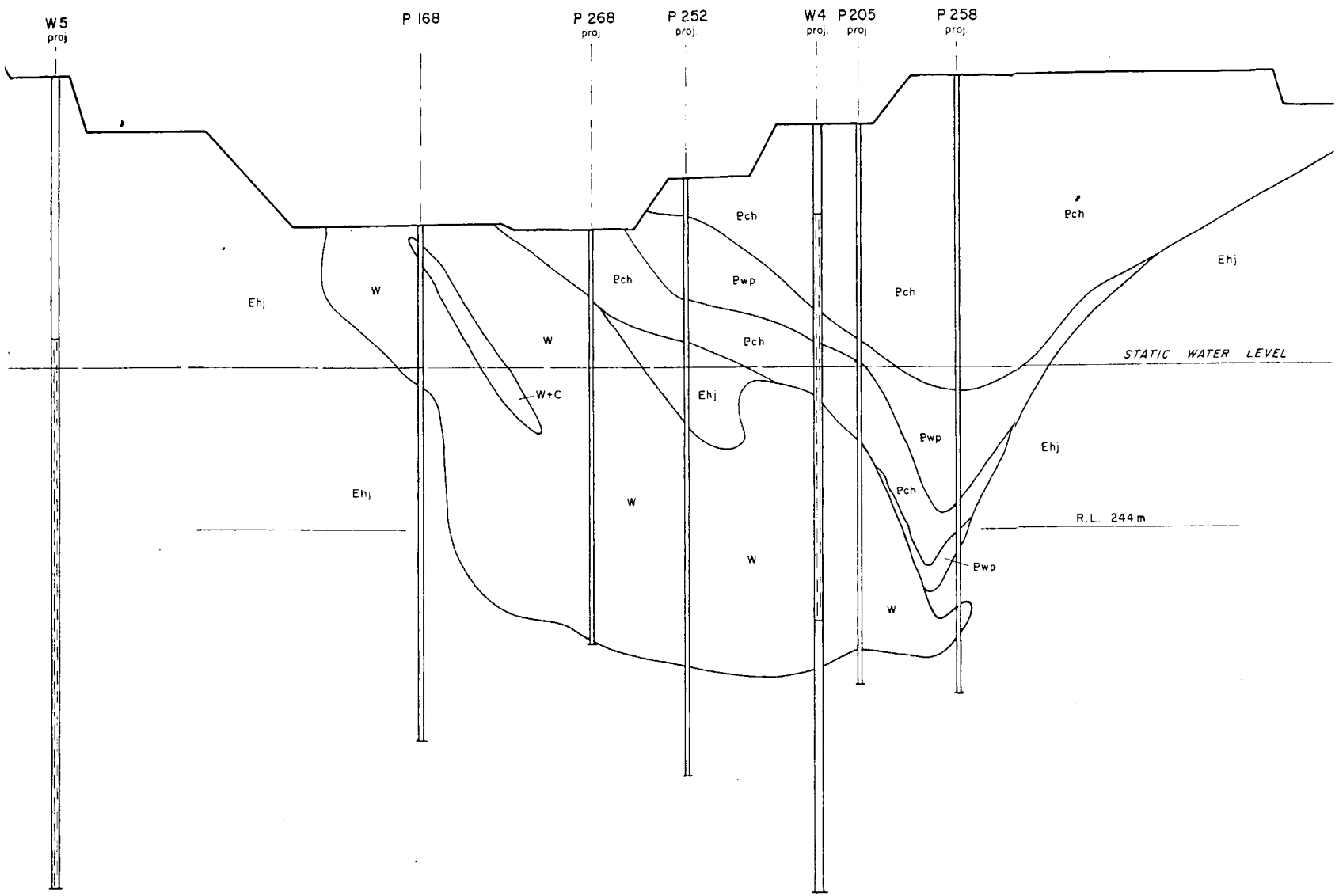
Encl.:- Plan
Photo

B

ELECTROLYTIC ZINC CO A'ASIA

BELTANA PIT DEWATERING ASSESSMENT

CROSS - SECTION



0 5 10 15 20 25 30 m

Scale 1:500

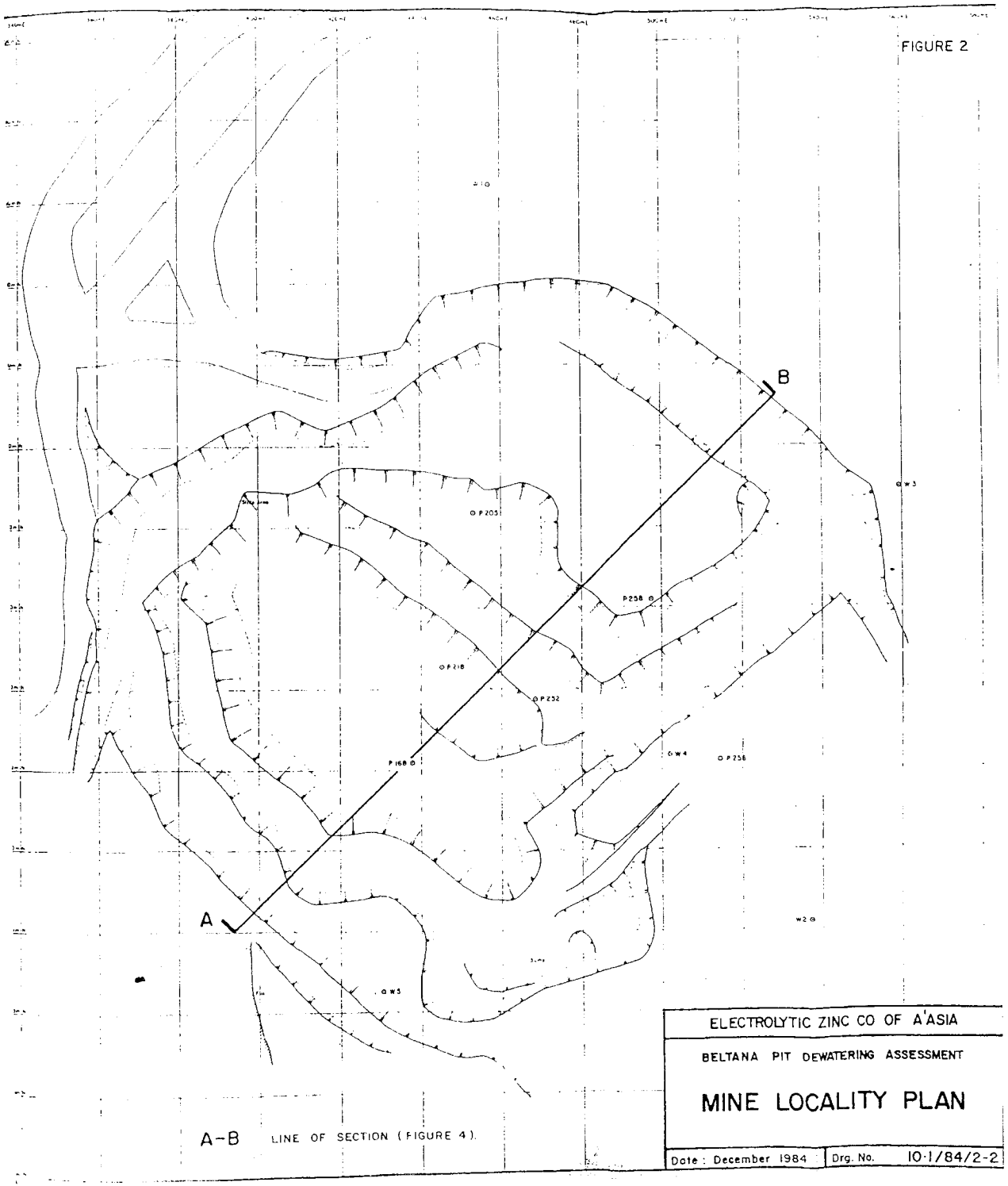
LEGEND

W+C	Wollastonite + Carbonate
W	Wollastonite → willemite
Ehj	Ajax Limestone
Pwp	Pound Quartzite
Pch	Callanna Beds

ROCKWATER PTY LTD
December 1984

10-1/84/1-4

FIGURE 2



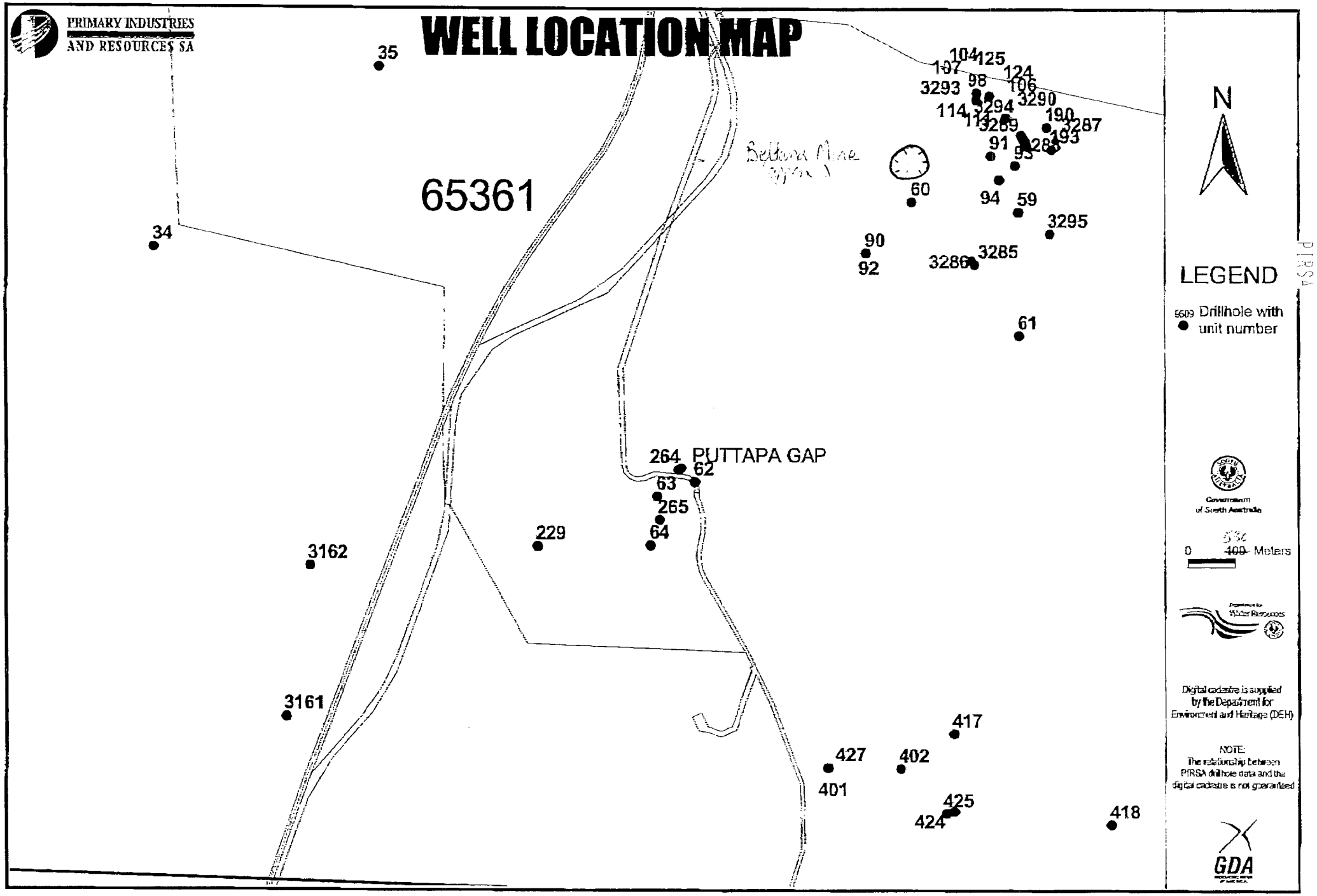
A-B LINE OF SECTION (FIGURE 4).

ELECTROLYTIC ZINC CO OF A'ASIA

BELTANA PIT DEWATERING ASSESSMENT

MINE LOCALITY PLAN

Date : December 1984 | Drg. No. 10-1/84/2-2



The Department of Water, Land and Biodiversity Conservation

Summary of Latest Water Information for Drillholes

PRIMARY INDUSTRIES AND RESOURCES SA

Unit No	Classification	Max Drilled Depth (m)	Orig Drill Date	Current Depth (m)	Current Depth Date	Cased To (m)	Standing Water Level (m)	Standing Water Level Date	Well Yield (Gal/hr)	Well Yield Date	Salinity EC	Salinity TDS (mg/L)	Salinity Date	pH	Location Hundred	Location Parcel	Permit No	Chem Anal	Logs Drillers	Logs Geol	Logs Geophys	Status	Status Date
6536 62	Water Well	20.12	01/43	20.12	01/43		16.46	01/43	301	01/43	3038	1685	11/51			S 1075							
6536 63	Water Well	4.27		4.27												B 1052							
6536 64	Water Well	39.62		39.62	09/59	10.97	10.67	09/59			9056	5141	09/59			B 1052						Operational	
6536 264	Water Well	134.00	05/82	134.00	05/82	42.00	76.50	05/82	5005	05/82	1570	865	07/82	6.80		B 693	10430		●			Backfilled	05/8
6536 265	Water Well	198.00	09/82	198.00	09/82	96.00	90.00	09/82	396	09/82						B 1052	92080		●				

DATA VALIDATION SUMMARY REPORT; GROUNDWATER

Project Manager: PB
Project No.: 429655949
Site: Perilya
Matrix: water
Laboratory: ALS
Lab Batch Nos: EM27659
Other Information:

Validation Conducted by: Bridy Fox Date: 22/11/04

Authorised by:

Component		Assessment				Comments
Frequency of laboratory QA/QC		OK	✓	NOT OK		Refer to Note 1
Number of tests requested/reported		OK	✓	NOT OK		Refer to Note 2
Sample handling/preservation/holding times		OK	✓	NOT OK		
Limits of reporting		OK	✓	NOT OK		
Blank Analysis						
	Field blank	OK	✓	NOT OK		
	Method blank	OK	✓	NOT OK		
	Rinsate blank	OK	✓	NOT OK		
Field duplicate RPDs		OK	✓	NOT OK		
Laboratory duplicates RPDs		OK	✓	NOT OK		Refer to Note 3
MS/MSDs						
	% Recoveries	OK	✓	NOT OK		
	RPDs	OK	✓	NOT OK		
Surrogate recoveries		OK	✓	NOT OK		

Other observations

Note 1 There are no duplicates or matrix spikes taken for the major ions calcium, magnesium, sodium, potassium and sulphate. This is not considered to affect the interpretaion of results as laboratory duplicate and matrix spike results reported for other analytes suggest that the accuracy and precision of the report data is sufficient for data validation purposes.

Note 2 Although no field duplicate sample was taken, laboratory duplicate and lab control sample spikes suggest that the accuracy and precision of the report data is sufficient for data validation purposes.

Note 3 Laboratory duplicate relative percent differences (RPDs) were elevated for cadmium and manganese in PITW_20/10/04 and PITW_20/10/04CHK. This apparent lack of precision can most likely be attributted to both primary and duplicate sample concentrations reporting close to laborotory limits of reporting (LOR), where precision is inherently low (but actual diferences minor), and consequently is not considered to affect the interpretation of results.

Summary Comments:

Groundwater analytical data can be used as a basis of interpretation, subject to the limitations outlined above.

Recommended Corrective Action

None

Site: PERILYA
Matrix: WATER
Laboratory: ALS-MELBOURNE
Lab Batch No: EM27659-0

Method	Parameter	Number of Tests Requested	Number of Tests Reported	Holding Times (a)	Limits of Reporting (b)	Laboratory Blank		Field Duplicate		Laboratory Duplicate		Matrix Spike		LCS	
						Number Required	Number Reported	Number Required	Number Reported	Number Required	Number Reported	Number Required	Number Reported	Reported	OK
GENERAL/ALS/EA-005	pH	2	2	✓	✓	0	0	1	0	1	1	0	0		
GENERAL/ALS/EA-015	TDS	2	2	✓	✓	1	1	1	0	1	1	0	0	✓	✓
GENERAL/ALS/ED-030	Carbonate as CaCO3	2	2	✓	✓	1	0	1	0	1	1	1	0		
GENERAL/ALS/EZ-005	Total Cations	2	2	✓	✓	0	0	1	0	1	0	0	0		
GENERAL/ALS/EZ-010	Total Anions	2	2	✓	✓	0	0	1	0	1	0	0	0		
GENERAL/ALS/EZ-015	Actual (Anion / Cation) Difference	2	2	✓	✓	0	0	1	0	1	0	0	0		
GENERAL/ALS/EZ-020	Allowed (Anion / Cation) Difference	2	2	✓	✓	0	0	1	0	1	0	0	0		
MAJOR-IONS/ALS/ED-005F	Calcium	2	2	✓	✓	1	1	1	0	1	0	1	0	✓	✓
MAJOR-IONS/ALS/ED-010F	Magnesium	2	2	✓	✓	1	1	1	0	1	0	1	0	✓	✓
MAJOR-IONS/ALS/ED-015F	Sodium	2	2	✓	✓	1	1	1	0	1	0	1	0	✓	✓
MAJOR-IONS/ALS/ED-020F	Potassium	2	2	✓	✓	1	1	1	0	1	0	1	0	✓	✓
MAJOR-IONS/ALS/ED-035	Bicarbonate as CaCO3	2	2	✓	✓	1	0	1	0	1	1	1	0	✓	✓
MAJOR-IONS/ALS/ED-040F	Sulphate	2	2	✓	✓	1	1	1	0	1	0	1	0	✓	✓
MAJOR-IONS/ALS/ED-045	Chloride	2	2	✓	✓	1	1	1	0	1	1	1	1	✓	✓
METALS/ALS/EG-020F	Arsenic	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Barium	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Beryllium	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Cadmium	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Chromium	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Cobalt	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Copper	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Lead	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Manganese	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Nickel	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Vanadium	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
	Zinc	2	2	✓	✓	1	1	1	0	1	1	1	2	✓	✓
METALS/ALS/EG-035F	Mercury	2	2	✓	✓	1	1	1	0	1	1	1	1	✓	✓

Table 1: Summary of Analytical results

Location							PITW	PITW	W1
Field ID							PITW_20/10/04	PITW_20/10/04CHK	W1_20/10/04
Date Sampled							20/10/04	20/10/04	20/10/04
Sample Type							Primary Sample	Laboratory Duplicate	
Chemical	**LOR**	**MDL**	**Units**		**EPP Water Quality 2003 - Potable**	**EPP Water Quality 2003 - Agriculture/aquaculture - irrigation**	**EPP Water Quality 2003 - Agriculture/aquaculture - livestock**			
GENERAL										
Difference	0.01		ME/L					4.78	NA	3.76
Difference	0.01		ME/L					1.39	NA	1.32
pH	0.01			6.5-9.0	6.5-8.5	4.5-9		8.16	8.19	7.22
Sulphate	1		MG/L		500		1000	**909**	NA	**856**
TDS	1		MG/L					4900	5000	4660
Total Anions	0.01		ME/L					82.8	NA	78.5
Total Cations	0.01		ME/L					78	NA	74.7
MAJOR IONS										
Calcium	1		MG/L					269	NA	273
Carbonate as CaCO3	1		MG/L					<1	<1	<1
Chloride	1		MG/L					2100	2140	1900
MAJOR-IONS										
Bicarbonate as CaCO3	1		MG/L					230	229	352
METALS										
Arsenic	0.001		MG/L	0.05	0.007	0.1	0.5	**0.590**	**0.621**	**0.246**
Barium	0.001		MG/L		0.7			0.051	0.048	0.05
Beryllium	0.001		MG/L	0.004		0.1	0.1	<0.001	<0.001	<0.001
Cadmium	0.0001		MG/L	0.002	0.002	0.01	0.01	0.0001	0.0002	<0.0001
Chromium	0.001		MG/L			1	1	<0.001	<0.001	<0.001
Cobalt	0.001		MG/L			0.05	1	<0.001	<0.001	<0.001
Copper	0.001		MG/L	0.01	2	0.2	0.5	0.002	0.002	0.003
Lead	0.001		MG/L	0.005	0.01	0.2	0.1	<0.001	<0.001	<0.001
Magnesium	1		MG/L					217	NA	185
Manganese	0.001		MG/L		0.5	2		0.004	0.005	<0.001
Mercury	0.0001		MG/L	0.0001	0.001	0.002	0.002	<0.0001	<0.0001	<0.0001
Nickel	0.001		MG/L	0.15	0.02	0.2	1	<0.001	<0.001	<0.001
Potassium	1		MG/L					11	NA	10
Sodium	1		MG/L					1070	NA	1050
Vanadium	0.01		MG/L			0.1	0.1	0.06	0.06	0.07
Zinc	0.005		MG/L	0.05		2	20	[illegible]	[illegible]	**0.107**

LEGEND

Greater than EPP Water Quality 2003 - Potable

Greater than EPP Water Quality 2003 - Agriculture/aquaculture - irrigation

Greater than EPP Water Quality 2003 - Agriculture/aquaculture - livestock

NA - Not Analysed

LAB_DUPLICATE RESULTS

Batch No.	**EM27659.CSV**
Matrix:	**WATER**
Sample No.	**PITW_20/10/04**
Sample Duplicate No.	**PITW_20/10/04CHK**

Parameters	LOR	Units	Sample Result	Duplicate Result	Difference	Average	RPD
GENERAL							
pH	0.01		8.16	8.19	0.03	8.175	0.37
TDS	1	MG/L	4900	5000	100	4950	2.02
MAJOR IONS							
Carbonate as CaCO3	1	MG/L	-1	-1	0	1	0.00
Chloride	1	MG/L	2100	2140	40	2120	1.89
MAJOR-IONS							
Bicarbonate as CaCO3	1	MG/L	230	229	1	229.5	0.44
METALS							
Arsenic	0.001	MG/L	0.589	0.621	0.032	0.605	5.29
Barium	0.001	MG/L	0.051	0.048	0.003	0.0495	6.06
Beryllium	0.001	MG/L	-0.001	-0.001	0	0.001	0.00
Cadmium	0.0001	MG/L	0.0001	0.0002	0.0001	0.00015	66.67
Chromium	0.001	MG/L	-0.001	-0.001	0	0.001	0.00
Cobalt	0.001	MG/L	-0.001	-0.001	0	0.001	0.00
Copper	0.001	MG/L	0.002	0.002	0	0.002	0.00
Lead	0.001	MG/L	-0.001	-0.001	0	0.001	0.00
Manganese	0.001	MG/L	0.004	0.005	0.001	0.0045	22.22
Mercury	0.0001	MG/L	-0.0001	-0.0001	0	0.0001	0.00
Nickel	0.001	MG/L	-0.001	-0.001	0	0.001	0.00
Vanadium	0.01	MG/L	0.06	0.06	0	0.06	0.00
Zinc	0.005	MG/L	0.171	0.189	0.018	0.18	10.00

ALS Environmental

CERTIFICATE OF ANALYSIS

CONTACT:	MR PHIL BAYNE	**BATCH:**	EM27659
CLIENT:	URS AUSTRALIA PTY LTD	**SUB BATCH:**	0
ADDRESS:	25 NORTH TERRACE HACKNEY SA 5069	**LABORATORY:**	MELBOURNE
		DATE RECEIVED:	22/10/2004
		DATE COMPLETED:	01/11/2004
		SAMPLE TYPE:	WATER
ORDER No.:		**No. of SAMPLES:**	2
PROJECT:	PERILYA		

COMMENTS

Results apply to sample(s) as submitted. EG-020 metals conducted by ALS Sydney, NATA Site No. 10911. Ionic balances are within acceptable limits as detailed in the 20th edition APHA "Standard Methods for the Examination of Water and Wastewater".

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
All pages of this report have been checked and approved for release.

ISSUING LABORATORY: MELBOURNE

Address
Unit 6 / Adamco Business Park
2 Sarton Road
Clayton VIC 3168

Phone: 61-3-9538 4444
Fax: 61-3-9538 4400
Email: tim.kilmister@alsenviro.com

Signatory

Valda Chen	Wade Guye	Aaron Stott	Steven McGrath	Phillip Hill
Senior Inorganic Chemist	Inorganic Chemist	Senior Organic Chemist	Organic Chemist	Senior Microbiologist

Reports signed by signatories as required

Batch: EM27659
Sub Batch: 0
Date of Issue: 01/11/2004
Client: URS AUSTRALIA PTY LTD
Client Reference: PERILYA

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2								
		Date Sampled		20/10/2004	20/10/2004								
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	W1_ 20/10/04	PITW_ 20/10/04								
EA-005	pH Value		0.01	7.22	8.16								
EA-015	Total Dissolved Solids (TDS)	mg/L	1	4660	4900								
ED-005F	Calcium - Filtered	mg/L	1	273	269								
ED-010F	Magnesium - Filtered	mg/L	1	185	217								
ED-015F	Sodium - Filtered	mg/L	1	1050	1070								
ED-020F	Potassium - Filtered	mg/L	1	10	11								
ED-030	Carbonate as CaCO3	mg/L	1	<1	<1								
ED-035	Bicarbonate as CaCO3	mg/L	1	352	230								
ED-040F	Sulphate - Filtered	mg/L	1	856	909								
ED-045	Chloride	mg/L	1	1900	2100								
EG-020F	Arsenic - Filtered	mg/L	0.001	0.246	0.589								
EG-020F	Barium - Filtered	mg/L	0.001	0.050	0.051								
EG-020F	Beryllium - Filtered	mg/L	0.001	<0.001	<0.001								
EG-020F	Cadmium - Filtered	mg/L	0.0001	<0.0001	0.0001								
EG-020F	Cobalt - Filtered	mg/L	0.001	<0.001	<0.001								
EG-020F	Chromium - Filtered	mg/L	0.001	<0.001	<0.001								
EG-020F	Copper - Filtered	mg/L	0.001	0.003	0.002								
EG-020F	Manganese - Filtered	mg/L	0.001	<0.001	0.004								
EG-020F	Nickel - Filtered	mg/L	0.001	<0.001	<0.001								
EG-020F	Lead - Filtered	mg/L	0.001	<0.001	<0.001								
EG-020F	Vanadium - Filtered	mg/L	0.01	0.07	0.06								
EG-020F	Zinc - Filtered	mg/L	0.005	0.197	0.171								
EG-035F	Mercury - Filtered	mg/L	0.0001	<0.0001	<0.0001								
EZ-005	Total Cations	me/L	0.01	74.7	78.0								
EZ-010	Total Anions	me/L	0.01	78.5	82.8								
EZ-015	Actual (Anion / Cation) Difference	me/L	0.01	3.76	4.78								
EZ-020	Allowed (Anion / Cation) Difference	me/L	0.01	1.32	1.39								

Batch: EM27659
Sub Batch: 0
Date of Issue: 01/11/2004
Client: URS AUSTRALIA PTY LTD
Client Reference: PERILYA

QUALITY CONTROL REPORT

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	200	201	202					
		Date Sampled		20/10/2004	20/10/2004	22/10/2004	22/10/2004	22/10/2004					
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	W1_ 20/10/04MS	PITW_20/10 /04 CHK	METHOD BLANK	LCS	MS					
				CHECKS AND SPIKES									
EA-005	pH Value		0.01	----	8.19	----	----	----					
EA-015	Total Dissolved Solids (TDS)	mg/L	1	----	5000	<1	101%	----					
ED-005F	Calcium - Filtered	mg/L	1	----	----	<1	108%	----					
ED-010F	Magnesium - Filtered	mg/L	1	----	----	<1	103%	----					
ED-015F	Sodium - Filtered	mg/L	1	----	----	<1	102%	----					
ED-020F	Potassium - Filtered	mg/L	1	----	----	<1	98.0%	----					
ED-030	Carbonate as CaCO3	mg/L	1	----	<1	----	----	----					
ED-035	Bicarbonate as CaCO3	mg/L	1	----	229	----	98.0%	----					
ED-040F	Sulphate - Filtered	mg/L	1	----	----	<1	110%	----					
ED-045	Chloride	mg/L	1	77.0%	2140	<1	106%	----					
EG-020F	Arsenic - Filtered	mg/L	0.001	89.0%	0.621	<0.001	97.0%	77.0%					
EG-020F	Barium - Filtered	mg/L	0.001	93.0%	0.048	<0.001	93.0%	92.0%					
EG-020F	Beryllium - Filtered	mg/L	0.001	91.0%	<0.001	<0.001	97.0%	89.0%					
EG-020F	Cadmium - Filtered	mg/L	0.0001	88.0%	0.0002	<0.0001	97.0%	88.0%					
EG-020F	Cobalt - Filtered	mg/L	0.001	95.0%	<0.001	<0.001	104%	90.0%					
EG-020F	Chromium - Filtered	mg/L	0.001	88.0%	<0.001	<0.001	95.0%	87.0%					
EG-020F	Copper - Filtered	mg/L	0.001	82.0%	0.002	<0.001	99.0%	85.0%					
EG-020F	Manganese - Filtered	mg/L	0.001	90.0%	0.005	<0.001	99.0%	89.0%					
EG-020F	Nickel - Filtered	mg/L	0.001	85.0%	<0.001	<0.001	103%	91.0%					
EG-020F	Lead - Filtered	mg/L	0.001	79.0%	<0.001	<0.001	105%	81.0%					
EG-020F	Vanadium - Filtered	mg/L	0.01	76.0%	0.06	<0.01	102%	94.0%					
EG-020F	Zinc - Filtered	mg/L	0.005	125%	0.189	<0.005	100%	90.0%					
EG-035F	Mercury - Filtered	mg/L	0.0001	95.0%	<0.0001	<0.0001	97.0%	----					
EZ-005	Total Cations	me/L	0.01	----	----	----	----	----					
EZ-010	Total Anions	me/L	0.01	----	----	----	----	----					
EZ-015	Actual (Anion / Cation) Difference	me/L	0.01	----	----	----	----	----					
EZ-020	Allowed (Anion / Cation) Difference	me/L	0.01	----	----	----	----	----					

EM 276589 (W)

CHAIN OF CUSTODY FORM

Sheet 1 of 1

THIS COLUMN FOR LAB USE ONLY

Job Code: (08)

Due Date:

FROM: URS (AUSTRALIA)
ACN 000 691 690
25 North Terrace
HACKNEY SA.
Ph: 8366 1000

DATE: 21 Oct 2004

Fax: (08) 83661001

TO: ALS.
Adamco Busines Park
2 Sarton Rd
Clayton Vic.

Project No: Perilya
Project Manager: PJB
Agreement No: ME215 04

Sampler(s): PJB
Signature(s):
Checked:

Custody seal intact? YES NO

Sample cold? YES NO

Released for URS by:
Date: Time:

Received for Laboratory by:
Date: 22/10/4 Time: 7:30am

Container Size, Type, Preservative and Analysis

Container Identification

Size							
Type*							
Preservative Code							
Analytes	heavy metal screen (16)	K, Mg, Na, Ca Cl, SO_4, carbonate, bicarbonate	TDS	pH			

Lab identification	Date	Time	Matrix	Sample Number	Comments	Total no	Tick required analytes						
(1)	20 Oct 04	PM	Water	W1-20/10/04	1 L plastic no pres.		✓	✓	✓	✓			Not filtered.
(2)				PitW-20/10/04	1L + 250ml plastic no. pres.		✓	✓	✓	✓			Not filtered.

FAXED 22/10 10:53

Remarks: Please use non preserv. plastic for all analysis - filter & preserve at lab as required. TOTAL

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle

Courier Job No:

Specify Turnaround Time: Standard.

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES

Project Number

Project Manager

Site:

Laboratory:

SHELL Data Import Checklist

Lab Filename (Batch No)	No 1 Macro: copied to 'Originals' directory	No 1 Macro: opened in excel, saved as XLS to 'workfile' directory	No 1 Macro: renamed sheet1 to OLDDATA	No 1 Macro: Used SMPro.xlsm to insert headings	No 1 Macro: Filter non-blank results, copy to new data sheet	Fill in: Site	Fill in: Location	Fill in: FieldID (plus date/depth)	Fill in: check dates (US format)	Fill in: CASE TYPES	Spell Check: check chemicals	Spell Check: check locations	PreTest Macro: Test surrogates	PreTest Macro: Test units	PreTest Macro: Test Duplicate Rows	PreTest Macro: Test Empty Cells	PreTest Macro: Get sample data	No 2 Macro: Verify file with hardcopy	No 2 Macro: Sort Data for Loading	No 2 Macro: Save as XLS	No 2 Macro: Delete Heading, Move data sheet to front, save as CSV in converted directory	Num of rows	Loaded into SMPro
EM27659	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	139	✓

URS

QAQC File Log

All tables to be save to the SMPRO\TABLES directory in the job directory as QAQC##.XLS
ie S:\A96\00177\2000\2200\smpro\tables\qaqc01.xls

Job Number: 42655949 Site: Perilya

Batch Number	Sample ID	Duplicate ID	QAQC File No.	Printed
EM27659	PITW. 20/10/04	CHK	RPD1	

All 13 samples labelled GFT1 – GFT13 to be digested with water only using 1:1 ratio, bottle rolled for 24hrs, assayed for Fe, Mn, S, Zn, Pb, As, Cd, Bi. Codes PREP9, WAT3E.

Two samples labelled GFT1and GFT2 to be assayed for Fe, Mn, S, Cl, Zn, Pb, As, Cd, Bi (total). Sample is to be split from the original bulk material. Codes PREP2, IC4, LECO1, MET1.

Samples labelled GFT1, GFT2, GFT3, GFT6, GFT13 to be assayed for semi-quantitative mineralogy. Sample is to be split from the original bulk material. Codes PREP2, XRD1.

Please find a breakdown of schemes and prices below. Note that the listed prices are exclusive of GST.

PREP2 For samples up to 3kg in weight, the samples will be dried to a core temperature of approximately 100°C. The total sample will then be milled in either LM5 pulveriser to a nominal 90% passing 106 μm. An analytical pulp of 250 g will be taken from the bulk and the residue retained, where practical, in the original bag.

Price per sample $6.30

XRD1 **Semi-Quantitative Mineralogy of Whole Rocks or Multi-phase Samples.**

This uses XRD to identify the minerals present.

Semi-quantitative estimates of the minerals identified are reported in terms as

Dominant, used for the component apparently most abundant, regardless of its probable percentage level.
Sub dominant, the next most abundant component(s) providing its percentage level is judged above about 20%.
Accessory, components judged to be present between the levels of roughly 5 and 20%.
Trace, components judged to be below about 5%.

Price per sample $48.00

IC4 A 0.1 g subsample of the analytical pulp is fused with lithium metaborate followed by dissolution to give a "total solution". The solution is presented to an ICPOES for the determination of elements of interest.

Al_2O_3(0.01%)	CaO(0.01%)	K_2O(0.01%)	Total Fe as Fe_2O_3(0.01%)
MgO(0.01%)	MnO(0.01%)	Na_2O(0.01%)	P_2O_5(0.01%)
SiO_2(0.01%)	TiO_2(0.01%)	L.O.I.	

Price per sample $46.00

LECO1 The sample is ignited at high temperature in a stream of oxygen. The resulting sulphur dioxide is measured by an infra-red detector using a LECO analyser.

S(100 ppm)

Price per sample $17.60

MET1 A multi-element suite of elements by ICP and is used where concentrates or other metallurgical products are present. A modified aqua-regia attack is used to dissolve the elements being analysed.

As(50 ppm)	Bi(50 ppm)	Cd(10 ppm)	Pb(50 ppm)
Zn(50 ppm)			

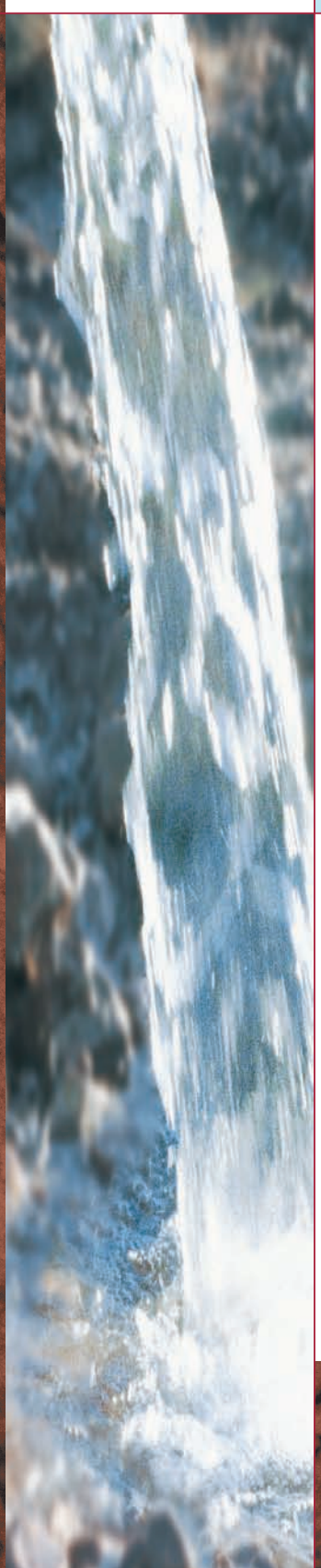
Price per sample $33.40

PREP9	Samples will be immersed in water to a ratio of 1gram:1ml. The sample will be rolled for a total of 24hrs, solution will be filtered and run for elements of interest. Price per sample $10.00			
WAT3E	Water analysis by ICPOES.			
	Fe(0.03mg/l)	Mn(0.10mg/l)	S(0.1mg/l)	Zn(0.02mg/l)
	Pb(0.05mg/l)	As(0.1mg/l)	Cd(0.02mg/l)	Bi(0.05mg/l)
				Price per solution $15.00
REP1	Batch fee applicable to each batch of samples submitted.			**$35.00**

*** Please note that the listed detection limits for WAT3E elements may differ to the above listed.

The total amount for the samples/elements required is $825.50 plus GST.

Total (including GST) is $908.05.



Rockwater
PROPRIETARY LIMITED

DEWATERING EVALUATION OF BELTANA PIT AND REPORT ON BORE CONSTRUCTION/TESTING

DECEMBER 2006

REPORT FOR
PERILYA LIMITED

10.1/06/002

76 Jersey Street Jolimont 6014 Western Australia ABN: 43 008 804 653
Postal: PO Box 201 Wembley 6913 Western Australia
Ph: 61 8 9284 0222 Fax: 61 8 9284 1785
Email: consult@rockwater.com.au www.rockwater.com.au

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EXECUTIVE SUMMARY

Renewed mining of the zinc deposit at Beltana by Perilya Ltd in 2007 is planned to deepen the pit floor from 73 m (234 m AHD) at present, to 97 m (210 m AHD). In October 2006, the water level in the pit was at 254 m AHD, having recovered 20 m in the three years since the previous mining phase. An additional 1.2 m of water has been added during test-pumping operations. Dewatering pumping will be required to extract the estimated 52,000 cubic metres of water in the pit, and to lower groundwater levels by 44 m.

Highly-permeable dolomite aquifer underlies the pit floor within and below the interval to be mined. Three bores constructed to elevations in the range 182 to 201 m AHD in October-November 2006 produced individual supplies of 1,040 to 1,380 cubic metres per day.

Bore pumping-rates required to lower water levels to allow the planned mining have been estimated using aquifer parameters obtained from test-pumping the bores, and aquifer geometry based on geological maps and sections provided by Perilya Ltd. Techniques included extrapolation of drawdown trends and numerical modelling using MODFLOW software.

Groundwater pumping at 800 m^3/d for six months is calculated to effect dewatering to below 210 m AHD. Higher or lower pumping rates could be utilised, for shorter or longer periods respectively. To allow 30 per cent contingency it is suggested that the adopted total pumpage from groundwater be 180,000 m^3.

It is recommended that the pit water be pumped out at 1,000 m^3/d for 52 days then the dewatering bore(s) be pumped at 600 m^3/d for about 300 days (ten months). Of these pumpages, 400 m^3/d will be used for dust suppression and ore-wetting; the remainder will be pumped to a lined evaporation pond, presently planned to measure 190 m by 190 m (36,100 m^2). Calculations based on average rainfall and evaporation rates suggest that water depth in the pond would peak at about 0.9 m in the seventh month, if pumping starts in March 2007. Alternatively, for an evaporation pond measuring 150 m by 150 m (22,500 m^2) the maximum water depth is calculated to be 2m. In the pond design, allowance would be made for 'freeboard' and exceptional rainfall.

The water in the pit and the aquifers beneath and adjacent to it is brackish to slightly saline, with salinity values in the range 3,500 to 6,000 milligrams per litre Total Dissolved Solids. Values of pH are in the range 7.9 to 8.7, indicating alkaline conditions. Samples of water from the pit indicated low levels of six metals analysed (soluble mercury, zinc, lead, manganese, copper and cadmium); iron was medium to low, at 1.8 mg/L. Water from bore W9 contained significant levels of zinc (7.4 mg/L) iron (18 mg/L) and manganese (2.0 mg/L) and low values of the other metals. Such metal contents are significant not for health reasons but for nuisance precipitation of iron and manganese scale or sludge.

The effects of dewatering the Beltana pit to the planned depth are expected to be limited to the immediate environs of the pit. Groundwater levels will not be significantly lowered except close to the mine because of the small lateral extent of the aquifer. Discharge water is relatively benign, being non-acidic, and will be contained on site.

1 INTRODUCTION

The Beltana zinc mine, owned by Perilya Limited, is a pit 73 m deep, containing 20 m of water which has accumulated from groundwater inflow and rainfall since the mine last operated in 2003. Mining is planned to extend to 97 m in 2007. As previous testing had shown that highly permeable aquifers lie beneath the pit (Rockwater, 1984), dewatering bores were constructed and test-pumped in 2006 to provide dewatering facilities and allow assessment of the rates of pumping required to reduce water levels for the new mining operation.

This report presents the data from the 2006 drilling and testing operations, and an assessment of dewatering pumping rates for renewed mining. Locality plans are presented in Figures 1 to 4. A glossary of terms and abbreviations is presented in Appendix III.

2 MINE HYDROGEOLOGICAL SETTING

The deposit of zinc silicate (willemite) lies within faulted and brecciated dolomite/limestone, locally hematite-altered, of Cambrian age: mainly the Wilkawillina Formation, formerly named the Ajax Dolomite. These strata are in faulted contact with Proterozoic-age strata of the Rawnsley Quartzite and Callana Beds. A geological map is presented in Figure 3. Generally the strata have low permeability, but locally the dolomite is highly permeable as a result of brecciation and the development of vugs. Groundwater levels were originally at 262 m AHD.

Dewatering investigations in 1984 led to the construction of three dewatering bores which produced water at rates of 300, 1250 and 1,290 m^3/d. They were constructed to depths of 83 to 101 m below the original ground surface, to elevations of 198 to 224 m AHD. Mining operations in 1987 and 2003 extended to 256 and 234 m AHD respectively, and did not penetrate the main aquifer. Pumping rates from sumps in the mine were reported to be about 300 m^3d; the dewatering bores were not pumped significantly.

The configuration of the Beltana pit in 2006 and as planned for 2007 are shown in Figures 3 and 4 respectively. It is planned that the pit be deepened by 24 m to 210 m AHD and extended to the south by about 100 m.

The water level in the pit in October 2006 was at about 254 m AHD for which the contained volume of water is calculated to be 44,400 m^3. As this volume of water accumulated over a period of 1,217 days (from June 2003 to October 2006) the average rate of inflow was 36 m^3/d plus evaporation minus rainfall. Taking the latter factors into account, the rate of water inflow is estimated to have been about 41 m^3/d. This value contrasts with the high permeability of the underlying aquifer. It suggests limited connection between the pit and the aquifer, and limited lateral extent of aquifer adjacent to the pit.

3 DEWATERING INVESTIGATIONS, 2006

3.1 DESIGN OF PROGRAMME

The investigations were designed to evaluate dewatering of the pit and the underlying strata to 210 m AHD or lower, to allow mining to that elevation in about six months. Previous (1984) drilling and test-pumping data were assessed, together with accounts of dewatering operations for mining in 1987 and 2003.

Data from the earlier programme are presented in the Rockwater report (1984) and are summarised in Table 1. Locations of bores W1 to W5 are shown in Figures 2 and 3.

It was found that the bulk of the groundwater is contained in fractures and cavities in dolomite of the Wilkawillina Formation, and is generally confined by Callana Beds or impermeable Wilkawillina Formation. Aquifer transmissivity is very variable, being very high in fractured/cavernous dolomite and low in unfractured dolomite and other lithologies. Barrier boundaries exist beyond the tested localities.

The three production bores from 1984 will not be utilised for future dewatering operations because bore W1 is of insufficient depth (terminated at 224 m AHD) and bores W4 and W5 have been destroyed.

The 2006 drilling was designed to test the dolomite aquifer previously identified in the central and northern sectors of the deposit, the mineralised dolomite extending to the south of the pit, and the Beltana Fault on the western side of the pit. Five test holes were to be drilled to elevations below 200 m AHD, and three of them converted to production bores of 154 mm diameter. The latter were to be test-pumped to determine bore pumping rates and aquifer response.

Locations of the drill sites were influenced by access within and outside the present pit, and the configuration of the final pit (as planned). The sites, W6 to W10, are shown in Figures 2 to 4. Geological sections showing the position of bores (transposed where necessary) are presented in Figures 5 and 6.

3.2 DRILLING AND TESTING OPERATIONS

Drilling and bore construction were carried out by Underdale Drillers Pty Ltd with an Ingersoll Rand TH60 rig using air-hammer technique. The holes were drilled at 216 mm diameter. W8, W9, and W10 were cased as production bores with 154 mm diameter steel casing, W7 was cased with 60 mm diameter PVC casing as an observation bore, and W6 was not cased. Test-pumping was conducted under sub-contract by Aquatec Pumps Pty Ltd using a submersible pump. Water produced during drilling and test-pumping was discharged into the mine pit.

Bore collars were levelled-in to AHD by Apfel Surveys on completion of the testing operations. Several mineral holes used for monitoring water levels were included in the survey.

Table 1 : Bore Data from 1984 Drilling Programme

Bore	Location (MGA)	Ground Elevation m AHD	Depth Drilled		Static Water Level		Air-lift Supply m^3/d	Casing Diameter mm	Depth Cased m	Slotted Interval m	Status**	Aquifer***	Pumping Test Rate m^3/d
			m	m AHD	m	m AHD							
W1	254292mE 6603643mN	307.1	83.5	224	45.5	261.6	150	153	83	40-83	Prod	W	1250
W2	254268mE 6603450mN	297.6	120	178	45.0	252.6	0	N/A	N/A	N/A	Obs	C	N/A
W3	254344mE 6603529mN	298.8	138	161	40.6	258.2	0	N/A	N/A	N/A	Obs	C	N/A
W4	254261mE 6603501mN	298.8	101	198	36.2	262.6	610	157	66	17-66*	Prod	W	1290
W5	254169mE 6603487mN	299.3	101	198	38.7	260.6	150	153	101	33-101	prod	W	300

* open-hole 66-101 m
** prod. = production bore; obs. = observation bore
*** W = Wilkawillina Formation; C = Callana Beds
N/A = Not applicable

Table 2 : Bore Data from 2006 Drilling Programme

Bore	Location (MGA)	Ground Elevation m AHD	Depth Drilled		Static Water Level		Air-Lift Supply m^3/d	Casing Diameter mm	Depth Cased m	Slotted Interval m	Status **	Aquifer ***	Pumping-Test Rate m^3/d
			m	m AHD	m (bgl)	m AHD							
W6	254130mE 6603467mN	305.8	92	213.8	48.55	253.57	0	N/A	N/A	N/A	Unc.	?	N/A
W7	254168mE 6603417mN	294.2	135	159.2	42.30	251.90	20	60	135	90-135	Obs.	C	N/A
W8	254243mE 6603530mN	254.5	72	182.5	+0.03	254.53	900	154	59.5	29.5-59.5*	Prod.	W	1040
W9	254287mE 6603654mN	308.0	133	175.0	54.40	253.60	1300	154	133	61-97 103-133	Prod.	W	1380
W10	254246mE 6603676mN	309.1	108	201.1	55.485	253.615	1300	154	102	60-102*	Prod.	W	1300

* open hole 59.5 -72 m in W8 and 102 – 108 m in W10
** Obs = observation bore; prod = production bore; Unc = Uncased except for surface collar
*** W = Wilkawillina Formation, C = Callana Beds
N/A Not applicable

3.3 DRILLING RESULTS

Data are presented in Appendix I and summarised in Table 2. Diagrams of the bores are presented in Figures 7 to 11.

Bores W8, W9 and W10 intersected high-yielding dolomite aquifer and were completed to elevations of 175 to 201 m AHD i.e. 9 to 35 m below the planned final pit floor (at 210 m AHD). Drilled depths were 133 m and 108 m for bores W9 and W10, respectively, which are located outside the pit. Bore W8 was collared in the pit floor 1 m above current water level, and was drilled to 72 m depth. Collapsing formation prevented the installation of casing to full depth in bores W8 and W10, which have 12.5 m and 6 m respectively, of uncased hole.

Annular rubber seals were set above the slotted sections of production-bore casing to contain any loose material that may fall from the upper part of the holes. No gravel pack was installed, so that water flow in the annulus outside the casing would not be impeded.

Aquifer material in the three production bores is fractured vuggy dolomite, similar to that intersected in the 1984 production bores W1 and W4. Air-lift yields from the 2006 bores were higher because of greater depth of drilling, larger hole size (216 mm compared with 203 mm diameter), and larger air-capacity of the drilling rig.

Bore W6 penetrated tight dolomite to 84 m, then quartzite and dolomite to 88 m; air-circulation was lost from 88 to 92 m at which depth drilling was discontinued. The hole might have intersected the Beltana Fault, separating the Wilkawillina Dolomite from the Rawnsley Quartzite. Given that the lost circulation zone is 40 m below water level, it is possible that the rock here has high permeability. However, the loss of circulation prevented the achievement of air-lift flow measurements. To appraise the permeability at this location, the hole could be injection-tested.

Bore W7 intersected siltstone and sandstone of the Callana Beds from surface to 128 m, then crystalline dolomite to 138 m. A very small supply of water, about 20 m^3/d, was airlifted from the hole at 124 to 138 m. Evidently both the Callana Beds and the Wilkawillina Formation have low permeability at this location.

3.4 WATER LEVELS

Static water levels measured in the production bores, observation bores, and several mineral holes are shown in Figure 12. Most of the groundwater levels were 253.5 to 253.9 m AHD, similar to the pit water level of about 254 m AHD. Lower levels of 252.2 and 252.3 m AHD were measured in two holes drilled into the Callana Beds.

Groundwater levels at three locations to the south-south-west of the pit (bores BTC221, X1, X2) are about 10 m lower than other groundwater levels in the project area. This may be the result of low-permeability barriers between these locations and the dolomite aquifers associated with the mineral deposit.

3.5 TEST PUMPING

3.5.1 Procedures

Production bores W8, W9 and W10 were each test-pumped with a step-rate test of four hours and a constant-rate test of 48 hours. During testing, water levels were measured in the pumped bore and several observation bores. The step-rate test results were used for selecting pumping rates for the constant rate tests, and are not presented here.

Water from the pumping tests was discharged into the mine (which already contained 20 m of water).

It was appreciated that the body of water in the pit might affect the results of the pumping tests, but the situation could not be changed. If recharge boundary effects became apparent in the drawdown data they would be allowed for. Comparisons could be made with the results of the 1984 pumping tests, conducted when the pit was 17 m above the groundwater level.

Values of aquifer transmissivity (permeability x aquifer thickness) have been calculated approximately using the Jacob approximation of the Theis equation (e.g. Kruseman and de Ridder, 1991). Because of non-conforming shape of the drawdown plots, no storativity values have been calculated. The test results and the calculated aquifer coefficients are given in Table 3.

3.5.2 Bore W8 **Figures 13 and 14**

Bore W8 is located about 10 m from the water's edge (at start of test-pumping) on the present ramp, and about 1 m above the water level at that time. At the bore, the productive dolomite aquifer is covered by 28 m of impermeable Callana Beds, which at this location extend 8 m below the base of the pit.

The constant-rate test was conducted at 1,040 m^3/d. Water levels were measured in the pumped bore, W8, and in observation bores BTC 222, BTC 219, W10 and X3. Values for the angled mineral holes have been corrected for the hole inclination (one at 60^o, one at 80^o).

During pumping, the drawdown data for bore W8 followed an approximate straight-line trend on semi-logarithmic scale, at 0.9 m/log cycle for the period 10.5 to 500 minutes (Figure 13). The later trend gradually steepened to 4.3 m/log cycle and a final drawdown of 8.96 m. The water-level recovery trend, after pumping ceased, was 0.7 m/log cycle.

In the three responsive observation bores the drawdowns were less than those in the pumped bores, although the trends were the same (0.9 m/log cycle) until about 700 minutes after which they steepened to a final drawdown of 2.05 m. Observation bore X3 showed no drawdown.

Table 3 : Summary of Pumping-Test and Aquifer Data

Bore	Year Drilled	Test-Pumping Rate	Static Water Level	Main Aquifer Top	Main Aquifer Base	Drawdown Rate Early	Drawdown Rate Late	Trans-missivity Early	Trans-missivity Late	Final Draw-down 24 Hours		Base of Bore		Recom. Pump Setting		Recom. Pumping Rate 2007	Status
		m^3/d	m AHD	m AHD	m AHD	m/log cycle	m /log cycle	m^2/d	m^2/d	m	m AHD	m	m AHD	m	m AHD	m^3/d	
W1	1984	1,250	261.6 (1984)	259	224	0.06	2.4	3,800	94	1.7	305.4	83.5	223.6	N/A	N/A	N/A	Stock Bore
W4	1984	1,290	262.6 (1984)	238	198	0.37	32.3	244	97	9.5	289.3	101	197.8	N/A	N/A	N/A	Destroyed
W5	1984	300	260.6 (1984)	256	198	ND	27	ND	2	24.8	274.5	101	198.4	N/A	N/A	N/A	Destroyed
W8	2006	1,040	254.5 (2006)	226	194	0.9	4.3	210	44	2.05	252.4	72	182	58	196	1,000	Prod.*
W9	2006	1,380	253.6 (2006)	248	188	0.05	2.5	5,000	100	1.9	251.7	133	175	102	206	1,300	Prod.
W10	2006	1,300	253.2 (2006)	247	201	0.06	2.4	4,000	100	2.0	251.6	108	201	100	209	1,300	Prod

* Prod. = Production Bore

The plots are interpreted to indicate a local aquifer transmissivity of about 210 m^2/d in the bore environs and to the north-east and south-west. The aquifer is limited by impermeable boundaries or low-permeability material causing the increase in the drawdown trends after about 500 minutes. Taking the late (2,000–3,000 minutes) drawdown trend of 4.3 m/log cycle, the 'effective' aquifer transmissivity is indicated to be 44 m^2/d.

No effect of water leakage from the pit to the aquifer is evident from the data; such leakage must be relatively small. This is supported by the similarity of the bore W8 drawdown trend with that for Bore W4 (Rockwater, 1984, Fig. 12); there was no water in the pit at the time of the latter test.

The drawdowns in about ten observation bores at the end of the 48 hour test are shown in Figure 14. Close to the south-western and north-eastern margins of the pit, drawdowns of about 2 m were recorded. Further to the north-east, in Camp Bore and P129, there was sufficient drawdown for the bores to become dry. The actual drawdown values are not known. No significant water-level responses were recorded in the bores to the east and south of the pit.

3.5.3 Bore W9 **Figures 15 and 16**

Bore W9 was test-pumped at 1,380 m^3/d. The rate of drawdown was initially 0.05 m/log cycle, increasing to 2.5 m /log cycle after 2,000 minutes (Figure 15). The final drawdown was 1.9 m. Observation bore W10 at 46 m distance from the pumped bore showed the same drawdown trend but with 0.15 m less drawdown than the pumped bore. The water-level recovery trend was 0.22 m/log cycle, at 40–120 minutes after pumping ceased.

The calculated aquifer transmissivity values are 5,000 and 100 m^2/d for the early and late trends respectively. Evidently the aquifer is limited by impermeable boundaries or low permeability material; the transmissivity value of 100 m^2/d is an 'effective' value which incorporates these effects.

There are no indications in the data that there was significant leakage from the pit to the pumped aquifer. The drawdown plot for Bore W9 is almost identical to that for Bore W1 when it was test-pumped in 1984 (Rockwater, 1984) when there was no water in the pit.

Values of drawdown at 48 hours in observation bores in the pit environs are shown in Figure 16. The pattern is similar to that for the W8 test, but with slightly smaller values. Bore W7 indicated a strong water level response in dolomite aquifer south of the pit. Measurements in Bore W8 were precluded by high pit water levels.

3.5.4 Bore W10 **Figures 17 and 18**

The results for Bore W10 are almost identical to those for W9. Drawdown rates in the pumped bore were initially 0.06 m/log cycle increasing to 2.4 m/log cycle in the late stages. The final drawdown was 2.0 m. Observation Bore W9 showed the same drawdown trend, but

with 0.3 m less drawdown that the pumped bore. The water-level recovery trend was 0.2 m /log cycle at 40–120 minutes after pumping ceased.

Aquifer transmissivity values are calculated to be 4,000 m^2/d for the early data and 100 m^2/d for the late data. As for the other pumping tests the latter value is the 'effective' transmissivity which incorporates aquifer boundaries and adjacent low-permeability material.

Values of drawdown in observation bores at the end of the W10 test (Figure 18) are almost the same as those for Bore W9.

3.5.5 Pit Water Levels

Discharge of pumping-test water into the pit, a total of 7,860 m^3, produced a water-level rise of about 1.5 m to an elevation of 255.2 m AHD. The calculated volume from the pit dimensions at this elevation, for a water-level rise of 1.5 m, is 8,160 m^3. While these volumes are based on approximate measurements, they indicate that all or most of the pumped water remained in the pit.

4 AQUIFER ASSESSMENT

4.1 TEST RESULTS

Table 3 provides a summary of the results of test-pumping six production bores at the Beltana pit: three in 1984 (W1, W4 and W5) and three in 2006 (W8, W9 and W10).

4.2 SUMMARY OF HYDRAULIC FEATURES

The following hydraulic features have been indicated by the pumping tests and other measurements.

(1) The most highly-permeable material is vuggy/fractured dolomite in the northern part of the pit and environs, where aquifer transmissivities are indicated to be 4,000–5,000 m^2/d initially, decreasing to 'effective' values of 90–100 m^2/d in the longer term, when adjacent less-transmissive material affects the water-level drawdown trends. The highly-transmissive aquifer lies in the elevation-ranges of 190 to 260 m AHD at the sites drilled (W1, W9, and W10).

(2) Highly-permeable dolomite also occurs beneath the central part of the pit, at elevations in the range 188 to 238 m AHD at the sites drilled (W4 and W8). This aquifer is mainly deeper than the present pit floor; there are very low rates of leakage between the pit water and the aquifer.

(3) The Callana Beds and the dolomite to the south, east and south-west of the pit have very low permeability.

(4) The Beltana Fault on the western side of the pit may be permeable, as evidenced by lost-circulation at 36 m below water level in bore W6. Drilling and logistical factors prevented bore construction and hydraulic testing of this cavity or fracture.

(5) The Rawnsley Quartzite lying to the west of the Beltana Fault is considered to be generally impermeable, but it has not been tested at this locality.

(6) Pumping from the pit and bores to effect mine-dewatering will reduce groundwater levels beneath the pit and to the north: almost certainly at least 300 m northwards beyond Camp Bore, which will again become dry.

(7) After a period of standing, the pit water level and the local groundwater levels equate approximately. They were initially (in 1984) at 262 m AHD, and were at 254 m AHD in October 2006 following episodes of mine dewatering to 234 m AHD until mid 2003. The slow rate of seepage into the pit, estimated to be 41 m^3/d average for three years, is attributed to (1) a low-permeability layer above the main aquifer, and (2) the small areal extent of aquifer outside the pit. Given that the groundwater basin – with high permeability – is apparently small, pumping will reduce water levels over a large proportion of the basin and reduce hydraulic gradients (in the basin) that support groundwater flow to the pit. Had the groundwater basin around the pit been extensive, groundwater levels at Camp Bore, for example, would have recovered to near 262 m AHD after pumping ceased.

5 DEWATERING ASSESSMENT

5.1 HISTORICAL DATA

Pumping water from the Beltana mine in 1987 and 2003 reduced groundwater levels sufficiently to allow mining to 234 m AHD. The pumping rates were not recorded but may have been 300 m^3/d for two periods of six to twelve months. By October 2006 after three years of recovery there was a residual drawdown of eight metres in and around the pit, extending at least 300 m to the north. The dewatered material appears to be mainly low-permeability rock above the main aquifer of vuggy/fractured dolomite.

5.2 FUTURE DEWATERING

5.2.1 Pit Water

The volume of water stored in the present pit is calculated to be 52,000 m^3. This can be pumped out at say 1,000 m^3/d for 52 days.

5.2.2 Dewatering Bores

The three dewatering bores (W8, W9, and W10) currently installed can be pumped in the short term at rates of 1,000, 1,300, and 1,300 m^3/d. With prolonged pumping, these rates will almost certainly reduce, as water levels fall. Predictions of water-level reductions are made herein based on plots of drawdown versus square root of time (Figure 19). This technique is applicable to bounded aquifers and provides linear data plots, which can be extrapolated.

Extrapolating the trends of drawdown in the production bores, and interference drawdown, leads to the estimated pumping water levels of 188 to 201 m AHD after five months of pumping.

The extrapolations assume that all three bores are pumped continuously at the pumping-test rates – although in practice the pumping rates will gradually decline. The results indicate that there are good prospects of dewatering to 210 m AHD within the required eight months.

To provide an analysis that more precisely takes into account the interpreted aquifer boundaries, and different pumping rates, a numerical model was used to simulate borefield operation. It is described in Section 5.3 below

5.3 MODELLED DEWATERING OPERATION

The numerical model utilises 'Processing Modflow Pro' processing software, a version of the industry-standard MODFLOW program devised by the US Geological Survey (McDonald and Harbaugh, 1988). The model covers an area of 3.1 km north-south and 1.5 km east-west around and including the Beltana Pit. It contains 54 columns and 86 rows with minimum cell size of 10 m x 10 m in the pit area.

Hydraulic factors utilised in the model included values from the pumping test results and adopted values based on geology and drilling information. The main ranges of values used in the model are listed below:

Initial Water Level: 254 m AHD
Bottom of Aquifer: 170 m AHD
Top of Aquifer: 245 m AHD
Permeability in the pit and up to 200 m to the north: 4 to 80 m/d; locally 0.0001 to 0.03 m/d.
Permeability peripheral to the pit: mainly 0.0001 m/d; higher values locally within 200 m of the pit
Storage coefficient: mainly 0.0001 to 0.0015; up to 0.045 in dolomite aquifer
Specific yield: mainly 0.01 in the pit and 0.005 peripherally
Recharge from rainfall/run-off: nil

5.3.1 Calibration

The model was calibrated to the water-level drawdowns measured during the pumping tests, by adjusting the above parameters until a satisfactory match was obtained. Figure 20 shows drawdown-time plots from the model output and field measurements; there is a close fit of data. Figure 21 shows the model-calculated and measured values of drawdown at monitoring points for 48 hours of the W9 pumping test. Given the aquifer heterogeneity the calibration is acceptably close.

5.3.2 Model Operation and Results

The model was run with several pumping rates from one or more pumped bores for periods of up to 180 days (six months). Model-calculated values of groundwater levels in the aquifer beneath the central part of the pit were tabulated and compared with the planned final pit depth of 210 m AHD. The relevant results are presented in Table 4.

Table 4 : Model-calculated Water Levels during Dewatering Operation

Bore	Pumping Rate m^3/d	Water Level Beneath Pit			
		30 days m AHD	60 days m AHD	90 days m AHD	180 days m AHD
W8	800	241	230	219	187
W9 or W10	800	242	230	219	188
W8 & W9	400 x 2	241	230	219	187
W8, W9, & W10	300 x 3	240	227	215	179
W8	1200	234	218	202	RPR*
W9 or W10	1200	235	219	203	RPR
W8 & W9	800 x 2	228	207	185	RPR
W8, W9 & W10	800 x 3	217	183	RPR	RPR

*RPR = Reduced pumping rate because of excessive drawdown in the pumped cell.

Water-level reductions to 210 m AHD or lower in less than six months are indicated to be achievable with a total pumping rate of 800 m^3/d from one, two or three of the bores. At 1,200 m^3/d the target dewatering would be reached in less than 90 days, and at 1,600 to 2,400 m^3/d in less than 60 days.

The model-calculated water-level values are based on the assigned pumping rates being maintained for the stated periods. Modelling takes no account of reduction in bore efficiency as water levels are reduced; in practice, bore pumping rates may decline therefore pumping periods would be longer. Alternatively more than one bore could be pumped, to maintain the target groundwater extraction rate.

5.3.3 Sensitivity Analysis

To examine the sensitivity of modelling results to the key aquifer coefficients of permeability and storativity, the model was run with coefficients at half and twice the adopted values. The results are presented in Table 5. They indicate that the model is relatively insensitive to aquifer permeability: with double or half the adopted values, the water-level values are changed by only two metres or less.

The model is sensitive to storativity values. If actual values are double the adopted values, water levels would be 11 to 34 m higher than predicted, and pumping would need to run for an additional 30 days compared with the estimated times (this may be ascertained from comparison of Tables 4 and 5). If actual values are half the adopted vales, then the pumping period would be reduced by more than 30 days.

Further model runs have indicated that if storativity is twice the adopted values, dewatering to 210 m AHD would require the extraction rate to be 800 m^3/d for 230 days, 1,200 m^3/d for 150 days, or 1,600 m^3/d for 112 days.

Table 5 : Sensitivity Analysis of Numerical Model

Bore	Pumping Rate m^3/d	Water level beneath pit after 60 days (m AHD)					
		K* x 1 S* x 1 m AHD	K* x 2 S* x 1 m AHD	K* x 1 S* x 2 m AHD	K* x 2 S* x 2 m AHD	K* x 0.5 S* x 1 m AHD	K* x 1 S* x 0.5 m AHD
W8	800	230	230	241	242	228	208
W8	1200	218	219	235	236	217	RPR*
W8 & W9	800 x 2	207	209	228	230	205	RPR*
W8, W9, & W10	800 x 3	183	186	217	219	RPR*	RPR*

* K = aquifer permability (aquifer transmissivity ÷ thickness)
S = aquifer storativity, both specific yield and storage coefficient
*RPR = Reduced pumping rate because of excessive drawdown in the pumped cell.

6 WATER DISPOSAL

The hydraulic testing and modelling of the aquifer system have led to a realistic estimate that dewatering to 210 m AHD could be achieved by pumping out the stored pit water (estimated to be 52,000 m^3) and pumping the groundwater at about 800 m^3/d for six months. These estimates are based on numerical modelling of a heterogeneous aquifer and are approximate only. For the purpose of examining water disposal requirements, a contingency 30 percent is applied to the groundwater estimate. Then the volumes are taken to be:

Surface water: 52,000 m^3 (pumped for 52 days)
Groundwater: 1,000 m^3/d for 180 days = 180,000 m^3
Water usage for dust suppression and ore wetting: 400 m^3/d for 232 days = 98,800 m^3
Nett estimated volume of water to be disposed of: 139,200 m^3

It is intended that the water be discharged to a lined evaporation pond of adequate area and depth to store the water and allow it to evaporate.

Evaporation and rainfall estimates for Beltana are given in Table 6 below. The average annual nett evaporation is 2,193 mm; while actual values will exhibit considerable variability, this average value is adopted for initial design purposes. Although the evaporation values are for pan evaporation which can be about 10 percent higher than evaporation from a pond, they are taken to be applicable because in practice the use of spray-discharge will enhance the efficiency of evaporation at the pond.

6.1 GROUNDWATER PUMPING AT 1,000 M^3/D

For evaporation at 2.2 m per annum to consume 139,200 m^3 in less than two years, the area of pond required would be about 36,100 m^2, i.e. 190 m by 190 m. For a pond of this size, the consumption of water by evaporation will on average range from 1,800 to 13,000 m^3/month

(Table 7). Based on start-up in March and average rainfall, the maximum water in storage is calculated to be 99,300 m^3 in October 2007. The depth of pond would need to be 2.8 m plus an allowance for 'freeboard' and exceptional rainfall events (up to 200 mm).

Table 6 : Beltana Evaporation and Rainfall Data

Month	Beltana Average Monthly* Evaporation (mm)	Beltana Average Monthly* Rainfall (mm)	Nett Average Monthly Evaporation (mm)
Jan	360	25	335
Feb	280	20	260
Mar	255	20	235
Apr	150	15	135
May	90	25	65
Jun	60	10	50
Jul	50	22	53
Aug	95	20	75
Sep	160	15	145
Oct	245	15	230
Nov	300	10	290
Dec	340	20	320
Total annual	**2,410**	**217**	**2,193**

* Values estimated from Australian Climatic Atlas

Table 7 : Estimates of Average Water Consumption by Evaporation from a Pond of 36,100 m^2 and a Groundwater Dewatering Pumping Rate of 1,000 m^3/d

Month	Consumption by Evaporation (m^3)	Average Monthly Discharge (m^3)	Nett Volume of Stored Water* (m^3)
Jan-07	12,996		
Feb-07	10,108		-
Mar-07	9,206	18,600	9,395
Apr-07	5,415	18,000	21,980
May-07	3,249	18,600	37,331
Jun-07	2,166	18,000	53,165
Jul-07	1,805	18,600	69,960
Aug-07	3,430	18,600	85,130
Sep-07	5,776	18,000	97,354
Oct-07	8,845	10,800	99,310
Nov-07	10,830	-	88,480
Dec-07	12,274	-	76,206
Jan-08	12,996	-	63,210
Feb-08	10,108	-	53,102
Mar-08	9,206	-	43,896
Apr-08	5,415	-	38,481
May-08	3,249	-	35,232
Jun-08	2,166	-	33,066
Jul-08	1,805	-	31,261
Aug-08	3,430	-	27,832
Sep-08	5,776	-	22,056
Oct-08	8,845	-	13,211
Nov-08	10,830	-	2,381
Dec-08	12,274	-	-

* The nett discharge to the pond = 600 m^3/d

6.2 GROUNDWATER PUMPING AT 600 M^3/D

6.2.1 Pit Area of 36,100 m^2

An alternative scenario would be to pump groundwater at 600 m^3/d for a longer period, say 300 days (ten months). Given the usage at 400 m^3/d for dust suppression etc, the discharge to the evaporation pond would be 200 m^3/d. The volumes are taken to be :

Surface water: 52,000 m^3 (pumped for 52 days)
Groundwater: 600 m^3/d for 300 days = 180,000 m^3
Water usage for dust suppression and ore wetting: 400 m^3/d for 352 days = 140,800 m^3/d
Nett estimated volume of water to be disposed of: 91,20000 m^3

The nett volume of stored water is calculated to peak at 32,000 m^3 (Table 8). This volume would require a water storage depth of 0.9 m plus safety factors.

Table 8 : Estimates of Average Water Consumption by Evaporation from a pond of 36,100 m^2 and a Groundwater Dewatering Pumping Rate of 600 m^3/d

Month	Consumption by Evaporation (m^3)	Average Monthly Discharge (m^3)	Nett Volume of Stored Water* (m^3)
Jan-07	12,996		
Feb-07	10,108		-
Mar-07	9,206	18,600**	9,395
Apr-07	5,415	14,400	18,380
May-07	3,249	6,200	21,331
Jun-07	2,166	6,000	25,165
Jul-07	1,805	6,200	29,560
Aug-07	3,430	6,200	32,330
Sep-07	5,776	6,000	32,554
Oct-07	8,845	6,200	29,910
Nov-07	10,830	6,000	25,080
Dec-07	12,274	6,200	19,006
Jan-08	12,996	6,200	12,210
Feb-08	10,108	3,000	5,102
Mar-08	9,206	-	-

* The nett rate of discharge of groundwater to the evaporation pond = 200 m^3/d
** pit water to be discharged at 1,000 m^3/d for 52 days, minus 400 m^3/d for dust suppression

6.2.2 Pit Area of 22,500 m^2

If the maximum depth of water in the pond is taken to be close to 2 m, it is estimated that a pond area of 22,500 m^2 would provide the requisite evaporation to allow disposal of 200 m^3/d of water from a 600 m^3/d dewatering operation.

Table 9 lists the calculated nett volumes of water in storage based on a March 2007 start-up.

Table 9 : Estimates of Average Water Consumption by Evaporation from a pond of 22,500 m^2 (150 x 150) and a Groundwater Dewatering Pumping Rate of 600 m^3/d

Month	Consumption by Evaporation (m^3)	Average Monthly Discharge (m^3)	Nett Volume of Stored Water* (m^3)
Jan-07	8,100		
Feb-07	6,300		-
Mar-07	5,738	18,600**	12,863
Apr-07	3,375	14,400	23,888
May-07	2,025	6,200	28,063
Jun-07	1,350	6,000	32,713
Jul-07	1,125	6,200	37,788
Aug-07	2,138	6,200	41,850
Sep-07	3,600	6,000	44,250
Oct-07	5,513	6,200	44,938
Nov-07	6,750	6,000	44,188
Dec-07	7,650	6,200	42,738
Jan-08	8,100	6,200	40,838
Feb-08	6,300	3,000	37,538
Mar-08	5,738	-	31,800
Apr-08	3,375	-	28,425
May-08	2,025	-	26,400
Jun-08	1,350	-	25,050
Jul-08	1,125	-	23,925
Aug-08	2,138	-	21,788
Sep-08	3,600	-	18,188
Oct-08	5,513	-	12,675
Nov-08	6,750	-	5,925
Dec-08	7,650	-	-
Jan-09	8,100	-	-

* The nett rate of discharge of groundwater to the evaporation pond = 200 m^3/d
** pit water to be discharged at 1,000 m^3/d for 52 days, minus 400 m^3/d for dust suppression

The nett volume of stored water is calculated to peak at 45,000 m^3. This volume would require a water storage depth of 2 m. As calculated, the water in the pond would have all evaporated in 22 months from commencement of discharge.

6.3 WATER DISPOSAL SUMMARY

Based on the adopted climatic and hydrogeological data, groundwater pumped from bores at and near the Beltana pit at rates of between 1,000 and 600 m^3/d for between six and ten months could (as calculated) be disposed-of by evaporation from a pond of 36,100 m^2 area. It is assumed that 400 m^3/d of pumped water be consumed in dust-suppression and ore-wetting operations. Groundwater pumping rates of about 600 m^3/d appear to be preferable because the calculated water storage depth is 0.9 m, being more manageable than 2.8 m calculated for a pumping rate of 1,000 m^3/d.

Alternatively, for a maximum water depth of 2 m and a groundwater pumping rate of 600 m^3/d (a disposal rate of 200 m^3/d) it is calculated that a pond area of 22,500 m^2 would provide the required evaporation.

It is noted that the calculations are based on climatic averages and should be regarded as approximate only.

7 WATER QUALITY

Water samples were taken from the Beltana pit and the three production bores for chemical analysis of the major ions. Additionally, samples were taken from Bore W9 and the pit for analysis of dissolved heavy metals; these samples were filtered and acidified in the field according to sampling protocols for such analyses. The laboratory reports are presented in Appendix II and the results are listed in Table 10. Where two or more samples were taken from a bore, they are suffixed a, b and/or c in reference to the time of sampling during the bore pumping test. Plots of the water analyses in the form of a Piper diagram are presented in Figure 22.

Water samples were taken regularly during drilling operations for determining salinity from conductivity measurements by field instrument. Values are given in the bore diagrams (Figures 7 to 11).

Salinities of the groundwater in the dolomite covered a small range, 4,200 to 4,700 milligrams per litre Total Dissolved Solids calculated from conductivity measurements. Water from the pit had slightly higher salinity, 5,600 mg/L TDS. Lower salinity water of 2,900 mg/L TDS was obtained from the Callana Beds at Bore W7.

The waters are sodium-chloride dominant, with moderately high magnesium and calcium as is typical of dolomite aquifers. They are moderately alkaline, with pH values in the range 7.6 to 8.7. In the samples with pH greater than 8.3, carbonate ions as well bicarbonate ions are present. The water will tend to be encrusting rather than corrosive.

In the Piper diagram (Figure 22) the analyses have a tight grouping, indicating chemical similarity of the waters. The W7 sample has a slightly higher percentage of bicarbonate and magnesium than the other samples. The chemistry of the pit water is very similar to that of the groundwater, although proportionately it is slightly higher in chloride and sulphate. Its high pH indicates that there is no effect of sulphide oxidation, in the pit.

Of the two samples analysed for metals, Bore W9 water shows notably high values of zinc (7.4 mg/L), iron (18.0 mg/L), and manganese (2.0 mg/L), whereas the pit water has values of about one tenth or one twentieth of these values (Table 10). Based on these results, it is expected that the bore water will provide precipitate of iron and manganese. None of the metals analysed are at levels that exceed health guidelines. The aesthetic guidelines exceeded by zinc, iron and manganese refer to taste and staining factors.

If iron and manganese precipitate in the water storage pond, the quality of the water would be better than that of the groundwater, provided water salinity increase was controlled.

Table 10 : Chemical Analyses of Water Samples

Analyte	Units	Pit	Bore W7	Bore W8a	Bore W8b	Bore W8c	Bore W8d	Bore W9	Bore W9a	Bore W9b	Bore W10a	Bore W10b
		15/11/2006	31/10/2006	30/10/2006	5/11/2006	5/11/2006	9/11/2006	15/11/2006	27/10/2006	15/11/2006	6/11/2006	12/11/2006
Nitrate, NO_3	mg/L	30.0	13.0	1.9	<0.2	<0.2	7.0	-	7.0	5.7	6.4	5.8
Calcium, Ca	mg/L	310	140	260	280	260	280	-	260	290	240	290
Magnesium, Mg	mg/L	280	190	190	190	190	200	-	200	210	200	210
Sodium, Na	mg/L	1400	970	1000	1100	1000	1000	-	1200	1200	1200	1200
Potassium, K	mg/L	17	25	16	19	17	11	-	18	12	19	19
Chloride, Cl	mg/L	2500	1300	1900	1900	1900	1900	-	2000	2000	2000	2000
Sulphate, SO_4	mg/L	930	400	710	680	660	680	-	740	730	760	750
Bicarbonate, HCO_3	mg/L	220	470	260	470	310	310	-	360	300	410	270
Carbonate, CO_3	mg/L	<1	<1	41	<1	43	25	-	<1	23	<1	40
pH	pH units	8.2	7.9	8.7	8.2	8.7	8.3	-	7.9	8.5	7.6	8.7
Total Dissolved Solids	mg/L	5600	2900	4300	4100	4200	4400	-	4500	4600	4700	4700
Conductivity @ 25°C	µS/cm	9600	5300	7400	7400	7400	7400	-	7900	7900	7900	7900
Sum of Ions (calc.)	mg/L	5639	3303	4444	4599	4375	4442	-	4720	4703	4826	4758
Soluble Mercury, Hg	mg/L	<0.0001	-	-	-	-	-	<0.0001	-	-	-	-
Zinc, Zn	mg/L	0.33	-	-	-	-	-	7.40	-	-	-	-
Lead, Pb	mg/L	<0.005	-	-	-	-	-	<0.005	-	-	-	-
Iron, Fe	mg/L	1.80	-	-	-	-	-	18.00	-	-	-	-
Manganese, Mn	mg/L	0.28	-	-	-	-	-	2.00	-	-	-	-
Copper, Cu	mg/L	<0.1	-	-	-	-	-	<0.1	-	-	-	-
Cadmium, Cd	mg/L	<0.01	-	-	-	-	-	<0.01	-	-	-	-

Sample	Description
W9a	Taken from Bore W9 during airlifting/developing
W8a	Taken from Bore W8 during airlifting/developing
W8b	Taken from Bore W8 at the start of the step-rate test
W8c	Taken from Bore W8 at the end of the step-rate test
W10a	Taken from Bore W10 during airlifting/developing
W8d	Taken from Bore W8 at the end of the constant-rate test
W10b	Taken from Bore W10 at the end of the constant-rate test
W9b	Taken from Bore W9 at the end of the constant-rate test

8 CONCLUSIONS

The construction of three groundwater production bores at the Beltana pit provide the means of dewatering the underlying dolomite aquifers to allow mining to 210 m RL in 2007. Individually the bores are capable of being pumped at 1,000 to 1,300 m^3/d in the short term but the limited extent of aquifers will necessitate pumping-rate reductions under sustained (several months) pumping.

Numerical modelling has indicated that the required dewatering could be achieved in less than six months by pumping at a total rate of 800 m^3/d from one, two or three of the bores. Higher or lower rates could be adopted, for shorter or longer pumping periods. To provide a contingency of 30 percent, the total volume of groundwater to be pumped has been assumed to be 180,000 m^3.

The rate at which water can be disposed of by evaporation from a pond will influence the rates of pumping.

Three scenarios are summarised in Table 11. In each case the pit water is first pumped out at 1,000 m^3/d then the groundwater is pumped at the stated rate (600 or 1,000 m^3/d). Water is consumed at 400 m^3/d for dust suppression and ore wetting, and the remainder is discharged to the evaporation pond. Two pond areas have been considered : 36,100 m^2 and 22,500 m^2.

Table 11 : Calculated Maximum Depths of Water in Evaporation Pond

Groundwater Pumping Rate m^3/d	Discharge Rate to Evap. Pond m^3/d	Calculated Maximum Depth of Water in Pond of 36,100 m^2 Area m	Calculated Maximum Depth of Water in Pond of 22,500 m^2 Area m
1,000	600	2.8	ND*
600	400	0.9	2

ND* = Not determined

The above values for dewatering and water disposal should be taken as approximate, as they are based on modelling of heterogeneous aquifers, and climatic factors which can vary significantly. They are believed to be realistic.

Dated: 4 December 2006 **Rockwater Pty Ltd**

J R Passmore
Principal Hydrogeologist

D P Janssen
Hydrogeologist

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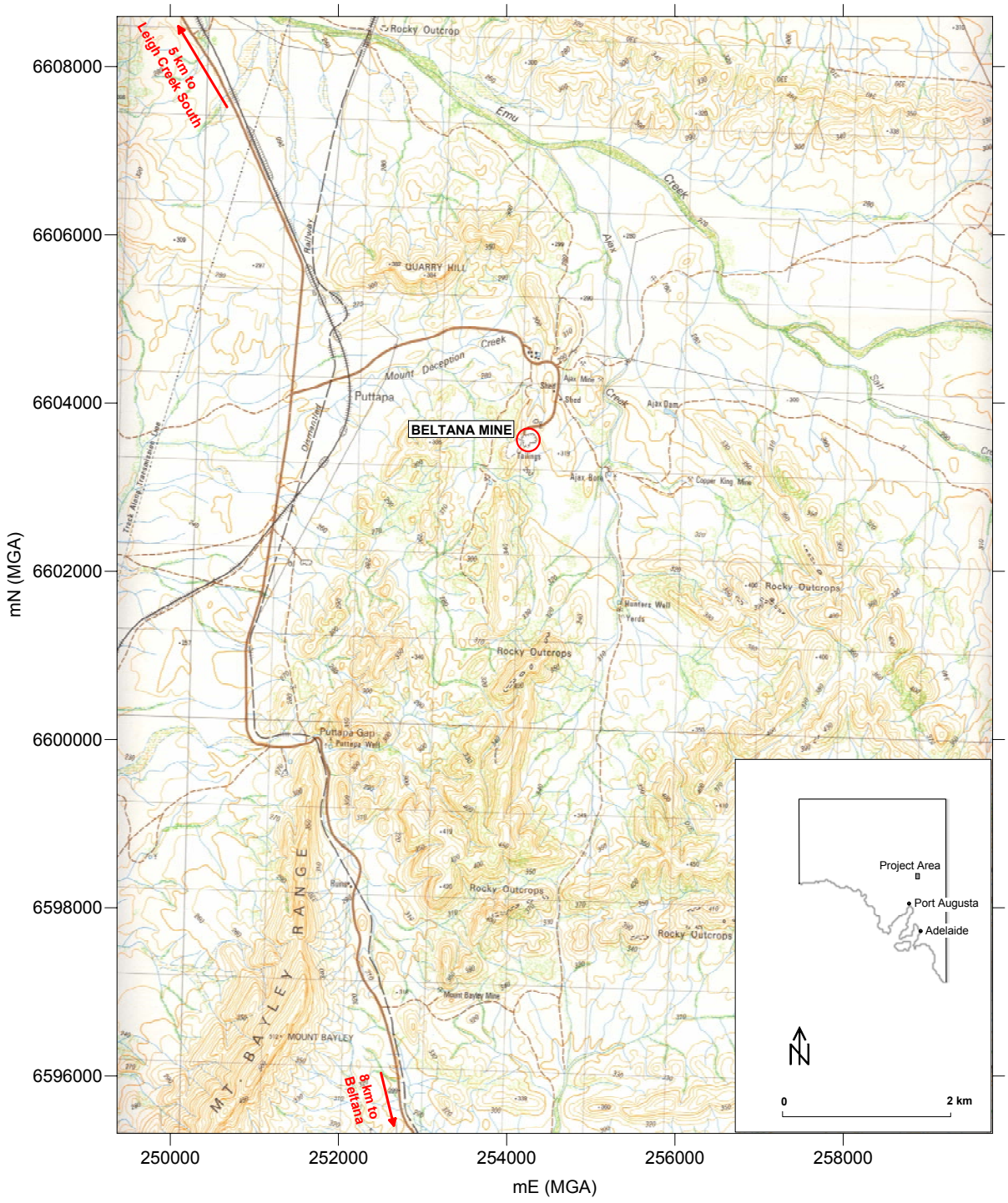
McDonald, M.G., and A.W. Harbaugh, 1988, A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model. Book 6, Chapter A1, Techniques of Water Resources Investigations. U.S. Geol. Surv., Washington, DC. (A:3980).

Kruseman, G. P. and de Ridder, N. A., 1991, Analysis and Evaluation of Pumping Test Data, Second Edition. International Institute for Land Reclamation and Improvement/ILRI publication 47.

Rockwater, 1984, Test Results and Dewatering Assessment for Open-Pit Mining, Beltana Mine, SA. Unpublished report for Electrolyte Zinc Co of Australasia December 1984

FIGURES

Figure 1



10.1/Surfer/locality topo map beltana.srf

(Base map used: Copley Sheet 6536-1, 1:50,000 topographic series)

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

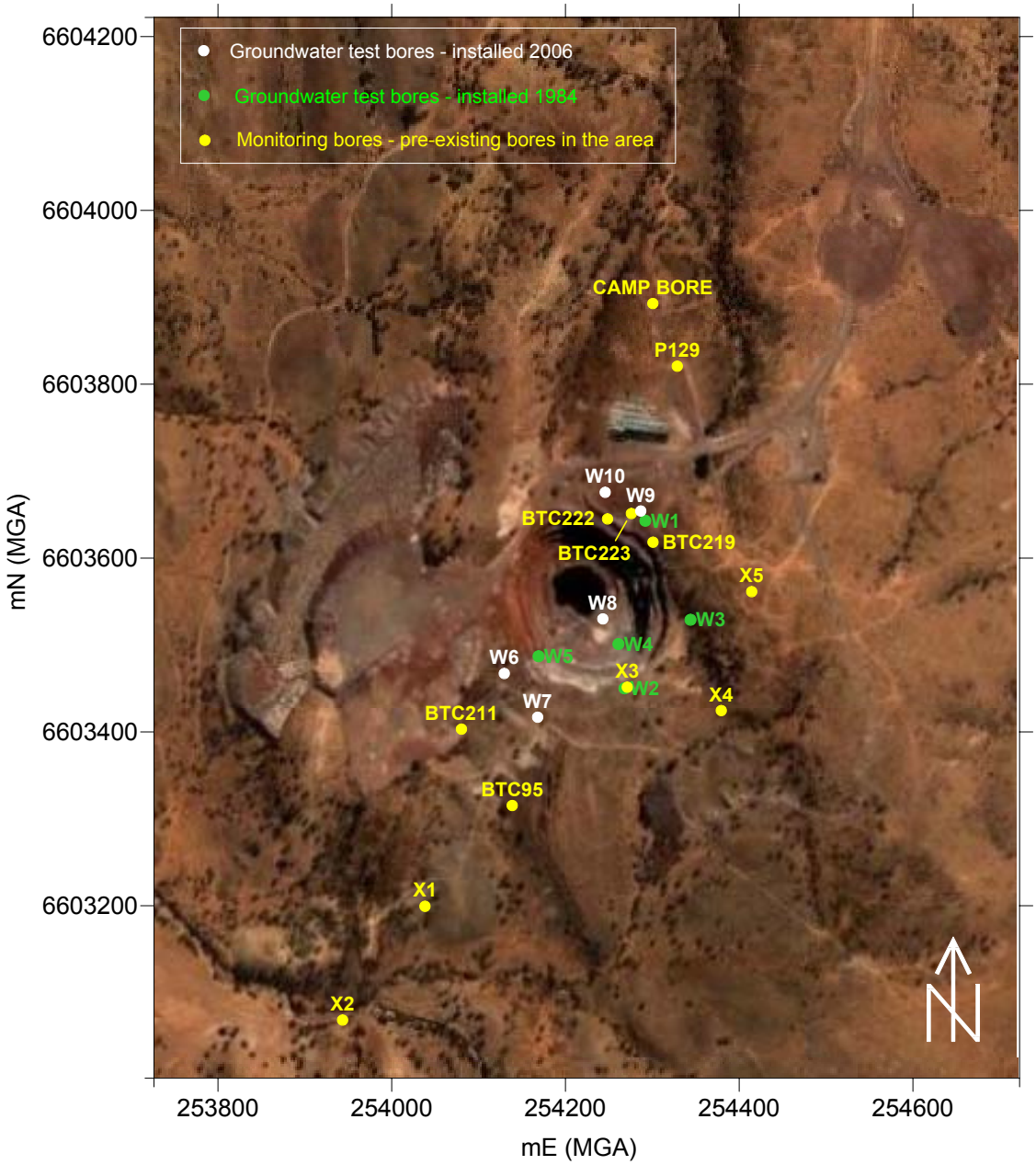
DATE: December 2006

Dwg. No: 10.1/06/02-01

BELTANA MINE AND SURROUNDS, LOCALITY MAP

Rockwater Pty Ltd

Figure 2



10.1/Surfer/bore locations_aerial photo.srf

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

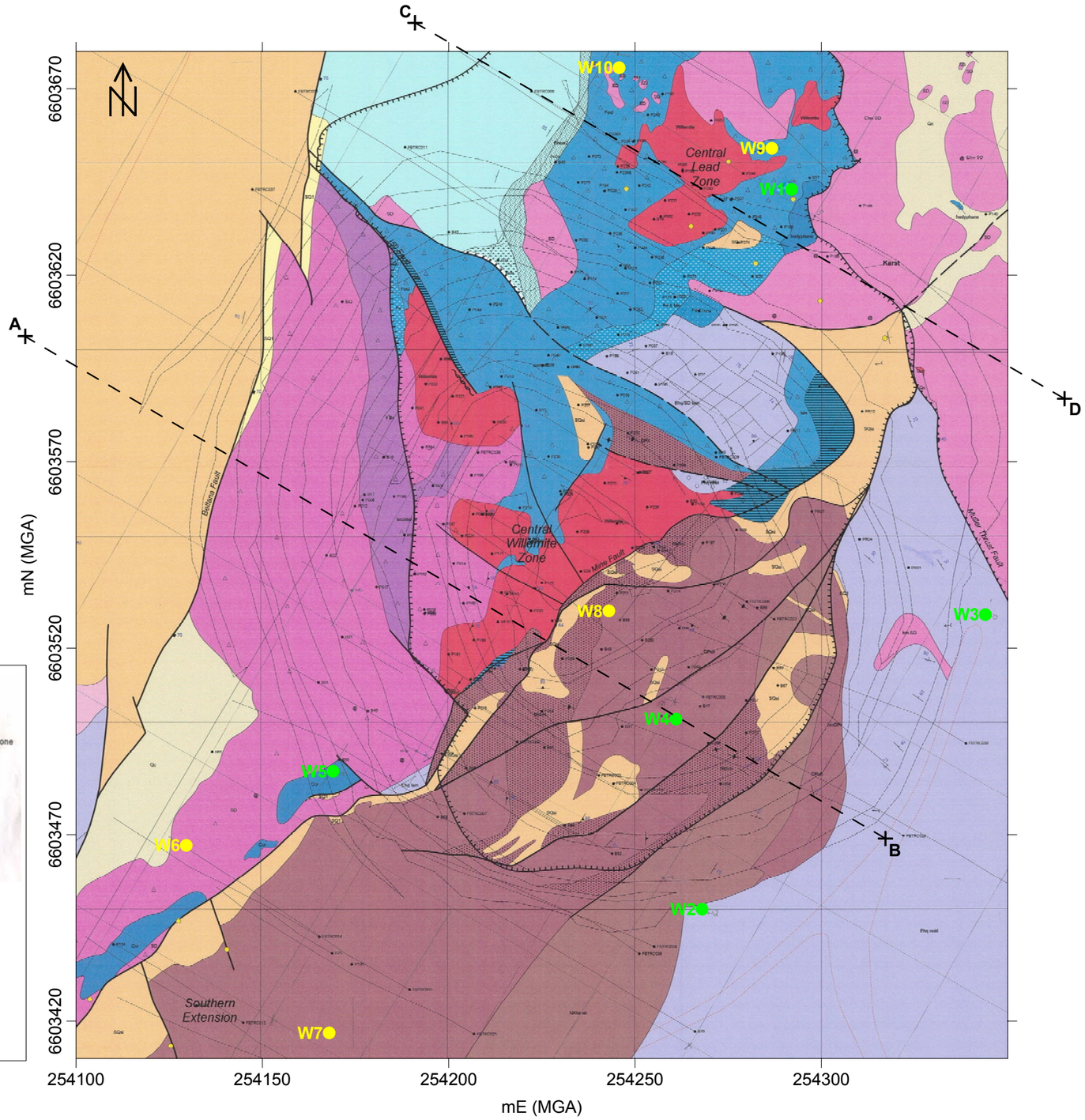
DATE: December 2006

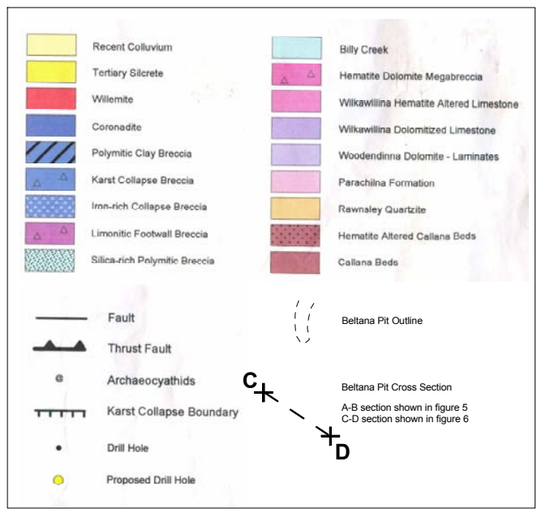
Dwg. No: 10.1/06/02-02

BELTANA MINE
AIRPHOTO LOCALITY MAP

Rockwater Pty Ltd

FIGURE 3





I:/10.1/Surfer/Pit Geology revised.srf

CLIENT:	Perilya Ltd
PROJECT:	Beltana Pit Dewatering
DATE:	December 2006
Dwg. No:	10.1/06/02-03

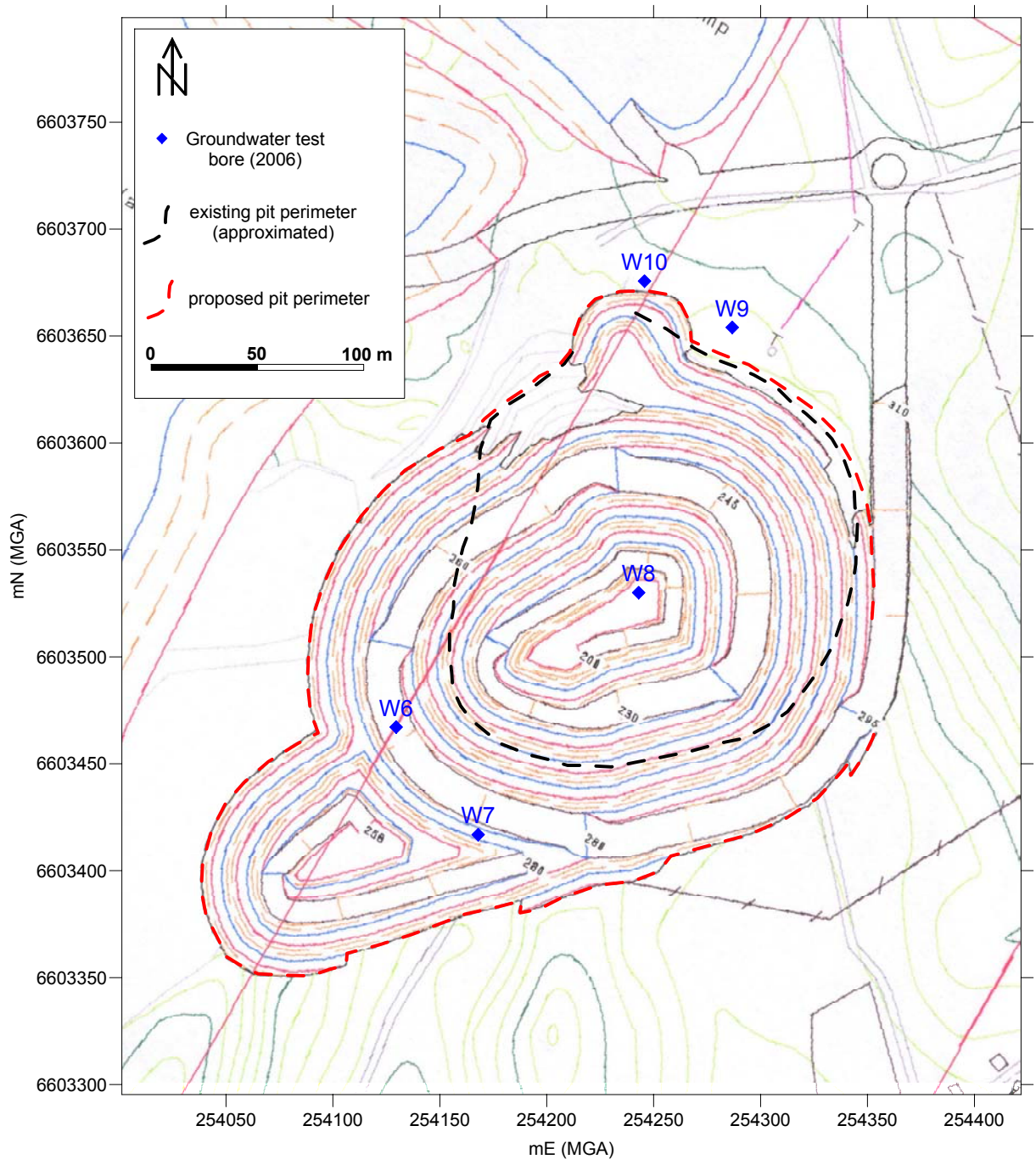
- 1984 GroundwaterTest Bores
- 2006 Groundwater Test Bores

0 50 100 m

BELTANA GEOLOGICAL MAP
(Geology provided by Perilya Ltd)

Rockwater Pty Ltd

Figure 4



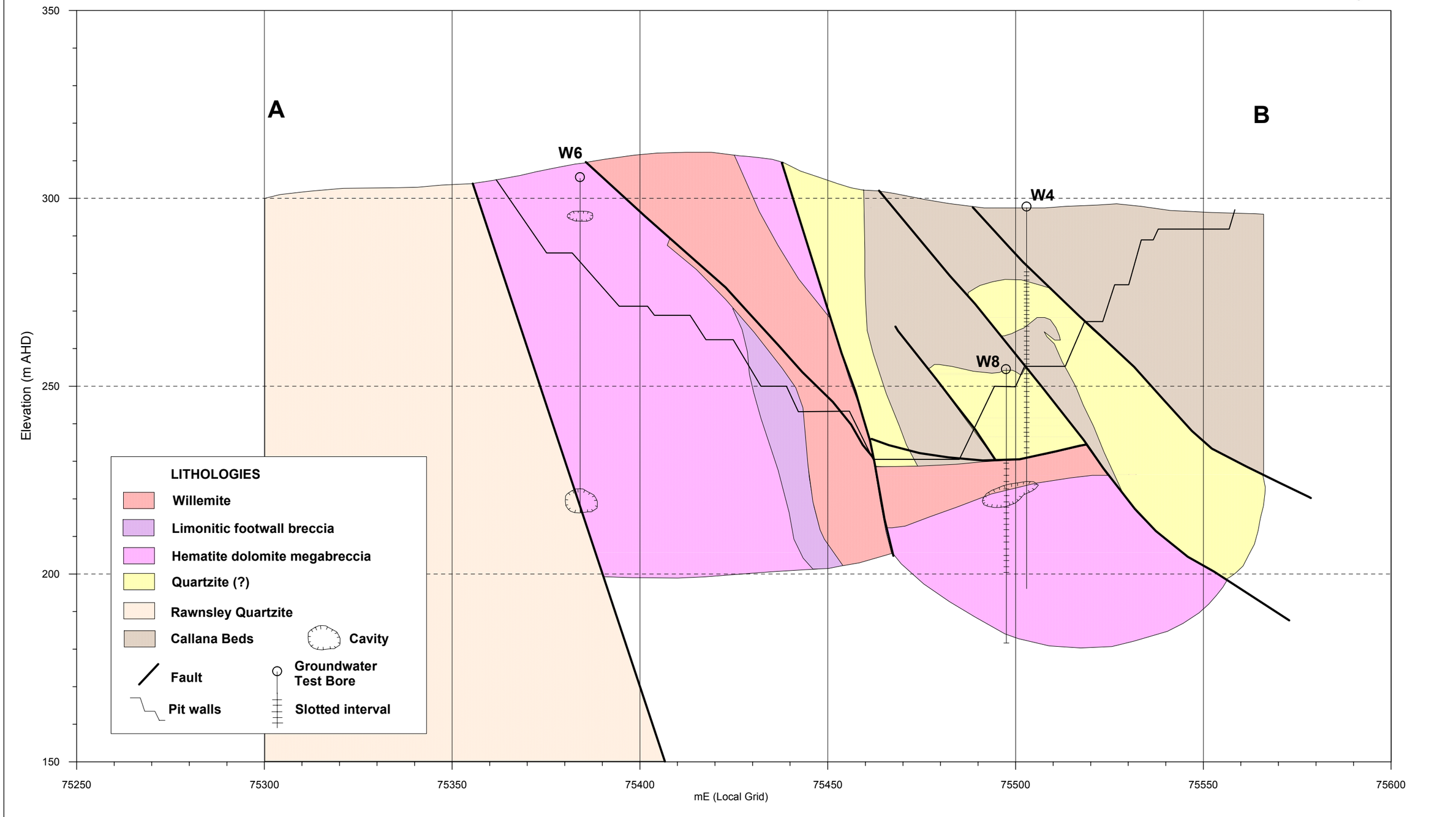
10.1/Surfer/pit extension plan.srf

CLIENT:	Perilya Ltd
PROJECT:	Beltana Pit Dewatering
DATE:	December 2006
Dwg. No:	10.1/06/02-04

BELTANA PIT:
EXISTING AND PROPOSED
PIT PERIMETERS

Rockwater Pty Ltd

Figure 5



10.1/Grapher/Beltana pit section (W8).grf

Client: Perilya Ltd.

Project : Beltana Pit Dewatering

Date : December 2006

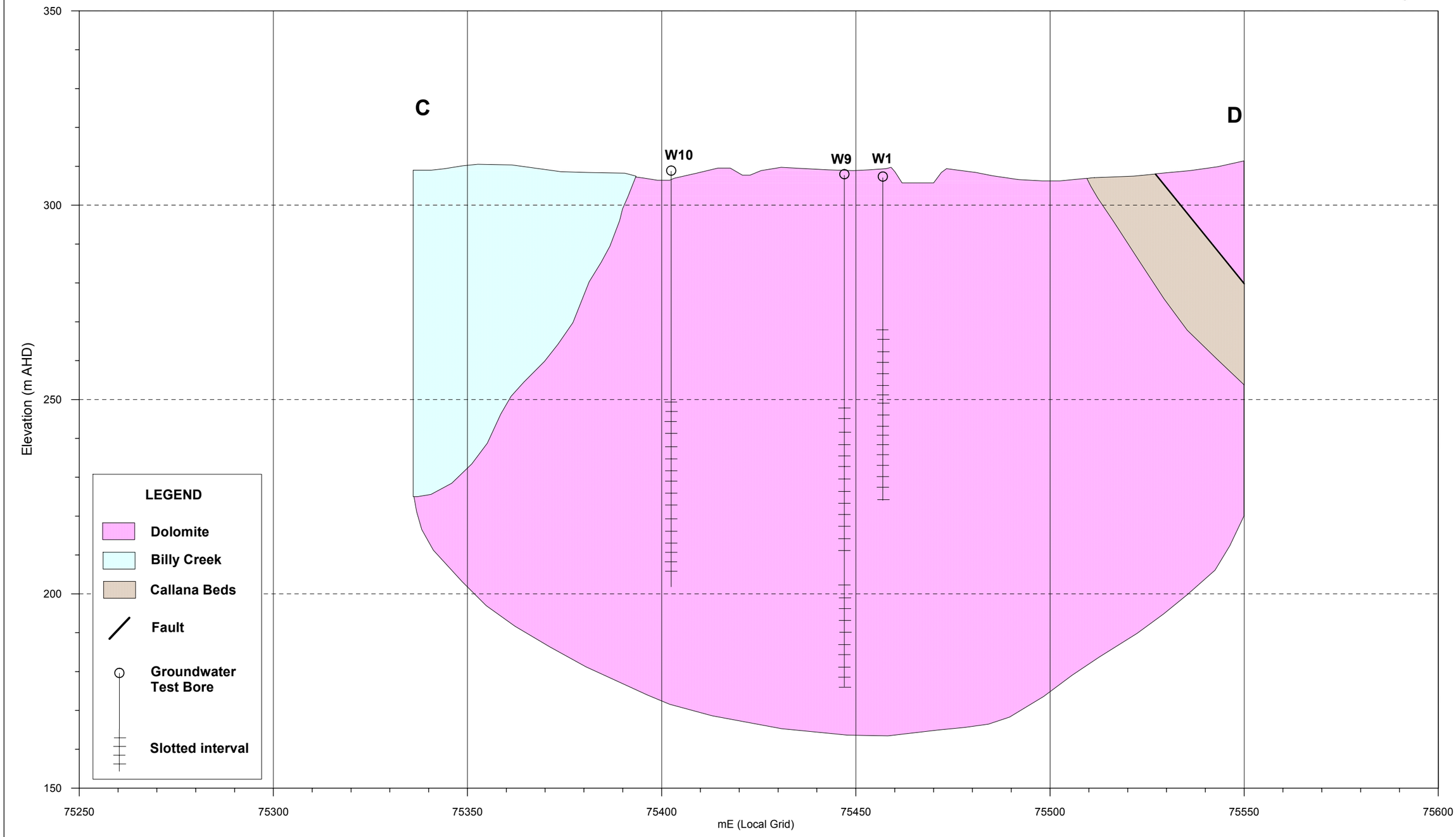
Dwg. No: 10.1/06/02-05

BELTANA PIT CROSS SECTION, SECTION A-B
(Geology provided by Perilya Ltd)

LINE 25722.5 N (local grid)

Rockwater Pty Ltd

Figure 6



10.1/Grapher/Beltana pit section (W9).grf

Client: Perilya Ltd.

Project : Beltana Pit Dewatering

Date : December 2006

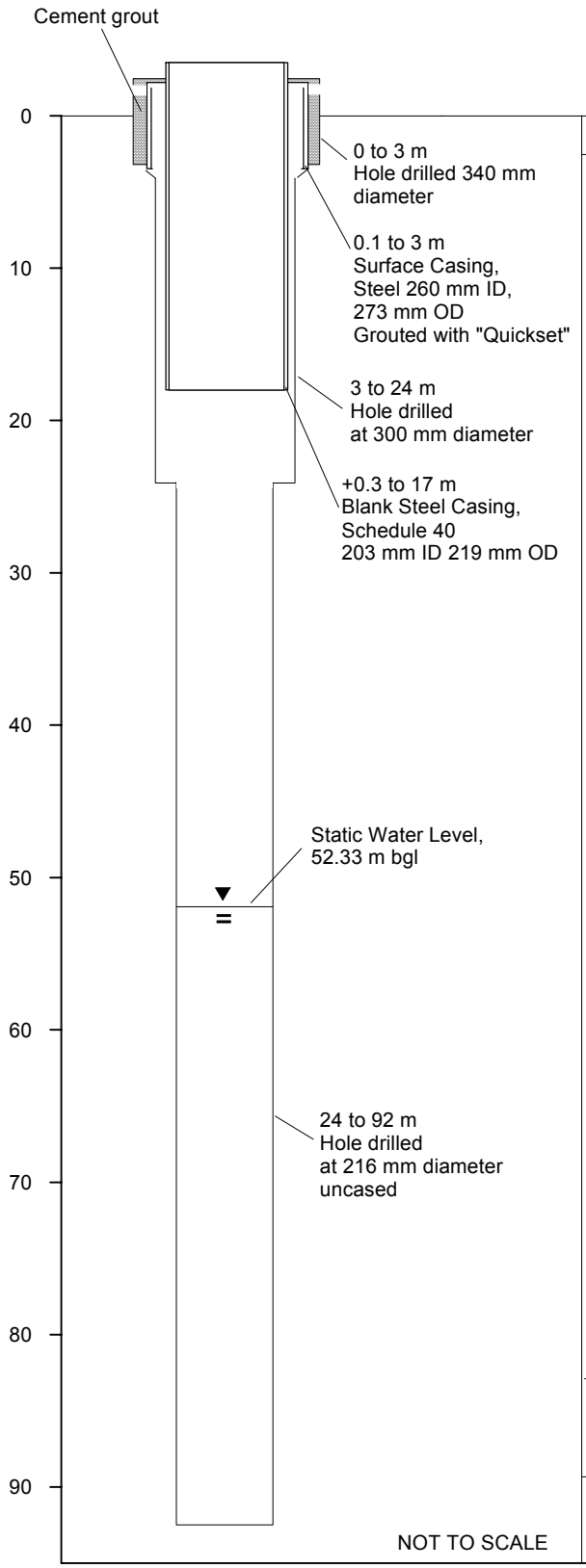
Dwg. No: 10.1/06/02-06

BELTANA PIT CROSS SECTION, SECTION C-D
(Geology provided by Perilya Ltd)

LINE 25850 N (local grid)

Rockwater Pty Ltd

Figure 7



DEPTH (m)	LITHOLOGY	FLOW RATE & SALINITY
0 - 1	**Overburdern**, and broken rock.	
1 - 84	**Dolomite**, red/brown, hematised, finely crystalline, rare white/yellow veins. 10 - 16 m, fractured, limonite staining on partings. Cavity/void at this interval affected circulation. 60 - 65 m, fractured, limonite staining on partings, thin quartz/ calcite veins.	
84 - 88	**Quartzite**, white, weathered. Dolomite, red/brown, fractured/ sheared. Quartzite content decreases with depth.	No water airlifted
88 - 92	**No cuttings**, lost circulation, cavity.	

10.1/Grapher/W6 obs bore.grf

Client : Perilya Ltd

Project : Beltana Pit Dewatering

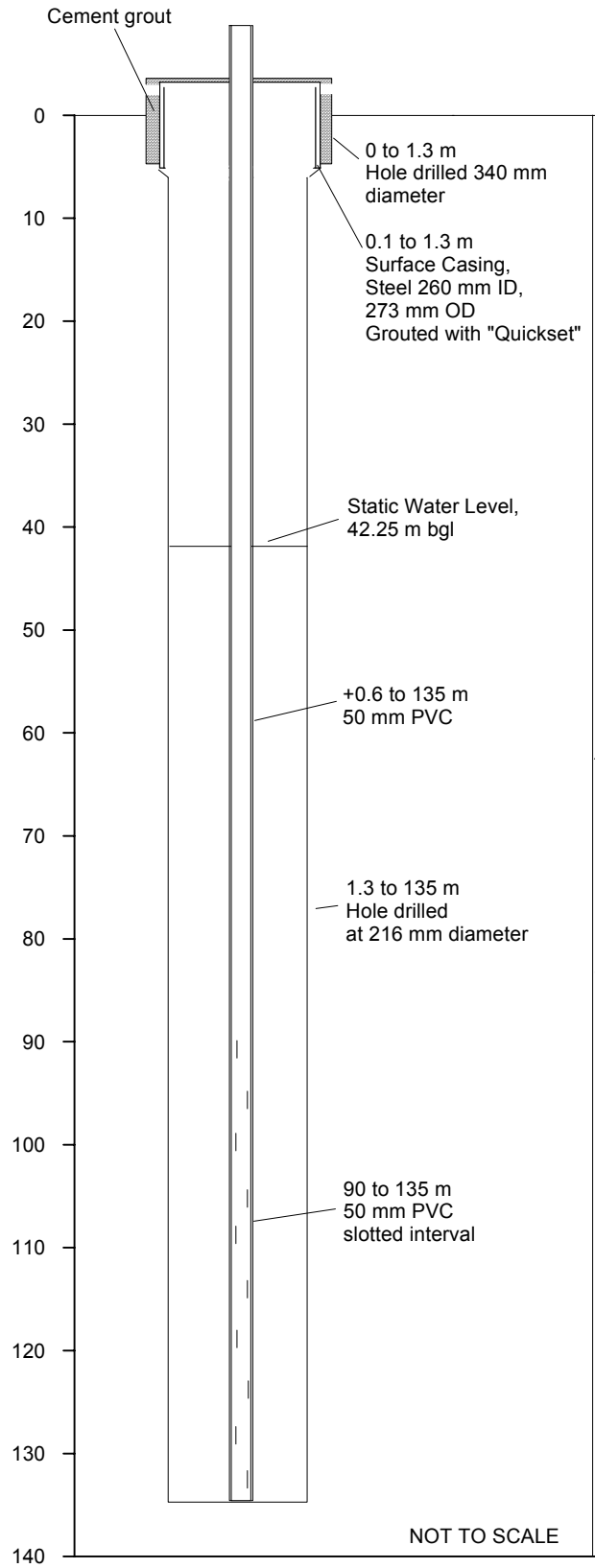
Date : December 2006

Dwg No : 10.1/06/02-07

OBSERVATION BORE W6
CONSTRUCTION DIAGRAM

Rockwater Pty Ltd

Figure 8



DEPTH (m)	LITHOLOGY	FLOW RATE & SALINITY
0 - 36	**Siltstone/sandstone**, grey, soft, thinly laminated, micaceous in part, yellow-brown on some partings. Sandstone fine-grained, siliceous, v. minor proportion. From 18 m some light brown sandstone, some green/grey shale. At 28 m minor clay, light grey. At 34 - 36 m increased proportion sandstone, light brown.	
36 - 50	**Sandstone**, quartz, light brown, fine-grained, thinly bedded, with some light brown clay. Sandstone is well-cemented, hard chips. Interbedded with red/brown siltstone/claystone, hard and soft.	
50 - 58	**Sandstone**, white/pale-grey, quartz, fine-grained, 'spotty' with ferruginous grains and patches. Chips are hard and well-cemented, minor clayey material.	
58 - 84	**Siltstone**, sandstone and shale, brown, interbedded. Sandstone is grey/brown, fine-grained quartz, well-cemented, hard chips. Siltstone is brown, siliceous, hard. Minor white sandstone, siliceous, cemented.	
84 - 125	**Sandstone**, grey/brown, quartz, fine-grained, hard, with clay/shale layers, brown. Some brown siltstone cemented. At 124 m a silty sandstone with coarse quartz grains, dolomitisation.	Moisture at 84 m Slurry at 90 m Trickle at 92 m (muddy) Trickle flow at 104 m 2850 mg/L TDS
125 - 135	**Dolomite**, red/brown, hematised, finely crystalline, thin pink veins, rare calcite crystals. Some shale/ siltstone, grey.	Airlift: 20 m^3/d 3500 mg/L TDS

10.1/Grapher/W7 obs bore.grf

Client : Perilya Ltd

Project : Beltana Pit Dewatering

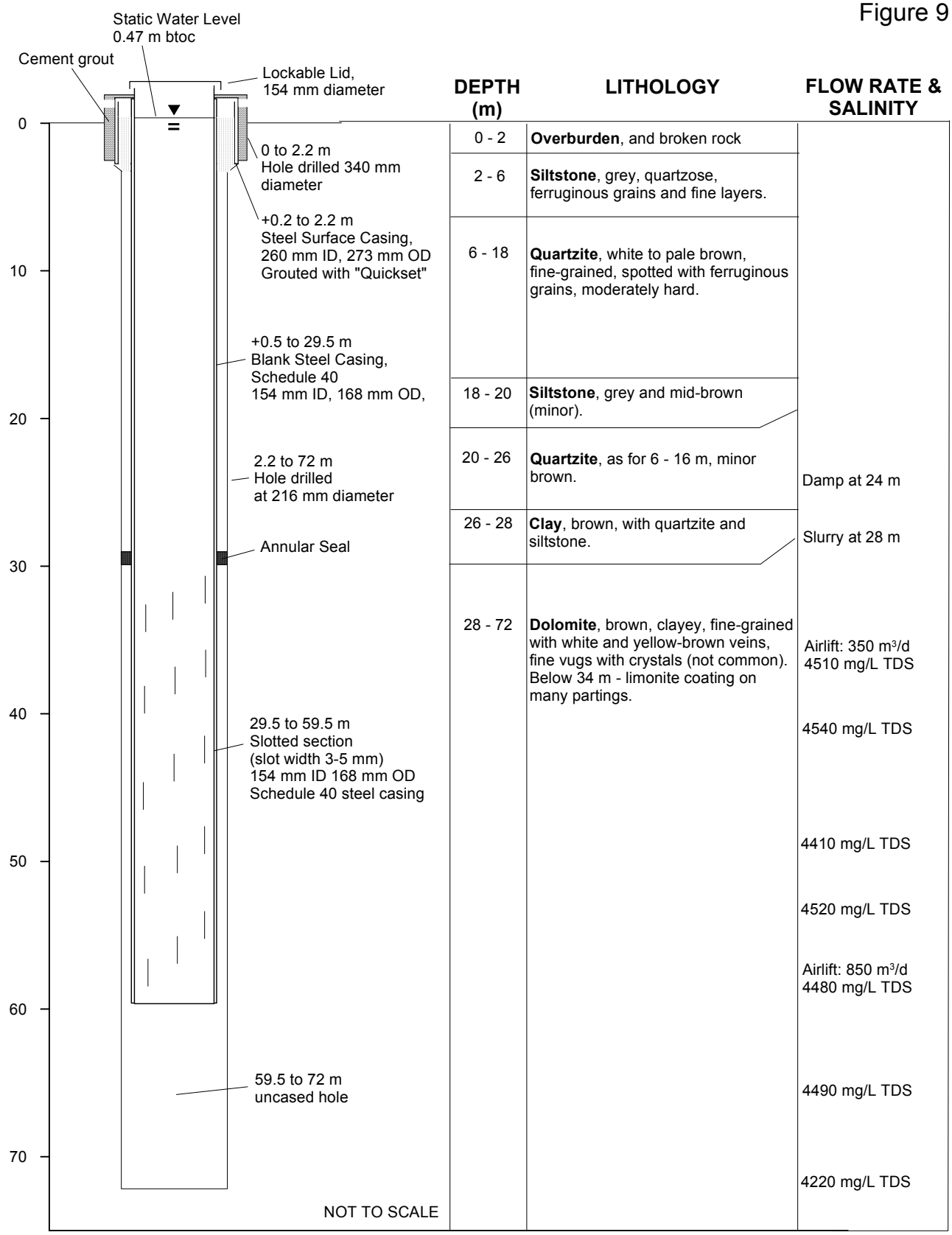
Date : December 2006

Dwg No : 10.1/06/02-08

OBSERVATION BORE W7
CONSTRUCTION DIAGRAM

Rockwater Pty Ltd

Figure 9



DEPTH (m)	LITHOLOGY	FLOW RATE & SALINITY
0 - 2	**Overburden**, and broken rock	
2 - 6	**Siltstone**, grey, quartzose, ferruginous grains and fine layers.	
6 - 18	**Quartzite**, white to pale brown, fine-grained, spotted with ferruginous grains, moderately hard.	
18 - 20	**Siltstone**, grey and mid-brown (minor).	
20 - 26	**Quartzite**, as for 6 - 16 m, minor brown.	Damp at 24 m
26 - 28	**Clay**, brown, with quartzite and siltstone.	Slurry at 28 m
28 - 72	**Dolomite**, brown, clayey, fine-grained with white and yellow-brown veins, fine vugs with crystals (not common). Below 34 m - limonite coating on many partings.	Airlift: 350 m^3/d 4510 mg/L TDS 4540 mg/L TDS 4410 mg/L TDS 4520 mg/L TDS Airlift: 850 m^3/d 4480 mg/L TDS 4490 mg/L TDS 4220 mg/L TDS

10.1/Grapher/W8 production.grf

Client : Perilya Ltd

Project : Beltana Pit Dewatering

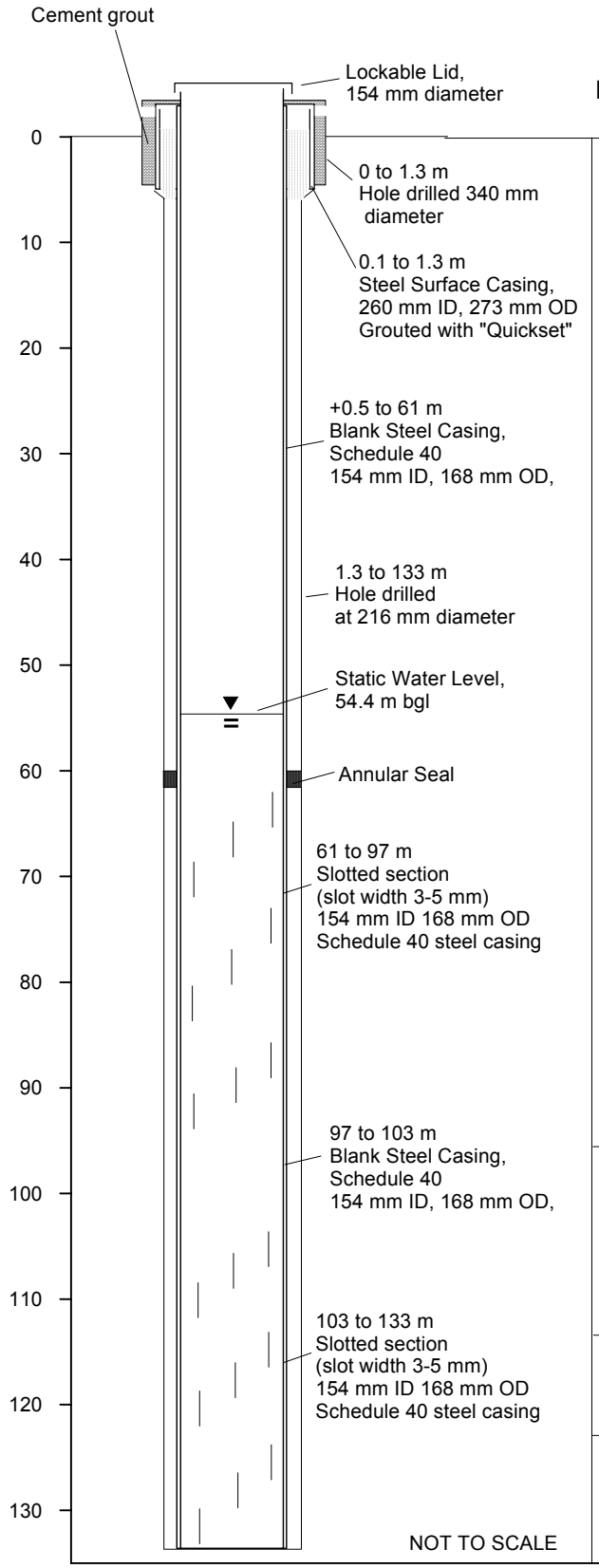
Date : December 2006

Dwg No : 10.1/06/02-09

PRODUCTION BORE W8
CONSTRUCTION DIAGRAM

Rockwater Pty Ltd

Figure 10



DEPTH (m)	LITHOLOGY	WATER FLOW & SALINITY
0 - 96	**Dolomite**, red-brown, hematised, finely crystalline, locally mg-cg. Minor fine veins and blebs of calcite, some minor vugs, fine. Some very feruginous layers eg. 6 - 7 m, 10 - 11 m, 52 - 56 m. main fractures at 70 - 88 m	First water at 60 m Airlift: 30 m^3/d 4530 mg/L TDS Airlift: 350 m^3/d 4570 mg/L TDS Airlift: 850 m^3/d 4740 mg/L TDS
96 - 116	**Dolomite**, red-brown to brown, finely crystalline, locally mg-cg. Some limonite-coated partings. Few small vugs with calcite/dolomite crystals.	Airlift: 850 m^3/d 4960 mg/L TDS
116 - 120	**Dolomite**, red-brown, common fragments with limonite on partings, some medium to coarse-grained crystal dolomite.	
120 - 134	**Dolomite**, brown, fine to coarsely crystalline, predominantly fine, many limonite-coated partings, some small vugs. At about 120 m, some brecciated dolomite, re-cemented.	

10.1/Grapher/W9 production.grf

Client : Perilya Ltd

Project : Beltana Pit Dewatering

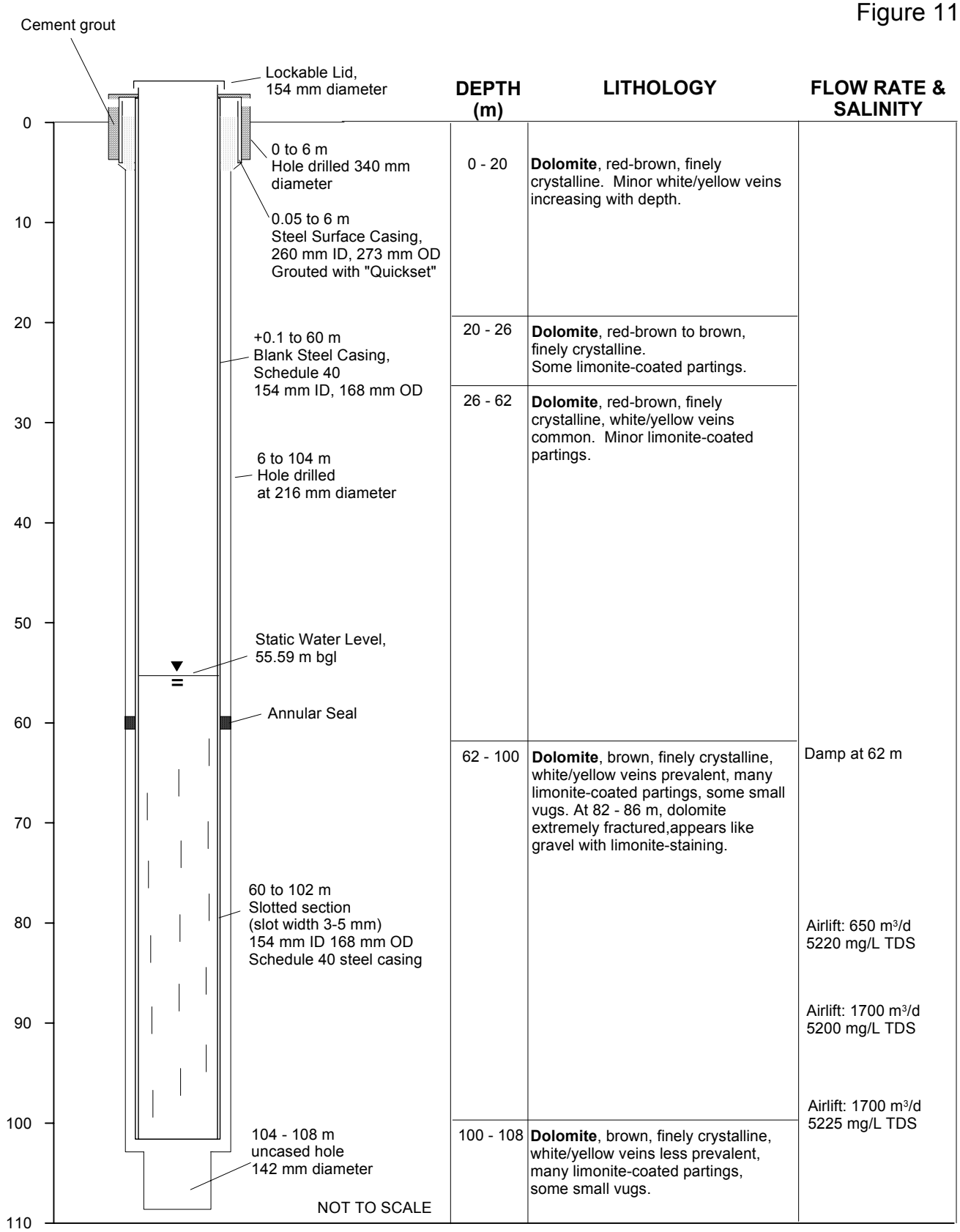
Date : December 2006

Dwg No : 10.1/06/02-10

PRODUCTION BORE W9
CONSTRUCTION DIAGRAM

Rockwater Pty Ltd

Figure 11



DEPTH (m)	LITHOLOGY	FLOW RATE & SALINITY
0 - 20	**Dolomite**, red-brown, finely crystalline. Minor white/yellow veins increasing with depth.	
20 - 26	**Dolomite**, red-brown to brown, finely crystalline. Some limonite-coated partings.	
26 - 62	**Dolomite**, red-brown, finely crystalline, white/yellow veins common. Minor limonite-coated partings.	
62 - 100	**Dolomite**, brown, finely crystalline, white/yellow veins prevalent, many limonite-coated partings, some small vugs. At 82 - 86 m, dolomite extremely fractured,appears like gravel with limonite-staining.	Damp at 62 m Airlift: 650 m³/d 5220 mg/L TDS Airlift: 1700 m³/d 5200 mg/L TDS Airlift: 1700 m³/d 5225 mg/L TDS
100 - 108	**Dolomite**, brown, finely crystalline, white/yellow veins less prevalent, many limonite-coated partings, some small vugs.	

10.1/Grapher/W10 production.grf

Client : Perilya Ltd

Project : Beltana Pit Dewatering

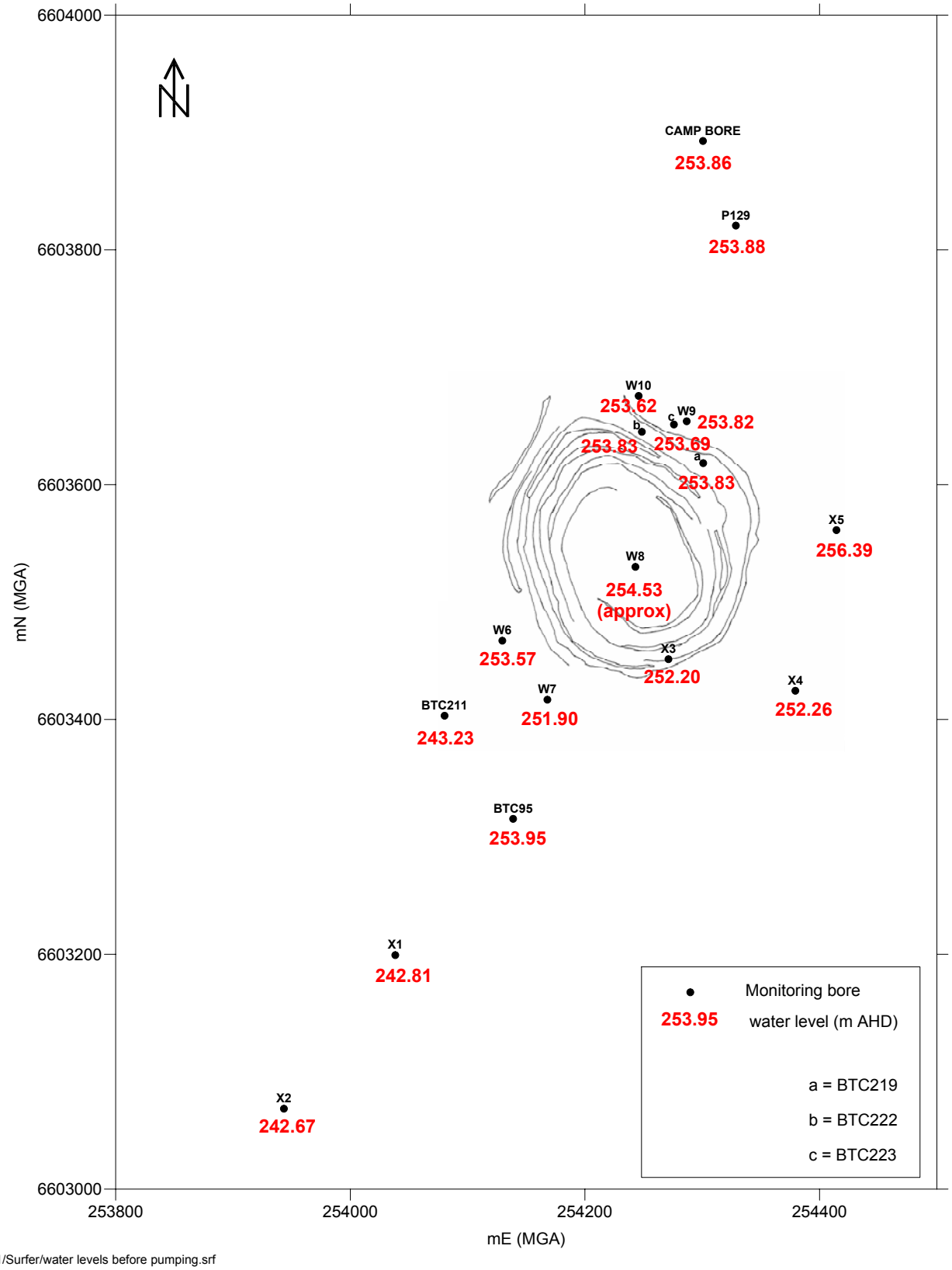
Date : December 2006

Dwg No : 10.1/06/02-11

PRODUCTION BORE W10
CONSTRUCTION DIAGRAM

Rockwater Pty Ltd

Figure 12



10.1/Surfer/water levels before pumping.srf

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

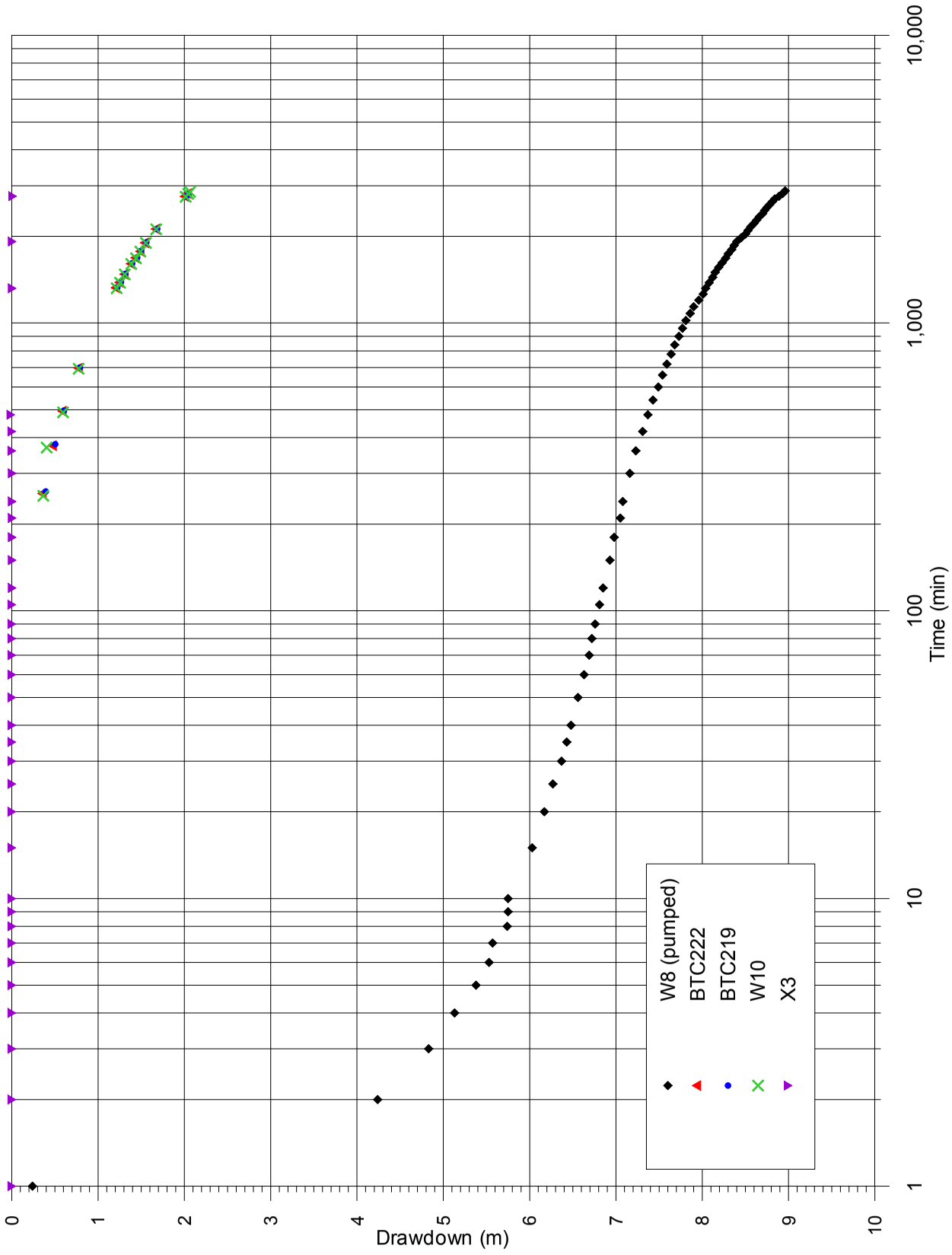
DATE: December 2006

Dwg. No: 10.1/06/02-12

STATIC WATER LEVELS BEFORE PUMPING (m AHD)

Rockwater Pty Ltd

Figure 13



10.1/Grapher/Pumping tests/W8 48 hr constant test..xls/W8 48 hr.grf

Client: Perilya Ltd.

Project : Beltana Pit Dewatering

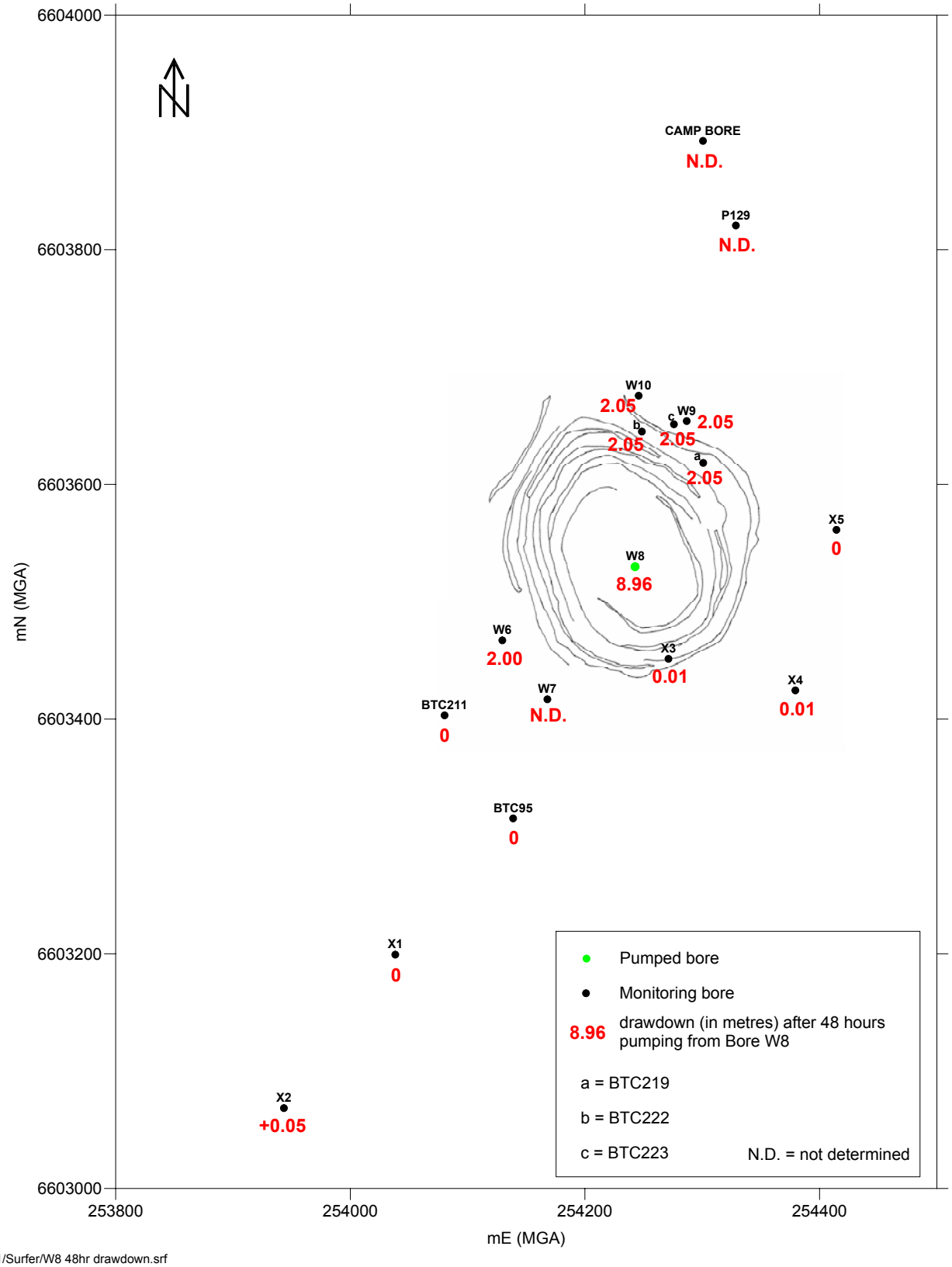
Date : December 2006

Dwg. No: 10.1/06/02-13

BORE W8 PUMPING TEST: DRAWDOWN-TIME
SEMI-LOGARITHMIC PLOT
Test Started 07/11/2006
Pumping Rate = 1,040 m^3/day

Rockwater Pty Ltd

Figure 14



10.1/Surfer/W8 48hr drawdown.srf

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

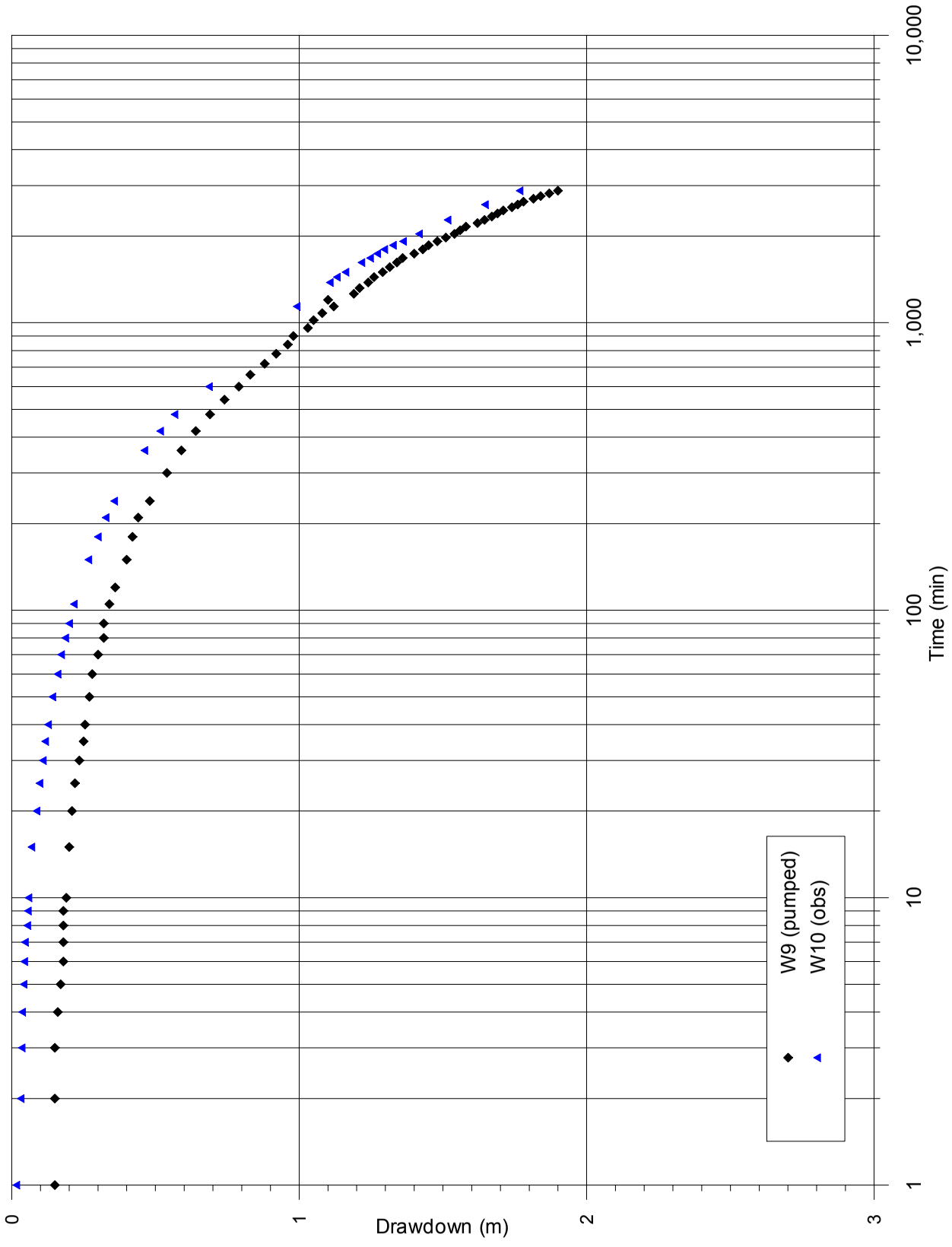
DATE: December 2006

Dwg. No: 10.1/06/02-14

BORE W8 PUMPING TEST: AREAL DRAWDOWN AT 48 HOURS

Rockwater Pty Ltd

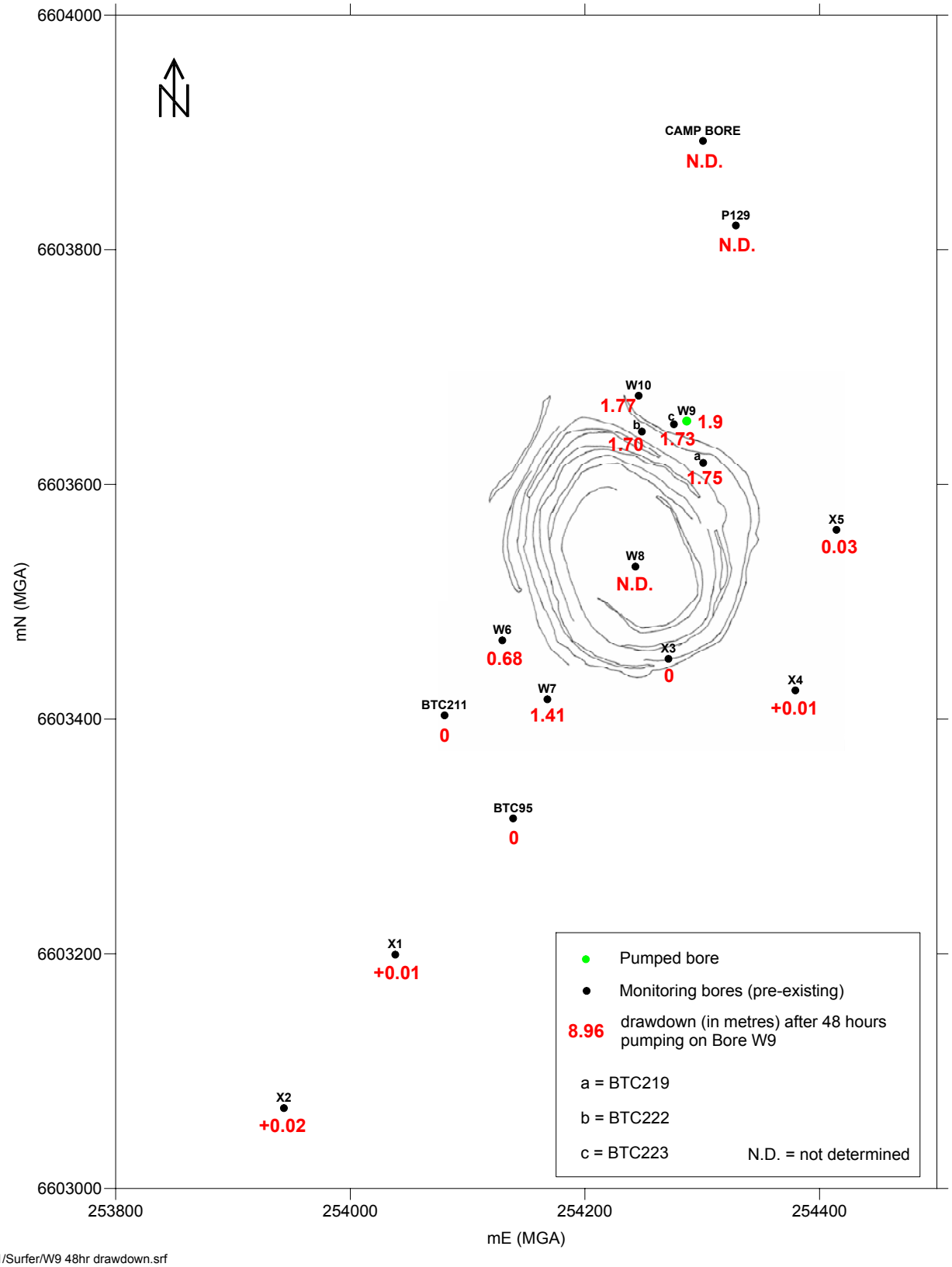
Figure 15



10.1/Grapher/Pumping tests/W8 48 hr constant test..xls/W8 48 hr.grf

Client: Perilya Ltd.	BORE W9 PUMPING TEST: DRAWDOWN-TIME SEMI-LOGARITHMIC PLOT
Project : Beltana Pit Dewatering	Test Started 13/11/2006
Date : December 2006	Pumping Rate = 1,380 m^3/day
Dwg. No: 10.1/06/02-15	Rockwater Pty Ltd

Figure 16



10.1/Surfer/W9 48hr drawdown.srf

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

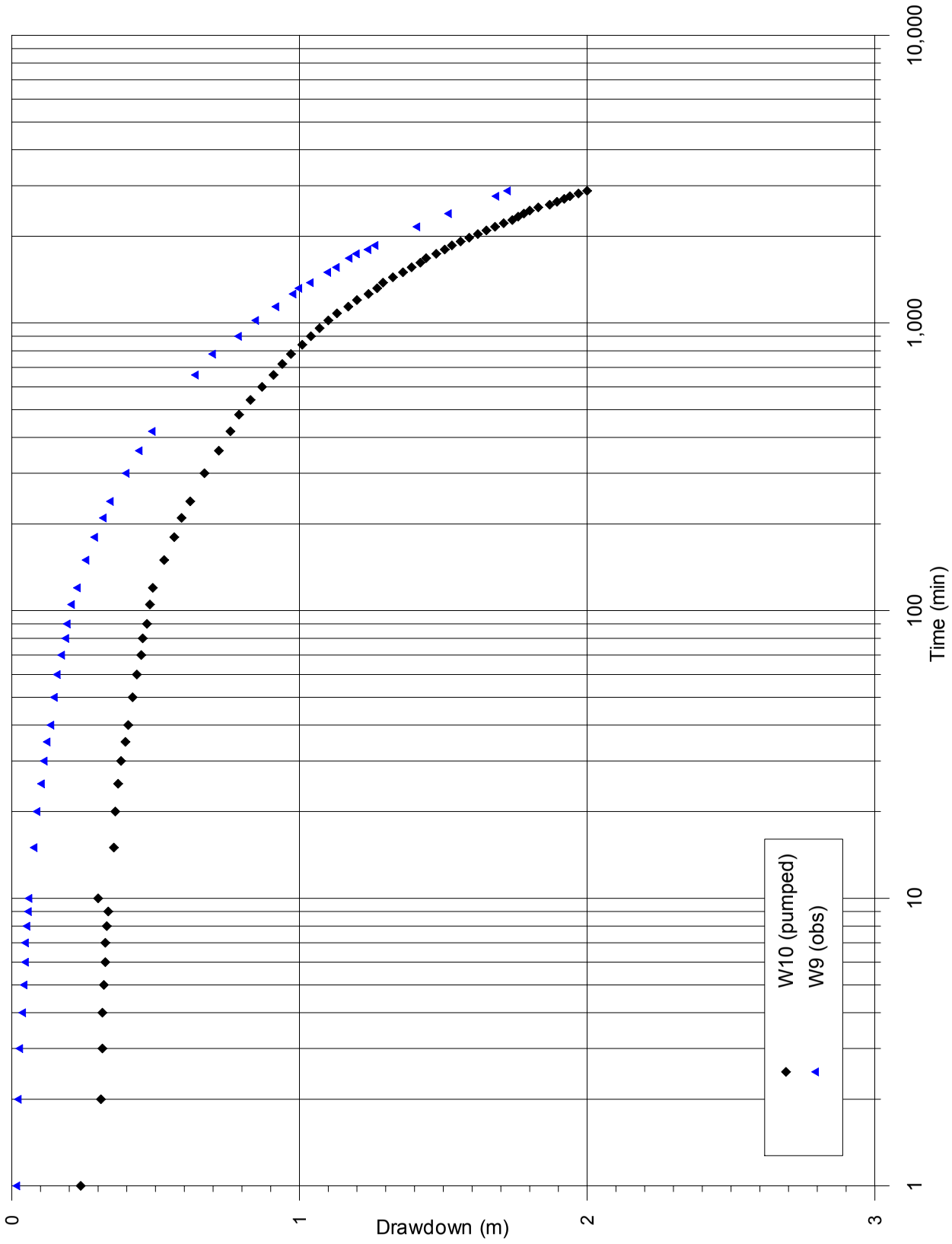
DATE: December 2006

Dwg. No: 10.1/06/02-16

BORE W9 PUMPING TEST: AREAL DRAWDOWN AT 48 HOURS

Rockwater Pty Ltd

Figure 17



10.1/Grapher/Pumping tests/W8 48 hr constant test..xls/W8 48 hr.grf

Client: Perilya Ltd.

Project : Beltana Pit Dewatering

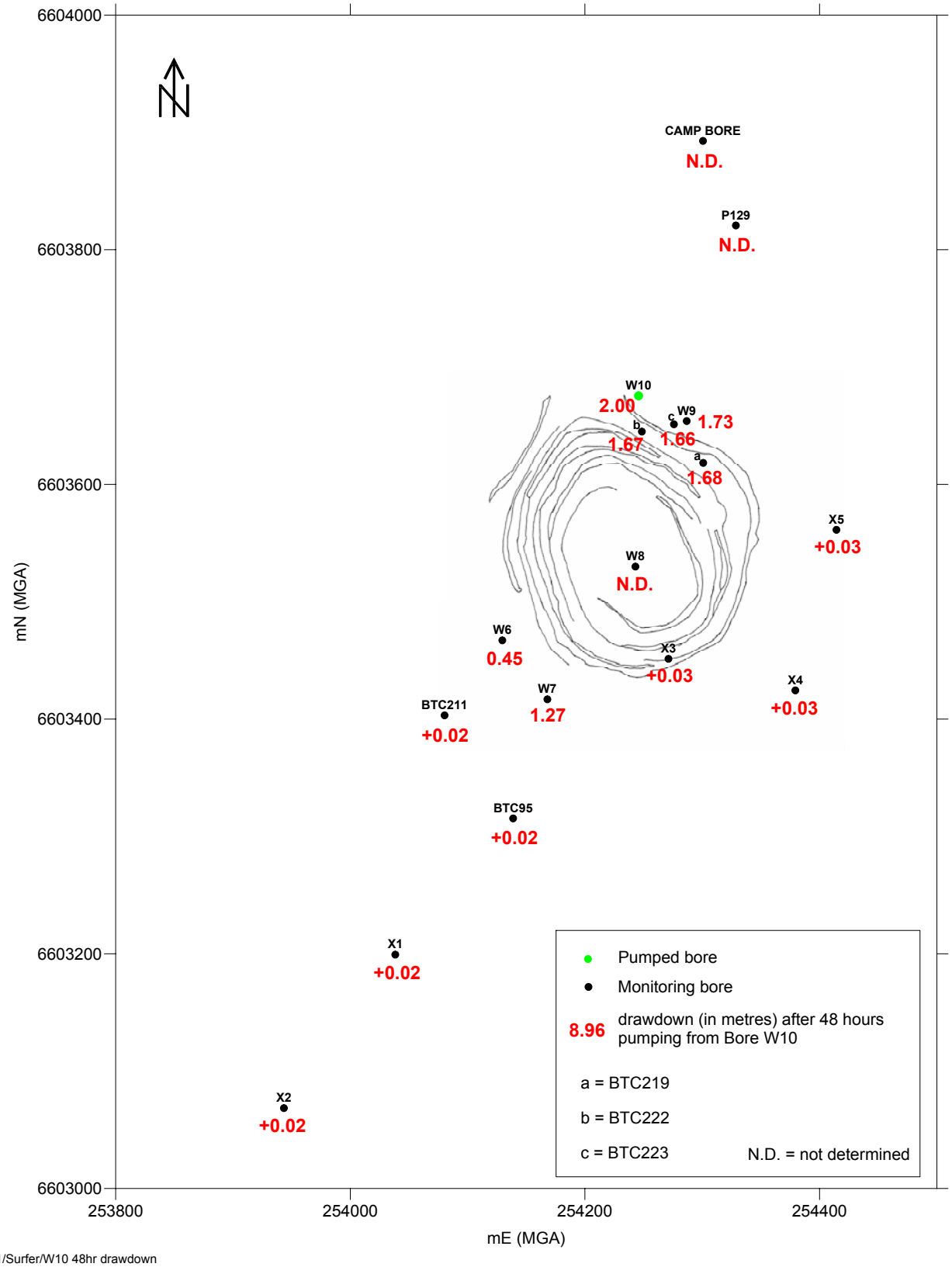
Date : December 2006

Dwg. No: 10.1/06/02-17

BORE W10 PUMPING TEST: DRAWDOWN-TIME SEMI-LOGARITHMIC PLOT
Test Started 10/11/2006
Pumping Rate = 1,300 m^3/day

Rockwater Pty Ltd

Figure 18



10.1/Surfer/W10 48hr drawdown

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

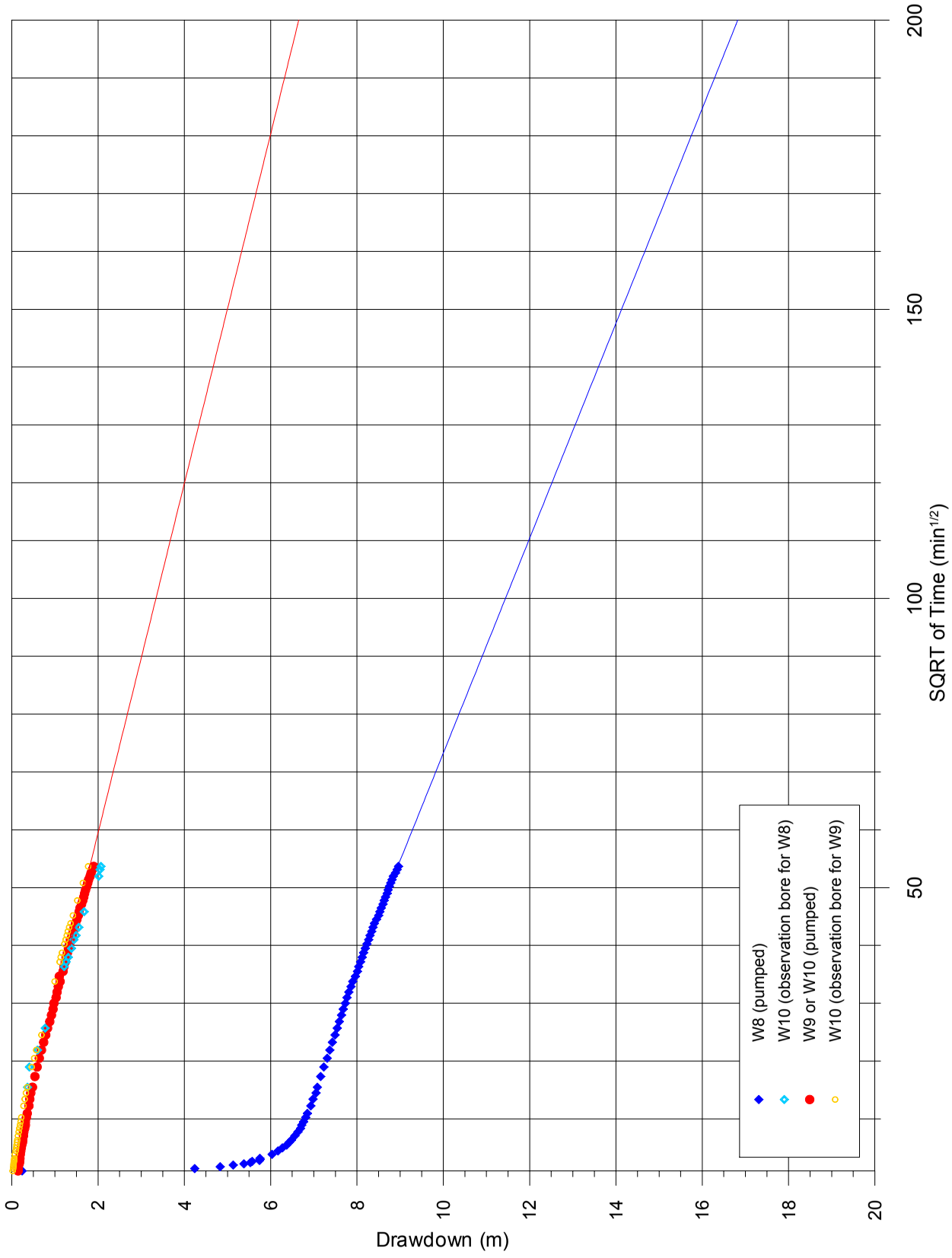
DATE: December 2006

Dwg. No: 10.1/06/02-18

BORE W10 PUMPING TEST
AREAL DRAWDOWN AT 48 HOURS

Rockwater Pty Ltd

Figure 19



10.1/Grapher/Pumping Tests/48 hr SQRT All bores.grf

Client: Perilya Ltd.

Project : Beltana Pit Dewatering

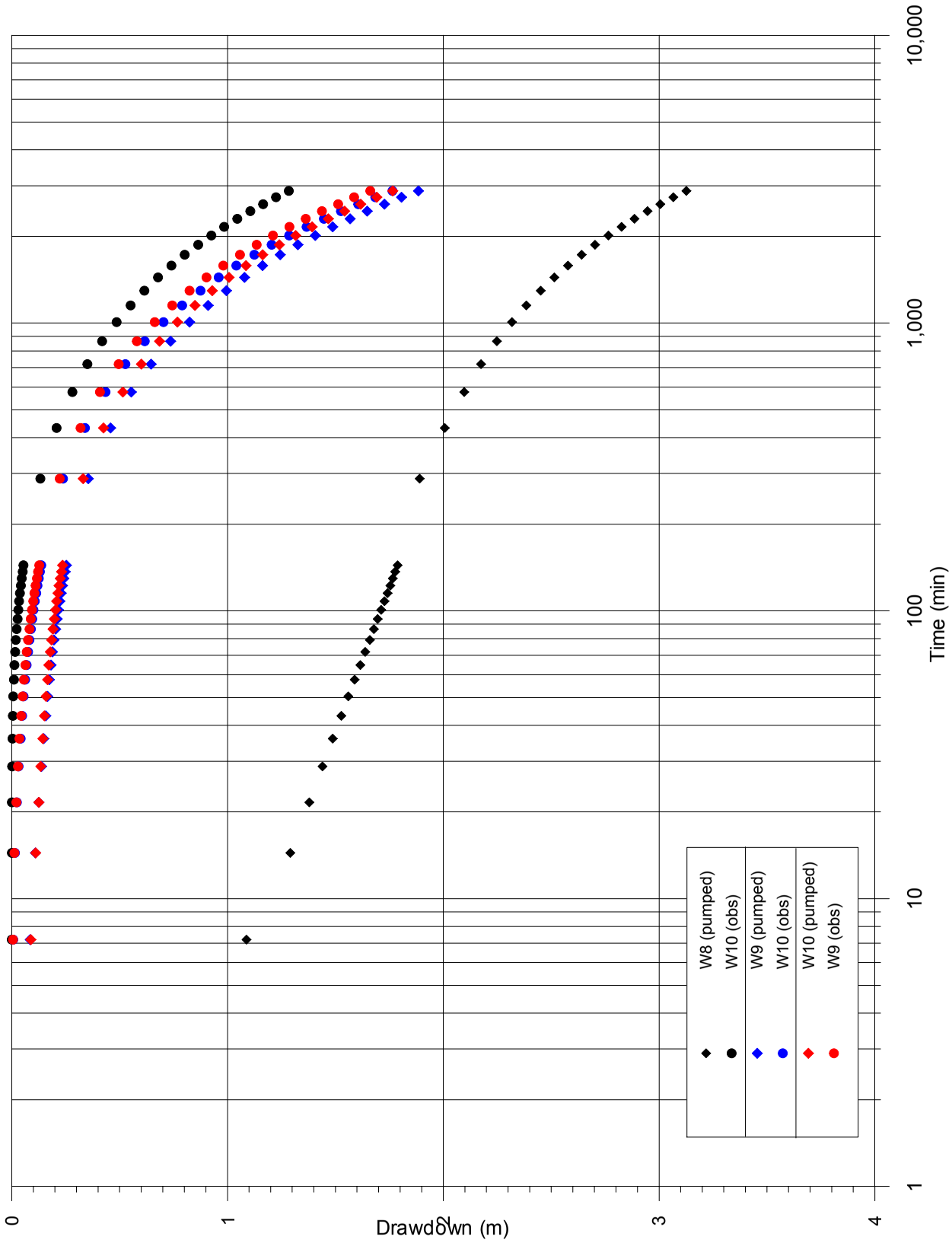
Date : December 2006

Dwg. No: 10.1/06/02-19

PLOT OF DRAWDOWN VERSUS SQUARE ROOT OF TIME FOR W8, W9 and W10 PUMPING TESTS

Rockwater Pty Ltd

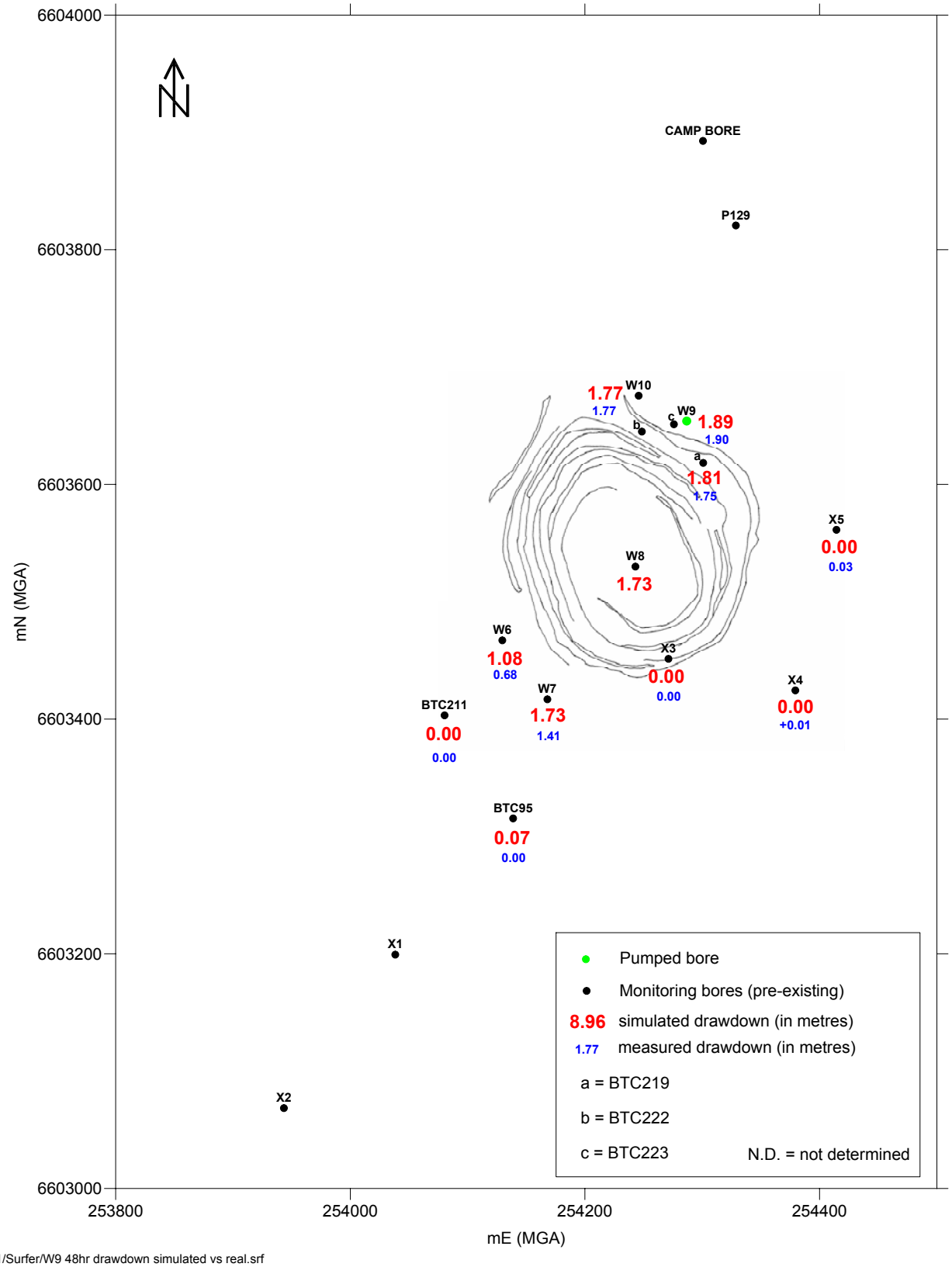
Figure 20



10.1/Models/Beltanadw Dec06/W8/W9/W10 pt simulation..xls/pumping test simulation drawdowns.grf

Client: Perilya Ltd.	PUMPING TEST SIMULATION: DRAWDOWN-TIME SEMI-LOGARITHMIC PLOT
Project : Beltana Pit Dewatering	
Date : December 2006	
Dwg. No: 10.1/06/02-20	Rockwater Pty Ltd

Figure 21



10.1/Surfer/W9 48hr drawdown simulated vs real.srf

CLIENT: Perilya Ltd

PROJECT: Beltana Pit Dewatering

DATE: December 2006

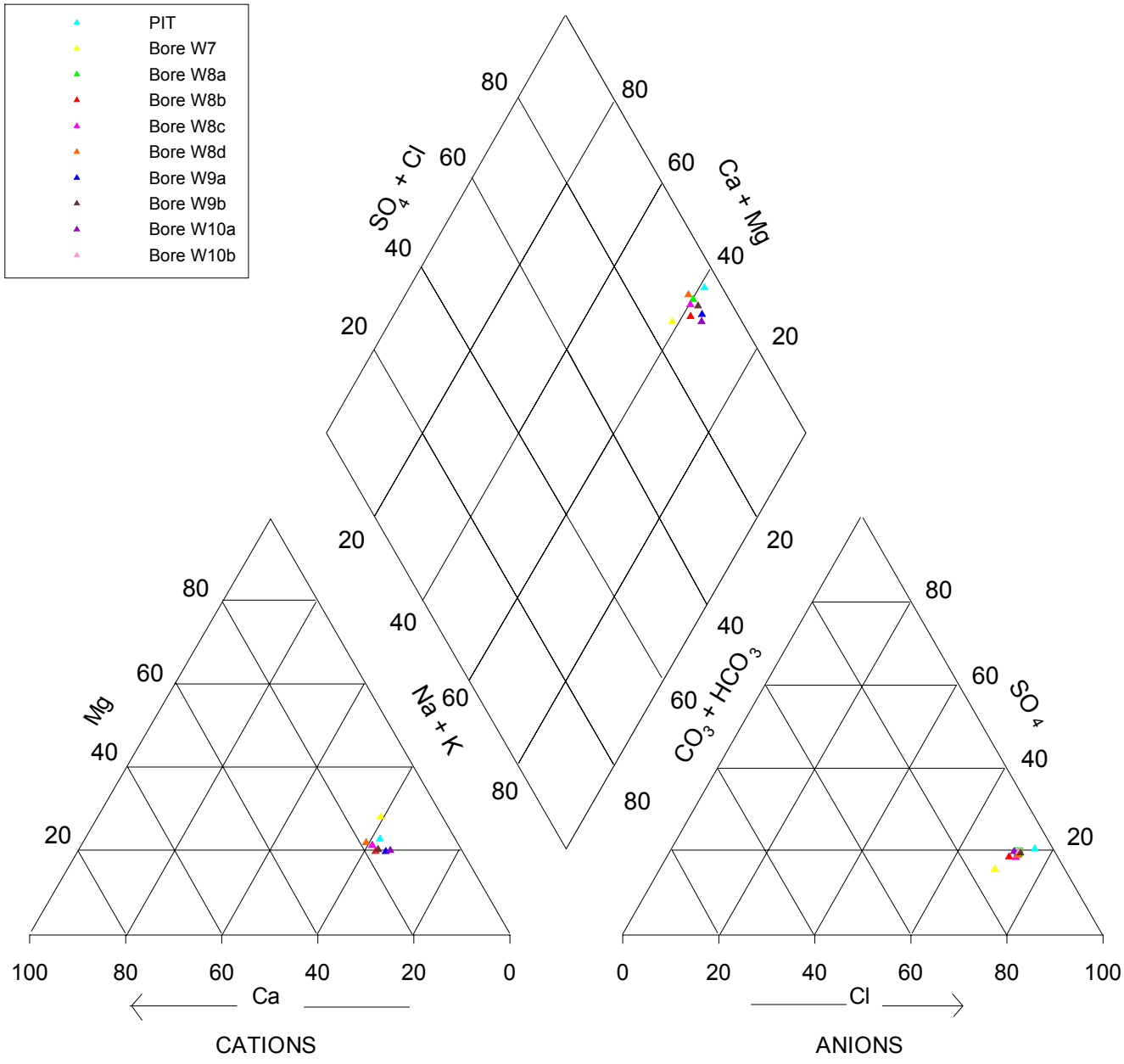
Dwg. No: 10.1/06/02-21

BORE W9 PUMPING TEST: AREAL DRAWDOWN AT 48 HOURS, SIMULATED VERSUS MEASURED VALUES

Rockwater Pty Ltd

Figure 22

Beltana Mine Water Samples
(from surface water and bores)



10.1/Grapher/PIPER_beltana.xls/PIPER_beltana.grf

Client: Perilya Ltd	PIPER DIAGRAM OF BELTANA MINE WATER SAMPLES
Project: Beltana Pit Dewatering	
Date: December 2006	
Drawing: 10.1/06/02-22	Rockwater Pty Ltd

APPENDIX I

BORE COMPLETION DATA
BELTANA PIT GROUNDWATER TEST HOLES, 2006

BORE W6 COMPLETION DATA

Location:	Beltana Mine near Leigh Creek, South Australia.
Bore No:	W6
MGA Coordinates:	254 129.60 mE 6 603 467.13 mN
Elevation of Collar:	305.90 m AHD
Elevation of Ground:	305.80 m AHD
Status:	Uncased observation bore
Date Commenced:	01/11/2006 **Date Completed:** 03/11/2006
Drilling Contractor:	Underdale Drillers Pty Ltd
Drilling Rig:	Ingersoll Rand TH60
Drilling Method:	Air-hammer
Depth Drilled:	92m
Diameter Drilled:	0-3.0 m, 340 mm 3.0 – 24.0 m, 216 mm 24.0 – 92.0 m, 152 mm
Casing:	0 – 3.0 m, 310 mm ID, 325 mm OD steel casing 1 – 17 m, 203 mm
Static Water Level:	257.25 m AHD (7/11/2006)
Airlift:	Nil; lost circulation at 88 m.

BORE W7 COMPLETION DATA

Location:	Beltana Mine near Leigh Creek, South Australia.
Bore No:	W7
MGA Coordinates:	254 167.95 mE 6 603 416.84 mN
Elevation of Collar:	PVC collar – 294.75 m AHD Steel collar – 294.27 m AHD
Elevation of Ground:	294.20 m AHD
Status:	Observation bore, 60 mm PVC
Date Commenced:	30/10/2006 **Construction Completed:** 01/11/2006
Date Completed:	07/11/2006 - PVC installed
Drilling Contractor:	Underdale Drillers Pty Ltd
Drilling Rig:	Ingersoll Rand TH60
Drilling Method:	Air-hammer
Depth Drilled:	135 m
Diameter Drilled:	0 – 6.0 m, 340 mm 6.0 – 135 m, 216 mm
Casing:	0 – 6.0 m, 310 mm ID 325 mm OD steel casing +0.55 – 135 m, 60 mm PVC
Slots:	90 – 135 m, drilled holes 10 mm diameter approximately 2% open area
Static Water Level:	251.90 m AHD
Airlift:	20 m^3/d
Salinity:	3,550 mg/L TDS (by conductivity) 3,303 mg/L TDS (by sum of ions)

BORE W8 COMPLETION DATA

Location:	Beltana Mine near Leigh Creek, South Australia.
Bore No:	W8
MGA Coordinates:	253947 m E 6603066 m N (by GPS)
Elevation of Collar:	About 255 m AHD
Elevation of Ground:	About 254.5 m AHD
Status:	Production Bore
Date Commenced:	27/10/2006 **Construction Completed:** 30/10/2006
Drilling Contractor:	Underdale Drillers Pty Ltd
Drilling Rig:	Ingersoll Rand TH 60
Drilling Method:	Air-hammer
Depth Drilled:	72 m
Diameter Drilled:	0 – 2.2 m, 340 mm 2.2 – 72 m, 216 mm
Casing:	0 – 2.2 m, 310 mm ID 325 mm OD steel casing 10.5 – 59.5 m, 154 mm ID 168 mm OD steel casing 59.5 – 72 m, uncased hole
Slots:	29.5 – 59.5 m, vertical, oxy-cut, 3-5 mm width, approximately 2.4 per cent open area
Internal Diameter of Pump Housing:	154 mm
Static Water Level:	254.53 m AHD
Airlift:	900 m^3/d (approx) when cased
Pumping Test:	1. Step rate test : 4 x 1 hour steps at 7, 10, 14, 16 L/sec 2. Constant rate test : 1 x 48 hour test at 1,040 m^3/day
Recommended Pumping Rate:	1,000 m^3/d
Recommended Pump Inlet Setting:	58 metres below collar
Water Salinity:	4,500 mg/L TDS (by conductivity) 4,444 mg/L TDS (by sum of ions)

BORE W9 COMPLETION DATA

Location:	Beltana Mine near Leigh Creek, South Australia.
Bore No:	W9
MGA Coordinates:	254 286.72 m E 6 603 654.04 m N
Elevation of Collar:	308.49 m AHD
Elevation of Ground:	About 308.00 m AHD
Status:	Cased, air-lift developed (1.5 hours)
Date Commenced:	20/10/2006 **Construction Completed:** 27/10/2006
Drilling Contractor:	Underdale Drillers Pty Ltd
Drilling Rig:	Ingersoll Rand TH60
Drilling Method:	Air-hammer
Depth Drilled:	133 m
Diameter Drilled:	0 – 1.3 m, 340 mm 1.3 – 133 m, 216 mm
Casing:	0 – 1.3 m, 310 mm ID 325 mm OD steel casing +0.5 – 133 m, 154 mm ID 168 mm OD steel casing
Slots:	61 – 97 m and 103 – 133 m, vertical, oxy-cut, 3-5 mm width, approximately 2.4 per cent open area
Internal Diameter of Pump Housing:	154 mm
Static Water Level:	54.88 m below bore collar 54.4 m below ground surface 253.6 m AHD (approx)
Airlift:	1300 m^3/d (approx) when cased
Pumping Test:	1. Step rate test : 4 x 1 hour steps at 4, 8, 12, 16 L/sec 2. Constant rate test : 48 hours at 1,380 m^3/day
Recommended Pumping Rate:	1,300 m^3/d
Recommended Pump Inlet Setting:	102 m below bore collar
Water Salinity:	4,750 mg/L TDS (by conductivity) 4,720 mg/L TDS (by sum of ions)

BORE W10 COMPLETION DATA

Location:	Beltana Mine near Leigh Creek, S.A.
Bore No:	W10
MGA Coordinates:	254 245.74 m E 6 603 675.64 m N
Elevation of Collar:	309.21 m AHD
Elevation of Ground:	309.10 m AHD
Status:	Production Bore
Date Commenced:	03/11/2006 **Construction Completed:** 06/11/2006
Drilling Contractor:	Underdale Drillers Pty Ltd
Drilling Rig:	Ingersoll Rand TH 60
Drilling Method:	Air-hammer
Depth Drilled:	108 m
Diameter Drilled:	0 – 6.0 m, 340 mm 6.0 – 104 m, 216 mm 104 – 108 m, 142 mm
Casing:	0 – 6.0 m, 310 mm ID 325 mm OD steel casing +0.1 – 102 m, 154 mm ID 168 mm OD steel casing
Slots:	60 – 102 m, vertical, oxy-cut, 3-5 mm width approximately 2.4 per cent open area
Internal Diameter of Pump Housing:	154 mm
Static Water Level:	253.62 m AHD
Airlift:	1,300 m^3/d (approx) when cased
Pumping Test:	1. Step rate test : 4 x 1 hour steps at 8, 13, 16 L/sec (pump tripped on last step) 2. Constant rate test : 48 hours at 1,300 m^3/day
Recommended Pumping Rate:	1,300 m^3/d
Recommended Pump Inlet Setting:	100 m below bore collar
Water Salinity:	5,200 mg/L TDS (by conductivity) 4,826 mg/L TDS (by sum of ions)

APPENDIX II

GROUNDWATER ANALYSES RESULTS

LABORATORY REPORT COVERSHEET

DATE:	5 December 2006
TO:	Rockwater Pty Ltd PO Box 201 JOLIMONT WA 6913
ATTENTION:	Ms Miranda Taylor
YOUR REFERENCE:	Beltana
OUR REFERENCE:	99550
SAMPLES RECEIVED:	17/11/2006
SAMPLES/QUANTITY:	12 Waters

The above samples were received intact and analysed according to your instructions. Unless otherwise stated, solid samples are reported on a dry weight basis and liquid samples as received.

DON SARATHCHANDRA
Senior Chemist

SGS Australia Pty Ltd ABN 44 000 964 278 | Environmental Services | 52 Murray Road | Welshpool 6106 | Western Australia | www.au.sgs.com
t +61 (0)8 9458 7278 f +61 (0)8 9451 3505

CLIENT: Rockwater Pty Ltd **OUR REFERENCE:** 99550
PROJECT: Beltana

LABORATORY REPORT

Your Reference Our Reference Date Sampled Type of Sample	Units	W9 99550-11 15/11/2006 Water	PIT 99550-12 15/11/2006 Water
Soluble Mercury, Hg	mg/L	<0.0001	<0.0001
Zinc, Zn	mg/L	7.4	0.33
Lead, Pb	mg/L	<0.005	<0.005
Iron, Fe	mg/L	18	1.8
Manganese, Mn	mg/L	2.0	0.28
Copper, Cu	mg/L	<0.1	<0.1
Cadmium, Cd	mg/L	<0.01	<0.01

CLIENT: Rockwater Pty Ltd **OUR REFERENCE:** 99550

PROJECT: Beltana

LABORATORY REPORT

Your Reference Our Reference Date Sampled Type of Sample	Units	W9a 99550-1 27/10/2006 Water	PIT 99550-2 28/10/2006 Water	W8a 99550-3 30/10/2006 Water	W7 99550-4 31/10/2006 Water	W8b 99550-5 05/11/2006 Water
Nitrate, NO_3	mg/L	7.0	30	1.9	13	<0.2
Calcium, Ca	mg/L	260	310	260	140	280
Magnesium, Mg	mg/L	200	280	190	190	190
Sodium, Na	mg/L	1,200	1,400	1,000	730	1,100
Potassium, K	mg/L	18	17	16	25	19
Chloride, Cl	mg/L	2,000	2,500	1,900	1,300	1,900
Sulphate, SO_4	mg/L	740	930	710	400	680
Bicarbonate, HCO_3	mg/L	360	220	260	470	470
Carbonate, CO_3	mg/L	<1	<1	41	<1	<1
pH	pH Units	7.9	8.2	8.7	7.9	8.2
Total Dissolved Solids @ 180^{o}C	mg/L	4,500	5,600	4,300	2,900	4,100
Conductivity @25^{o}C	µS/cm	7,900	9,600	7,400	5,300	7,400
Cation/Anion balance	%	2.87	2.82	0.18	0.39	1.45
Sum of Ions (calc.)	mg/L	4,720	5,639	4,444	3,303	4,599

CLIENT: Rockwater Pty Ltd **OUR REFERENCE:** 99550

PROJECT: Beltana

LABORATORY REPORT

Your Reference Our Reference Date Sampled Type of Sample	Units	W8c 99550-6 05/11/2006 Water	W10a 99550-7 06/11/2006 Water	W8d 99550-8 09/11/2006 Water	W10b 99550-9 12/11/2006 Water	W9b 99550-10 15/11/2006 Water
Nitrate, NO_3	mg/L	<0.2	6.4	7.0	5.8	5.7
Calcium, Ca	mg/L	260	240	280	290	290
Magnesium, Mg	mg/L	190	200	200	210	210
Sodium, Na	mg/L	1,000	1,200	1,000	1,200	1,200
Potassium, K	mg/L	17	19	11	19	12
Chloride, Cl	mg/L	1,900	2,000	1,900	2,000	2,000
Sulphate, SO_4	mg/L	660	760	680	750	730
Bicarbonate, HCO_3	mg/L	310	410	310	270	300
Carbonate, CO_3	mg/L	43	<1	25	40	23
pH	pH Units	8.7	7.6	8.3	8.7	8.5
Total Dissolved Solids @ 180^{o}C	mg/L	4,200	4,700	4,400	4,700	4,600
Conductivity @25^{o}C	µS/cm	7,400	7,900	7,400	7,900	7,900
Cation/Anion balance	%	-0.16	0.61	2.48	3.49	3.79
Sum of Ions (calc.)	mg/L	4,375	4,826	4,442	4,758	4,703

CLIENT: Rockwater Pty Ltd **OUR REFERENCE:** 99550

PROJECT: Beltana

LABORATORY REPORT

TEST PARAMETERS	UNITS	LOR	METHOD

Soluble Mercury, Hg	mg/L	0.0001	PEM-005
Zinc, Zn	mg/L	0.01	PEM-007
Lead, Pb	mg/L	0.005	PEM-003
Iron, Fe	mg/L	0.02	PEM-007
Manganese, Mn	mg/L	0.005	PEM-007
Copper, Cu	mg/L	0.01	PEM-007
Cadmium, Cd	mg/L	0.001	PEM-007
Brief Water Analysis			
Nitrate, NO_3	mg/L	0.2	PEI-020
Calcium, Ca	mg/L	0.2	PEM-007
Magnesium, Mg	mg/L	0.1	PEM-007
Sodium, Na	mg/L	0.5	PEM-007
Potassium, K	mg/L	0.1	PEM-007
Chloride, Cl	mg/L	1	PEI-020
Sulphate, SO_4	mg/L	1	PEI-020
Bicarbonate, HCO_3	mg/L	5	PEI-006
Carbonate, CO_3	mg/L	1	PEI-006
pH	pH Units	0.1	AN-101
Total Dissolved Solids @ 180^{o}C	mg/L	10	PEI-002
Conductivity @25^{o}C	µS/cm	2	AN-106
Cation/Anion balance	%		Calc.
Sum of Ions (calc.)	mg/L		Calc.

CLIENT: Rockwater Pty Ltd **OUR REFERENCE:** 99550
PROJECT: Beltana

LABORATORY REPORT

NOTES:

LOR - Limit of Reporting.

This test is not covered by the scope of our NATA accreditation.

APPENDIX III

GLOSSARY OF SELECTED TERMS AND ABBREVIATIONS

APPENDIX III
Glossary of Selected Terms and Abbreviations

Term	Meaning
Alluvium	Stream deposits consisting of sand, silt, clay and gravel
AHD	Australian Height Datum
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water
Bedrock	Solid rock, exposed or covered by overburden such as laterite, alluvium, or other material
bgl	Below ground level
Bore	Drilled hole usually lined with steel or plastic casing for the purpose of obtaining or monitoring groundwater
Brackish Water	Water containing between 1,000 and 5,000 mg/L of total dissolved solids, tasting slightly salty
Fresh Water	Water containing less than 1,000 mg/L of total dissolved solids, and generally suitable for drinking
Groundwater	Water occurring below the land surface in pores or fissures, generally in motion and part of the hydrogeological cycle
Laterite	A residual ferruginous deposit
Leakage	Vertical flow of groundwater from one aquifer to another, generally through a less permeable layer
m/d	Meters per day
m^2/d	Square metres per day
m^3	Cubic metres of water; equal to 1,000 litres
m^3/d	Cubic metres per day
mg/L	Milligrams per litre
mg/L TDS	Milligrams per litre of Total Dissolved Solids
m^3/yr	Cubic metres per year
mm/yr	Millimetres per year
Numerical Modelling	Computer based modelling of aquifers and their contained groundwater, under various conditions
Runoff	Overland flow in channels or as sheet flow originating from rainfall
Saline Water	Water containing more than 5,000 mg/L of dissolved salts
S	Storativity
T	Transmissivity
TDS	Total dissolved solids
Permeability	Transmitting capacity of unit thickness of aquifer: the rate of fluid flow under a hydraulic gradient of 1.0 through a cross section of one unit width over unit thickness of the aquifer
Transmissivity	Transmitting capacity of the whole thickness of the aquifer: equal to permeability multiplied by aquifer thickness
Storativity	The volume of water released or stored per unit surface area of the aquifer per unit charge in the hydraulic head (water level). Storage coefficient is the storativity of confined aquifer. Specific yield is the storability of unconfined aquifer

Beltana Native Vegetation Management Plan

Introduction

A native vegetation management plan has been prepared by Perilya (as Freehold Mining Pty Ltd) for the proposed Beltana Mine. This plan has been developed in accordance with the guideline documentation provided by PIRSA, and retains the structure and headings provided in the guidance documentation.

Site and Vegetation Description

An aerial photograph of the Beltana mine area is presented as Figure 1. This figure shows the Mining Lease (ML), Retention Lease (RL) and Miscellaneous Purpose Licence (MPL) areas associated with the Beltana Mine.

Figure 1 shows the topography and location of the leases.

Panoramic photographs of the site showing vegetation types are presented as photographs 1 – 16.

Photograph station locations (1 – 6) are shown in Figure 2.

Figure 1 Topography and lease location

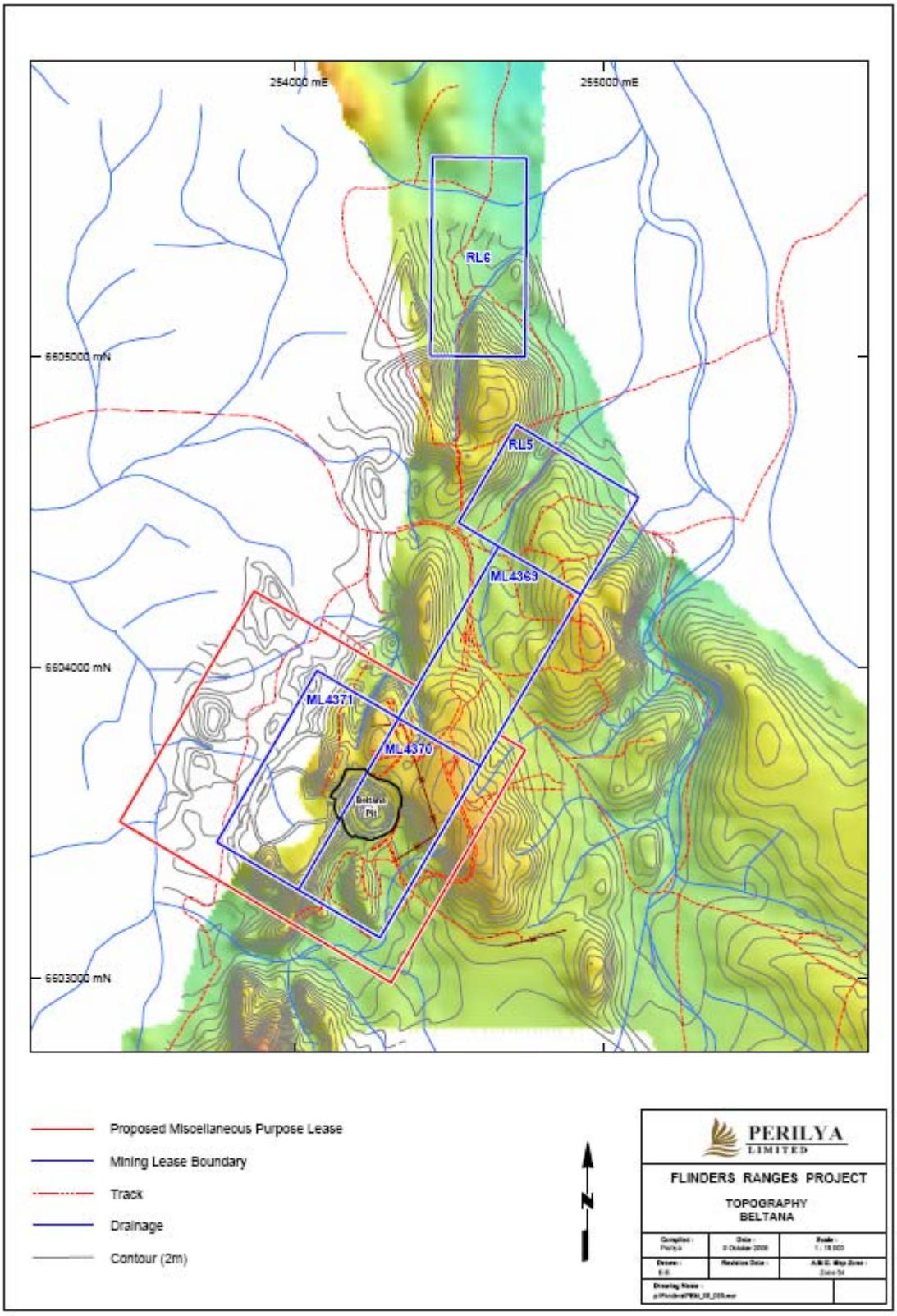
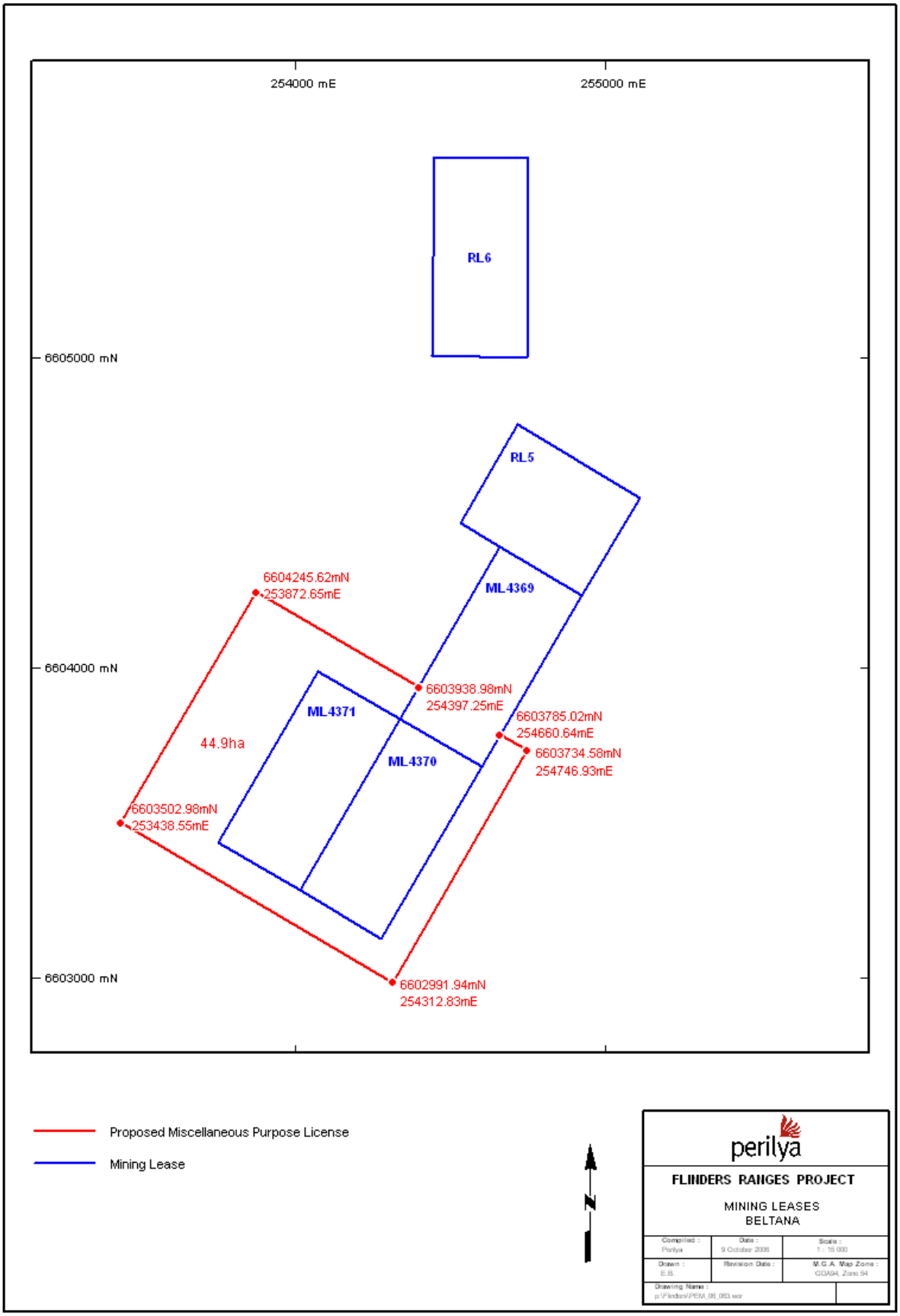
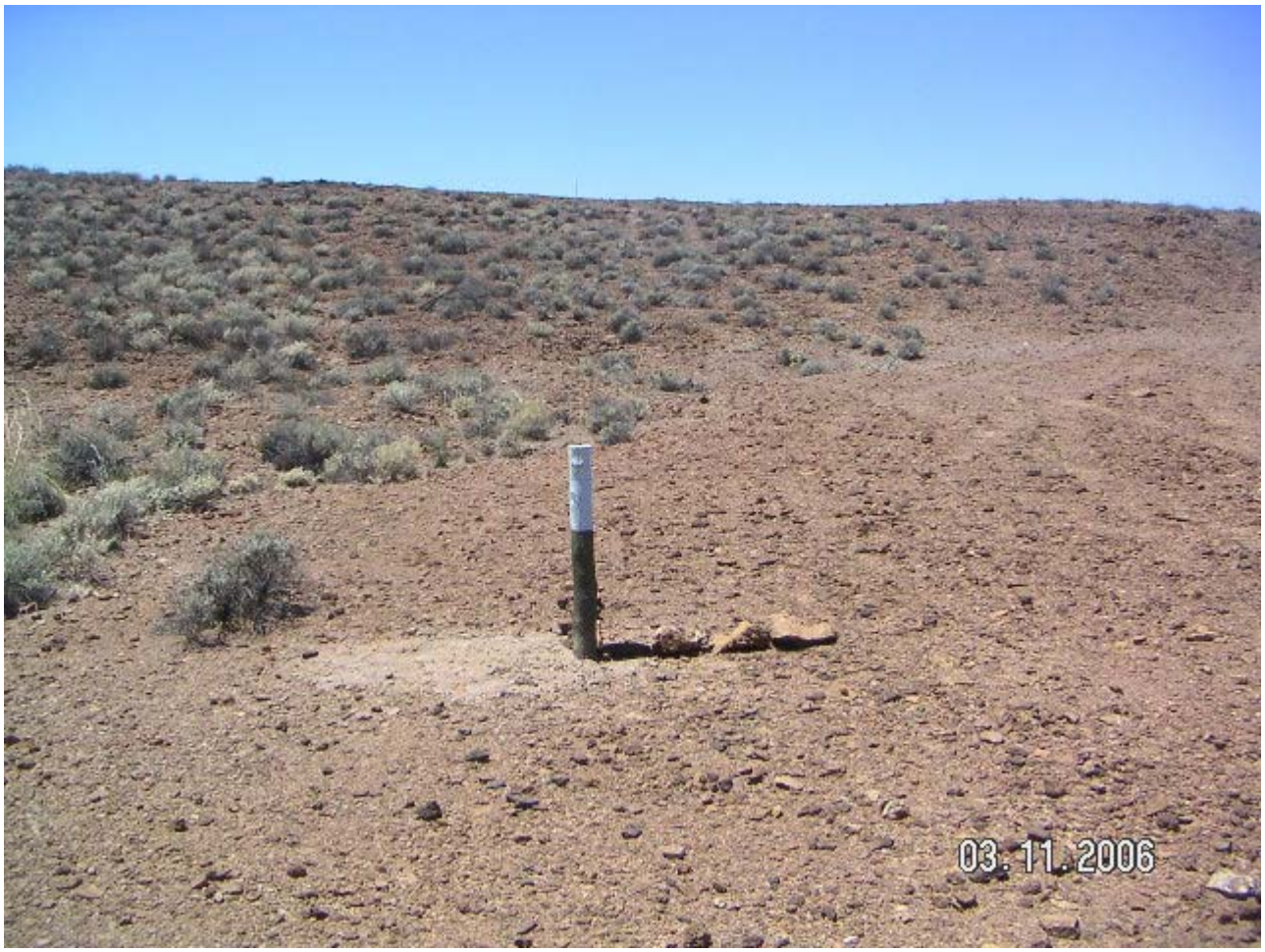


Figure 2 – Location of Photograph Stations

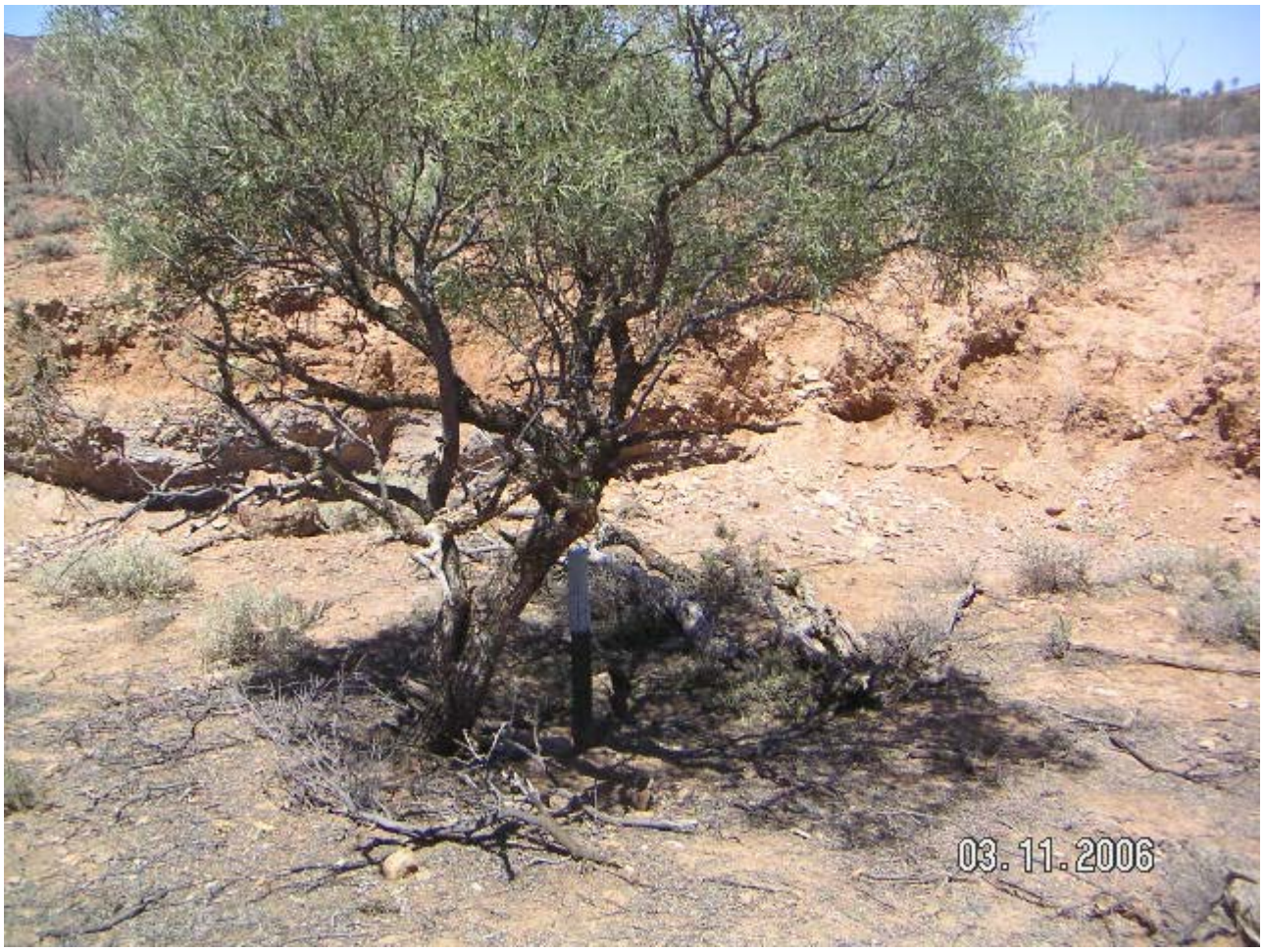


Photograph 1 - Station Five Looking East



Photograph 2 - Station Five Looking South

Photograph 3 – Station Four Looking East



Photograph 4 – Station Four Looking North

Photograph 5 –Station One Looking East

Photograph 6 – Station One Looking West

Photograph 7 – Station Six Looking East

Photograph 8 – Station Six Looking West

Photograph 9 – Station Three Looking North

Photograph 10 – Station Three Looking West

Photograph 11– Station Two Looking South

Photograph 12 – Station Two Looking West

Proximity to Other Native Vegetation

Vegetation around the mine site is part of a much larger area of similar native vegetation that occurs in the surrounding region. There has been no large-scale clearing of native vegetation anywhere in this region, although this has occurred in the town of Leigh Creek and in the Leigh Creek coalfields to the north. These are located about 16 and 22 kilometres away respectively.

Land Use History

The area has a long history of pastoral grazing and also uncontrolled grazing by feral goats and rabbits. Kangaroos and euros also have a significant grazing impact on the native vegetation. Unlike domestic sheep numbers, the native and feral herbivore populations are not easily managed and continue to have an impact on vegetation in times of drought when domestic stock numbers are likely to have been reduced.

A limited amount of total vegetation clearance has been carried out in connection with pastoral activities. This includes clearing of fence lines, and clearing around stock watering points, which also includes heavier grazing by stock where they congregate around the watering points. Vegetation clearance has also been carried out as part of past mining activities at the Beltana Mine.

Area of Vegetation to be Cleared, "Scattered trees", "Significant trees"

About 21 hectares of land will be cleared. The majority of land to be cleared is vegetated with chenopod low shrubland with very few or no trees. Most of the trees in the area are associated with watercourses or grow at the base of hills, where they also receive additional water from runoff. About 80 trees will be cleared in the area of the proposed waste rock dump extension and also in the area of the new evaporation pond. These are all *Casuarina pauper* (Black Oak), which has no special conservation significance under either the national EPBC Act 1999 or the state National Parks and Wildlife Act 1972. This species is very common locally and in the region. It regenerates readily, as shown by the presence of numerous seedlings and juvenile plants, especially along watercourses, and the removal of these trees will have little effect on the species as a whole.

A plan showing the areas to be cleared is presented as Figure 3.

Dominant Vegetation Communities

The dominant vegetation around the mine site is chenopod low shrubland vegetation on flats and hillsides and Black Oak low scattered woodland along watercourses. Very few weed species were recorded in the area during vegetation surveys in 2006. The same species (mainly Low Bluebush and Bladder Saltbush) that dominate the low shrublands also occur as understorey in the low woodland areas. This area probably once supported grasses in the understorey and may do so again following a significant rainfall event, but these have all been removed by grazing. Small areas of *Eucalyptus socialis* (Beaked Red Mallee) very open low woodland also occurs in some areas, but not in areas that will be disturbed by the proposed development. This species is also very common in the Flinders Ranges.

Height and Size of the Dominant Vegetation Layer

Low woodland vegetation is generally up to eight metres in height, with some mallee vegetation up to 10-12 metres. The low shrubland vegetation is generally less than one metre in height.

Density and Age of the Vegetation

The most dense vegetation occurs in the Black Oak woodlands along watercourses, but seldom attains a density that would qualify it as "woodland" (i.e. with a cover value >10%) except over very small areas. Black Oak is represented by all growth stages, from seedling to senescent. Mallees are mostly mature and senescent trees, but with few hollows suitable for fauna nesting sites. Low shrubs are mostly mature plants, but a few juveniles were recorded.

Health of Vegetation

Perennial vegetation is in good condition given the effects of the dry seasonal conditions. Ephemeral and annual vegetation was mostly absent because of these conditions and the heavy grazing pressure exerted by domestic, feral and native herbivores. There has been no logging in this area, except perhaps of the removal of a few Black Oaks for use in pastoral fences. No evidence of fire was seen at the site and this would be an unlikely occurrence given the sparse nature of the vegetation and the lack of suitable understorey species to carry a fire.

Presence of Any Tree Hollows or other Habitat Values

The only tree hollows are in mallee, but these are few in number. It is anticipated that no trees with hollows will be disturbed by this development.

The Likelihood of the Presence of Threatened Flora

A survey of the area was carried out in October 2006 by Dr Frank Badman of Badman Environmental, who has considerable experience of threatened flora in northern South Australia, including working on >110 Species Profiles and Threats (SPRAT) sheets for the South Australian Department for Environment and Heritage in 2005 and 2006. No threatened flora species were found. A search of the EPBC database (www.deh.gov.au\epbc\index.html) found three species listed as Vulnerable under the EPBC Act. A further four species that could occur in the area are listed as threatened under the regulations of the state National Parks and Wildlife Act 1972.

Species listed under the EPBC Act are:

- *Codonocarpus pyramidalis* (F.Muell.)F.Muell. (Slender Bell-fruit)
- *Maireana melanocarpa* Paul G.Wilson (Black-fruit Bluebush) and
- *Swainsona murrayana* Wawra (Slender Darling-pea).

All three are listed as Vulnerable under the EPBC Act and the first as Endangered and the others as Rare under state legislation. The status of each species in this area is discussed below.

Codonocarpus pyramidalis. This species is widely but sparsely distributed throughout the northern Flinders Ranges to as far north as Lyndhurst, but with few if any recent records north of Leigh Creek[1]. A Species Profiles and Threats Sheet is currently being prepared on behalf of the South Australian Department for Environment and Heritage[2]. This species has not been detected by vegetation surveys in the mine area and does not appear to be present in this area. The closest published records to the Beltana Mine are from Sliding Rock Creek near Beltana, 9 km east of Beltana and 12 km east of Beltana[3].

Maireana melanocarpa. This species is known to occur in the general area and its occurrence in this area has been reported in some detail[4]. A special watch was kept for this species during the Badman Environmental survey in October 2006. It is also likely that Davies would have searched this area during his field work in the early 1990s[5]. The closest records to the Beltana Mine are from Puttapa, Beltana and Copley[6].

Swainsona murrayana. Although this species is listed from the general area on the EPBC database[7], this is apparently based on a reported sighting from the Beverley Mine Site[8]. This record was based on an unvouchered sighting during an early vegetation survey and has long

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[1] *SADEH Plant Distribution Mapper at www.flora.sa.gov.au/.*
[2] *South Australian Department for Environment and Heritage, Plant Biodiversity Centre, Hackney Road, Adelaide.*
[3] *SADEH Plant Distribution Mapper at www.flora.sa.gov.au/.*
[4] *Davies, R.J.-P. (1995).* Threatened Plant Species Management in the Arid Pastoral Zone of South Australia*. Pastoral Management Branch, Department of Environment and Natural Resources, Adelaide.*
[5] *Davies, R.J.-P. (1995).* Threatened Plant Species Management in the Arid Pastoral Zone of South Australia*. Pastoral Management Branch, Department of Environment and Natural Resources, Adelaide.*
[6] *SADEH Plant Distribution Mapper at www.flora.sa.gov.au/.*
[7] *www.deh.gov.au\epbc\index.html.*
[8] *Heathgate Resources (1998).* Beverley Uranium Mine Environmental Impact Statement *Main Report. Heathgate Resources, Adelaide.*

been disputed and finally dismissed following more recent surveys[9]. The dismissal of this record is based on the fact that no voucher specimen was ever collected, the identification was based only on vegetative material and that the closest vouchered records, and the only ones for South Australia[10], are from Bagalowie, Orroroo, Oodlawirra and Olary, which are all well to the south of this area. The main distribution of this species is in New South Wales[11].

Four other species that are currently listed as rare under the South Australian National Parks and Wildlife Act 1972[12] have also been recorded in the general area of the Beltana Mine. These are the grass *Austrostipa petraea* (Flinders Ranges Spear-grass), the sub-shrub *Frankenia subteres*[13], the low shrub *Goodenia saccata* (Flinders Ranges Goodenia) and the small tree *Santalum spicatum* (Sandalwood). None of these was recorded during any of the recent surveys.

Significant Environmental Benefit (SEB) Calculation

A large scale aerial photograph of the area to be cleared is presented as Figure 3.

The proposed MPL area has been assessed as falling into the category of "Native Vegetation with some disturbance" (DWLBC 2005)[14] under the following criteria:

- Vegetation structure altered (the understorey at least has been modified by grazing)
- Most seed sources available to regenerate original structure
- Obvious signs of disturbance (eg, open pit, tracks)
- Minor clearing (<10% of the area cleared by grazing)
- Evidence of some grazing (tracks, pads and soil surface crust disturbed).

The vegetation of the Beltana Mine area is typical of the foothills and plains of the northern Flinders Ranges.

The clearing of vegetation around the Beltana Mine will have little impact on flora of listed conservation significance at the local, regional or state level. Vegetation clearance associated with the proposed development will affect only vegetation types that are common in the general area and over broader areas of the northern Flinders Ranges.

Existing impacts on native vegetation are mainly those associated with domestic grazing by sheep and also grazing by feral goats, kangaroos and euros. These effects cannot be quantified without considerable monitoring, although Badman (2004)[15] demonstrated that the grazing effects of kangaroos inside the Beverley Mine Lease fence, some 100km to the north-east of the Beltana

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[9] *Badman, F.J. (2006).* Southern EL 3251 Flora Survey*. Unpublished report prepared for Heathgate Resources Ltd, Adelaide.*

[10] *SADEH Plant Distribution Mapper at www.flora.sa.gov.au/.*

[11] *www.deh.gov.au\epbc\index.html.*

[12] *SADEH Plant Distribution Mapper at www.flora.sa.gov.au/.*

[13] *This taxon has no common name.*

[14] DWLBC (2005). *Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the clearance of native vegetation associated with the Mineral and Petroleum Resources Industry, September 2005.* Guidelines prepared for the Native Vegetation Council by the Department of Water, Land and Biodiversity Conservation, Government of South Australia, Adelaide.

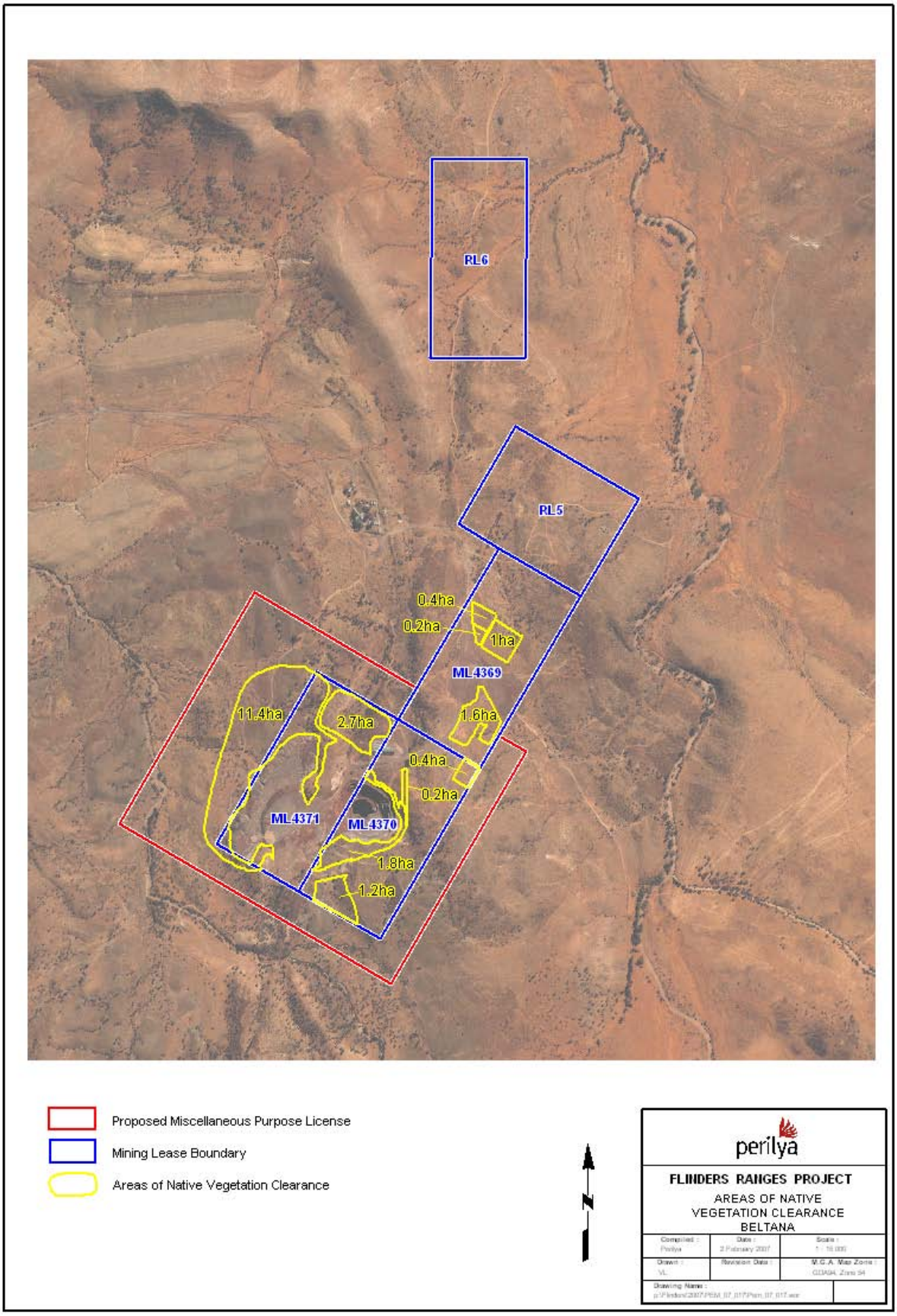
[15] Badman, F.J. (2004). *Beverley Uranium Mine Vegetation Monitoring Observations, September 2004.* Report prepared for Heathgate Resources Pty Ltd, Adelaide.

Mine, was equivalent to the grazing pressure of cattle outside the fence. Badman (2002)[16] also found that total grazing pressure remains the same when domestic stock are removed from a mine lease because kangaroos and perhaps rabbits move in to take advantage of the extra vegetation provided by the removal of stock.

When calculating the SEB ratio using the Department of Water, Land and Biodiversity Conservation guidelines (Table 1 in DWLBC 2005), the Beltana Mine survey area should probably be treated as having a 6:1 ratio. This ratio has been adopted for the calculation of SEB.

[16] Badman, F.J. (2002). *A comparison of the effects of grazing and mining on vegetation in selected parts of northern South Australia*. PhD Thesis, Department of Environmental Biology, University of Adelaide, Adelaide.

Figure 3 Areas to be cleared of natural vegetation



Appraisal of the Impacts of the Clearance

The vegetation surrounding the Beltana Mine is typical of that of large areas of the foothills of the northern Flinders Ranges and has no special conservation significance. The total area to be cleared, about 21 ha, comprises a very small part of the total area of this type of vegetation in this region. The clearance will have minimal impact on this type of vegetation at either a local, regional or state level.

Significant Environmental Benefit (SEB) to be provided in exchange for the proposed clearance

The following statements have been prepared taking the MESA Information Sheet M30 – Interim Guidelines on Requirements for Mineral Exploration and Mining under the Native Vegetation Act 1991 and Regulations 2003 into account.

It is intended to make a payment into the Native Vegetation Fund. The amount of the payment is calculated as follows:

Data:

Area to be cleared: 21 ha

Benefit ratio: 6:1

Management costs: $800/hectare

Land value: $20/hectare

SEB calculation:

Land benefit = 21 Ha x 6:1 benefit ratio = 126 ha

Land value = 126 x $20/ha = $2,520

Management costs = 21 ha @ $800/ha = $16,800

Total SEB payment = land value + management costs

= $2,5201320 + $16,800

= $19,320

Revegetation Plan

The area to be revegetated is estimated to be 21 hectares, and consists of the footprint of the extended waste rock dump area, stockpile areas, workshop and emulsion mixing areas, the evaporation pond footpring and the pit haul road.

Species to be Used and Distribution Rates

Revegetation will use local endemic species, with all seed collected locally, i.e. within 5 km of the Beltana Mine site. Seed will be distributed at a rate of 10 kg/hectare. Seed will be collected from all available species so as to obtain a mix of the species that are currently present in the area.

Management Techniques to be Used to Revegetate Disturbed Areas:

Replacement planting

- All revegetation will be from locally collected seed, with germination dependant on naturally occurring rainfall events. Tube stock is not a viable option in this semi-arid area unless it can be watered to ensure its survival through at least the first two summers.

Vermin and or weed control

- Unless other effective control measures are in place, fencing may be required to exclude goats, kangaroos and rabbits in order to allow the establishment of native vegetation. Any outbreak of weed species, particularly those that are proclaimed species or are new to the area, shall be immediately controlled. Advice may be sought from relevant officers within PIRSA.

Protective fencing

- The length of time over which fencing is required may depend on the rainfall event that produces the establishment of native vegetation. A significant rainfall event, when there is abundant plant growth over the whole of the region, would provide a greater opportunity for the successful establishment of new vegetation. Light falls of rain would have little chance of producing successful revegetation without suitable fencing to exclude kangaroos, goats and rabbits.

Seed collection

- Seeds should be collected locally. This can be done by use of a vacuum cleaner powered by a portable generator. Agencies such as Greening Australia or volunteer organisations could be used to assist with this work.

Hollow log relocation

- No trees will be cleared by the work proposed here. Most stands of trees in this area are located along watercourses, with others at the base of hills. These will not be affected.

Erosion control

- Flattening the batters of the existing waste dump will lessen the chance of erosion. When ripping the dump, all tine marks will follow the contour. This will assist in trapping or holding seed and in concentrating precipitation and trapping nutrients, as well as preventing erosion from water run-off.

Ongoing maintenance

Maintenance will include:

- Monitoring and control of weed species, particularly proclaimed species and any infestations of species that are new to the district.
- Maintenance of fencing to exclude herbivores until native vegetation has become established.
- Monitoring and control of any erosion, especially when caused by water flows.
- Managing any dust hazard from the waste dump.

How SEB will be Provided

SEB will be provided by a payment into the Native Vegetation Management Fund.

ebs
environmental & biodiversity services

Beltana Fauna Survey

RL6, RL5, ML4369, ML4371, ML4370 and MPL areas

December 2006

Table of Contents

Cover Photos: Top – General photo of *Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak); Middle – *Macropus rufus* (Red Kangaroo); Bottom – *Egernia stokesii* (Gidgee Skink).

Acknowledgements

The survey team comprised of the following people:

- Dr Travis How (Environmental and Biodiversity Services) – Survey Co-ordinator
- Rob Gration (Environmental and Biodiversity Services) - Mammals
- Matt Launer (Environmental and Biodiversity Services) – Reptiles
- Keith Bellchambers (Sub-consultant) – Birds

We would like to thank the following people for their assistance and for information provided during the project:

- Rick Aldam (Perilya Limited)
- Mark Hutchinson (Reptiles – South Australian Museum)
- Ralph Foster (South Australian Museum)
- Terry Reardon (Bats – South Australian Museum)
- Carolyn Kovach (Reptiles – South Australian Museum)
- Cath Kemper (Mammals – South Australian Museum)

Executive Summary

A fauna survey was conducted within RL6, RL5, ML4369, ML4371, ML4370 and MPL areas of the Beltana Mine in late November, early December 2006. The site is located approximately 16 km south of Leigh Creek in the pastoral region of South Australia.

A total of four sites representing the dominant habitat type within the project area were surveyed for fauna species following the standard biological survey methodology developed by the Department for Environment and Heritage (Owens 2000). The dominant habitat type within the project area was a *Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak).

The major findings of the survey were:

Mammals - A total of 78 observations of 13 mammal species were made, of which only four are considered to be introduced. An additional five bat species could be present but this could not be confirmed from their recorded calls.

Reptiles - A total of 40 observations of 10 reptile species were made, all of which were native species. No amphibian species were observed however little suitable habitat was observed within the project area for amphibian species.

Birds - A total of 160 observations of 27 bird species were made, with only one of these an introduced species.

No species of national conservation significance were observed during the survey. However, one species of state conservation significance, *Pyrrholaemus brunneus* (Redthroat) was recorded within the project area. Three individuals of this state **rare** bird species were recorded during the field survey. An additional five species of national significance and 14 species of state significance have been recorded previously in close proximity to the project site. A lack of suitable habitat within the project area for the majority of these species indicates that they are unlikely to occur within the project area. However, several species could possibly occur within the project site.

It is recommended that mining operation and associated works be undertaken in as small as possible area to reduce the impact on the fauna species and their habitat within the region. Fauna species observed within the area should be removed prior to starting work to reduce the direct impact of the project on fauna. Any trenches or holes left open on site should be monitored for fauna species with trapped animals removed and relocated and site staff should undergo specific training to increase their knowledge of the local fauna species and their management.

1. Introduction

This report documents a fauna survey undertaken within the RL6, RL5, ML4369, ML4371, ML4370 and MPL areas of the Beltana Mine. The existing project site is approximately 450 km north of Adelaide and 16 km south of Leigh Creek. The field survey component of the project was undertaken between the 29th of November and the 4th of December 2006. The field survey involved surveying four sites within 2 kilometres of the existing mine site (see Figure 1).

The objectives of this fauna study were to:

- Undertake a review of existing data and previous reports for the study area and surrounding region;
- Undertake an intensive field survey to establish baseline data for the Beltana Mine area;
- Determine the presence or likely presence of fauna species or fauna habitat listed under State and Commonwealth legislation;
- Liaise with the relevant authorities (primarily the South Australian Museum and Department for Environment and Heritage) in relation to areas or species of concern;
- To prepare a report documenting the findings from the background research and field surveys. The report will also provide recommendations on avoiding or minimising possible and likely impacts on fauna species within and adjacent to the project area.

1.1 Site description

The existing Beltana Mine is located approximately 450 km north of Adelaide and 30 km south of Leigh Creek. The current pit area comprises an area of approximately 5 ha (Figure 1) with the survey encompassing the pit area and extending north east of the existing pit area.

The study area is dominated by a *Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak). This vegetation type offers habitat to a range of fauna species, particularly when it is in good condition.

The study area is located within the Willouran Environmental Association (6.2.8) which is characterised by low quartzite and dolomite ridges, fans and plains and a mixed coverage of low open woodland areas, low mixed chenopod shrubland over grasses and forbs, grassland and fringing woodland (Laut et al. 1977).

1.2 Climate

The study area site is within an arid region typified by low and erratic rainfall events. The average rainfall for the nearby weather station at Leigh Creek is 253 mm (22 year average 1982 - 2004). On average the majority of the rainfall falls between December and March each year with consistent but low rainfall in the other months.

The average maximum temperatures range from 35.0^{oC} in January down to 16.2^{oC} in July. Regular days in excess of 40^{oC} occur within the summer and early autumn months. The average minimum daily temperature ranges from 20.5^{oC} in February to 4.7^{oC} in July. The minimum temperature during the winter months regularly drops below 0^{oC}.

1.3 Land use

The study area is located on a pastoral lease and is currently grazed by stock (sheep). It appears that over-grazing by stock, goats rabbits and possibly kangaroos has occurred in the past with evidence of erosion and heavily grazed vegetation present.

Figure 1 General location of the Beltana project site

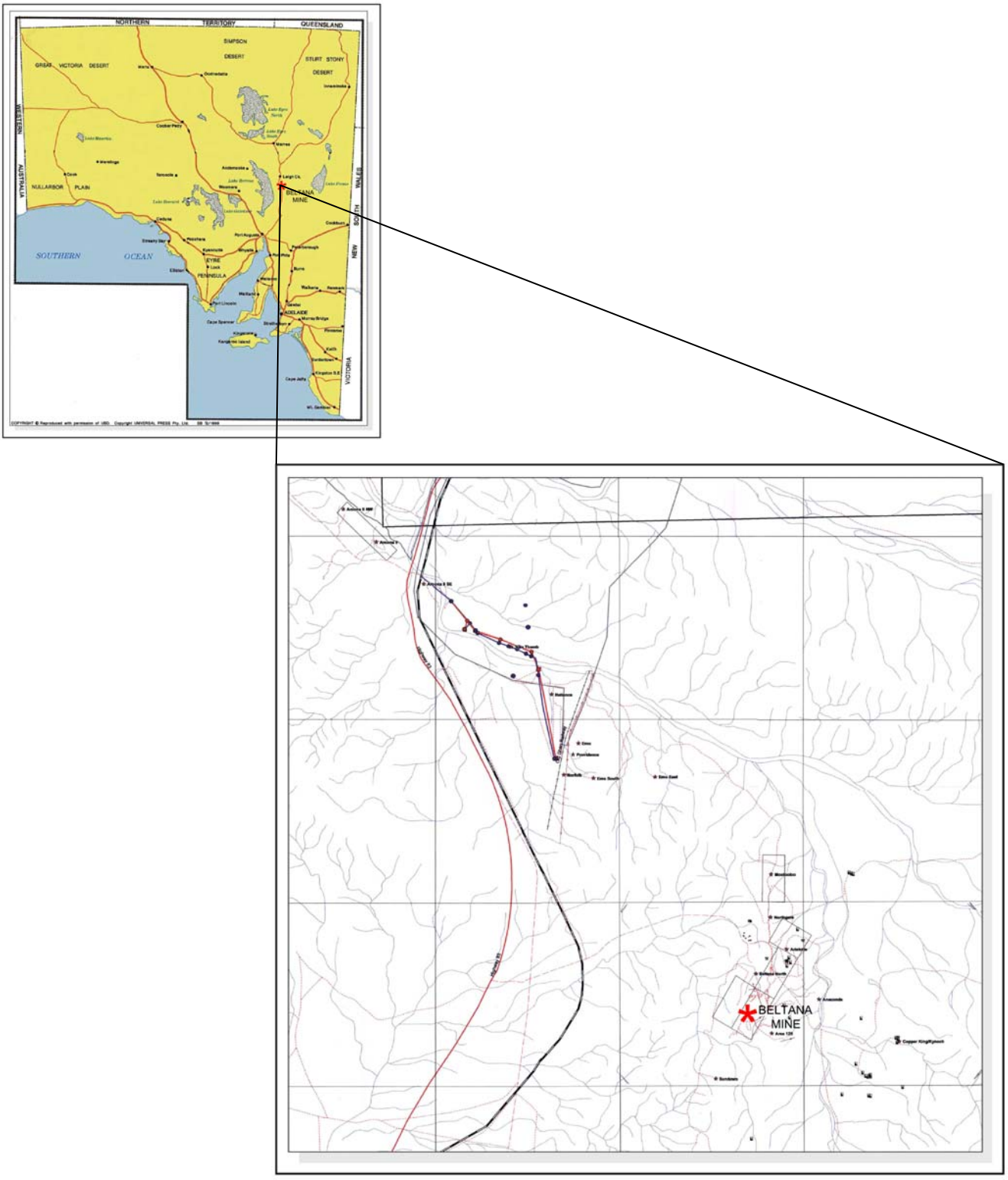
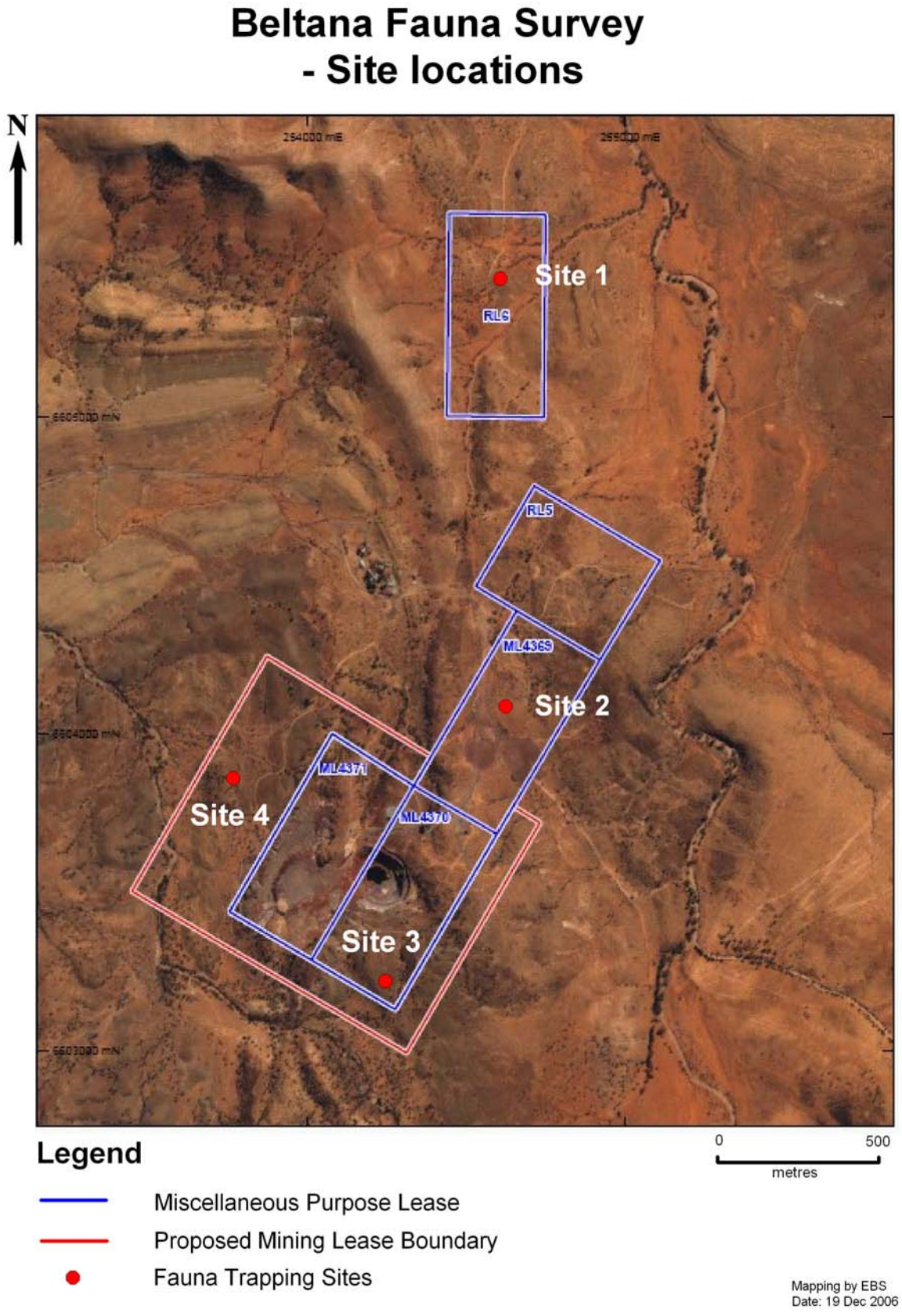


Figure 2 Location of survey sites



2. Methodology

2.1 Background research

Background research into the project area included undertaking a literature review and database searches. Previous fauna survey reports in the area (Playfair and Robinson 1997) were reviewed to determine the fauna species which have been previously recorded within the area and additional species which may occur in the area. The databases managed by the South Australian Museum and Department for Environment and Heritage were searched with an area 25 km x 25 km centred on the project site being searched.

2.2 Field survey

A detailed field survey was undertaken over a six day period between the 29th of November and the 4th of December 2006. A range of survey techniques were utilised for the project, all of which were based on the standard biological survey methodology developed by the Department for Environment and Heritage (Owens 2000). Pitfall traps, Elliott traps, cage traps, harp traps, spotlighting, active searching, bird surveys and the use of an Anabat detector were all employed at selected sites within the survey area. Opportunistic sightings of fauna were also made, generally whilst travelling between trapping sites. The taxonomy of all species follows Robinson *et al* (2000).

2.3 Trapping sites

Trapping sites were set up at four locations across the project area (Figure 2 and Appendix 1). As the project area primarily consisted of one habitat type (*Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak)), all survey sites were located within the one broad vegetation type (Figure 3). At each trapping site one trapping line was installed due to the small size of the survey area (generally in the pastoral zone, two trap lines are installed per site). Each trap line consisted of six pitfall traps, 15 Elliott traps and two cage traps. Trap lines were open for four nights at each site. Further details on the methods used are detailed in the following sections. The trapping effort for each site is detailed in Appendix 2.

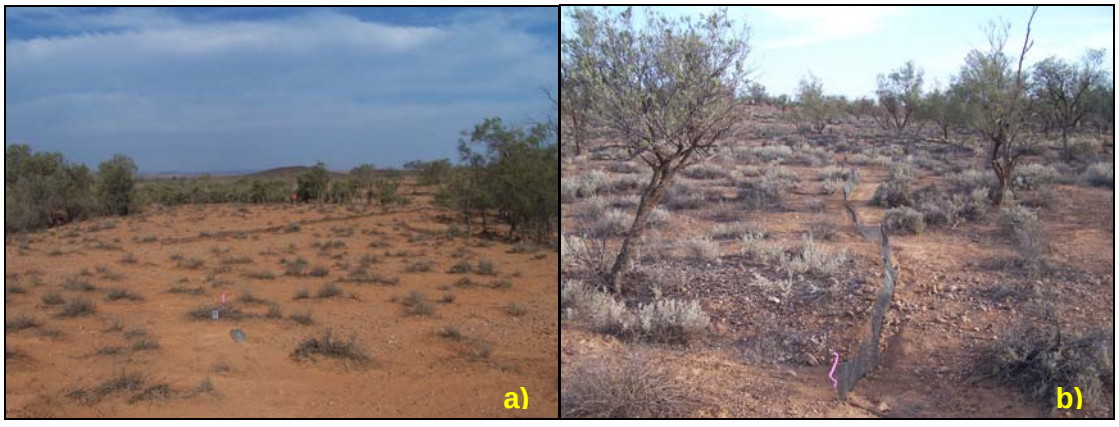


Figure 3. The dominant vegetation type within the survey areas was *Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak). Figure 3a is of Site BEL00101 and Figure 3b shows site BEL00201.

2.4 Pitfall traps

Pitfall trapping was conducted following the method outlined in '*Guidelines for Vertebrate Surveys in South Australia'* (Owens 2000). Briefly, six pitfall traps were installed for each trap line. Traps were placed 10 m apart with a 60 m long mesh fence installed to connect the traps. Surface spray was utilised for ant control at traps where ant activity was noticeably high. All pitfall traps were left open for four nights.

2.5 Elliott traps

Elliott traps were installed as detailed by Owens (2000). Fifteen traps were installed for each trap line and were placed approximately 10m apart. Each trap was baited with a mixture of rolled oats, peanut butter and linseed oil. Generally, all Elliott trap lines ran parallel with the pitfall trap lines and the traps were placed on the ground.

2.6 Cage traps

Cage traps were utilised as per the vertebrate survey guidelines (Owens 2000). For each trap line, two cage traps were installed with traps placed near the start and end of the pitfall trap line. The cage traps were left open for a total of four nights per site and were baited with a mixture of rolled oats, peanut butter and linseed oil.

2.7 Active searching

Active searching was undertaken at trapping sites to increase the number of species observed at each site. This was done by lifting rocks, rolling logs, digging burrows and peeling bark. Numerous species, particularly reptiles, were observed using this method. Active searching was undertaken within the trapping sites as well as at several sites which were not trapped but had good quality habitat present.

All of the trapping sites were searched for a minimum of one hour. A number of sites were searched for more than two hours in total. Appendix 2 details a summary of the active searching at each of the trap sites.

2.8 Bird survey

Due to the small size of the project site and the similar vegetation communities across the project site, bird surveys were not conducted at each trap site. Instead a bird survey for the entire area was undertaken on foot. This involved spending several hours in the morning and several hours in the late afternoon walking over the site, regularly stopping, and recording all of the bird species present. Opportunistic observations of bird species were also made for the duration of the survey. A total of four hours in the morning and two hours in the late afternoon were spent surveying for birds. An open top watertank adjacent to the site was also surveyed to see if any birds were coming into water.

2.9 Spotlighting

Spotlighting was undertaken, on foot, at each of the four trapping sites. This was done using handheld spotlights as well as head torches. Several species of Gecko were captured this way. Limited spotlighting from the vehicle was undertaken due to the small size of the project site.

2.10 Anabat bat detector

An Anabat detector was utilised at each site for one night with a total of four nights recording (Appendix 2). The bat detector records the calls of bat species which can then be identified. A number of the calls are similar and therefore, some species cannot be separated by call identification only. Additionally, the bat detector will only give the presence of a species and not the abundance of a species. A high number of bat calls may be the result of a high number of bats calling a few times or a low number of bats calling a number of times.

The bat detector was set up late in the afternoon and picked up when the traps were checked the following morning. Therefore, the detector was recording from sunset to sunrise as a minimum (>12 hours). The files on the bat detector were downloaded onto a laptop each day to ensure the detector was working properly.

2.11 Harp traps and mist nets

Harp traps were set up at all four of the trapping sites (Appendix 2). All sites had a minimum two nights of harp trapping with Site BEL00101 having three nights of harp trapping.

Mist nets were not utilised as part of the survey due to a lack of suitable netting sites. Mist netting requires open water, such as dams, to be present to attract the bats. No dams with water were located within the study area.

2.12 Opportunistic observations

Opportunistic observations were made throughout the survey period. These observations were made of all fauna species observed outside of trapping sites. This included observations made whilst travelling between trapping sites. Additionally, several areas were searched which were not trapping sites as they were considered to contain good quality habitat. All observations within these areas were recorded as opportunistic records.

2.13 Weather conditions

The fauna survey was conducted between the 29th of November and the 4th of December 2006. The maximum temperature gradually decreased over the duration of the survey from 36.5^{o}C in the shade to 30.9^{o}C (Table 1). The minimum temperature also decreased over the duration of the survey from 29.6^{o}C in the shade to 12.3^{o}C (Table 1). The weather during the survey period was warm to hot with most days having strong southerly winds. There were several small showers on the 30th of November, but not enough to record. The minimum and maximum temperatures recorded in the sun and shade at the Beltana project site during the fauna survey are presented in Table 1.

Table 1. Weather conditions during the Beltana fauna survey

Date	Temperature				Comments
	Sun		Shade		
	Min	Max	Min	Max	
30/11/06	27.5 ^{o}C	37.2 ^{o}C	29.6^{o}C	36.5^{o}C	Hot, cloudy, odd shower
1/12/06	19.5^{o}C	37.2^{o}C	20.3^{o}C	36.9^{o}C	Minimum cloud, strong south winds
2/12/06	14.3^{o}C	32.2^{o}C	15.4^{o}C	33.1^{o}C	Clear, cool, strong south winds
3/12/06	9.7^{o}C	30.8^{o}C	12.3^{o}C	30.9^{o}C	Clear, strong south winds in evening
4/12/06	19.9^{o}C		16.9^{o}C		Clear, calm, slight south winds

3. Survey results and discussion

The Beltana fauna survey was conducted during late spring / early summer at the end of a period of hot very dry weather. Due to the drought conditions observed prior to the survey, it is likely that the number of fauna species observed and the numbers of individuals of each species observed would be lower than at other times when the season was more favourable. Observations of both species and numbers of animals are likely to be greater following periods of good rainfall followed by warm weather conditions. The property was found to be currently grazed by sheep and introduced species (goats, camels and rabbits) as such there were areas where the degradation of both the vegetation present and the suitability of available habitat for fauna species within these areas, was evident.

3.1 Mammals

A total of 78 observations of at least 13 positively identified mammal species were made during the current fauna survey. Four of the mammal species are considered to be introduced. Appendix 3 summarises the survey data from the trapping sites and data collected opportunistically. The results from the Anabat Detector indicate that an additional five bat species may occur in the area but the identification could not be confirmed based on the recorded calls (Appendix 3). Therefore, identification was either classed as one of two species, identified to genus only or identified to species level but left with a ? due the identification not being certain (Appendix 3). Several of the species identified to genus level are possibly species already identified for the site through the Anabat Detector or from the Harp Trapping. For each positive identification of each species at a site using the Anabat Detector, only one individual was counted in the Appendix 3 table as the number of calls for a species does not necessarily relate to the number of individuals in an area. Appendix 8 provides examples of the bat calls recorded within the project site.

The most common native mammal species observed at during the Beltana survey were *Macropus robustus* (Euro), *Macropus rufus* (Red Kangaroo) and *Vespadelus baverstocki* (Inland Forest Bat), with 11, 6 and 5 individuals observed respectively. The most common introduced species were *Capra hircus* (Feral Goat) and *Camelus dromedarius* (One-humped Camel) with 18 and 6 individuals, respectively. Two species, *Camelus dromedarius* (One-humped Camel) and *Ovis aries* (Sheep), were only observed opportunistically.

No mammal species of state or national conservation significance were recorded during the fauna survey.

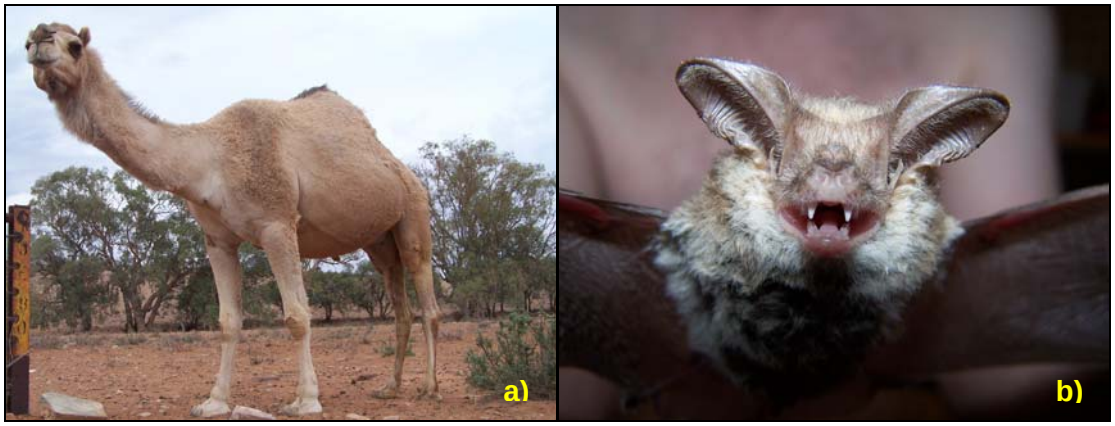


Figure 4. Six *Camelus dromedarius* (One-humped Camel) (Figure 4a) were recorded opportunistically within the survey area whilst a total of four *Nyctophilus geoffroyi* (Lesser Long-eared Bat) (Figure 4b) were caught in Harp Traps at Sites BEL00101 and BEL00401.

3.2 Reptiles and amphibians

A total of 40 observations of 10 reptile species were made during the Beltana fauna survey. No amphibian species were observed during the current survey. Fourteen observations of reptiles were made opportunistically with the majority either caught in pitfall traps or captured whilst actively searching sites. Appendix 4 summarises the survey data from the trapping sites and data collected opportunistically.

The most common reptile species observed during the survey were *Gehyra variegata* (Tree Dtella) and *Heteronotia binoei* (Bynoe's Gecko) with 19 and 9 individuals observed, respectively. No reptile species of national or state conservation significance were recorded during the Beltana fauna survey.

Figure 5. Three *Nephurus millii* (Barking Gecko) were recorded at site BEL00401 (Figure 5a) whilst one *Pygopus schraderi* (Hooded Scaly-foot) was recorded at site BEL00201 (Figure 1b).

3.3 Birds

A total of 160 observations of 27 bird species were made during the Beltana fauna survey. Appendix 5 summarises the survey data from the trapping sites and data collected opportunistically. None of the species are introduced species.

Due to the survey methodology for birds, the majority of species were recorded opportunistically and not directly associated with a trapping site. However, the entire bird survey was undertaken within the project area in the same habitat as where the trapping sites were located.

The most common bird species observed during the Beltana survey were *Taeniopygia guttata* (Zebra Finch), *Dromaius novaehollandiae* (Emu) and *Acanthiza uropygialis* (Chestnut-rumped Thornbill) with 25, 24 and 19 individuals observed, respectively. Other species not observed but likely to be common within the area include *Cacatua roseicapilla* (Galah), *Barnardius zonarius* (Australian Ringneck), *Cinclosoma castanotus* (Cinnamon Quail-thrush), *Psophodes cristatus* (Chirruping Wedgebill) and *Ocyphaps lophotes* (Crested Pigeon).

No species of national conservation significance were observed within the survey area, however, one species of state conservation significance, the state **rare** *Pyrrholaemus brunneus* (Redthroat) was recorded. Three individuals of this species were recorded within the survey area and are likely to be residents of the site. Further information on species of significance is presented in Section 3.5.

Five bird species listed as either migratory (includes species that belong to families listed as migratory) or marine species under the *EPBC Act* 1999 were recorded within the project area. These species are *Aquila audax* (Wedgetail Eagle), *Falco berigora* (Brown Falcon) and *Milvus migrans* (Black Kite) which belong to families listed as migratory and (Whiskered Tern) which is listed as a marine species. *Falco cenchroides* (Nankeen Kestrel) belongs to a migratory listed family as well as being listed as a marine species.

Figure 6. One *Podargus strigoides* (Tawny Frogmouth) was recorded at site BEL00401 (Figure 6a) whilst one *Psephotus varius* (Mulga Parrot) was recorded at site BEL00201 (Figure 1b).

3.4 Database searches

Searches of the South Australian Museum and Department for Environment and Heritage databases found 168 birds, 24 mammals, 56 reptiles and five amphibians

previously recorded within a 25km x 25km area centred on the project site (Appendix 6). A search of the Protected Matters Database (EPBC listed species) was also undertaken for a similar search area. Results of this search are presented in Appendix 7. Species of conservation significance recorded within close proximity to the project site are discussed in Section 3.5.

3.5 Species of conservation significance

No species of national conservation significance were recorded during the project. However, one species of state conservation significance, *Pyrrholaemus brunneus* (Redthroat) was recorded within the project area. This species has a **rare** conservation rating at a state level and three individuals were recorded within the site. A total of five species of national conservation significance and a further 15 species of state conservation significance have been recorded within close proximity to the project site (Table 2; Appendix 6).

***Pyrrholaemus brunneus* (Redthroat)**
Pyrrholaemus brunneus was recorded within the project area and is a species that is generally associated with chenopod shrublands (with or without an oversotrey) and drainage lines. It is likely that this species is a resident of the area as it is found in chenopod shrublands with or without an overstorey.

It is unlikely that the proposed project would have a significant impact on this species due to the small area of disturbance and the occurrence of vast areas of similar habitat within the region. A general observation of the vegetation outside of the proposed project area suggests that the vegetation condition improves further away from the project area.

***Leporillus* species (Stick-nest Rats)**
Two species, *Leporillus apicalis* (Lesser Stick-nest Rat) and *Leporillus conditor* (Greater Stick-nest Rat) are unlikely to occur within the project area as both species are considered to be either extinct (*L. apicalis*) or extinct on the mainland (*L. conditor*). The recording of these species was based on finding old stick-nests which these species construct. A remnant population of *Leporillus conditor* is known to occur on the Franklin Islands and has been successfully reintroduced to several offshore islands as well as being released at Roxby Downs as part of the Arid Recovery Project (Copley *et al* 2006). To date, all released populations appear to be surviving and increasing in numbers.

***Acanthiza iredalei iredalei* (Inland Thornbill)**

Acanthiza iredalei iredalei (Slender-billed Thornbill) is listed as being nationally **vulnerable** (Table 2; Appendix 6). *Acanthiza iredalei iredalei* is generally found within saltmarsh areas dominated by samphire, bluebush or saltbush around salt lakes or low heath on sandplains (Schodde and Mason 1999). This specific habitat type is not present on site, however, the area does contain low bluebush / saltbush shrublands which may be suitable for the species to occupy. The species has been recorded near Leigh Creek and therefore is known to occur within the region.

***Amytornis textilis modestus* (Thick-billed Grasswren)**
Amytornis textilis modestus (Thick-billed Grasswren) is listed as being nationally **vulnerable** (Table 2; Appendix 6) and has been recorded several times in close proximity (<20km) to the project site. The closest record is approximately 10 km east of the project area.

Amytornis textilis modestus is a small shy species which inhabits chenopod shrublands dominated by *Maireana* (Bluebush) species and *Atriplex* (Saltbush) species. It is possible that this species occurs within the project area as suitable habitat is found on site and it has been previously recorded within close proximity to the site. However, the habitat within the project area is likely to be marginal for this species (Bellcahmers, K. pers. com.). Due to the small size of the project area it is unlikely that the project will have a significant impact on the species.

***Petrogale xanthopus* (Yellow-footed Rock-wallaby)**
Petrogale xanthopus (Yellow-footed Rock-wallaby) is listed as being nationally **vulnerable** (Table 2; Appendix 6). This species inhabits rocky outcrops in semi-arid country where suitable crevices, ledges and shelter are present. This species was not found on site and the nearest known populations are 20 km south east of the project site in the North Flinders Ranges and a population of released animals at Aroona Dam near Leigh Creek (Brandle 1997). No suitable habitat was found within the project area for this species and therefore, it is highly unlikely that it would be found on site.

***Anas rhynchotis* (Australasian Shoveler), *Bizuria lobata* (Musk Duck), *Oxyura australis* (Blue-billed Duck), *Plegadis falcinellus* (Glossy Ibis), *Podiceps cristatus* (Great Crested Grebe), *Stictonetta naevosa* (Freckled Duck)**
A number of waterbird species of state conservation significance have been previously recorded within the project area. These include *Anas rhynchotis* (Australasian Shoveler), *Bizuria lobata* (Musk Duck), *Oxyura australis* (Blue-billed Duck), *Plegadis falcinellus* (Glossy Ibis), *Podiceps cristatus* (Great Crested Grebe), *and Stictonetta naevosa* (Freckled Duck). The conservation ratings for these species range from state **rare** to state **vulnerable**.

The majority of the previous records for these species occur in and around Aroona Dam, which is understandable due to the large water body that occurs at this location. Several of the records (eg for *Anas rhynchotis*) don't appear to be correlated with a known water body, however these are still more than 15 km from the project site and may be as a result of a flood event.

Water was found in the bottom of the existing Beltana Mine, however, no waterbird species were observed using this area. It is highly unlikely that any waterbird species would rely on this water supply and are more likely to utilise Aroona Dam which is much larger and the water quality is likely to be better.

***Morelia spilota* (Carpet Python) *Vermicella annulata* (Common Bandy Bandy)**
Morelia spilota (Carpet Python) has a state **vulnerable** conservation rating whilst *Vermicella annulata* (Common Bandy Bandy) is considered to be **rare** at the state level. Both of these species have been recorded previously within the Northern Flinders Ranges, over 20km to the south east of the project site.

Vermicella annulata is a nocturnal burrowing snake which feeds exclusively on Blind Snakes (*Typhlopidae*). This species is found in a range of habitat types and has been previously recorded within close proximity to the project site (approximately 20km south east of project site). As this is a rarely encountered burrowing species and relies on the presence of blind snakes, it is possibly found within the project site. However, it is considered that the available habitat for this within the project site is limited due to the shallow soils and lack of burrowing opportunities.

Morelia spilota has been previously recorded approximately 20km east south east of the project site in the Northern Flinders Ranges. This species occupies a range of habitat types including temperate woodlands, rainforests and shrublands. A lack of refuges (large crevices, tree hollows) within the project site indicates that the site may not contain suitable habitat for this species. However, a nearby *Eucalyptus camaldulensis* (Red Gum) creek line offers suitable habitat for the species with numerous hollows and large crevices present.

***Aphelocephala pectoralis* (Chestnut-breasted Whiteface)**
Aphelocephala pectoralis has a state **rare** rating (Table 2) and prefers habitats with open stony terrain with cover of Chenopod shrubs such as *Maireana* and *Atriplex* species. The majority of observations of this species are in the hilly stony country where creek lines are present and often offer denser shrubby vegetation (Garnett and Crowley 2000).

This species has been previously recorded approximately 7km north east of the project site with the record being made in 1900 and it is known to occur west of Leigh Creek South (Bellchambers, K. pers. com.). The site just west of Leigh Creek South contains similar to habitat to the project site (Bellchambers, K. pers. com.) and therefore suitable habitat is present within the project site for the species. The project will disturb only a small area of this habitat type and therefore, the project is unlikely to have a significant impact on the species, if it is present at the site.

***Emblema pictum* (Painted Finch)**
Emblema pictum was recorded in the 1940's approximately 14km north north west of the project site. This is an old record and a significant amount of survey work undertaken by the Department for Environment and Heritage failed to record this species across a range of habitat types within the north west Flinders Ranges region (Brandle 1997). Therefore, it is considered unlikely that this species is present within the area and that the project will not have a significant impact on the species.

***Cinclosoma castanotus* (Chestnut Quail-thrush)**
Cinclosoma castanotus is generally found within the low shrubs and undergrowth of mallee scrub, Acacia scrubs, dry sclerophyll woodland, heath, and native pine. This species has been recorded three times within close proximity to the project site including approximately 15 km of the south, 23km north east and 20 km north west of the project area.

The project area does not contain the preferred habitat for this species, however, it is possible that the species may pass through the area. It is unlikely that the proposed project would have a significant impact on the species.

***Falco peregrinus* (Peregrine Falcon)**
Falco peregrinus has a state **rare** conservation rating and occupies a range of habitat types. It is probable that this species would utilise the project area as part of its hunting ground, however, there were a lack of suitable nesting sites for the species. Therefore, it is unlikely that this species would be significantly affected by the proposed project.

***Climacteris affinis* (White-browed Treecreeper)**
Climacteris affinis has been previously recorded within the Northern Flinders Ranges, approximately 20 km south east of the project site. This species prefers woodlands or tall shrublands which are not present within the survey area. It is therefore, unlikely that this species is present within the survey area. However, it is possible that it may occur within the *Eucalyptus camaldulensis* (Red Gum) creek line adjacent to the site.

***Neophema chrysostoma* (Blue-winged Parrot)**
Several recordings of the state **vulnerable** *Neophema chrysostoma* occur approximately 15 km north east and 30 km south east of the project site. This species is considered to be a non-breeding winter visitor to the region (Brandle 1997) and therefore unlikely to be observed during the current survey. It is likely that if present on the site, it would be a seasonal and rare visitor. The project area is unlikely to offer significant habitat to this species and consequently, the project is unlikely to have a significant impact on the species.

Table 2. Fauna species of conservation significance previously recorded within close proximity to the Beltana project site.

Species Name	Common Name	Conservation significance	
		Aus	SA
Acanthiza iredalei iredalei	Slender-billed Thornbill	**VU**	**V**
Amytornis textilis modestus	Thick-billed Grasswren	**VU**	**R**
Anas rhynchotis	Australasian Shoveler		**R**
Aphelocephala pectoralis	Chestnut-breasted Whiteface		**R**
Biziura lobata	Musk Duck		**R**
Cinclosoma castanotus	Chestnut Quail-thrush		**R**
Climacteris affinis	White-browed Treecreeper		**R**
Emblema pictum	Painted Finch		**R**
Falco peregrinus	Peregrine Falcon		**R**
Neophema chrysostoma	Blue-winged Parrot		**V**
Oxyura australis	Blue-billed Duck		**R**
Plegadis falcinellus	Glossy Ibis		**R**
Podiceps cristatus	Great Crested Grebe		**R**
Pyrrholaemus brunneus	Redthroat		**R**
Stictonetta naevosa	Freckled Duck		**V**
Leporillus apicalis	Lesser Stick-nest Rat	**EX**	**EX**
Leporillus conditor	Greater Stick-nest Rat	**VU**	**V**
Petrogale xanthopus	Yellow-footed Rock-wallaby	**VU**	**V**
Morelia spilota	Carpet Python		**V**
Vermicella annulata	Common Bandy-Bandy		**R**

Aus Conservation Status (national) – *EPBC Act* 1999
CR = critically endangered
EN =endangered
VU = nationally vulnerable
M = migratory
Ma = marine listed
SA Conservation Status (state) – *NPW Act* 1972
E = endangered
V = vulnerable
R = rare

4. Recommendations

The recommendations from the fauna survey include:

- Minimise the impacts of the project on the environment by utilising a footprint which is as small as possible;
- Ensure all activities are maintained within the nominated areas including all vehicles and machinery movements, stockpiling of material and excavations;
- Any fauna species likely to be directly impacted upon by the mining operations should be caught and relocated into suitable habitat outside of the disturbance area;
- Any trenches or holes associated within the mining operations which are left open should be regularly checked for fauna species;
- Any fauna species caught in trenches or holes associated with the mining operations should be caught and relocated into suitable habitat outside of the disturbance area;
- Undertake staff training sessions to promote the awareness of fauna species within the project area and their reliance on undisturbed habitat. Also reinforce the need to minimise impacts on these species through works undertaken on site.

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Appendix 1 – Trapping sites for the Beltana Fauna Survey

Site Identification	Site Location		Vegetation Community
	Easting	Northing	
BEL00101	254706	6605539	*Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak)
BEL00201	254700	6604332	*Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak)
BEL00301	254240	6603116	*Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak)
BEL00401	253691	6603761	*Maireana astrotricha* (Low Bluebush) and *Atriplex vesicaria* (Bladder Saltbush) Low Shrubland with emergent *Casuarina pauper* (Black Oak)

Locations are given using the WGS 84 datum

Appendix 2 – Trapping effort for the Beltana Fauna Survey

Site	Elliott traps		Pitfall traps		Cage traps		Harp traps	Spotlight	Day search	Bat detector
	nights	trap nights	nights	trap nights	nights	trap nights	nights	hours	hours	nights
BEL00101	4	60	4	24	4	8	3	1	1	1
BEL00201	4	60	4	24	4	8	2	1	1	1
BEL00301	4	60	4	24	4	8	2	1	1	1
BEL00401	4	60	4	24	4	8	2	1	1	1
TOTAL	16	240	16	96	16	32	9	4	4	4

Appendix 3 – Mammal species recorded during the Beltana Fauna Survey

Species	Common Name	BEL-001	BEL-002	BEL-003	BEL-004	Opportune	Total
**Camelus dromedarius*	One-humped Camel					6	**6**
**Capra hircus*	Feral Goat		4	5	6	3	**18**
***Chalinolobus gouldii*	Gould's Wattled Bat	1	1	1			**3**
***Chalinolobus morio*	Chocolate Wattled Bat			1			**1**
Macropus robustus	Euro		2	4	5		**11**
Macropus rufus	Red Kangaroo			3		3	**6**
***Mormopterus sp / Chalinolobus gouldii?*		1					**1**
***Mormopterus sp?*	Freetail Bat		1				**1**
Nyctophilus geoffroyi	Lesser Long-eared Bat	2			2		**4**
***Nyctophilus sp.*	Long-eared Bat	1		1			**2**
**Oryctolagus cuniculus*	European Rabbit	1				4	**5**
**Ovis aries*	Feral Sheep				2	2	**4**
Pseudomys bolami	Bolam's Mouse	1					**1**
Sminthopsis crassicaudata	Fat-tailed Dunnart	1					**1**
***Tadarida australis*	White-striped Mastiff Bat	1	1	1	1		**4**
#Vespadelus baverstockii	Inland Forest Bat	5	2	1			**8**
***Vespadelus darlingtoni?*	Large Forest Bat		1				1
***Vespadelus sp.?*				1			1
Total		**14**	**12**	**18**	**16**	**18**	**78**

* Denotes introduced species
**Denotes bat species identified only by calls – each site was given a 1 in relation to number of individuals if identified using this method as not data on abundance can be determined when using an Anabat Detector
#Denotes bat species identified by calls and trapping individuals
?positive identification of species could not be determined based on the call

Appendix 4 – Reptile species recorded during the Beltana Fauna Survey

Species	Common Name	BEL-001	BEL-002	BEL-003	BEL-004	Opportune	Total
Ctenotus olympicus	Saltbush Ctenotus	1					**1**
Ctenotus regius	Eastern Desert Ctenotus				1		**1**
Egernia stokesii	Gidgee Skink				2		**2**
Gehyra variegata	Tree Dtella	6		1	1	11	**19**
Heteronotia binoei	Bynoe's Gecko		2	2	2	3	**9**
Morethia boulengeri	Common Snake Eye	1		1			**2**
Nephrurus milii	Barking Gecko				3		**3**
Pygopus schraderi	Hooded Scaly-foot		1				**1**
Tiliqua rugosa	Sleepy Lizard				1		**1**
Varanus gouldii	Sand Goanna		1				**1**
Total		**8**	**4**	**4**	**10**	**14**	**40**

* Denotes introduced species

Appendix 5 – Bird species recorded during the Beltana Fauna Survey

Species	Common Name	BEL-001	BEL-002	BEL-003	BEL-004	Opportune	Total
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					4	**4**
Acanthiza apicalis	Inland Thornbill					1	**1**
Acanthiza chrysorrhoa	Yellow-rumped Thornbill					1	**1**
Acanthiza uropygialis	Chestnut-rumped Thornbill					19	**19**
Aphelocephala leucopsis	Southern Whiteface					10	**10**
Aquila audax	Wedge-tailed Eagle					3	**3**
Barnardius zonarius	Australian Ringneck			1			**1**
Chlidonias hybridus	Whiskered Tern					1	**1**
Corvus coronoides	Australian Raven					6	**6**
Cracticus torquatus	Grey Butcherbird					2	**2**
Dromaius novaehollandiae	Emu		8			16	**24**
Falco berigora	Brown Falcon					1	**1**
Falco cenchroides	Australian Kestrel					1	**1**
Gymnorhina tibicen	Australian Magpie					4	**4**
Lichenostomus virescens	Singing Honeyeater					1	**1**
Malurus lamberti	Variegated Fairy-wren					13	**13**
Malurus leucopterus	White-winged Fairy-wren					9	**9**
Milvus migrans	Black Kite		7	2			**9**
Petroica goodenovii	Red-capped Robin					3	**3**
Phaps chalcoptera	Common Bronzewing					1	**1**
Podargus strigoides	Tawny Frogmouth				1		**1**
Pomatostomus superciliosus	White-browed Babbler					9	**9**
Psephotus varius	Mulga Parrot				1	5	**6**
Pyrrholaemus brunneus	Redthroat					3	**3**
Rhipidura leucophrys	Willie Wagtail					1	**1**
Taeniopygia guttata	Zebra Finch					25	**25**
Todiramphus pyrrhopygia	Red-backed Kingfisher					1	**1**
Total		**0**	**15**	**3**	**2**	**140**	**160**

* Denotes introduced species

Appendix 6 – Fauna species previously recorded within or in the vicinity of the project area (source: Department for Environment and Heritage and SA Museum databases)

Class	Species name	Common name	Conservation significance	
			AUS	SA
AMPHIBIA	*Crinia riparia*	Streambank Froglet		
AMPHIBIA	*Limnodynastes tasmaniensis*	Spotted Grass Frog		
AMPHIBIA	*Litoria rubella*	Red Tree Frog		
AMPHIBIA	*Neobatrachus centralis*	Trilling Frog		
AMPHIBIA	*Neobatrachus pictus*	Painted Frog		
AVES	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater		
AVES	*Acanthiza apicalis*	Inland Thornbill		
AVES	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill		
AVES	*Acanthiza iredalei*	Slender-billed Thornbill	**VU**	**V**
AVES	*Acanthiza uropygialis*	Chestnut-rumped Thornbill		
AVES	*Accipiter cirrhocephalus*	Collared Sparrowhawk	**M**	
AVES	*Accipiter fasciatus*	Brown Goshawk	**M, Ma**	
AVES	*Acrocephalus australis*	Australian Reed Warbler	**M**	
AVES	*Acrocephalus stentoreus*	Clamorous Reedwarbler	**M, Ma**	
AVES	*Actitis hypoleucos*	Common Sandpiper	**M**	
AVES	*Aegotheles cristatus*	Australian Owlet-nightjar		
AVES	*Amytornis textilis*	Thick-billed Grasswren	**VU**	**R**
AVES	*Anas castanea*	Chestnut Teal	**M**	
AVES	*Anas gracilis*	Grey Teal	**M**	
AVES	*Anas rhynchotis*	Australasian Shoveler	**M**	**R**
AVES	*Anas superciliosa*	Pacific Black Duck	**M**	
AVES	*Anhinga melanogaster*	Darter		
AVES	*Anthochaera carunculata*	Red Wattlebird		
AVES	*Anthus novaeseelandiae*	Richard's Pipit	**Ma**	
AVES	*Aphelocephala leucopsis*	Southern Whiteface		
AVES	*Aphelocephala pectoralis*	Chestnut-breasted Whiteface		
AVES	*Apus pacificus*	Fork-tailed Swift	**M, Ma**	
AVES	*Aquila audax*	Wedge-tailed Eagle	**M**	
AVES	*Ardea alba*	Great Egret, (White Egret)	**M, Ma**	
AVES	*Ardea pacifica*	White-necked Heron		
AVES	*Artamus cinereus*	Black-faced Woodswallow		
AVES	*Artamus leucorhynchus*	White-breasted Woodswallow		
AVES	*Artamus minor*	Little Woodswallow		
AVES	*Artamus personatus*	Masked Woodswallow		
AVES	*Artamus superciliosus*	White-browed Woodswallow		
AVES	*Ashbyia lovensis*	Gibberbird		
AVES	*Aythya australis*	Hardhead	**M**	
AVES	*Barnardius zonarius*	Australian Ringneck		
AVES	*Biziura lobata*	Musk Duck	**M, Ma**	**R**
AVES	*Cacatua galerita*	Sulphur-crested Cockatoo		
AVES	*Cacatua roseicapilla*	Galah		
AVES	*Cacatua sanguinea*	Little Corella		
AVES	*Calamanthus campestris*	Rufous Fieldwren		
AVES	*Calidris acuminata*	Sharp-tailed Sandpiper	**M, Ma**	
AVES	*Calidris ruficollis*	Red-necked Stint	**M, Ma**	
AVES	*Certhionyx variegatus*	Pied Honeyeater		
AVES	*Charadrius australis*	Inland Dotterel	**M**	
AVES	*Charadrius ruficapillus*	Red-capped Plover	**M**	

Class	Species name	Common name	Conservation significance	
			AUS	SA
AVES	*Chenonetta jubata*	Australian Wood Duck	**M**	
AVES	*Cheramoeca leucosternus*	White-backed Swallow		
AVES	*Chlidonias hybridus*	Whiskered Tern	**Ma**	
AVES	*Chrysococcyx basalis*	Horsfield's Bronze-cuckoo	**Ma**	
AVES	*Chrysococcyx osculans*	Black-eared Cuckoo	**Ma**	
AVES	*Cincloramphus mathewsi*	Rufous Songlark		
AVES	*Cinclosoma castanotus*	Chestnut Quail-thrush		**R**
AVES	*Circus assimilis*	Spotted Harrier	**M, Ma**	
AVES	*Cladorhynchus leucocephalus*	Banded Stilt	**M**	
AVES	*Climacteris affinis*	White-browed Treecreeper		**R**
AVES	*Colluricincla harmonica*	Grey Shrike-thrush		
AVES	**Columba livia*	Rock Dove		
AVES	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	**Ma**	
AVES	*Corvus bennetti*	Little Crow		
AVES	*Corvus coronoides*	Australian Raven		
AVES	*Corvus mellori*	Little Raven		
AVES	*Cracticus torquatus*	Grey Butcherbird		
AVES	*Cuculus pallidus*	Pallid Cuckoo	**Ma**	
AVES	*Cygnus atratus*	Black Swan	**M**	
AVES	*Dacelo novaeguineae*	Laughing Kookaburra		
AVES	*Daphoenositta chrysoptera*	Varied Sittella		
AVES	*Dicaeum hirundinaceum*	Mistletoebird		
AVES	*Egretta novaehollandiae*	White-faced Heron		
AVES	*Elanus axillaris*	Black-shouldered Kite	**M**	
AVES	*Elseyornis melanops*	Black-fronted Dotterel	**M**	
AVES	*Emblema pictum*	Painted Finch		**R**
AVES	*Epthianura albifrons*	White-fronted Chat		
AVES	*Epthianura aurifrons*	Orange Chat		
AVES	*Epthianura tricolor*	Crimson Chat		
AVES	*Erythrogonys cinctus*	Red-kneed Dotterel	**M**	
AVES	*Falco berigora*	Brown Falcon	**M**	
AVES	*Falco cenchroides*	Nankeen Kestrel	**M, Ma**	
AVES	*Falco longipennis*	Australian Hobby	**M**	
AVES	*Falco peregrinus*	Peregrine Falcon	**M**	**R**
AVES	*Falco subniger*	Black Falcon	**M**	
AVES	*Fulica atra*	Eurasian Coot		
AVES	*Gallinula ventralis*	Black-tailed Native-hen		
AVES	*Geopelia cuneata*	Diamond Dove		
AVES	*Geopelia placida*	Peaceful Dove		
AVES	*Grallina cyanoleuca*	Magpie-lark	**Ma**	
AVES	*Gymnorhina tibicen*	Australian Magpie		
AVES	*Haliastur sphenurus*	Whistling Kite	**M, Ma**	
AVES	*Hieraaetus morphnoides*	Little Eagle	**M**	
AVES	*Himantopus himantopus*	Black-winged Stilt	**M, Ma**	
AVES	*Hirundo neoxena*	Welcome Swallow	**Ma**	
AVES	*Lalage tricolor*	White-winged Triller		
AVES	*Larus novaehollandiae*	Silver Gull	**Ma**	
AVES	*Lichenostomus ornatus*	Yellow-plumed Honeyeater		
AVES	*Lichenostomus penicillatus*	White-plumed Honeyeater		
AVES	*Lichenostomus plumulus*	Grey-fronted Honeyeater)		
AVES	*Lichenostomus virescens*	Singing Honeyeater		
AVES	*Malacorhynchus membranaceus*	Pink-eared Duck	**M**	

Class	Species name	Common name	Conservation significance	
			AUS	SA
AVES	*Malurus lamberti*	Variegated Fairy-wren		
AVES	*Malurus leucopterus*	White-winged Fairy-wren		
AVES	*Malurus splendens*	Splendid Fairy-wren		
AVES	*Manorina flavigula*	Yellow-throated Miner		
AVES	*Manorina melanocephala*	Noisy Miner		
AVES	*Megalurus gramineus*	Little Grassbird	**M**	
AVES	*Melanodryas cucullata*	Hooded Robin		
AVES	*Melithreptus brevirostris*	Brown-headed Honeyeater		
AVES	*Melopsittacus undulatus*	Budgerigar		
AVES	*Merops ornatus*	Rainbow Bee-eater	**M, Ma**	
AVES	*Microeca fascinans*	Jacky Winter		
AVES	*Milvus migrans*	Black Kite	**M**	
AVES	*Mirafra javanica*	Horsfield's Bushlark		
AVES	*Myiagra inquieta*	Restless Flycatcher		
AVES	*Neophema chrysostoma*	Blue-winged Parrot	**Ma**	**V**
AVES	*Neophema elegans*	Elegant Parrot		
AVES	*Ninox novaeseelandiae*	Southern Boobook	**Ma**	
AVES	*Northiella haematogaster*	Blue Bonnet		
AVES	*Nycticorax caledonicus*	Nankeen Night Heron	**Ma**	
AVES	*Nymphicus hollandicus*	Cockatiel		
AVES	*Ocyphaps lophotes*	Crested Pigeon		
AVES	*Oreoica gutturalis*	Crested Bellbird		
AVES	*Oxyura australis*	Blue-billed Duck	**M**	**R**
AVES	*Pachycephala inornata*	Gilbert's Whistler		
AVES	*Pachycephala rufiventris*	Rufous Whistler		
AVES	*Pardalotus rubricatus*	Red-browed Pardalote		
AVES	*Pardalotus striatus*	Striated Pardalote		
AVES	**Passer domesticus*	House Sparrow		
AVES	*Pelecanus conspicillatus*	Australian Pelican		
AVES	*Petrochelidon ariel*	Fairy Martin		
AVES	*Petrochelidon nigricans*	Tree Martin		
AVES	*Petroica goodenovii*	Red-capped Robin		
AVES	*Phalacrocorax carbo*	Great Cormorant		
AVES	*Phalacrocorax melanoleucos*	Little Pied Cormorant		
AVES	*Phalacrocorax sulcirostris*	Little Black Cormorant		
AVES	*Phalacrocorax varius*	Pied Cormorant		
AVES	*Phaps chalcoptera*	Common Bronzewing		
AVES	*Phylidonyris albifrons*	White-fronted Honeyeater		
AVES	*Platalea flavipes*	Yellow-billed Spoonbill		
AVES	*Platalea regia*	Royal Spoonbill		
AVES	*Plegadis falcinellus*	Glossy Ibis	**M, Ma**	**R**
AVES	*Podargus strigoides*	Tawny Frogmouth		
AVES	*Podiceps cristatus*	Great Crested Grebe		**R**
AVES	*Poliocephalus poliocephalus*	Hoary-headed Grebe		
AVES	*Pomatostomus ruficeps*	Chestnut-crowned Babbler		
AVES	*Pomatostomus superciliosus*	White-browed Babbler		
AVES	*Psephotus haematonotus*	Red-rumped Parrot		
AVES	*Psephotus varius*	Mulga Parrot		
AVES	*Psophodes cristatus*	Chirruping Wedgebill		
AVES	*Psophodes occidentalis*	Chiming Wedgebill		
AVES	*Pyrrholaemus brunneus*	Redthroat		**R**
AVES	*Recurvirostra novaehollandiae*	Red-necked Avocet	**M, Ma**	

Class	Species name	Common name	Conservation significance	
			AUS	SA
AVES	*Rhipidura albiscapa*	Grey Fantail		
AVES	*Rhipidura leucophrys*	Willie Wagtail		
AVES	*Smicrornis brevirostris*	Weebill		
AVES	*Sterna caspia*	Caspian Tern	**Ma**	
AVES	*Stictonetta naevosa*	Freckled Duck	**M**	**V**
AVES	*Stiltia isabella*	Australian Pratincole		
AVES	*Strepera versicolor*	Grey Currawong		
AVES	**Streptopelia chinensis*	Spotted Turtle-dove		
AVES	**Sturnus vulgaris*	Common Starling		
AVES	*Tachybaptus novaehollandiae*	Australasian Grebe		
AVES	*Taeniopygia guttata*	Zebra Finch		
AVES	*Threskiornis molucca*	Australian White Ibis	**Ma**	
AVES	*Todiramphus pyrrhopygia*	Red-backed Kingfisher		
AVES	*Todiramphus sanctus*	Sacred Kingfisher		
AVES	*Tringa nebularia*	Common Greenshank	**M, Ma**	
AVES	*Tringa stagnatilis*	Marsh Sandpiper	**M, Ma**	
AVES	*Turnix velox*	Little Button-quail		
AVES	*Vanellus miles*	Masked Lapwing	**M**	
AVES	*Vanellus tricolor*	Banded Lapwing	**M**	
AVES	*Zosterops lateralis*	Silvereye	**Ma**	
MAMMALIA	**Bos taurus*	Cattle		
MAMMALIA	*Canis lupus dingo*	Dingo		
MAMMALIA	**Capra hircus*	Goat		
MAMMALIA	*Chalinolobus gouldii*	Gould's Wattled Bat		
MAMMALIA	**Equus caballus*	Horse		
MAMMALIA	**Felis catus*	Cat		
MAMMALIA	*Leggadina forresti*	Forrest's Mouse		
MAMMALIA	*Leporillus apicalis*	Lesser Stick-nest Rat	**Ex**	**Ex**
MAMMALIA	*Leporillus conditor*	Greater Stick-nest Rat	**VU**	**V**
MAMMALIA	*Macropus fuliginosus*	Western Grey Kangaroo		
MAMMALIA	*Macropus robustus*	Euro		
MAMMALIA	*Macropus rufus*	Red Kangaroo		
MAMMALIA	*Mormopterus spp. (3 sp complex)*	Southern Freetail-bats		
MAMMALIA	**Mus musculus*	House Mouse		
MAMMALIA	**Oryctolagus cuniculus*	Rabbit		
MAMMALIA	**Ovis aries*	Sheep		
MAMMALIA	*Petrogale xanthopus*	Yellow-footed Rock-wallaby	**VU**	**V**
MAMMALIA	*Planigale tenuirostris*	Narrow-nosed Planigale		
MAMMALIA	*Pseudomys bolami*	Bolam's Mouse		
MAMMALIA	*Sminthopsis crassicaudata*	Fat-tailed Dunnart		
MAMMALIA	*Sminthopsis macroura*	Stripe-faced Dunnart		
MAMMALIA	*Tadarida australis*	White-striped Freetail-bat		
MAMMALIA	*Vespadelus baverstocki*	Inland Forest Bat		
MAMMALIA	**Vulpes vulpes*	Fox		
REPTILIA	*Cryptoblepharus plagiocephalus pib*	Desert Wall skink		
REPTILIA	*Ctenophorus decresii*	Tawny Dragon		
REPTILIA	*Ctenophorus nuchalis*	Central Netted Dragon		
REPTILIA	*Ctenophorus pictus*	Painted Dragon		
REPTILIA	*Ctenophorus vadnappa*	Red-barred Dragon		
REPTILIA	*Ctenotus brooksi*	Sandhill Ctenotus		
REPTILIA	*Ctenotus olympicus*	Saltbush Ctenotus		

Class	Species name	Common name	Conservation significance	
			AUS	SA
REPTILIA	*Ctenotus regius*	Eastern Desert Ctenotus		
REPTILIA	*Ctenotus robustus*	Eastern Striped Skink		
REPTILIA	*Ctenotus saxatilis*	Centralian Striped Skink		
REPTILIA	*Ctenotus strauchii*	Short-legged Ctenotus		
REPTILIA	*Ctenotus taeniatus*	Eyrean Ctenotus		
REPTILIA	*Cyclodomorphus melanops*	Spinifex Slender Bluetongue		
REPTILIA	*Delma butleri*	Spinifex Snake-lizard		
REPTILIA	*Demansia psammophis*	Yellow-faced Whipsnake		
REPTILIA	*Diplodactylus byrnei*	Pink-blotched Gecko		
REPTILIA	*Diplodactylus stenodactylus*	Sandplain Gecko		
REPTILIA	*Diplodactylus tessellatus*	Tessellated Gecko		
REPTILIA	*Diplodactylus vittatus*	Eastern Stone Gecko		
REPTILIA	*Diporiphora winneckei*	Canegrass Dragon		
REPTILIA	*Egernia inornata*	Desert Skink		
REPTILIA	*Egernia margaretae*	Masked Rock Skink		
REPTILIA	*Egernia stokesii*	Gidgee Skink		
REPTILIA	*Eremiascincus richardsonii*	Broad-banded Sandswimmer		
REPTILIA	*Furina diadema*	Red-naped Snake		
REPTILIA	*Gehyra 2n=44*	Southern Rock Dtella		
REPTILIA	*Gehyra purpurascens*	Purple Dtella		
REPTILIA	*Gehyra variegata*	Tree Dtella		
REPTILIA	*Gehyra variegata complex*	Tree Dtella		
REPTILIA	*Heteronotia binoei*	Bynoe's Gecko		
REPTILIA	*Lampropholis guichenoti*	Garden Skink		
REPTILIA	*Lerista bougainvillii*	Bougainville's Skink		
REPTILIA	*Lerista desertorum*	Great Desert Slider		
REPTILIA	*Lerista labialis*	Eastern Two-toed Slider		
REPTILIA	*Lerista muelleri*	Dwarf Three-toed Slider		
REPTILIA	*Lerista punctatovittata*	Spotted Slider		
REPTILIA	*Menetia greyii*	Dwarf Skink		
REPTILIA	*Morelia spilota*	Carpet Python		**V**
REPTILIA	*Morethia boulengeri*	Common Snake-eye		
REPTILIA	*Nephrurus milii*	Barking Gecko		
REPTILIA	*Pogona vitticeps*	Central Bearded Dragon		
REPTILIA	*Pseudechis australis*	Mulga Snake		
REPTILIA	*Pseudonaja nuchalis*	Western Brown Snake		
REPTILIA	*Pygopus schraderi*	Hooded Scaly-foot		
REPTILIA	*Ramphotyphlops bituberculatus*	Rough-nosed Blind Snake		
REPTILIA	*Rhynchoedura ornata*	Beaked Gecko		
REPTILIA	*Simoselaps australis*	Coral Snake		
REPTILIA	*Strophurus intermedius*	Southern Spiny-tailed Gecko		
REPTILIA	*Suta suta*	Curl Snake		
REPTILIA	*Tiliqua rugosa*	Sleepy Lizard		
REPTILIA	*Tympanocryptis intima*	Smooth-snouted Earless Dragon		
REPTILIA	*Tympanocryptis tetraporophora*	Eyrean Earless Dragon		
REPTILIA	*Tympanocryptis tetraporophora*	Eyrean Earless Dragon		
REPTILIA	*Varanus gouldii*	Sand Goanna		
REPTILIA	*Varanus tristis*	Black-headed Goanna		
REPTILIA	*Vermicella annulata*	Common Bandy-Bandy		**R**

* denotes introduced species

Aus Conservation Status (national) – *EPBC Act* 1999
CR = critically endangered
EN =endangered
VU = nationally vulnerable
M = migratory
Ma = marine listed

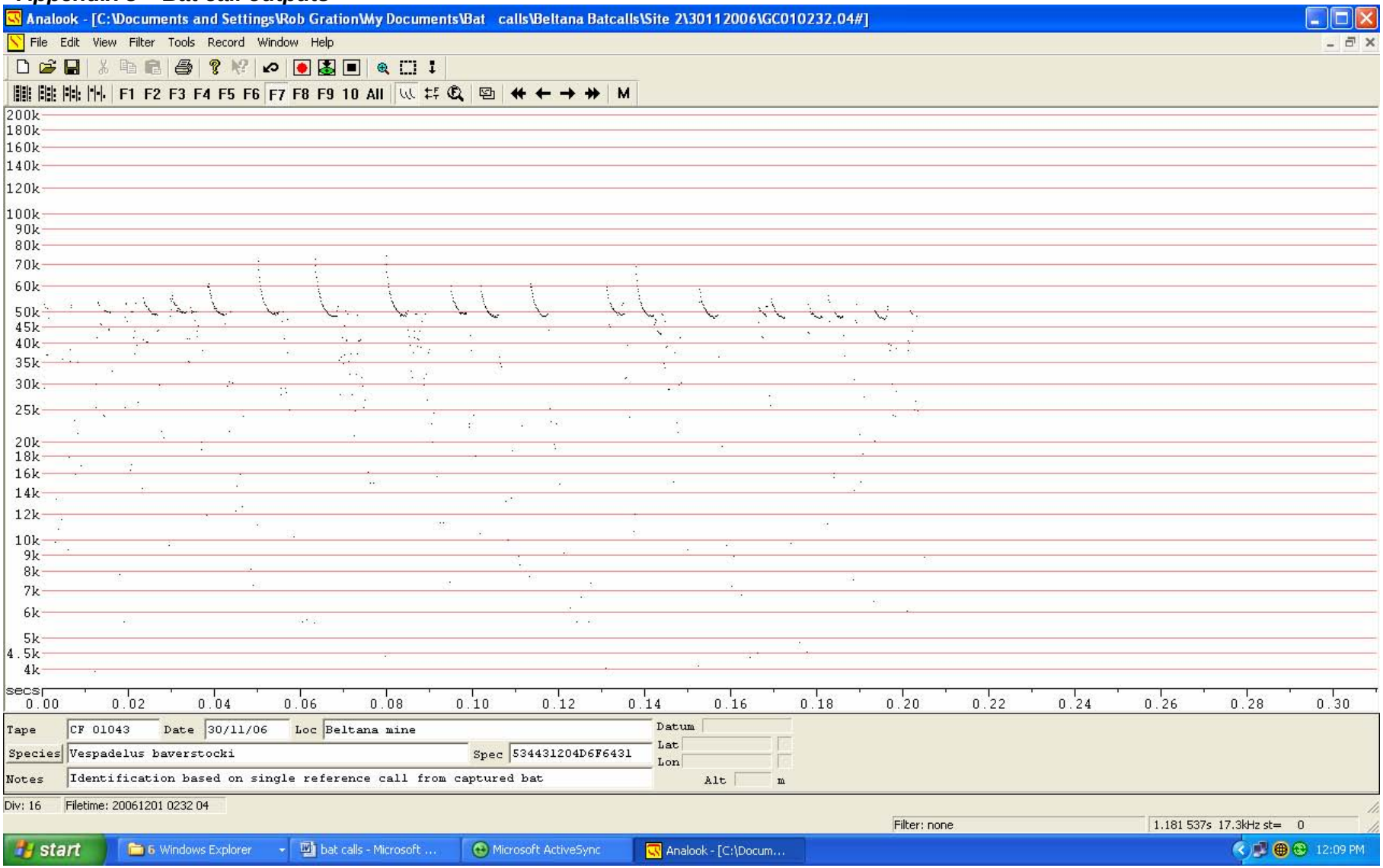
SA Conservation Status (state) – *NPW Act* 1972
E = endangered
V = vulnerable
R = rare

Appendix 7 – Fauna species of national significance listed under the EPBC Act 1999 (source: Protected Matters Database Search – 11th Dec 2006)

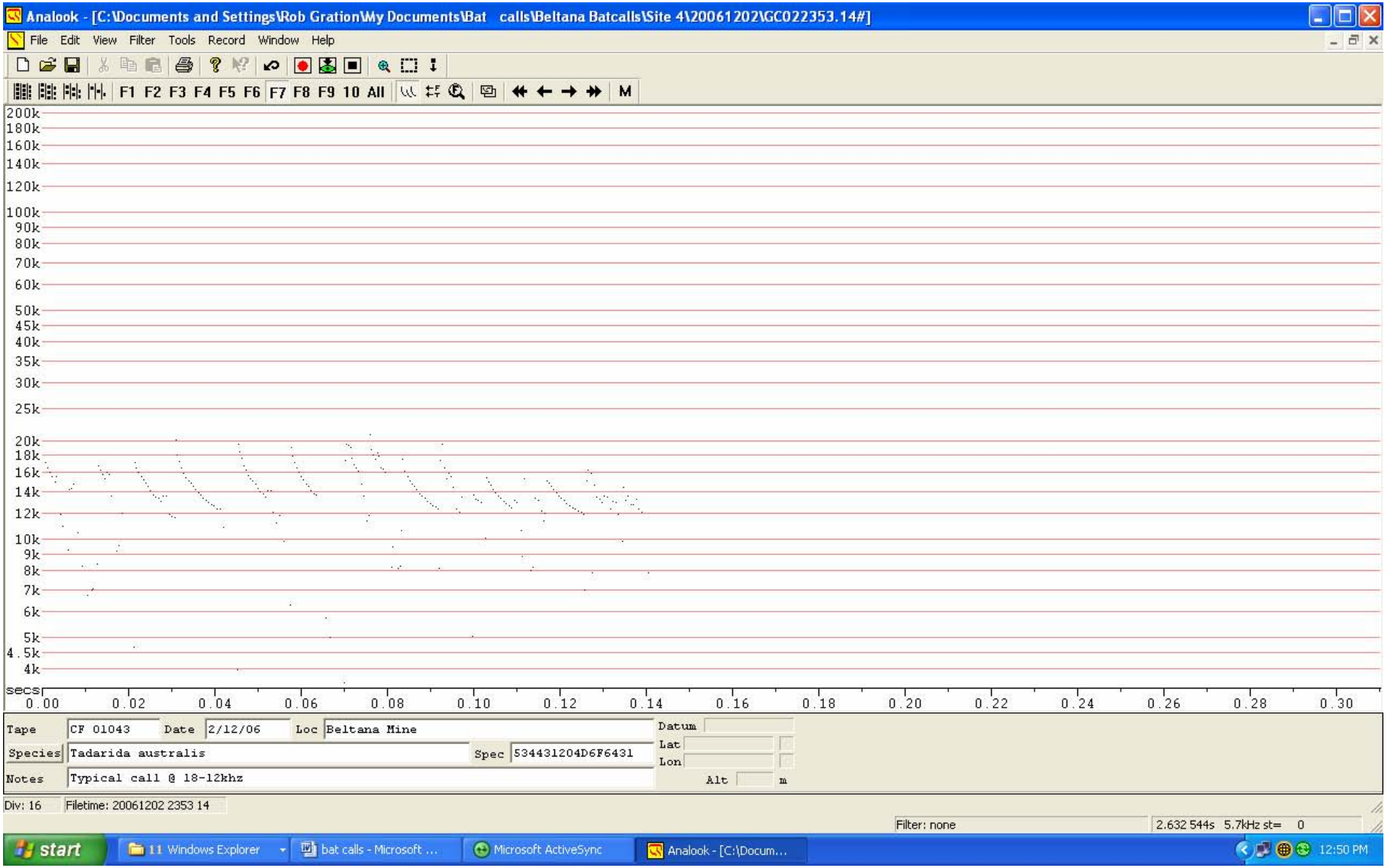
Species Name	Common Name	EPBC Rating
Acanthiza iredalei iredalei	Slender-billed Thornbill (western)	**VU**
Amytornis textilis modestus	Thick-billed Grasswren (eastern)	**VU**
Apus pacificus	Fork-tailed Swift	**M, Ma**
Ardea alba	Great Egret	**M, Ma**
Ardea ibis	Cattle Egret	**M, Ma**
Charadrius veredus	Oriental Plover	**M**
Haliaeetus leucogaster	White-bellied Sea-Eagle	**M**
Merops ornatus	Rainbow Bee-eater	**M**
Petrogale xanthopus xanthopus	Yellow-footed Rock-wallaby	**VU**
Rostratula australis	Australian Painted Snipe	**VU, M, Ma**

EPBC Act 1999 Status
CR = critically endangered
EN =endangered
VU = nationally vulnerable
M = migratory
Ma = marine listed

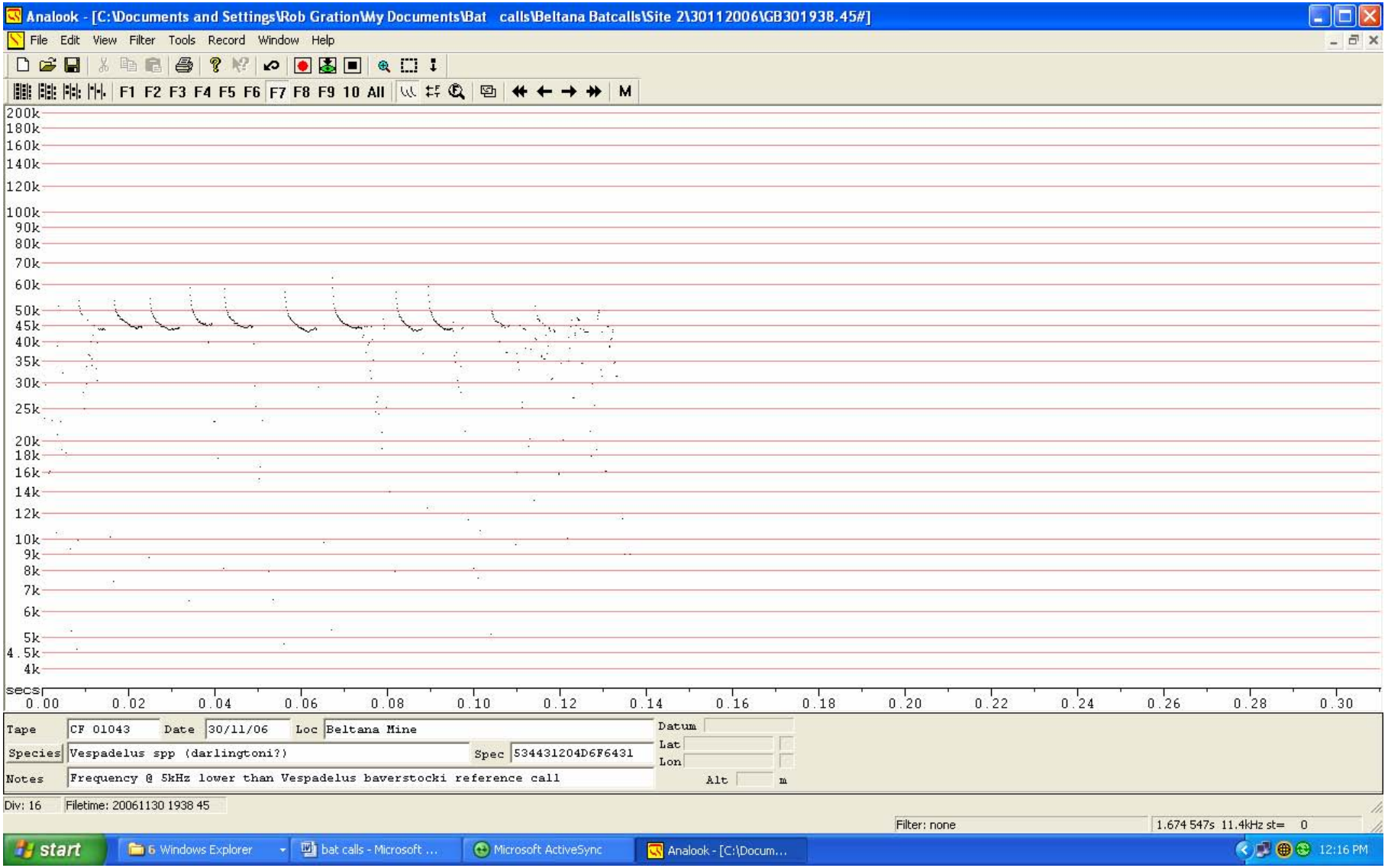
Appendix 8 – Bat call outputs



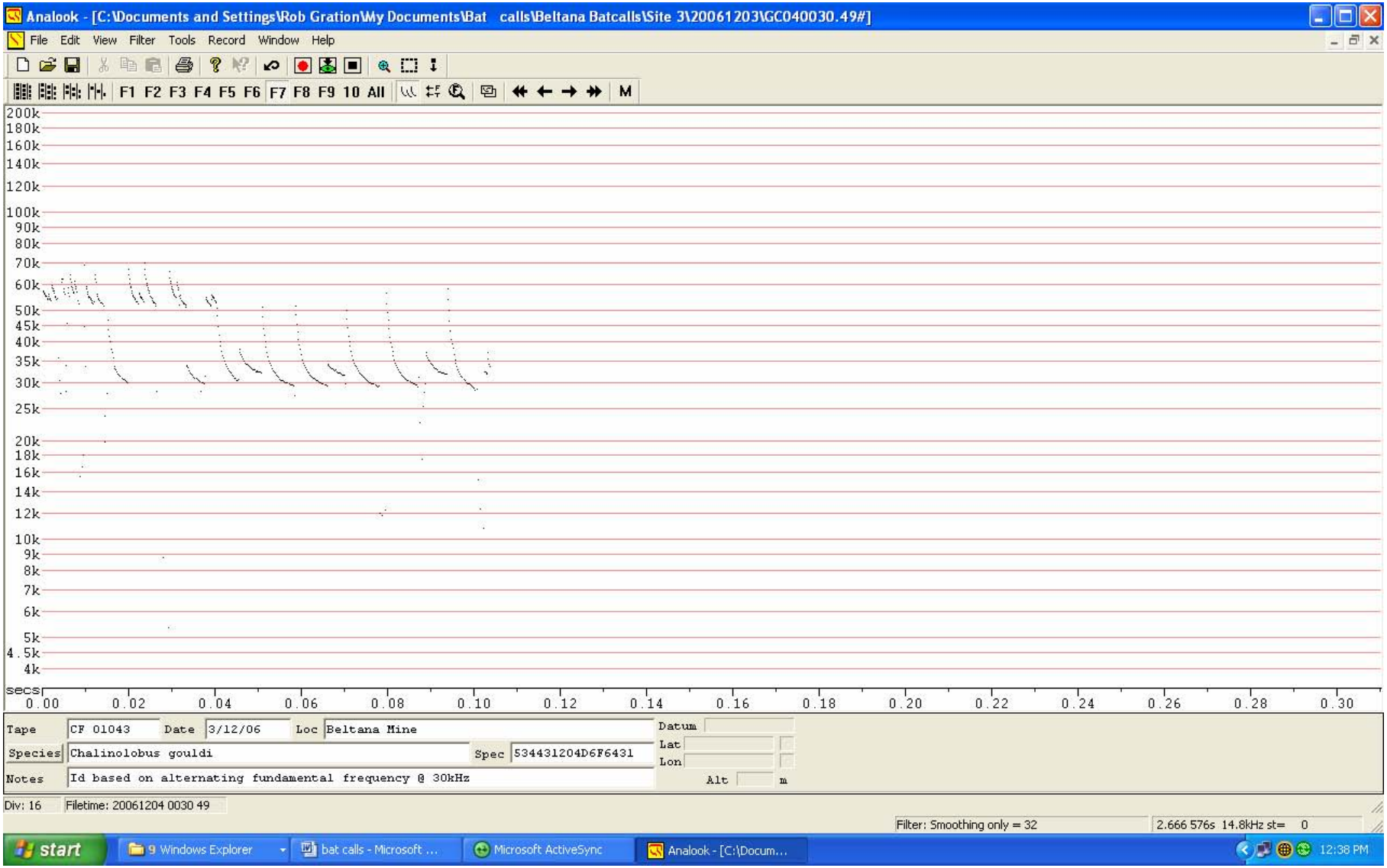
Vespadelus baverstocki



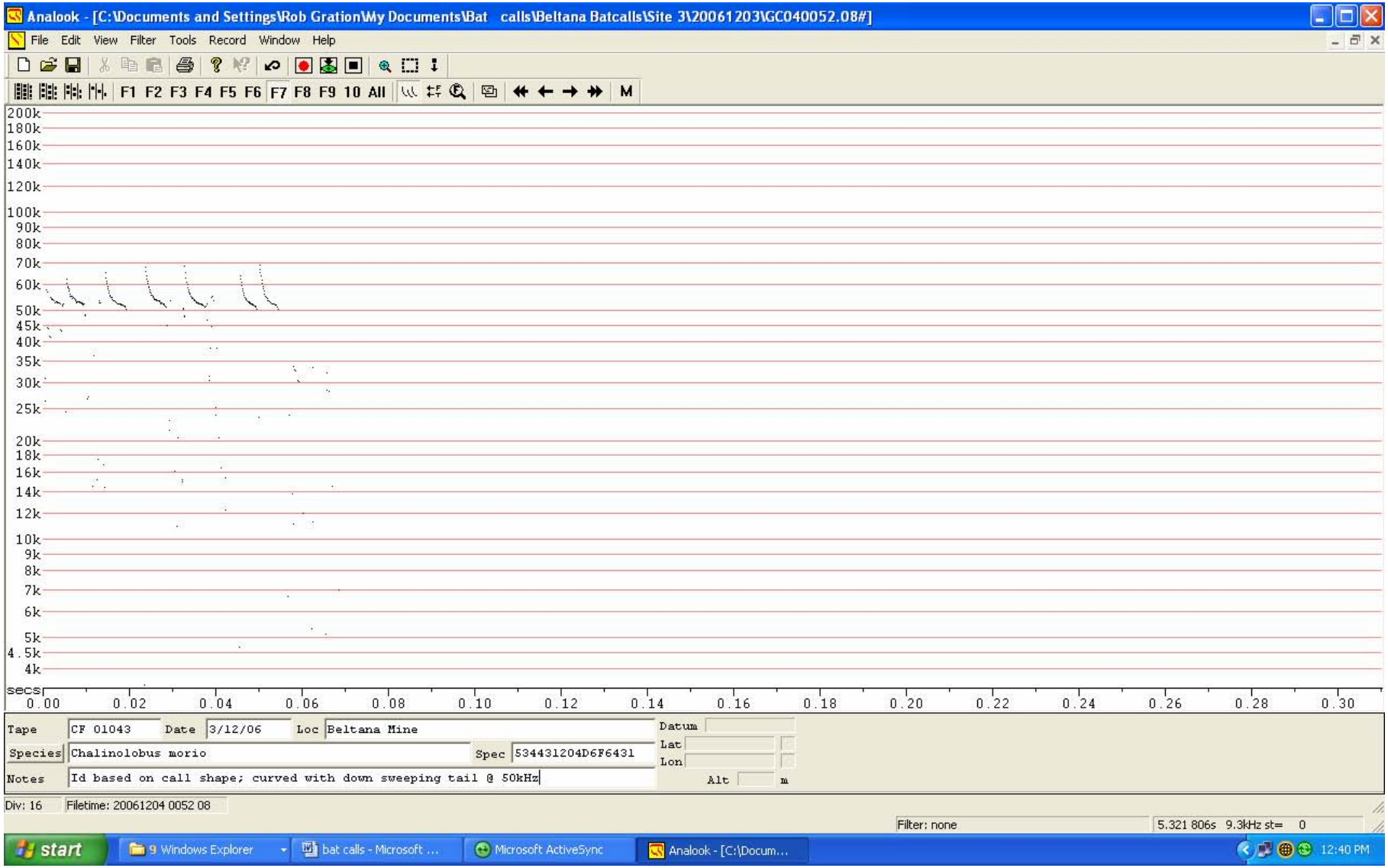
Tadarida australis



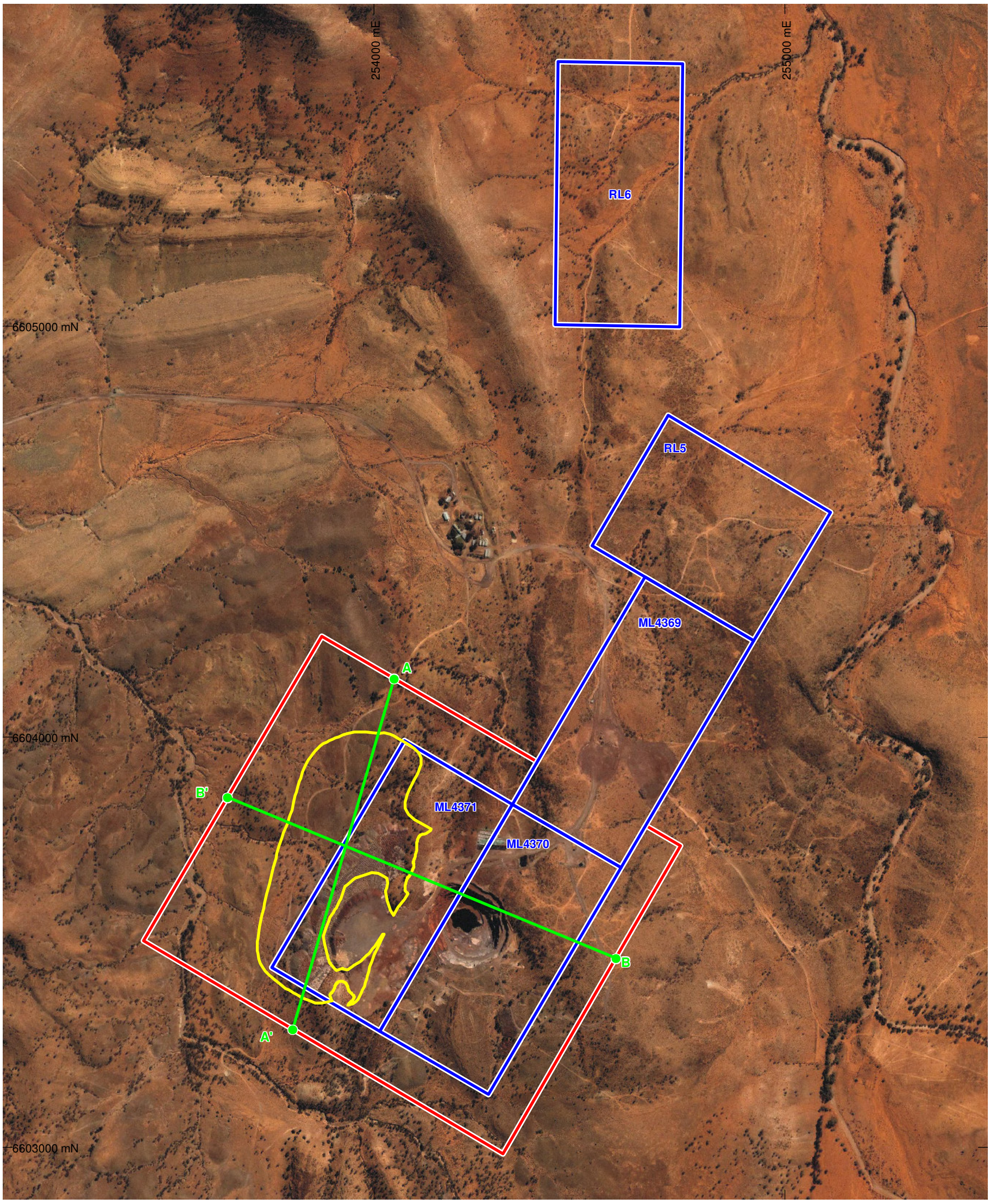
Vespadelus darlingtoni ?



Chalinolobus gouldii



Chalinolobus morio



Proposed Miscellaneous Purpose Licence

Mining Lease

Proposed Waste Dump

Section Line

N

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FLINDERS RANGES PROJECT

PROPOSED WASTE DUMP
BELTANA

Compiled : Perilya	**Date :** 9 October 2006	**Scale :** 1 : 10 000
Drawn : E.B.	**Revision Date :**	**M.G.A. Map Zone :** GDA94, Zone 54
Drawing Name : p:\Flinders\PEM_06_068.wor		

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6603200 mN
253800 mE
254000 mE
254200 mE
254400 mE
254600 mE
254800 mE
255000 mE

RO Plant
Camp Area
Existing Powerline
RL5
Contractors Workshop and Laydown Area
ML4369
Proposed Powerline
Fuel Storage Area
Crushed Ore Stockpiles
MPL
Proposed Camp Water supply Pipeline
Crusher
Pre-Crusher Stockpiles
Low Grade Dump
Waste Rock Dump
ML4371
Laydown Area
Dewatering Bores
Emulsion Storage and Mixing Area
Dewatering Pipeline
Proposed Water Storage Tank
ML4370
Perimeter Fence
Proposed Mine Pipeline
Gelignite & Fuse Store
Detonator Store
Mixed Anfo Store
Proposed Evaporation Pond Location

Proposed Miscellaneous Purpose Licence

Mining Lease

N

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FLINDERS PROJECT

BELTANA PIT
PROPOSED
SITE LAYOUT

Drawn : VL	Compiled : Perilya	Date : 4 Jan 2007	Scale : 1 : 5 000

Projection and Zone :	Drawing Path and Name:
MGA Zone 54 (GDA94)	P:\Flinders\2006\PEM_06_081\PEM_06_081.wor

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6603200 mN
253800 mE
254000 mE
254200 mE
254400 mE
254600 mE
254800 mE
255000 mE

Power Line
Camp Area
Steel Scrap Area
Semi Trailer Parking Area
Solar Cells & Comms Tower
Scrap Yard
Old Rubbish Dump
RL5
MPL
ML4369
Crusher
High Grade Stockpile
Crushed Ore Stockpile
Laydown Area
Mine Perimeter Fence
ML4371
Pit Dewatering Bore
Waste Rock Dump
Existing Beltana Pit
Evaporation Pond
ML4370
Gelignite & Fuse Store
Detonator Store
Mixed Anfo Store
Old Low Grade Stockpiles

Proposed Miscellaneous Purpose Licence

Mining Lease

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FLINDERS PROJECT

BELTANA PIT
MINE WORKINGS
AT PERILYA TAKEOVER

Drawn : VL	Compiled : Perilya	Date : 4 Jan 2007	Scale : 1 : 5 000

Projection and Zone :	Drawing Path and Name:
MGA94, Zone 50 (GDA94)	P:\Flinders\2007\PEM_07_001\PEM_07_001.wor

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6603200 mN

253800 mE
254000 mE
254200 mE
254400 mE
254600 mE
254800 mE
255000 mE

RO Plant
Camp Area
Existing Poweline
RL5
Contractors Workshop and Laydown Area
Proposed Poweline
ML4369
Fuel Storage Area
Crushed Ore Stockpiles
MPL
Proposed Camp Water supply Pipeline
Crusher
Low Grade Dump
Pre-Crusher Stockpiles
Laydown Area
Waste Rock Dump
ML4371
Dewatering Bores
Dewatering Pipeline
Emulsion Storage and Mixing Area
ML4370
Perimeter Fence
Proposed Mine Pipeline
Gelignite & Fuse Store
Detonator Store
Mixed Anfo Store
Proposed Evaporation Pond Location

Proposed Miscellaneous Purpose Licence
Mining Lease
Rehabilitation at End of Mining
Rehabilitation at Final Closure

N

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FLINDERS PROJECT

BELTANA PIT
PLANNED REHABILITATION

Drawn : VL	Compiled : Perilya	Date : 4 Jan 2007	Scale : 1 : 5 000

Projection and Zone :	Drawing Path and Name:
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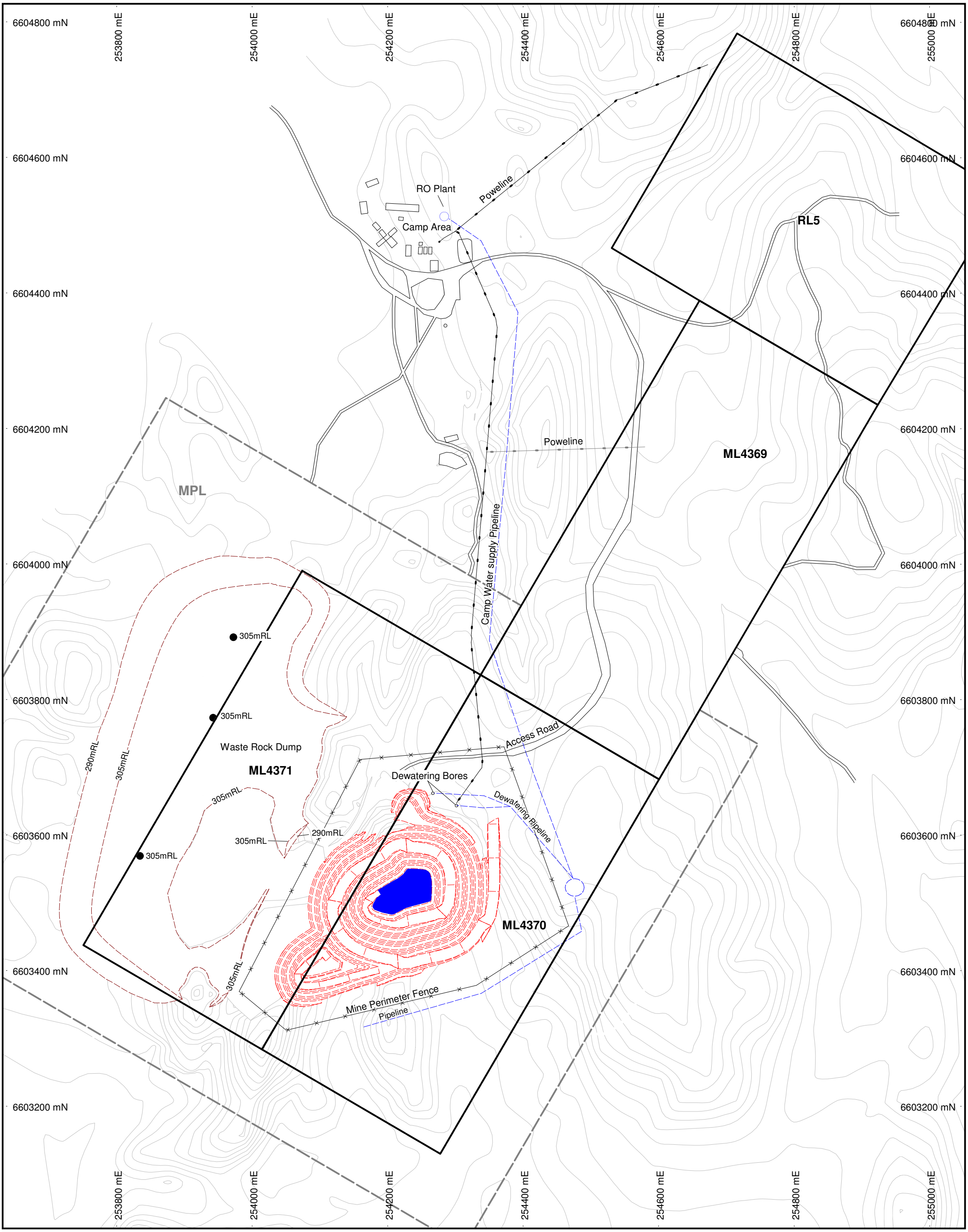
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254000 mE
254200 mE
254400 mE
254600 mE
254800 mE
255000 mE
RO Plant
Camp Area
Poweline
RL5
ML4369
MPL
Poweline
Camp Water supply Pipeline
305mRL
305mRL
Waste Rock Dump
ML4371
290mRL
305mRL
305mRL
305mRL
290mRL
305mRL
Access Road
Dewatering Bores
Dewatering Pipeline
ML4370
Mine Perimeter Fence
Pipeline
Proposed Miscellaneous Purpose Licence
Mining Lease
N
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FLINDERS PROJECT
BELTANA PIT
SITE LAYOUT
on FINAL CLOSURE
Drawn : VL
Compiled : Perilya
Date : 4 Jan 2007
Scale : 1 : 5 000
Projection and Zone :
MGA Zone 54 (GDA94)
Drawing Path and Name:
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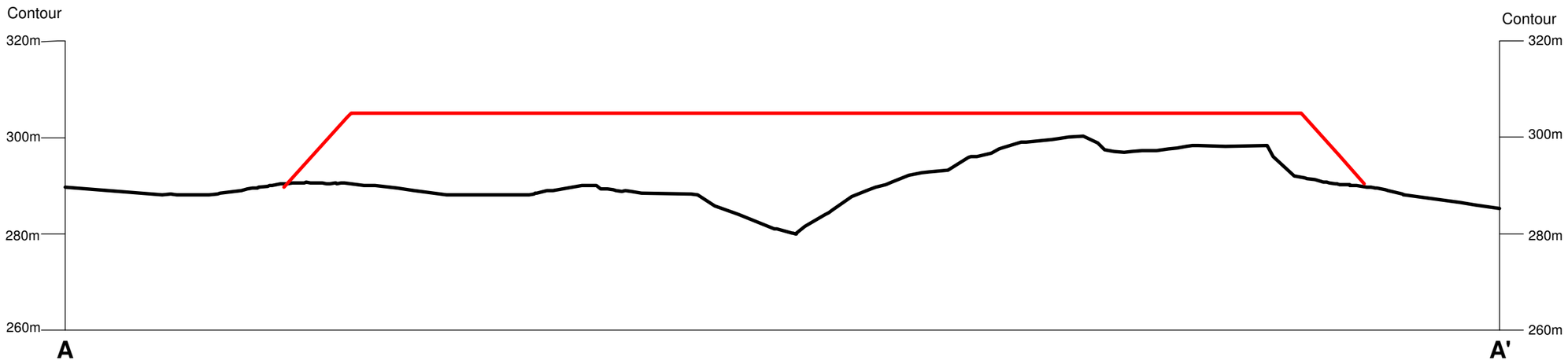

Proposed Waste Dump

Current Surface Profile

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FLINDERS RANGES PROJECT

BELTANA PROSPECT
SECTION A - A'
SHOWING PROPOSED WASTE DUMP PROFILE

Compiled : VL & EB	**Date :** 29 Jan 2007	**Scale :** 1 : 1 000 with a Vertical Exageration of 3
Drawn : VL	**Tenement :** MPLA - File No. T2628	**Projection and Zone :** Local

Drawing Path :
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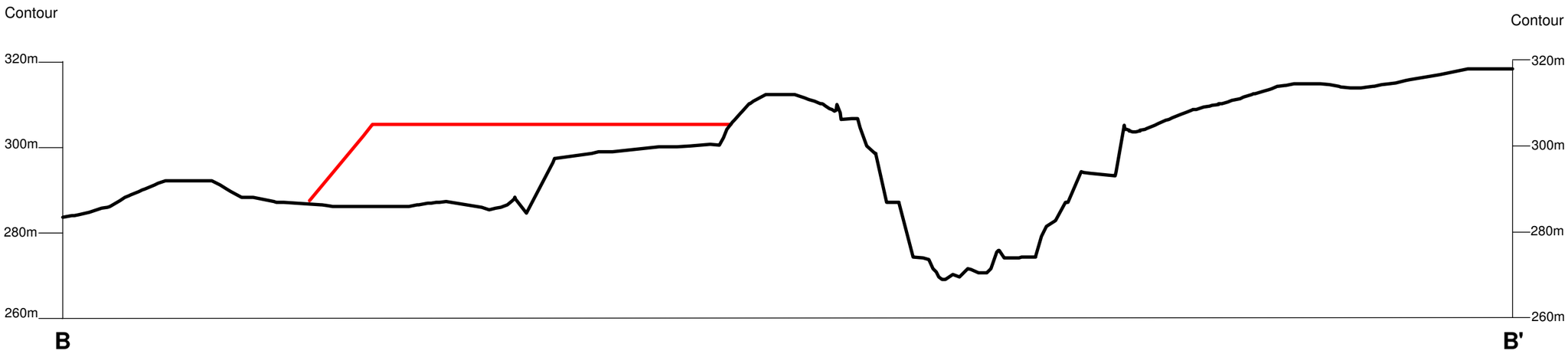

Proposed Waste Dump

Current Surface Profile

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FLINDERS RANGES PROJECT

BELTANA PROSPECT
SECTION B - B'
SHOWING PROPOSED WASTE DUMP PROFILE

Compiled : VL & EB	**Date :** 29 Jan 2007	**Scale :** 1 : 1 000 with a Vertical Exageration of 3
Drawn : VL	**Tenement :** MPLA - File No. T2628	**Projection and Zone :** Local

Drawing Path :
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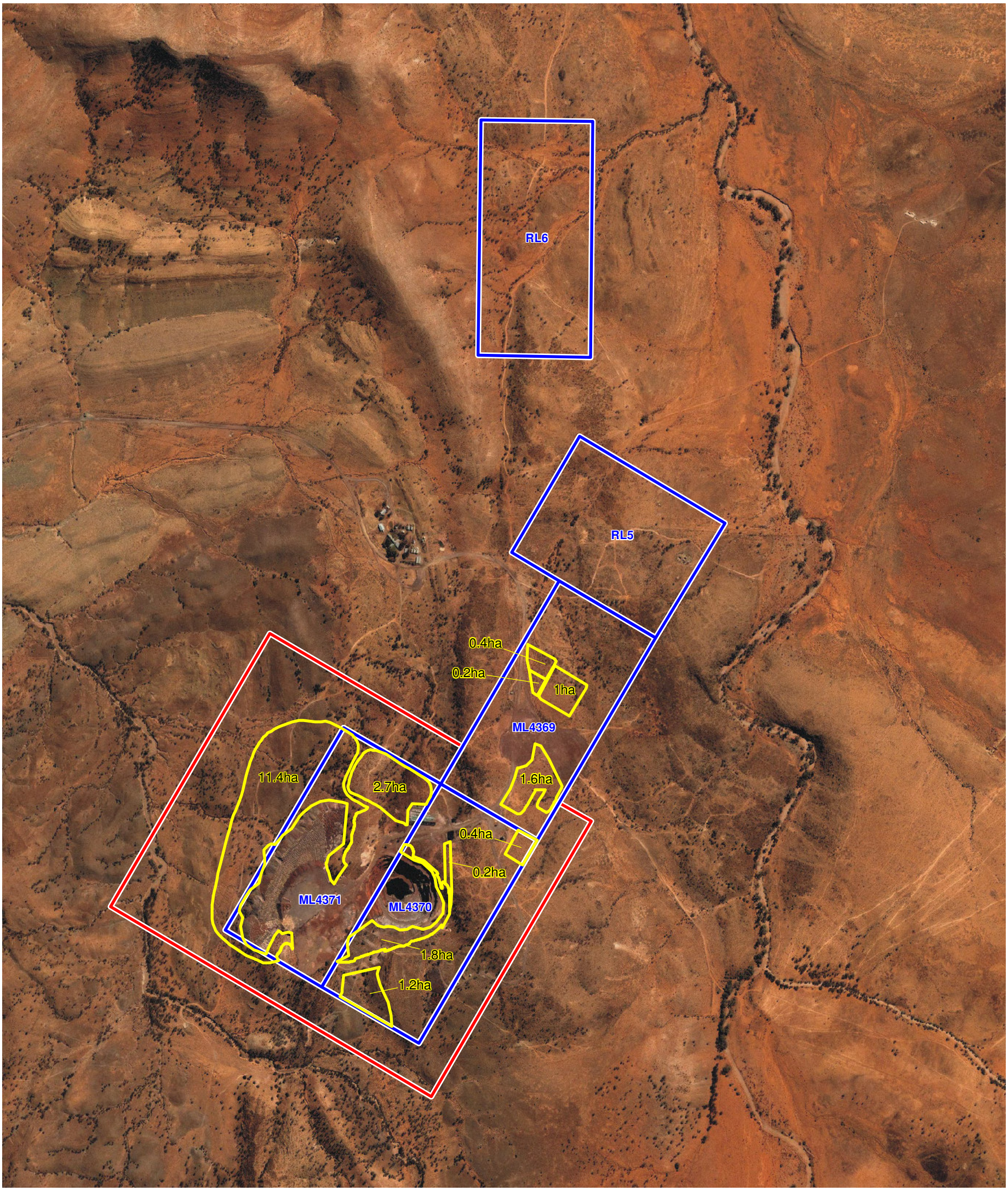

Proposed Miscellaneous Purpose Licence

Mining Lease Boundary

Areas of Native Vegetation Clearance

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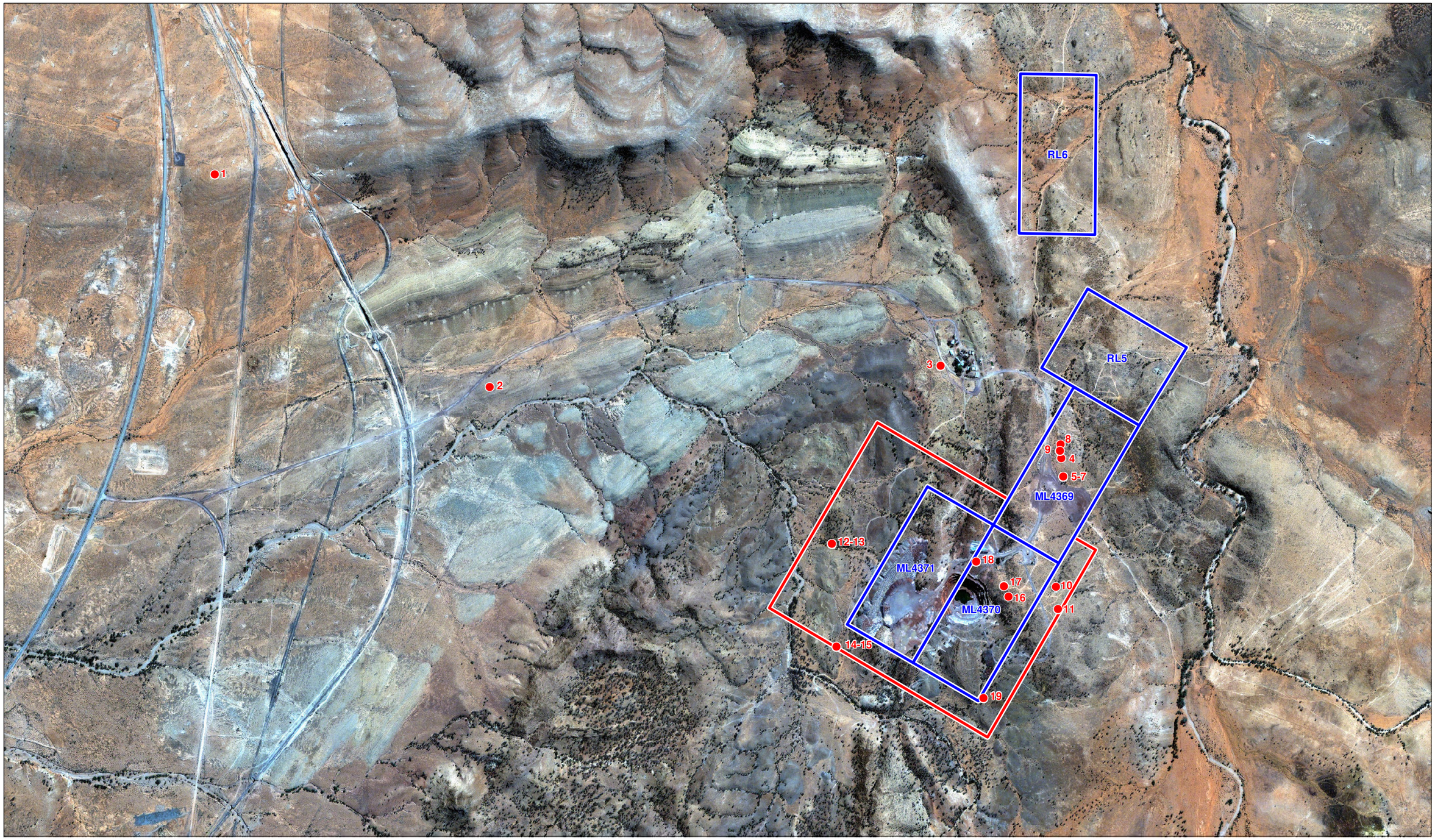
FLINDERS RANGES PROJECT

AREAS OF NATIVE VEGETATION CLEARANCE BELTANA

Compiled :	Date :	Scale :
Perilya	2 February 2007	1 : 15 000
Drawn :	**Revision Date :**	**M.G.A. Map Zone :**
VL		GDA94, Zone 54

Drawing Name : p:\Flinders\2007\PEM_07_017\Pem_07_017.wor



LEGEND

- Monitoring Point
- 12 Photo Location No.
- Mining Lease
- Miscellaneous Purpose Licence

N

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FLINDERS PROJECT

BELTANA
MONITORING LOCATIONS

Reference Files :	Compiled :	Date : 2 February 2007	1 : 250 000 Sheet Name
	Drawn : VL	Scale : 1 : 15 000	1 : 100 000 Sheet Name
Projection and Zone : MGA Zone 54 (GDA94)	Drawing Path and Name: p:\Flinders\PEM_07_018\PEM_07_018.wor		

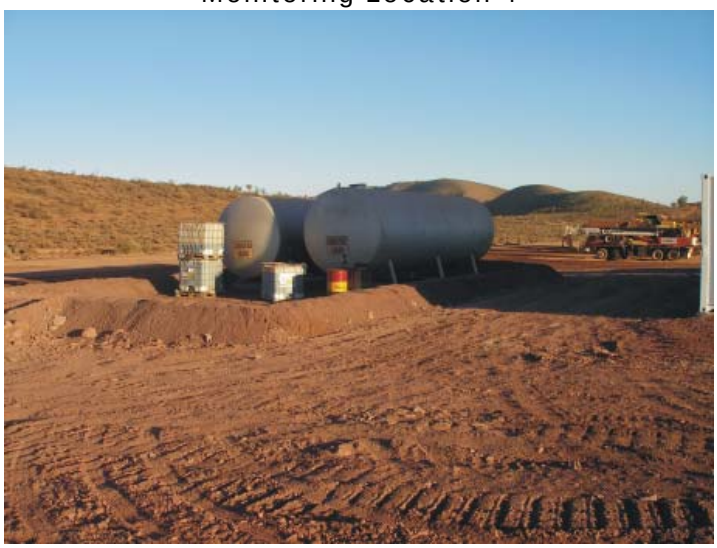
Monitoring Location 1

Monitoring Location 2

Monitoring Location 3

Monitoring Location 3B

Monitoring Location 4



Monitoring Location 5

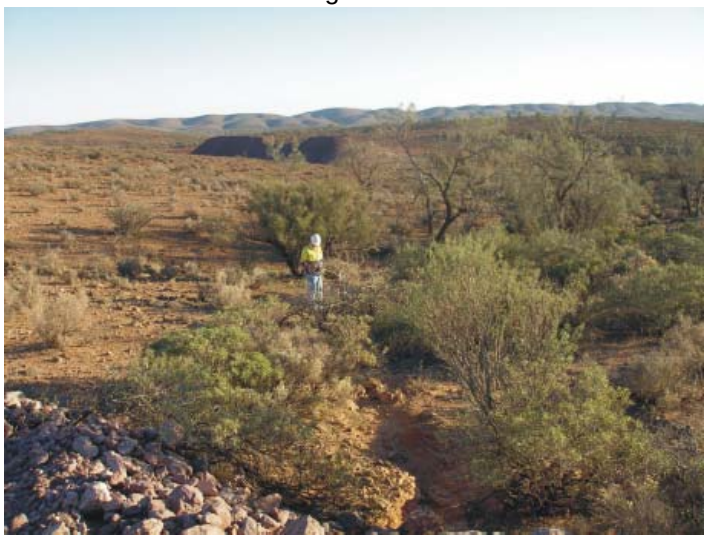
Monitoring Location 6

Monitoring Location 7

Monitoring Location 8

Monitoring Location 9

Monitoring Location 10



Monitoring Location 11

Monitoring Location 12

Monitoring Location 13

Monitoring Location 14

Monitoring Location 15

Monitoring Location 16

Monitoring Location 17

Monitoring Location 18

Monitoring Location 19

Health, Safety & Environment Board Committee Charter

1. Role of the Committee

1.1 The role of the Health, Safety & Environment Committee (**Committee**) is to assist the Board of Directors (**Board**) in the effective discharge of its responsibilities in relation to health, safety, and the environment.

1.2 The Committee has authority from the Board to review and investigate any matter within the scope of its charter and make recommendations to the Board in relation to the outcomes. The Committee has no delegated authority from the Board to determine the outcomes of its reviews and investigations and the Board retains its authority over such matters.

1.3 The Committee has unrestricted access to employees and records and is authorised to take advice from external parties as appropriate at Perilya's expense.

2. Duties

2.1 In meeting its purpose set out in paragraph 1.1 of this charter, the Committee has the following duties:

2.2 General Duties

(a) Promote throughout the Perilya Group a strong culture which values health, safety and the environment.

(b) Review the Health, Safety & Environment ("**HS&E**") policies of the Perilya Group and any recommendations for change and recommend to the Board any changes.

(c) Review HS&E performance for the Perilya Group.

(d) Review reports from the Health, Safety & Environment Management Committee ("**Management Committee**"); and

(e) Review investigations of major HS&E incidents within the Perilya Group;

2.3 Audit of HS&E Systems

(a) Consider audits and reports in relation to HS&E systems, processes and resourcing throughout the Perilya Group and recommend to the Board appropriate measures and responses.

2.4 Compliance

(a) Review HS&E compliance, including compliance standards, and provide appropriate recommendations for change to the Board.

(b) Consider developments in relevant HS&E legislation and regulations and provide appropriate recommendations for change to the Board.

2.5 Reporting

(a) Provide recommendations on HS&E matters as appropriate to the Board.

(b) Inform the Board of any significant HS&E matter.

(c) Investigate and report on HS&E matters requested by the Board.

3. Membership

3.1 The Committee will consist of at least two (2) independent, non-executive Directors and the Chief Executive Officer.

3.2 The Company Secretary or their nominee will act as the secretary to the Committee.

4. Meetings

4.1 Meeting Frequency

The Committee will meet as frequently as required but not less than four times each year.

Any member of the Committee or the Secretary to the Committee may call a meeting of the Committee.

4.2 Quorum

All members of the Committee must attend to form a quorum.

4.3 Committee Agenda and Papers

Committee agendas should be settled by the Chairman in conjunction with the Company Secretary, and Committee papers should be provided to Committee members sufficiently far in advance of scheduled meetings to permit adequate preparation.

4.4 Professional Advice

The Committee may have access where necessary to professional advice from external advisers, and may meet with external advisers without management being present.

5. Reporting

5.1 The Committee Chairman will:

(a) report to the Board on the proceedings of each Committee meeting (to the next Board meeting); and

(b) attend the Annual General Meeting and be available to respond to any shareholder questions on the Committee's activities and areas of responsibility.

6. Assessment

6.1 At least once each year the Committee and the Board will review the performance of the Committee, including the performance of individual Committee members.

6.2 At least once each year the Committee will review this Charter and make recommendations to the Board in relation to any proposed change to this Charter.

Audit and Risk Management Committee Charter

1. Role of the Committee

1.1 The role of the Audit and Risk Management Committee (**Committee**) is to assist the Board of Directors (**Board**) to meet its oversight responsibilities in relation to the Company's financial reporting, internal control structure, financial risk management procedures and internal and external audit functions.

1.2 Provide a formal forum for communication between the Board and senior financial management.

1.3 Improve the effectiveness of the internal and external audit functions and be a forum for improving communications between the board and the internal and external auditors.

2. Duties

The Committee will monitor, investigate and make recommendations to the Board with respect to:

2.1 **Financial Statements**:

(a) Consider the appropriateness of the Company's accounting policies and principles and any changes, as well as the methods of applying them, ensuring that they are in accordance with the stated financial reporting framework.

(b) Assess information from the external auditor that affects the quality of financial reports.

(c) Recommend to the board whether the financial and non-financial statements should be signed based on the committee's assessment of them.

(d) Call for the Chief Executive Officer (CEO) and General Manager Finance to state in writing to the Board that the integrity of the company's financial statements and notes thereto are founded on a sound system of risk management and internal compliance and control which implements the policies approved by the Board, and that Perilya's risk management and internal compliance and control systems, to the extent they relate to financial reporting, are operating efficiently and effectively in all material respects.

2.2 **Related-Party Transactions**

Review and monitor the propriety of related-party transactions.

2.3 **Internal Control and Financial Risk Management**

(a) (**Financial Risk Management**) Assess the internal processes for determining, managing and reporting on key financial risk areas (i.e. metal prices; foreign exchange, interest rates and significant cots). Including, review and of compliance with the Company's Financial Risk Management Policy, at least annually.

(b) (**Hedging**) Review Perilya's hedging policy (as set out in the Company's Financial Risk Management Policy), market-to-market positions, the effectiveness of hedging policies and practices and the level of hedging verses available resource reserves.

(c) (Insurance) Reviewing annually the insurance programs in place and considering the level of self insurance.

2.4 External Audit

(a) Make recommendations to the Board on the appointment and remuneration of the external auditors.

(b) Monitor the effectiveness and independence of the external auditor.

(c) Invite the external auditor to attend relevant committee meetings to, review the audit plan, discuss audit results and consider the implications of the external audit findings.

(d) Together with the external auditor, review the scope of the external audit (particularly the identified risk areas) and any additional agreed-upon procedures on a regular and timely basis.

(e) Provide the opportunity for the committee members to meet with the external auditors without management personnel being present at least twice a year.

2.5 Other Matters Review

(f) (Corporate Governance) Review for completeness and accuracy the reporting of the Company's corporate governance practices as required under the Australian Stock Exchange Listing Rules.

(g) (ASX – Continuous Disclosure) Ensure that a process is established by the Company's management to capture issues for the purpose of continuous disclosure to the Australian Stock Exchange.

3. Access

3.1 The Committee shall have the authority to seek any information it requires from any officer or employee of the Company or its controlled entities and such officers or employees shall be instructed by the Board of the Company employing them to respond to such enquiries.

3.2 The Committee may invite any executive director, executive, other staff member or external or internal auditor to attend all or part of a meeting of the Committee.

3.3 The Committee may consult independent experts and institute special investigations if it considers it necessary in order to fulfil its responsibilities.

4. Membership

4.1 The Audit and Risk Management Committee is a committee of the Board established in accordance with the Company's constitution.

4.2 Members of the Committee shall comprise of three (3) non-executive directors of the Company, with a majority of members to be independent non-executive directors.

4.3 The chairman and members of the Committee are appointed by the Board and may be appointed for specified terms. Membership of the Committee will be reviewed annually by the Board.

4.4 The Chairman of the Board may not be the Chairman of the Committee.

4.5 The Company Secretary is secretary to the Committee.

5. Meetings

5.1 Meeting Frequency

The Committee will meet as frequently as required but not less than four times each year.
Any member of the Committee or the Secretary to the Committee may call a meeting of the Committee.

5.2 Quorum

A quorum is two members.

5.3 Committee Agenda and Papers

Committee agendas should be settled by the Chairman in conjunction with the Company Secretary, and Committee papers should be provided to Committee members sufficiently far in advance of scheduled meetings to permit adequate preparation.

5.4 Professional Advice

The Committee may have access where necessary to professional advice from external advisers, and may meet with external advisers without management being present.

6. Reporting

6.1 The Committee Chairman will:

(a) report to the Board on the proceedings of each Committee meeting (to the next Board meeting); and

(b) attend the Annual General Meeting and be available to respond to any shareholder questions on the Committee's activities and areas of responsibility.

7. Assessment

7.1 At least once each year the Committee and the Board will review the performance of the Committee, including the performance of individual Committee members.

7.2 At least once each year the Committee will review this Charter and make recommendations to the Board in relation to any proposed change to this Charter.