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GEL 157 - Callabonna

GEL 179 – Callabonna East

Combined Annual and Final Report Year 4

17 February 2008 – 16 July 2009

GEL 157 – Callabonna

GEL 179 - Callabonna East

Combined Annual Report Year 4

17 February 2008 – 16 July 2009

Contents

1. Introduction

1.1 Licence Data

MNGI Pty Ltd, a wholly owned subsidiary of Petratherm Ltd, was granted GEL 157 (Callabonna) on 23 November 2004 and GEL 179 (Callabonna East) on 28 January 2005, each for a period of 5 years. In December 2005 Petratherm applied for Variations to the Work Programs of each of the two Callabonna tenements with the view of amalgamating their work programs into a single regional project and streamlining compliance reporting. The proposed variations were approved by PIRSA, and the revised first anniversary of the combined tenements was the 17th February 2006.

On the 17th September 2008, the Company received approval to suspend GEL's 157 and 179 (Callabonna Project) for a period of 12 months. At this date the Company also received approval to vary the Callabonna Project Work Program in order rectify timing of planned activities. On the 16th July 2009 following a request by the Company to PIRSA, the Callabonna Project was surrendered. In accordance with Section 33 of the Petroleum Regulations 2000, this report details work conducted during the fourth permit year of the licences.

The Callabonna Project licences are located in the northern Arrowie Basin on the gibber plains to the north of the Mt Painter and Mt Babbage Inliers of the Flinders Ranges (Figure 1).

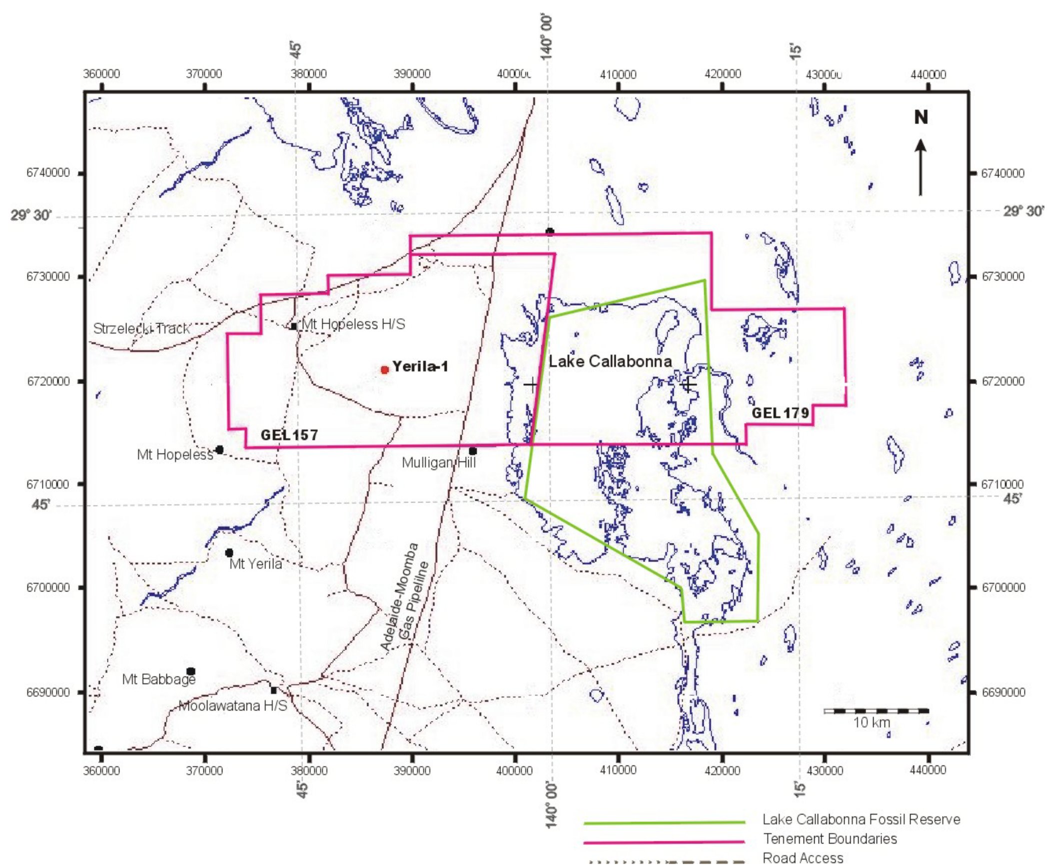

Figure 1. Map indicating the location of GEL157 Callabonna, GEL179 Callabonna East and the Yerila-1 well.

1.2 Overview

The Callabonna Hot Rock Project represents an exploration play for an Engineered Geothermal System (EGS) informally known as the Thermally Anomalous Granite (TAG) model (Figure 2). This model focuses on areas where high heat producing granitic rocks are covered by thick insulating sequences of sedimentary overburden, which maximise the local geothermal gradient.

Known high heat producing granites cropping out in the Mt Painter and Mt Babbage Inliers to the south of the Callabonna Project area continue under cover to the north. Existing regional gravity and magnetic data suggests that a distinct low density area covering approximately 1200 km^2 immediately north-northeast of the Mt Painter and Mt Babbage Inliers, is an intrusive body underlying about 2-3 km of sedimentary overburden (Figure 2). Petratherm's two licences, GEL157 and GEL179, cover about 1000 square kilometres over the centre of this body.

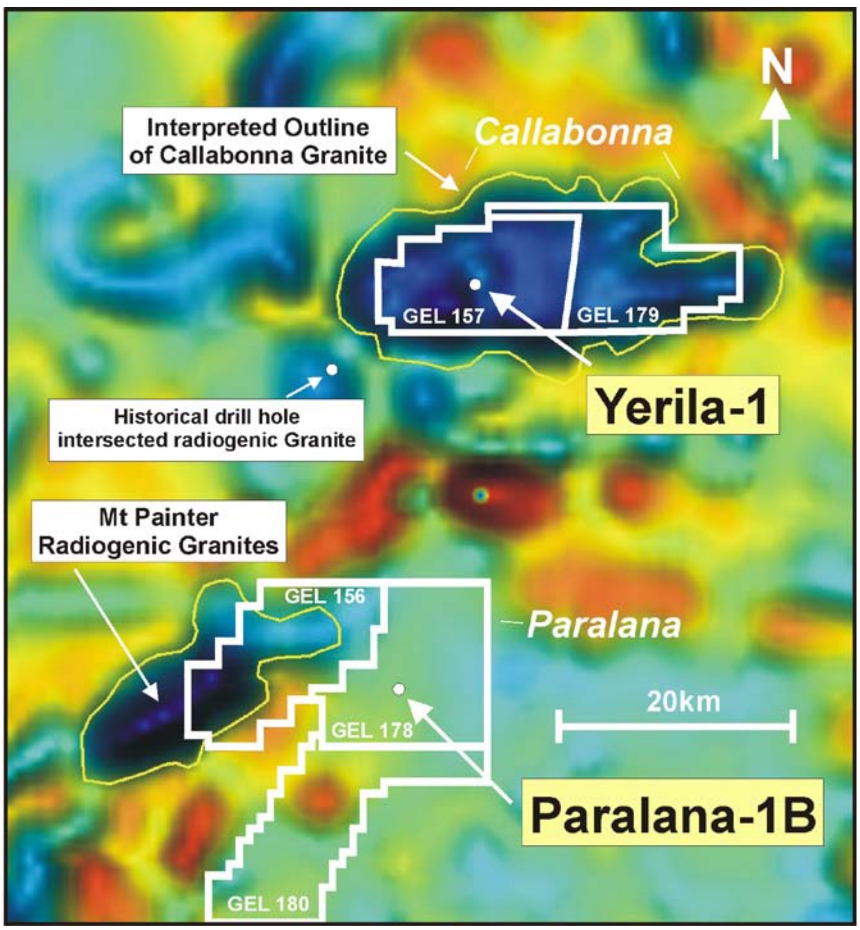

Figure 2: Regional 1VD Gravity Image, highlighting extent of the Callabonna Gravity Low (northern dark blue area), Petratherm's Licence Areas, and the location of Yerila-1.

2. Work Requirements

The combined work program for Year 4 of the Callabonna tenements (GEL 157 and GEL 179) is presented below.

Year of Licence	Work Program
4 Indicative Cost $80,000	• Magneto-telluric modelling of basement • Revised thermal model • Commercialisation plan • Site deep well • Aboriginal heritage and environmental approvals

3. Work Conducted

3.1 Magneto-telluric modelling of basement

The main objective was to provide information as to the depth to basement, the thicknesses of local stratigraphic units and to determine the suitability of the area to host a geothermal resource. The modelling work used soundings recorded along a north-south trending transect, and covered a distance of 5km. Sounding stations were spaced at 500m intervals. The data acquisition and processing contract was undertaken by Quantec Geoscience Australia; while the data inversion modelling was undertaken by Quantec Geoscience Canada. Data quality throughout the survey was generally good, although a number of stations required a repeat read where data quality was poor or acquisition error had occurred.

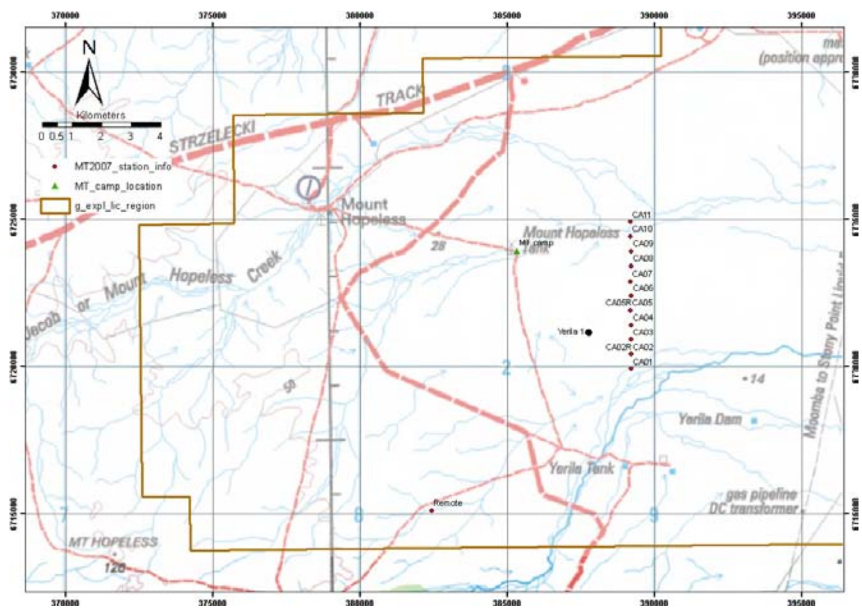

Figure 3 Callabonna MT line and remote reference station.

Data modelling and inversions

Prior to modelling the MT data, the data was rotated such that XY is TE, and YX is TM, this is the opposite convention to which the data was collected. This procedure ensures that the TM mode is perpendicular to geological strike and the TE mode is parallel to geological strike. The resistivity data shows a conductive sequence down to approximately 0.5Hz, beneath which there is a thin, less conductive layer from 0.5 to 0.1 Hz. Underlying these two conductive bands is a more resistive layer with frequencies less than 0.1 Hz as shown on figure 4.

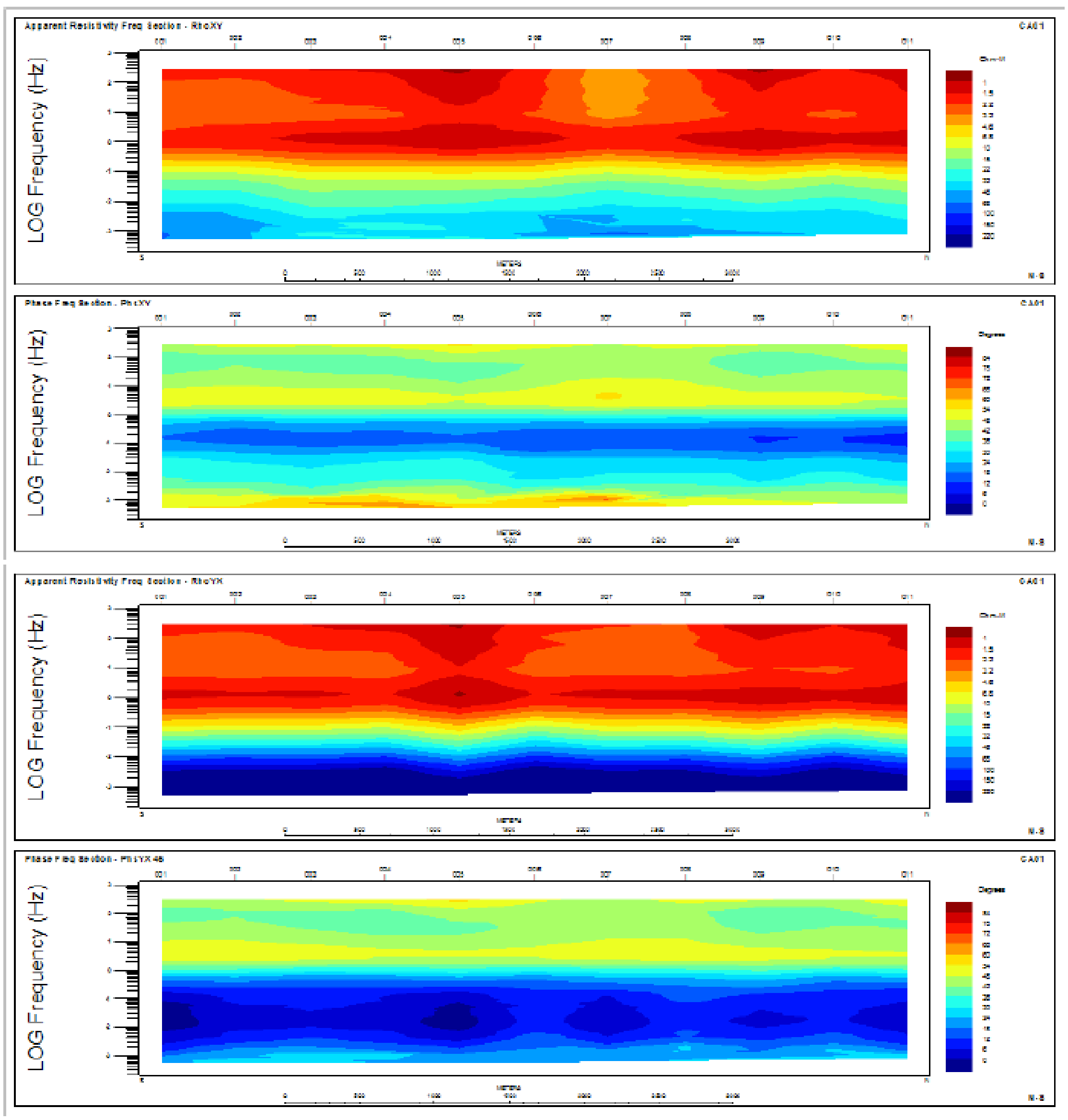

Figure 4 Raw data resistivity and phase profiles.

The phase data varies from high to low and suggests an increasing resistivity with depth, and this trend is confirmed by the resistivity data. A phase increase is noted at the very low frequencies and is indicative of an increased conductivity at depth; however there is no evidence for this in the resistivity data.

Bostick 1D Model

1 D inversions were performed using Bostick and Occam algorithms. The Bostick 1D inversions (figure 5) suggest a conductive layer of less than 10 ohms down to 1000 meters followed by a less conductive layer down to between 3000 and 3500meters. This is interpreted to be the depth to top of basement. Some variation is seen in the TE and TM modes; however the TM mode is believed to represent a more accurate model of the geology.

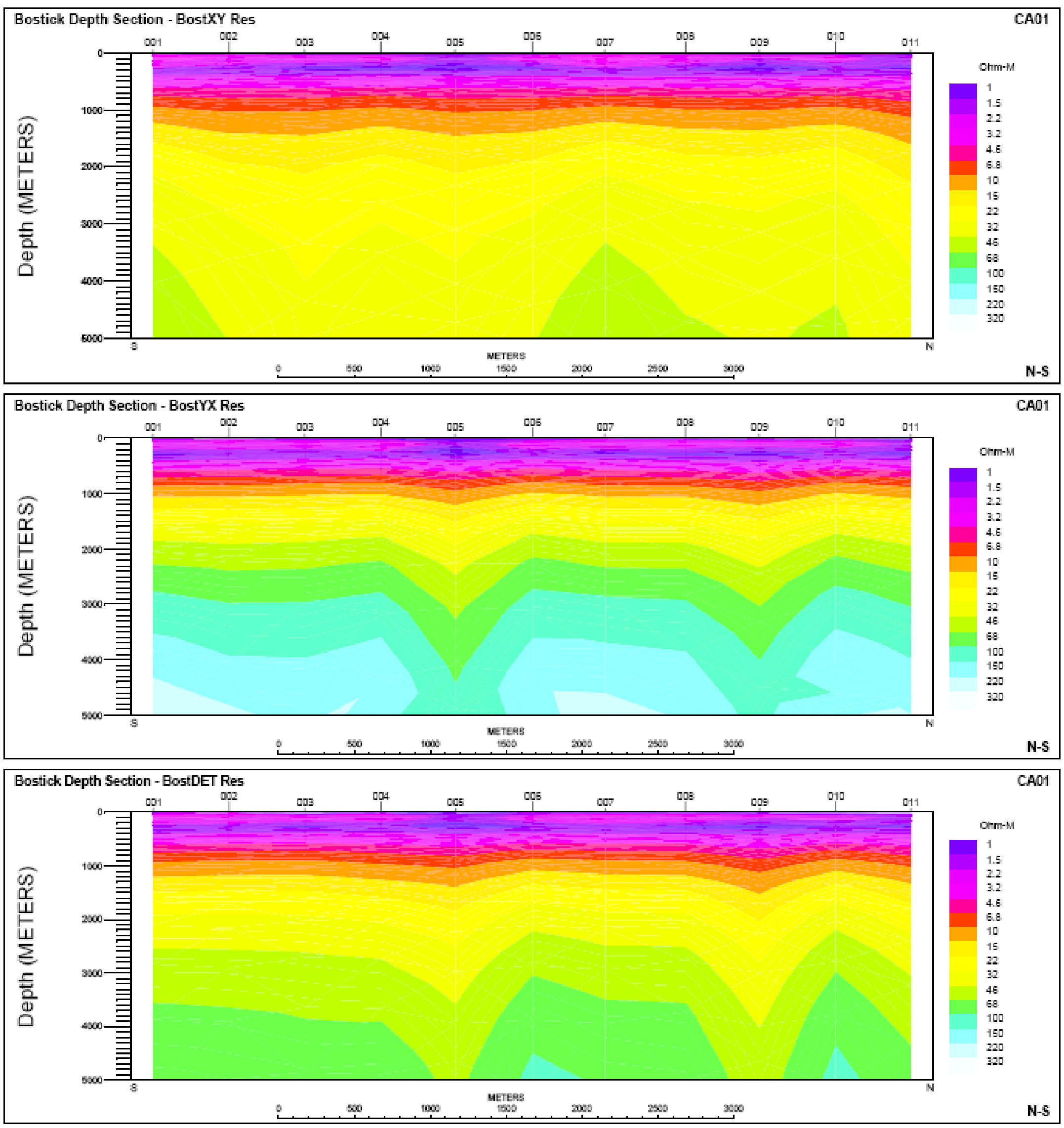

Figure 5 Bostick 1D inversion. a) 1D Cross-line (TE), b) 1D Inline (TM), c) 1D DET (avg)

Occam 1D Model

The Occam 1D inversion (figure 6) also gives a three layered response with the upper conductive unit extending to 1000 meters as seen in the Bostick 1D model. However the underlying less conductive layer in the Occam model extends to only 2000 meters depth, and as a result implies a shallower basement.

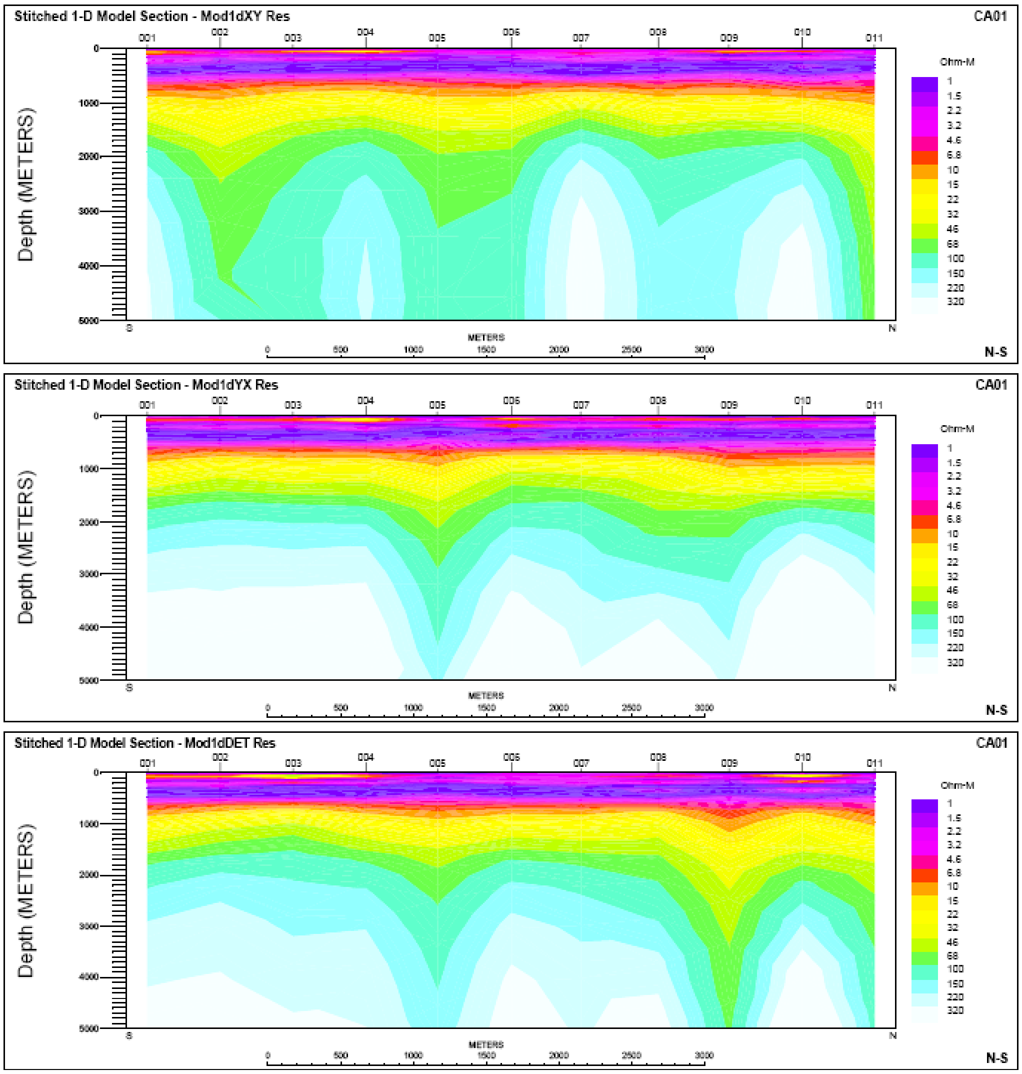

Figure 6 Occam 1D inversion. a) 1D Cross-line (TE), b) 1D Inline (TM), c) 1D DET (avg).

RLM 2D Model

2D models were also calculated using two different codes, RLM (Rodi and Mackie) and PW (de Lugao and Wannemaker). The RLM 2D inversion suggests a four layer resistivity model as shown in figure 7. This model further confirms the depth of the upper conductive unit to 1000m depth, and underlain by a thinner less conductive unit to 1500m. Between 1500m and 3000m an additional low resistivity unit is resolved; the base of this layer is interpreted to represent the top of the resistive basement at approximately 3000m. Deepening of all units at the start and end of the line is attributed to edge effects in the data.

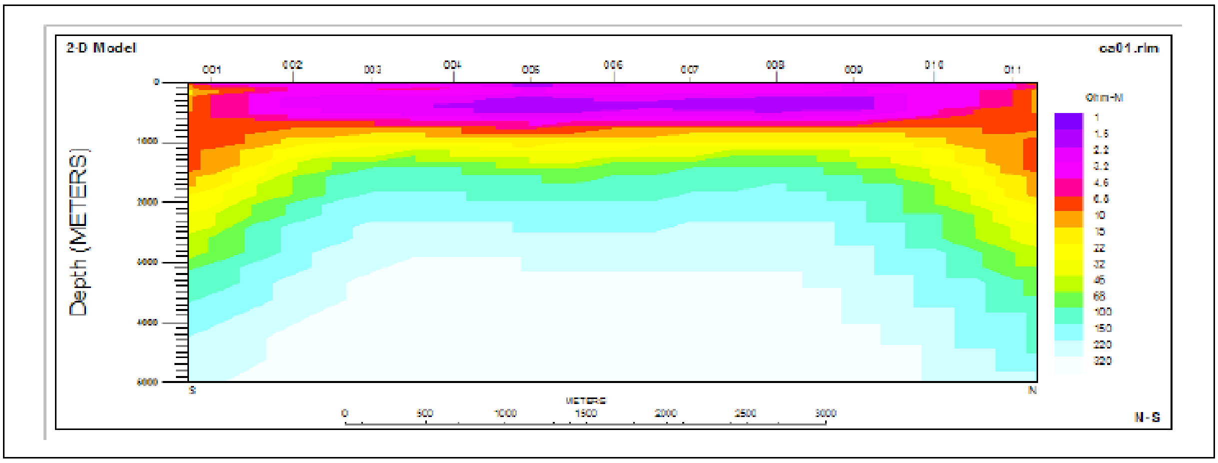

Figure 7 2D RLM resistivity inversion. TM rho/phs, TE phs, half space 100 ohm-m.

PW 2D Model

The PW 2D model results (figure 8) show similar results to the RLM model with a four layered model identified. The layer thickness, however, in each case is reduced and the depth to basement appears shallower in agreement with the Occam 1D inversion. The Occam and PW models are thought to provide more robust modelling of the MT data.

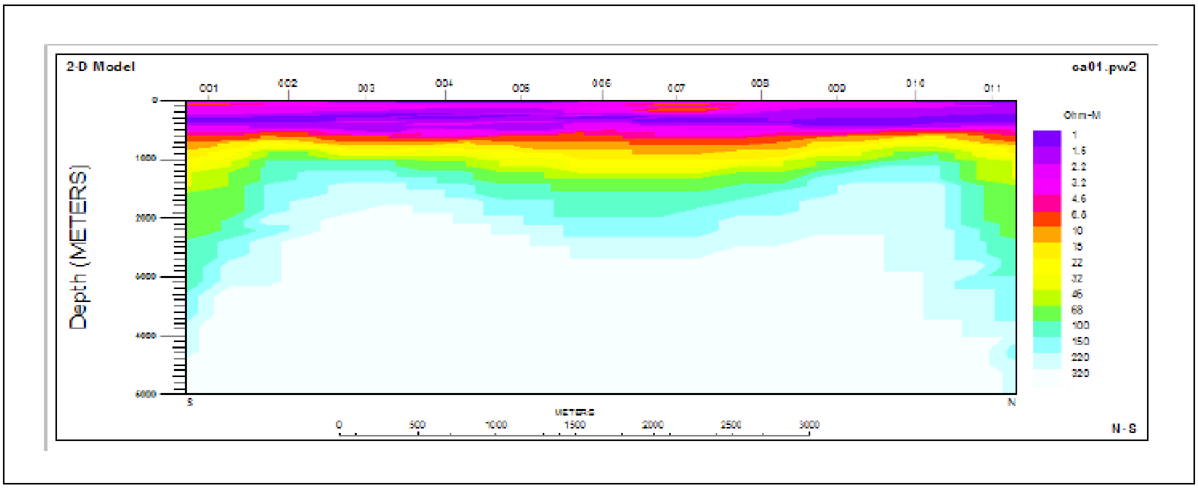

Figure 8 2D PW resistivity inversion. TM rho/phs, TE phs, RLM (final).

Conclusions and Recommendations
Modelling of the MT data and gravity data suggests a depth to basement of 2000m. Data quality throughout the survey was good; however it would be preferable to have the survey extended to the edge of the gravity anomaly in order that variation in the basement depth could be observed on the MT data.

3.2 Revised thermal model

A thermal evaluation was conducted at the Callabonna Prospect located approximately 80 km northwest of the Paralana Project on the eastern side of the Flinders Ranges in the mid North of SA. The purpose of the evaluation was to determine whether the area was a suitable site to host a geothermal resource.

Assumptions in the modelling.
The prospect was initially chosen on the basis of a well defined E-W trending ovoid gravity low (roughly 50 by 20 km in extent) in the region. Subsequent gravity modelling was not able to constrain the depth of the cover rocks, or adequately constrain the origin of the gravity low. A follow-up MT survey delineated an apparent resistivity gradient suggesting a cover sequence of approximately 2 km in thickness above the potential source of the gravity low.

PetraTherm drilled one well (Yerila-1) to depth of 695m in 2005 within the gravity low. The well penetrated Quaternary to Cretaceous sequences to around 649m where Cambrian red beds were intersected. T-logging indicated that the average thermal gradient in the upper 625m of the well was equivalent to 61.7°Ckm-1. No thermal conductivity or heat production rate measurements were made from Yerila-1.

2D thermal models were constructed for an E-W transect and a N-S transect (Figure 1-3) encompassing the gravity low. The parameters for the modelling are shown in Figures 1 & 3. A number of assumptions have been made:

1. The bulk thermal conductivity of the Quaternary to Cretaceous sequences is assumed to be 1.4Wm-1K-1. This value is based on the same sequences in PetraTherm's drill hole Paralana-1B to the SE. Although thermal conductivity has not been obtained from these sequences in Paralana-1B, a value of 1.4Wm-1K-1 provides a reasonable fit to the inferred heat flow (in the interval 110-129 mWm-2) from the Paralana-1B drill hole. If this thermal conductivity is adopted, a heat flow of 85.4mWm-2 is inferred for Yerila-1.

2. A heat production rate of 1uWm-3 has been assigned to the Quaternary to Cretaceous package.

3. The source of the gravity low is inferred to be granite with a heat production rate of 7.5uWm-3. The granite is assumed to be 4 km thick with a 2D extent of 50 by 20 km. Thermal conductivity for the granite is assigned to be 3.2 Wm-1K-1.

4. The Cambrian sequences above the granite are assumed to have a heat production rate of 1uWm-3 with a thermal conductivity of 3Wm-1K-1.

5. The deeper packages intruded by the granite are assumed to have a heat production rate of 2uWm-3 and a thermal conductivity of 3Wm-1K-1.

6. The surface heat flow above the centre of the granite is constrained to be 85mWm-2.

7. The surface temperature is assumed to be 23 degrees.

Results of the modelling

The results of the modelling are shown in Figures 1-3. Figure 1 shows the case for a 2D granite extent of 50km (inferred E-W extent). Given the granite is not equidimensional, if the selected parameters correspond closely to true values, the results in Figure 1c and 1d represent an upper end member result that will exceed to the true state.

Figure 1d shows that the modelled thermal gradients within the upper part of the granite (2-3km) are around 25-30°Ckm-1. Gradients within the mid and lower parts of the granite 3-5km are less than 25°Ckm-1. The results also show that the modelled gradient in the Quaternary to Cretaceous package is around 60-61°Ckm-1 above the inferred granite (Figure 1d). Figure 2a shows a detailed view of this result and shows it corresponds closely to the measured value (Figure 2b).

Maximum absolute temperatures are a function of assigned thermal conductivities however the following are likely to be indicative of the real state:

1. 3 km are 146.5°C

2. 3.5 km are 158°C

3. 4 km are 169.5°C

4. 4.5 km are 180°C

5. 5 km are 190°C

Figure 3 shows the case for a 2D granite extent of 20km (inferred N-S extent). Given the granite is not equant, if the selected parameters correspond closely to true values the results in Figure 3c and 3d represent a lower end member result.

Figure 3d shows that thermal gradients within the upper part of the granite (2-3km) would be around 25-20°Ckm-1. Gradients within the mid and lower parts of the granite 3-5km are around 20°Ckm-1 or less. The results also show that the modelled gradient in the Quaternary to Cretaceous package is around 50-55°Ckm-1 above the inferred granite (Figure 3d), reflecting the smaller modelled heat source extent.

Maximum absolute temperatures are a function of assigned thermal conductivities however the following are likely to be indicative of the real state:

1. 3 km are 141.7°C
2. 3.5 km are 153°C
3. 4 km are 164.5°C
4. 4.5 km are 175°C
5. 5 km are 185°C

3.3 Commercial feasibility study

Results from the thermal study concluded the maximum absolute temperatures presented in the table below

Depth	**Temperature**
3 km	146.5°C
3.5 km	158°C
4 km	169.5°C
4.5 km	180°C
5 km	190°C

The average gradient of 33 degrees per kilometre is not anomalous in the Australian context, and the Callabonna site is very remote to any potential market. Finacial modelling returned significantly negative net present value. These results conclude that the Callabonna target is not a viable geothermal site from which to generate commercially viable power.

3.4 Rehabilitation of Yerila-1 Well

Final rehabilitation was undertaken in May 2009. As prescribed by the EAR, the top 10 meters of the inner casing (4.5”) was cement plugged. Moreover, the headwork was cut about 40cm below surface and the ground levelled on the collar. An environmental audit report was submitted to PIRSA in May 2009.

4. Year 4 Expenditure

Commercial in Confidence

5. Compliance with the Petroleum Act 2000 (Reg. 33)

a) Summary of the regulated activities conducted during the licence year.

Petratherm performed rehabilitation of the Yerila 1 gradient test well in the Callabonna Project Area, followed up by an environmental audit pursuant to the guidelines within the SEO for Drilling and Well Operations in the Cooper and Eromanga Basins, South Australia (November 2003). Following completion of the rehabilitation operation the Company became aware that the licence was still under suspension and therefore the Company was non-compliant.

b) Report for the year on compliance with the Act, these regulations, the licence and any relevant statement of environmental objectives.

Petratherm Ltd undertook rehabilitation of the shallow gradient test well, Yerilia 1, on the 12th May 2009. Following this work the Company later became aware that GEL 157 was still in suspension, and therefore the activity was non-compliant pursuant to section 11 of the Petroleum Act 2000. The Company apologizes for this failure of compliance, and has altered its internal tenement management and field operations procedures to ensure this will not occur again.

The tenements were surrendered before completion of the full year 4 work plan and therefore is non-compliant. The tenements were surrendered because the commercial feasibility study which was based on the exploration and modelling results, indicate the project was not commercially viable.

Table: Environmental Objectives and Performance Assessment of drilling operations conducted at the Yerila-1 site.

Environmental objective	Possible impact	Main sources of risk	Comments	Performance Assessment
1. Minimise risk to public and third parties				
Minimise public and third party risks.	Creation of new public risks: public using rig road; well blowouts; post-drilling.	Access risks, well site risks	NOIEs were sent to all stakeholders. Stakeholders were contacted personally prior to and after the drilling and rehabilitation operations. Existing tracks were used. Site was completely rehabilitated. All signage and equipment were removed and sumps backfilled. Hole was cement plugged and wellhead cut below ground level. Access tracks are not visible from public roads. No complaints were received.	Y
2. Minimise disturbance and soil contamination				
Minimise soil impacts	Accelerated soil erosion, particularly in gibber (potential start-up of long term irreversible erosion on gibber slopes >2%) Development of borrow areas.	Access and pad construction	Minor well pad construction was designed on flat land, with minimal disturbance, next to a fence. No borrow pits were constructed. Sumps have been backfilled and original stock-piled soil re-spread. Site was lightly graded and levelled back to natural contour. Wheel track access road is visible in places but blending in with growth of new vegetation.	+1
Avoid storage and loading facility spills; rapid cleanup and impact minimisation following spills	Pollution through local fuel tank or filling point spills	Vehicle and plant refuelling, drilling operations.	Contaminated soil from fuel bund has been disposed of in sumps and re-buried.	Y
3. Avoid introduction of pest species				
Prevent introduction of pest plants	Establishment of further alien species in the locality	Importation on vehicles	All equipment & vehicles cleaned before brought on to site.	Y
4. Minimise disturbance to drainage patterns; avoid contamination of surface and shallow groundwaters				
Avoid drainage alterations	Downstream shifts; erosion	Access and pad construction	Yerila-1 was positioned on an almost imperceptible northerly slope, distant from any defined drainage but not in the path of any floodout. No new tracks were created for the drilling program. Site and access areas were lightly graded and levelled back to natural contour.	+1
5. Avoid disturbance to sites of cultural and heritage significance				
Avoid disturbance to sites of Aboriginal and European heritage significance	Intrusion or physical site damage to areas of Aboriginal and European heritage significance	Access and pad construction, vehicle and people movement	Heritage clearance survey conducted in drilling and camp sites and approval given. Local station manager consulted.	Y
Minimise visual	Visual impacts	Access and	No new access roads or borrow pits were	+1

impacts	through obtrusive access and pad development and/or visible long-term persistence of pad and access.	pad construction	constructed. Sumps have been backfilled and original stock-piled soil re-spread. Minimal pad construction. No burrow requirements. Site lightly graded and levelled back to natural contour. Wheel track access road visible in places but blending in with growth of new vegetation.	
6. Minimise loss of aquifer pressures and avoid aquifer contamination				
Minimise formation damage in drilling	Physical damage to formation beyond the drillhole.	Drilling	Casing and cementing applied.	Y
Prevent cross-connection between aquifers, and between aquifers and reservoirs	Contamination of higher-quality groundwater with lower-quality waters (salinity, trace elements).	Missing or inadequate casing or plugging post-drilling.	3 casing annulus used and completely cemented from the bottom of the section to surface. 11 meters of cement and drilling mud within the inner casing at TD. Hole cased off to total depth. Adequate surface casing to prevent blow out. Hole cement plugged.	Y
7. Minimise disturbance to native vegetation and fauna				
Avoid impacts on high biological value or wilderness value areas	Direct physical impact on high biological or wilderness value areas; fires started at pad	Access and pad construction; fires	Yerila-1 is not located in or near areas of high biological significance or wilderness values. No new access tracks. Minor pad construction thanks to the use of a moderate scale trailer-mounted rig, with minor vegetation clearance.	+2
Minimise disturbance to vegetation and habitat	Physical damage to soils, vegetation and habitat; wildfire	Access and pad construction or upgrade; Fires at drilling site	Minimal drilling pad construction, no new access tracks or land clearance were required for the drilling operations. Drilling site selected to avoid clearing of mid-height shrubs and most area is grassland or short-lived perennial dwarf shrubs. Stockpiling of surface soil and debris from scraped areas (drill pad, sumps, and pits) and respreading during the final rehabilitation. Site was lightly graded and levelled back to natural contour. Wheel track access has disturbed some vegetation but blending in with new growth. Note that the area has been in drought with little rainfall to sustain germination or significant growth of perennial species.	+1
Avoid disturbance to rare, endangered, vulnerable species and communities	Physical removal of rare, endangered, vulnerable species	Access and pad construction	Yerila 1 is not located in or near areas of high biological significance or wilderness values, hence drilling ops presented no long term impact to any such area.	+2
8. Minimise air pollution and greenhouse gas emissions				

Combustion by-products, particulates, vented hydrocarbon or CO2 release	Well testing, drilling	Any testing carried out in accordance with industry-accepted standards		NA
9. Maintain/enhance partnerships in community				
Liaison with local pastoral and mineral operations	Affected parties notified and consulted on proposed activities		Petratherm maintains regular contact with local landholders & stakeholders. The location of Yerila-1 and access to water was approved by landholder. NOIEs were distributed to affected parties within 21 day timeframe. Wherever possible Petratherm employs local contractors & personnel in support service roles.	Y
10. Avoid or minimise disturbance to stakeholders and associated infrastructure				
Minimise adverse impact on livestock	Interference with stock	Disturbance to stock grazing	Organic beef certification held at this location. MSDS of drilling fluid materials provided to Landholder for review. Drillhole location, site access & water access were approved by landholder. The wellhead has been cut 40cm below the surface and the ground has been levelled on the top of the buried collar. All equipment, materials, contaminated soils and rubbish have been removed from site.	Y
Avoid contamination of stockwaters with hydrocarbons	Interference with stock; pollution of stock water	No hydrocarbons expected	All drilling fluids, cuttings etc contained within sumps. No hydrocarbons intersected.	Y
Minimise adverse impact on Regional Reserve operations	Not applicable in this area			NA
11. Optimise waste reduction and recovery				
Minimise waste handling and disposal impact	Creation of wastes: sewerage, litter, overflow and spillage	Disposal of wastes while drilling	Sewage disposed locally via short-term septic pits. Wastes on site confined by bins/skips. Disposal eventually to EPA-licenced waste disposal facility at Beverley. Minor non-toxic wastes, chippings and muds disposed in drill sump. Litter cleanup during and post-drilling.	Y
12. Remediate and rehabilitate operational areas to agreed standards.				

Rehabilitate unsuccessful or suspended wellsite and access	wellsite and access permanently left in place if successful with visual impact, changed soil surfaces, colour contrasts	Post-drilling	All equipment, waste & materials removed from site. Sumps have been backfilled and original stock-piled soil re-spread. Site lightly graded and levelled back to natural contour. The wellhead has been cut 40cm below the surface and the ground has been levelled on the top of the buried collar. Wheel track access road lightly scarified. They are visible in places but blending in with growth of new vegetation.	Y
Undertake long-term planning for rehabilitation for potential producing wellsite	Not applicable in this case	Development of rehabilitation plans included in production management		NA
13. Minimise as far as reasonably practicable interruptions to natural gas supply.				
Not applicable in this case				NA

c) Actions taken to rectify non-compliance with obligations imposed by the Act, these regulations or the licence, and to minimise the likelihood of the recurrence of any such non-compliance; and d) summarise any management system audits undertaken during the relevant licence year including information on any failure or deficiency identified by the audit and any corrective actions that has, or will be, taken.

Petratherm Ltd recognises the importance of achieving regulatory compliance and is committed to achieving best practice in its management strategies, work practices and procedures, in an environmentally and socially responsible manner. Petratherm has a policy of continuing review and improvement in the developing of management systems to ensure it meets this commitment.

As a result of the non compliance with respect to failure to un-suspend the Callabonna Licences prior to rehabilitation of Yerila-1, the Company has updated its HSE field activity check list (HSE CHK08). The revised check list ensures all operating staff have checked tenement status prior to the undertaking of any field operation.

A HSE Management Systems Compliance Audit was carried out by external contractors ISRM in March 2009. Subsequently, Petratherm completed a self assessment of the HSE management system in July 2009.

e) List all reports and data relevant to the operation of the Act generated by the licensee during the licence year,

Author	Title	Date	Activity	GEL	Submitted
Petratherm	Surrender Letter	4/3/09	Licence Surrender	GEL157 & 179	4/3/09
Petratherm	Year 4 Annual Report	9/9/09	Annual Report	GEL157 & 179	9/9/00
Petratherm	Yerila-1 Well Environmental Audit Report	May 09 2009	Environmental Audit	GEL157 & 179	May 09
Petratherm	Callabonna MT survey – Interpretation Report	4/12/09	Geophysical Interpretation	GEL 157 &179	4/12/09
Petratherm	Callabonna MT survey – Operations Report	5/12/09	Geophysical Operations	GEL 157 &179	5/12/09
Petratherm	MT Environmental Audit	15/4/08	Environmental Audit	GEL 157 &179	15/4/08
Petratherm	Quarterly incident and cased hole activity reports 1st quarter 2007	Jan-Mar 2008		GEL157	Apr 2008
Petratherm	Quarterly incident and cased hole activity reports 2nd quarter 2007	Apr-Jun 2008		GEL157	Jul 2008
Petratherm	Quarterly incident and cased hole activity reports 3rd quarter 2007	Jul-Sept 2008		GEL157	Oct 2008
Petratherm	Quarterly incident and cased hole activity reports 4th quarter 2007	Oct-Dec 2008		GEL157	Jan 2008
Petratherm	Quarterly incident and cased hole activity reports 1st quarter 2007	Jan-Mar 2009		GEL157	Apr 2009
Petratherm	Quarterly incident and cased hole activity reports 2nd quarter 2007	Apr-Jun 2009		GEL157	Jul 2009

f) Report on any incidents reportable to the Minister under the Act and regulations during the relevant licence year.

No reportable incidents occurred during Year 4 of the Callabonna licences.

g) Report on any reasonably foreseeable threats that reasonably present , or may present, a hazard to facilities or activities under the licence, and report on any corrective action that has, or will be, taken.

No threats have been identified.

h) Operations proposed for the ensuing year

Final year of Licence