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GEL 157

2007 CALLABONNA MAGNETOTELLURIC SURVEY

CALLABONNA PROJECT

Submitted
by

Petratherm Ltd

2008

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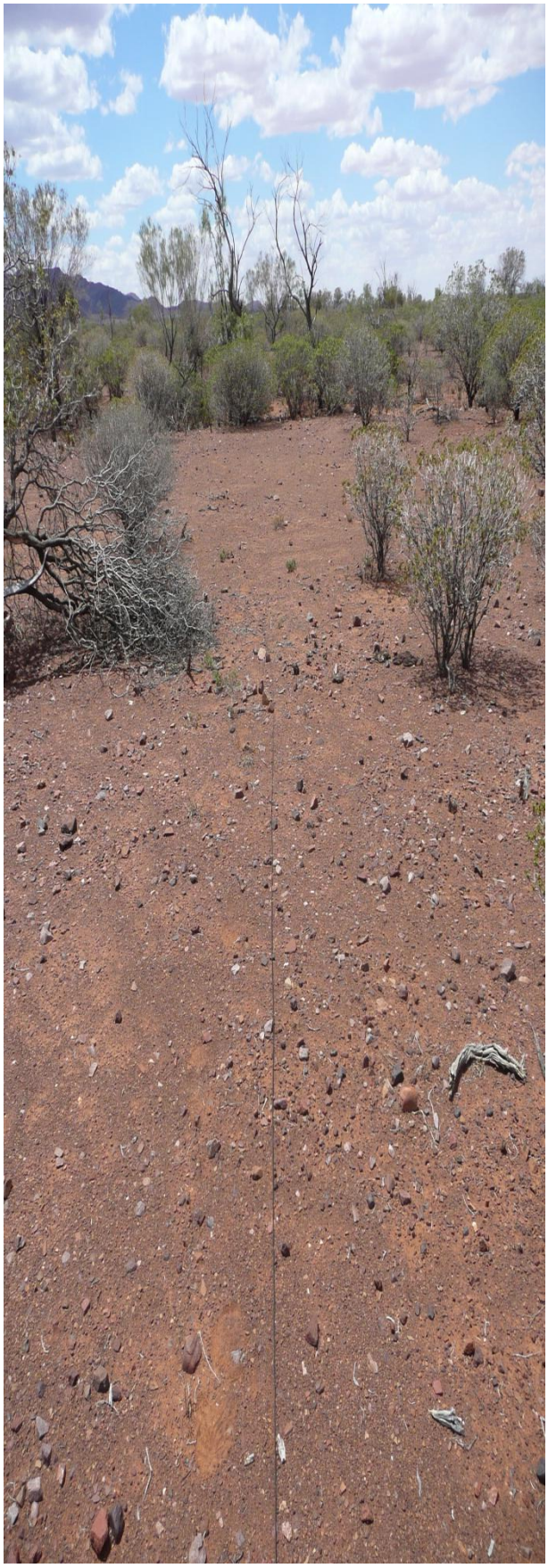

2007 Callabonna Magnetotelluric Survey

Operations Report for GEL 157 Volume 1

November 2008

petratherm

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1 Introduction

In December 2007, Petratherm conducted a magnetotelluric survey across tenement GEL 157, Callabonna. Petratherm Limited being the holder of tenement GEL 157. The tenement is located 89km NE of Arkaroola Village, 164km NE of Leigh Creek, as shown in figure 1.

Eleven soundings were recorded along an north-south trending transect, and covered a distance of 5km. Sounding stations were spaced at 500m intervals as shown in figure 2. The survey commenced on the 1th Dec and was completed on the 5th Dec 2007; weekly progress report as submitted to PIRSA is contained in Appendix 1.

The main objective of the survey 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.

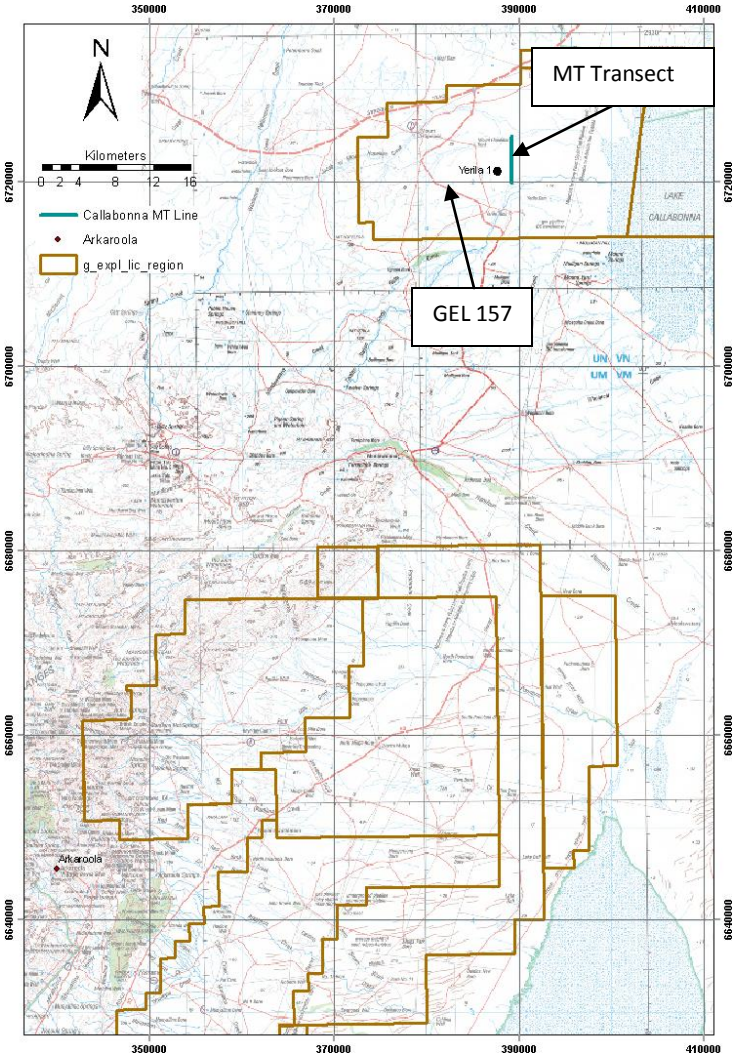

Figure 1. Location of Callabonna tenement GEL157, with MT transect shown.

The data acquisition was contracted to Quantec Geoscience Australia from Queensland and the contractor's logistics report is in Appendix 2. Data processing and data inversion modeling was conducted by Quantec Geoscience Australia and Canada respectively. A description of the processing sequence is outlined in Section 3, while the results of modeling are documented in the 2007 Callabonna Magnetotelluric Survey Interpretation Report.

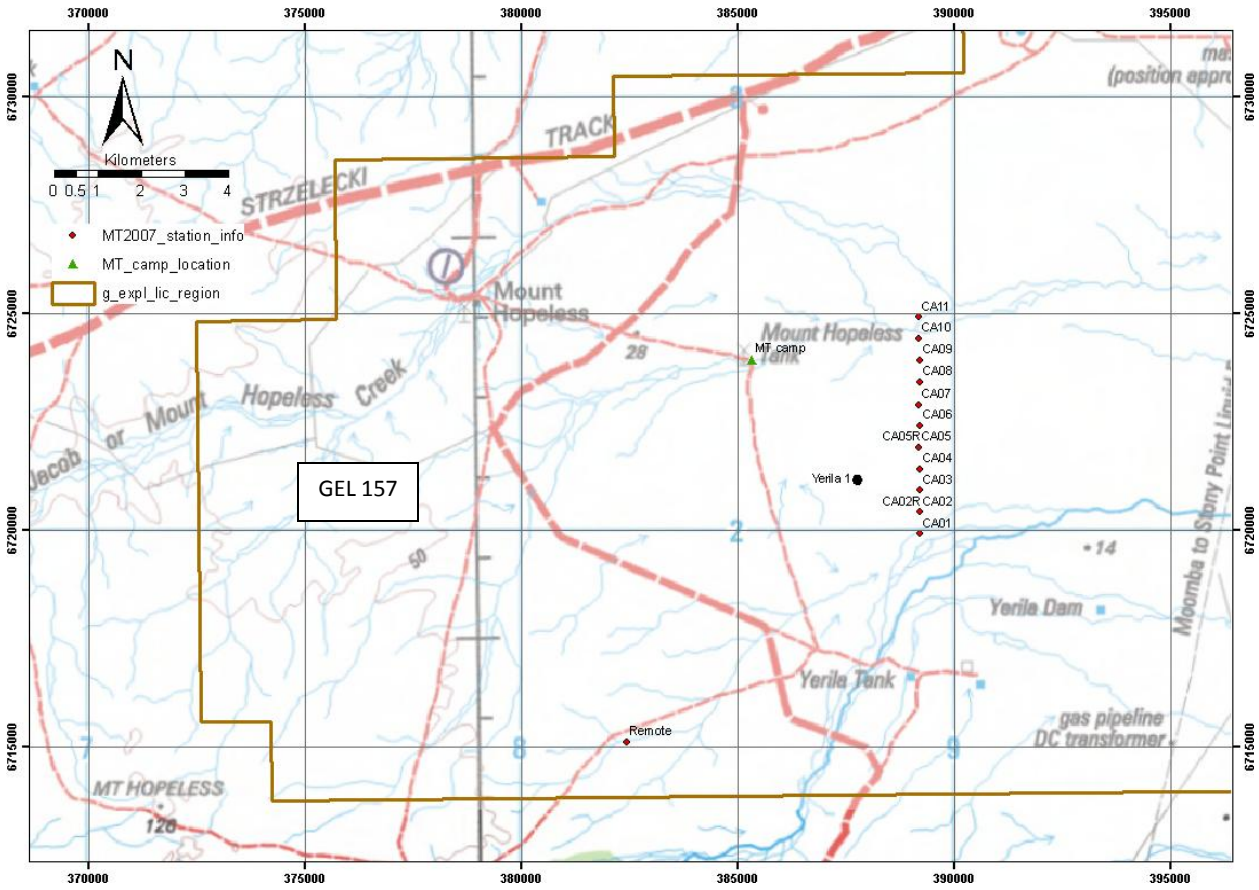

Figure 2 Callabonna Hill MT stations and remote reference station. The crew camp is positioned as shown in a Mitsubishi Canter Motor Home.

2 Planning and Consultation

2.1 Location

The location of the survey is described above and shown in figures 1 and 2. The location of each recording station and remote reference is detailed below in table 1.

Table 1 2007 Callabonna Magnetotelluric Survey station locations. WGS84 Zone 54.

Site	Easting	Northing	Hx sensor	Hy sensor	Hz sensor	Hx azimuth	Hy azimuth	Ex azimuth	Ey azimuth
Remote 00	382442	6715115	2129	2130	P50-2112	360	270	360	270
CA01	389209	6719911	2127	2128	9107	360	270	360	270
CA02	389185	6720407	2113	2119	9307	360	270	360	270
CA03	389188	6720910	1980	2118	9104	360	270	360	270
CA04	389189	6721410	2012	2115	7003	360	270	360	270
CA05	389181	6721902	2122	2125	9306	360	270	360	270
CA06	389210	6722410	2016	2111	9602	360	270	360	270
CA07	389183	6722890	1999	2011	9103	360	270	360	270
CA08	389187	6723416	1981	2200	9104	360	270	360	270
CA09	389191	6723906	2120	2121	7003	360	270	360	270
CA10	389181	6724408	2016	2111	9602	360	270	360	270
CA11	389182	6724903	2122	2125	9306	360	270	360	270
CA02R	389185	6720407	2113	2119	9307	360	270	360	270
CA05R	389181	6721902	2127	2128	9107	360	270	360	270
R= Repeat station									

2.2 Permitting

PIRSA was notified of the intended survey in a letter dated 3th September 2007. All other interested parties were informed by issue of a Notice of Intended Entry.

2.3 Cultural Heritage

In order to assess the cultural impact of the proposed MT survey, a search of the central archive of the Department of Aboriginal Affairs and Reconciliation for registered sites of significance was conducted. No significant sites are reported in the area close to any station sites or the remote reference station .

2.4 Environment

The 2007 Callabonna MT survey in GEL 157 was conducted under an existing SEO entitled **"**Statement of Environmental Objectives for Ground-based Geophysical (non-seismic) Operations in South Australia" (PIRSA, 2007). Current accepted acquisition methodologies require minimal disturbance to the environment and the operation was conducted in accordance with Petratherm's and Quantec's Environment, Health & Safety Management Systems. The following specific measures were taken to reduce environmental impact:

- Restriction of vehicles to use of existing roads & tracks wherever possible
- Restriction of vehicle speed to minimise dust & noise generation
- Avoidance of vehicle entry to waterways or drainage systems
- No clearing of land or vegetation
- No domestic animals to be brought on site
- Use of an established off-site camp
- Wash down vehicles and boots where necessary

In accordance with Section 6 of the SEO, a field inspection and assessment of achievement of the Environmental Objectives was carried out after completion of the operations, using the methodologies and criteria recommended in the SEO. Full details of the Environmental Audit are contained Appendix 3.

2.5 Health and Safety

Safety received a high priority from Petratherm and Quantec during the survey. An induction was held prior to the start of field operations. No Lost Time Injuries were reported on this project.

2.6 Recording Operations

Quantec Geoscience Australia was selected to acquire the MT data during this survey. Recording operations began on 1th December 2007 and were complete on 5th December 2007, full details are contained in Appendices 1 and 2. The acquisition parameters are listed in Table 2, and were selected based on prior practices in the Paralana region. On-site data processing ensured optimal parameters were being used. Figure 3 illustrates the magnetotelluric station layout.

Table 2 Acquisition parameters.

Survey Specifications	
Technique	Tensor soundings, remote-referenced
Station Configuration	"L" shaped E-field array Ex-East (090deg) Ey-North (0deg) 3 Low frequency coils, Hx, Hy, Hz
Remote Configuration	"L" shaped E-field array Ex-East (090deg) Ey-North (0deg) 3 Low frequency coils, Hx, Hy, Hz
Remote Reference Measurements	1 Hx/Hy set 1 Ex/Ey set (for verification/monitoring)
Dipole Length	100 metres
Data Acquisition	Full-waveform time-series acquisition

	Data processing/output in frequency-domain
Instrumentation	
Receiver System	Quantec RT-130 Data Logger
No. Channels	5 operational channels with internal A/D conversion (24bit@120db, and 6Mb buffer memory).
No. of recording units	8 data loggers deployed simultaneously of sites and remote reference.
Synchronization	8 GPS clocks (one for each data logger) with 10nsec precision/12.3 MHz clock-speed)
Receiver Coils	31 Phoenix model P50, and 9 EMI model BF4 and BF7 (10000sec to 1000Hz) Magnetometers, 3 at each site (Hx, Hy and Hz)
Receiver Electrodes	Ground contacts using steel plates
Survey Parameters	
Frequency Bandwidth	Operating: 0.001 to 1000Hz Effective: 0.001 to 400Hz
Time-Series Sampling	High Range: 1000 samples/sec Low Range: 20 samples/sec
Remote-Base Synchronization	GPS clocks
Time-Series Stacking	High Range: ~6912000 samples Low Range: ~3000000 samples
Sample/Recording Time	High Range: 4 to 6 sub-events @ 4 hrs, and 1 to 2 sub-events @ 15hrs per event (total recording and retrieving time approximately 14 to 22hours).

Strong winds were noted throughout the survey however this did not have an adverse effect on the data, no standby time was recorded due to weather conditions.

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. The repeat stations are detailed in table 1.

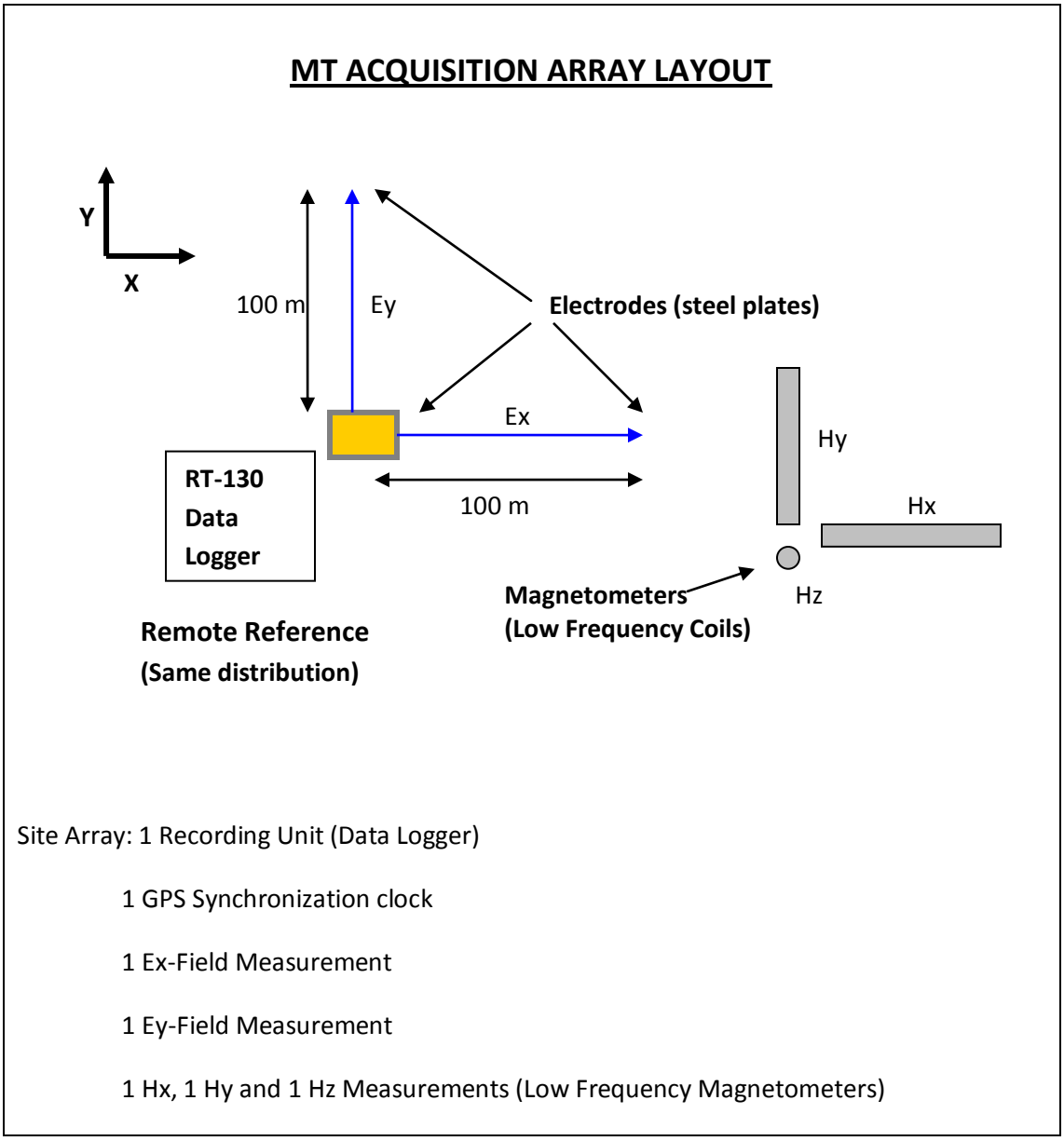

Figure 3 Magnetotelluric station layout used during the 2007 Callabonna survey.

The Quantec crew were accommodated on site in a motor home in the location as indicated in figure 2. The crew consisted of four personnel as detailed below in table 3.

Table 3 Quantec Field Crew.

Name	Position
Susanna Scappin	Data Processing
Yatha Hoffman	Field Operator
Dorian Cooper	Field Operator
Clinton Efford	Field Technican

2.7 Rehabilitation

When recording was complete at each station the disturbed soil was distributed to avoid the creation of piles. The site was also cleared of any rubbish.

3 Data Processing and Modeling

3.1 Processing Sequence

Full-waveform time-series data is collected in the field, processed and output in frequency-domain. Processing of the observed data was carried out in the field by Quantec Geoscience Australia, to ensure good quality soundings were recorded, where this was not the case the station was repeated. Prior to modeling the MT data, each MT sounding is processed to remove outliers and noisy readings. The data is then static corrected to remove any DC shifts as a result of sources close to the surface.

Finally the data is split into its individual scalar components, that is ExHy and EyHx and displayed as sounding curves. The data processing sequence is summarized below in table 4. Full details of station processing are contained in Appendix 4, Processing Notes.

Table 4MT Processing Sequence

Processing Sequence	
Post-Processing	Using QGI QuickLay Version 3.0_Alpha.23 1. Coherent noise rejection using remote-reference 2. Proprietary digital filtering (scrubbing) 3. Coherency sorting 4. Impedance estimate stacking
Final Data Processing	Edited and un-edited phase and resistivity sounding curves (0.001-300Hz @ 8pts. per decade) using Geotools.
Final Data Output	1. Auto and cross-power spectral estimates 2. Unrotated (XY and YX) Tensor impendances and errors (apparent resistivities and E/H phase – Tipper Transfer Functions (XrXi and YrYi)

4 Conclusions and Recommendations

The 2007 Callabonna Magnetotelluric Survey was a technical and operational success. The data acquired was of an excellent standard and enabled Petratherm to further evaluate the geothermal potential of tenement GEL 157. The acquisition methodology applied resulted in minimal environmental impact with little survey evidence visible during the Environmental Audit. No areas of cultural significance were documented prior to the survey and none were identified during the survey.

All contract personnel utilized during the survey performed well and would be recommended for future projects.

Appendix 1
Weekly Progress Report
Petratherm

Appendix 2
Contractor's Logistics Report
Quantec Geoscience Australia

Appendix 3
Environmental Audit
Petratherm

Appendix 4
Processing Notes
Quantec Geoscience Australia

PETRATHERM LTD – CALLABONNA PROJECT (GEL157)
WEEKLY GEOPHYSICAL SURVEY PROGRESS REPORT

TENEMENT ID: GEL 157 **Date: 07/12/2007**

Survey starting coord: 389200E,6724900 N (GDA94,Z54)

Bearing of Survey line: 101° True

Contractor: Quantec Geoscience **Reported by: L.McAllister**

Survey Commencement Date: 01/12/07

Days from Commencement: Day 5 **Distance Achieved: 5km**

This document reports on field activities associated with the acquisition of Magneto-telluric data conducted over Petratherm's Callabonna tenement (GEL 157). The tenement lies within the Mount Hopeless Pastoral Lease which is held by Broschil Pty Ltd.

A four man crew from Quantec Geoscience performed the survey over 5 days commencing on 01/12/07 until 05/12/07. The crew were camped close to the survey line as advised by the on-site manager.

The start point of the survey was 389200E, 6724900N (GDA94) and the orientation of the line was 000°T. A total of 5km of data were acquired with an average of 6 stations acquired per day, each station having a spacing of 500m, giving a total of 11 stations.

A single site setup consisted of an L shaped E field array, with 100m dipoles and Hx, Hy and Hz Low frequency coils, remote referenced. Data was collected at an effective bandwidth of 0.005 to 300 Hz.

With respect to processing, the data has yet to be modelled and only basic resistivity-frequency pseudosections have been generated as an internal interrogation of the data quality.

No Reportable incidents occurred.

Daily Schedule

Day of survey	Date	Description of Activities
1	01/12/07	Crew mobilised to Callabonna and remote reference station set-up.
2	02/12/07	Stations 01-06 set-up.
3	03/12/07	Stations 01-06 re-read due to faulty acquisition parameters.
4	04/12/07	Stations 01-06 completed and sites 07-11 set-up plus two repeat stations.
5	05/12/07	Remaining sites complete and camp demobilised.

Quantec Geoscience Pty Ltd.
128 Waterworks Road,
Ashgrove, QLD, 4060
Phone (07) 3366 8022
Fax (07) 3366 8030

Geophysical Survey Logistics Report

Regarding the Quantec SPARTAN TENSOR MAGNETOTELLURIC SURVEY over the PARALANA-CALLABONNA-FERGUSON HILL HOT ROCK PROJECT, South Australia, AUSTRALIA, on behalf of PETRATHERM LTD, Adelaide, SA, Australia.

S. Scappin,
B. Tournerie
T. Retallick
January, 2008
Project AU00034L

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1. INTRODUCTION

- **QGI Project No:** AU00034L
- **Project Name:** **PARALANA-CALLABONNA-FERGUSON HILL HOT ROCK MT**
- **Survey Areas:** Paralana
  Callabonna
  Ferguson Hill
- **Survey Period:** November 4th to December 8th, 2007
- **Survey Type**: Tensor Magnetotelluric (MT) Surveys
- **Client:** PETRATHERM LTD
- **Client Address** 105-106 Greenhill Road
  Unley - SA
  5061 - Australia
  Telephone: +61 (0)8 8274 5000
- **Representatives:** Mrs. Louise McAllister
  Mrs. Bettina Bendall
- **Objectives:** Map the structure and depth of the basement and attempt to map the presence of circulating fluids along the Paralana Fault.
- **Report Type:** Survey logistics, describing the survey parameters and methodology, as well as presenting the survey results in digital/map forms.

2. GENERAL SURVEY DETAILS

2.1 LOCATION

- **General Location:** The Paralana-Callabonna-Ferguson Hill MT project covers 3 different areas.
  - Paralana Grid: is located 35Km NE of Arkaroola Village, 150Km E of Leigh Creek (see Figure 1).
  - Callabonna Grid: is located 70Km NE of Arkaroola village, 200Km ENE of Leigh Creek (see Figure 1)
  - Ferguson Hill Grid: is located approx. 90Km N of Roxby Downs (see Figure 1).
- **State:** South Australia
- **Nearest Settlements:** Roxby Downs, Leigh Creek, Arkaroola
- **Nearest Highway:** Flinders Highway
- **Datum & Projection** WGS 84; UTM Zone 53J (Ferguson Hill Grid) and 54J
- **Latitude/Longitude:**

Paralana	approx. S30˚13'00" E139˚35'21"
Callabonna	approx. S29˚37'24" E139˚51'20"
Ferguson Hill	approx. S29˚49'26" E136˚42'04"

- **UTM position[1]:**

Paralana	approx. 364216E, 6656372N (Figure 2)
Callabonna	approx. 389200E, 6722400N (Figure 3)
Ferguson Hill	approx. 664377E, 6699523N (Figure 4)

[1] UTM coordinates (WGS 84) positioning (GPS) supplied by Petratherm Ltd (November-December, 2007).

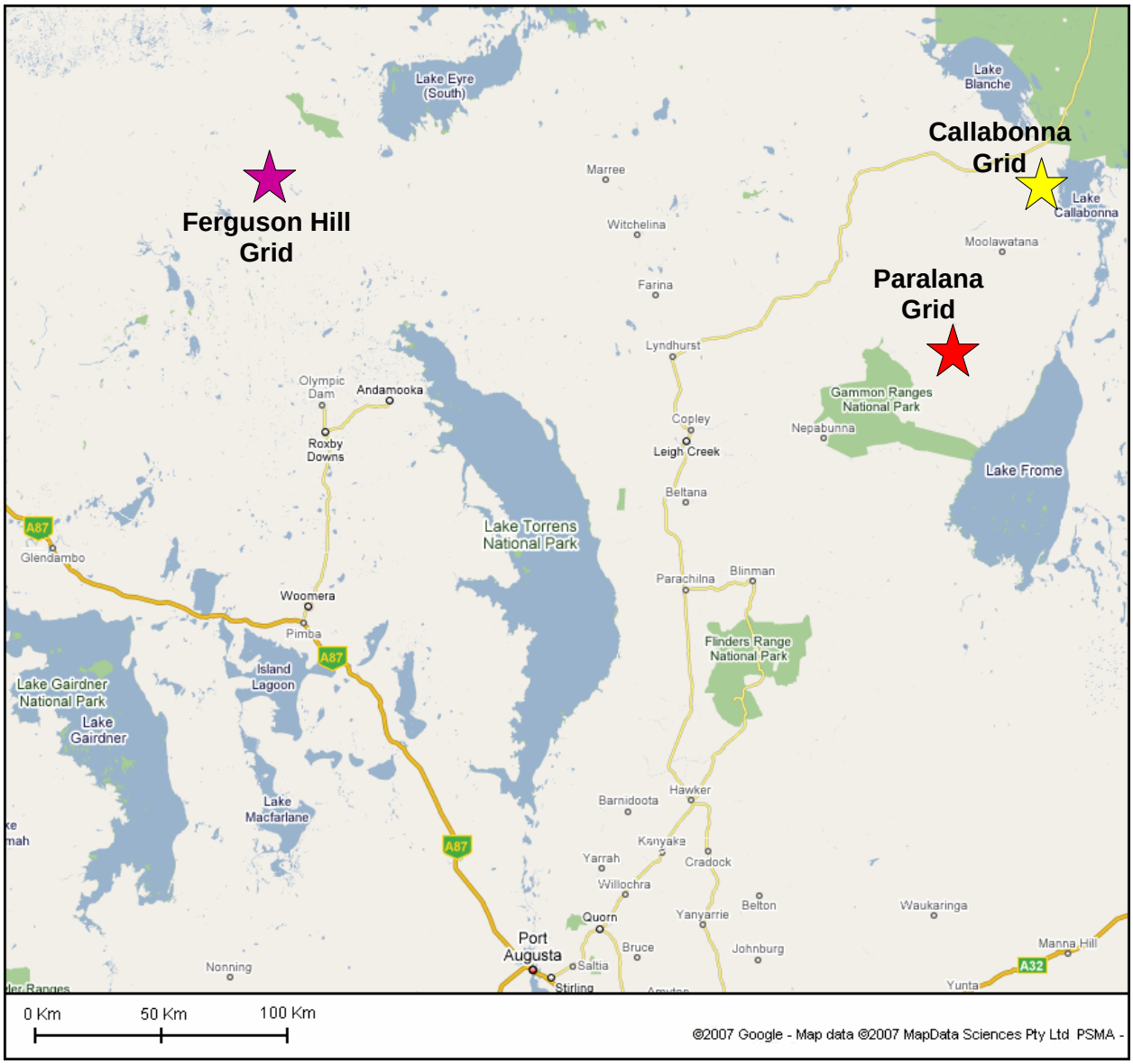

Figure 1: Paralana-Callabonna-Ferguson Hill Hot Rock MT Project: General Location Map (from Google Map website)

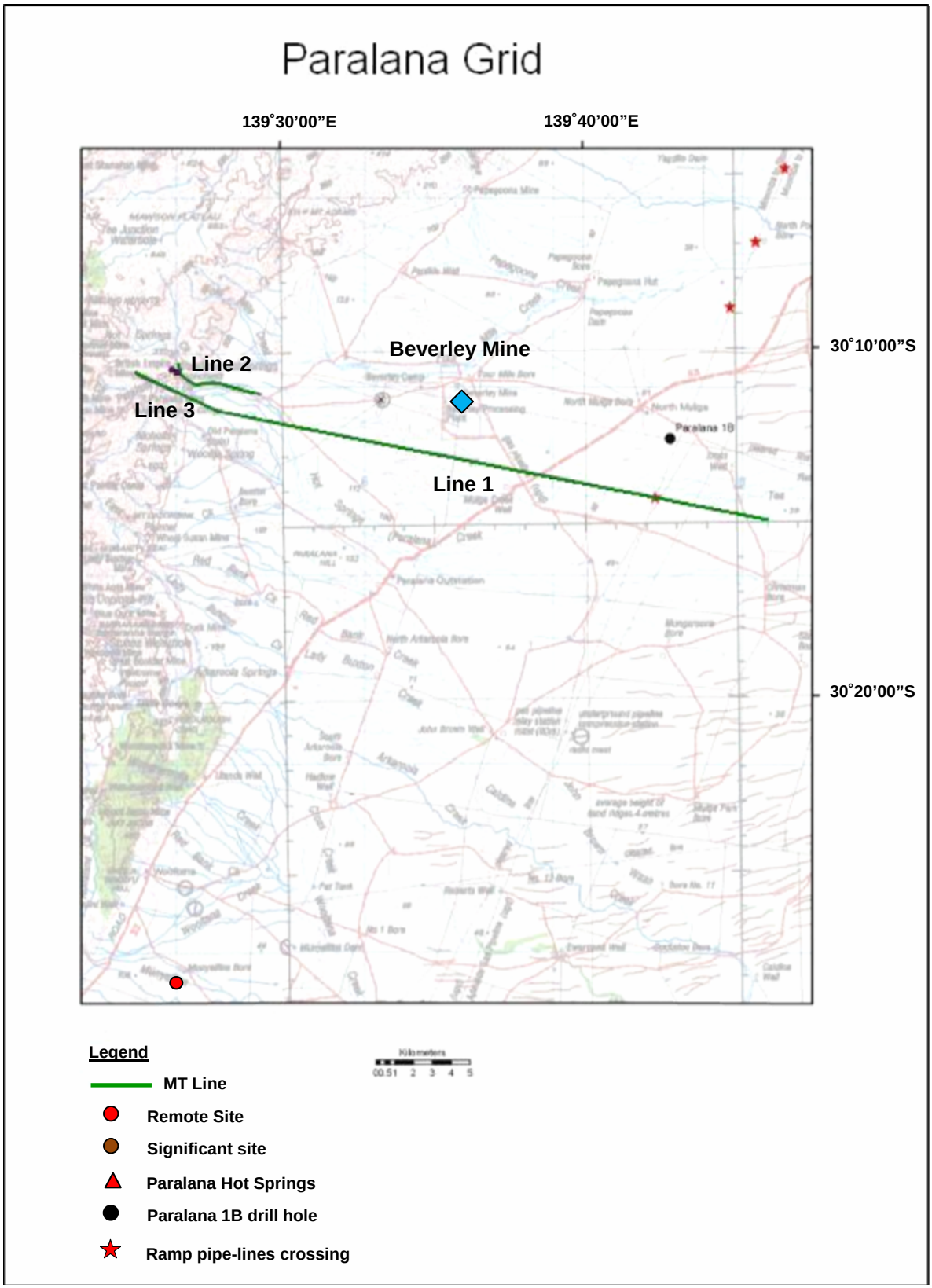

Figure 2: Paralana Grid General Location Map.

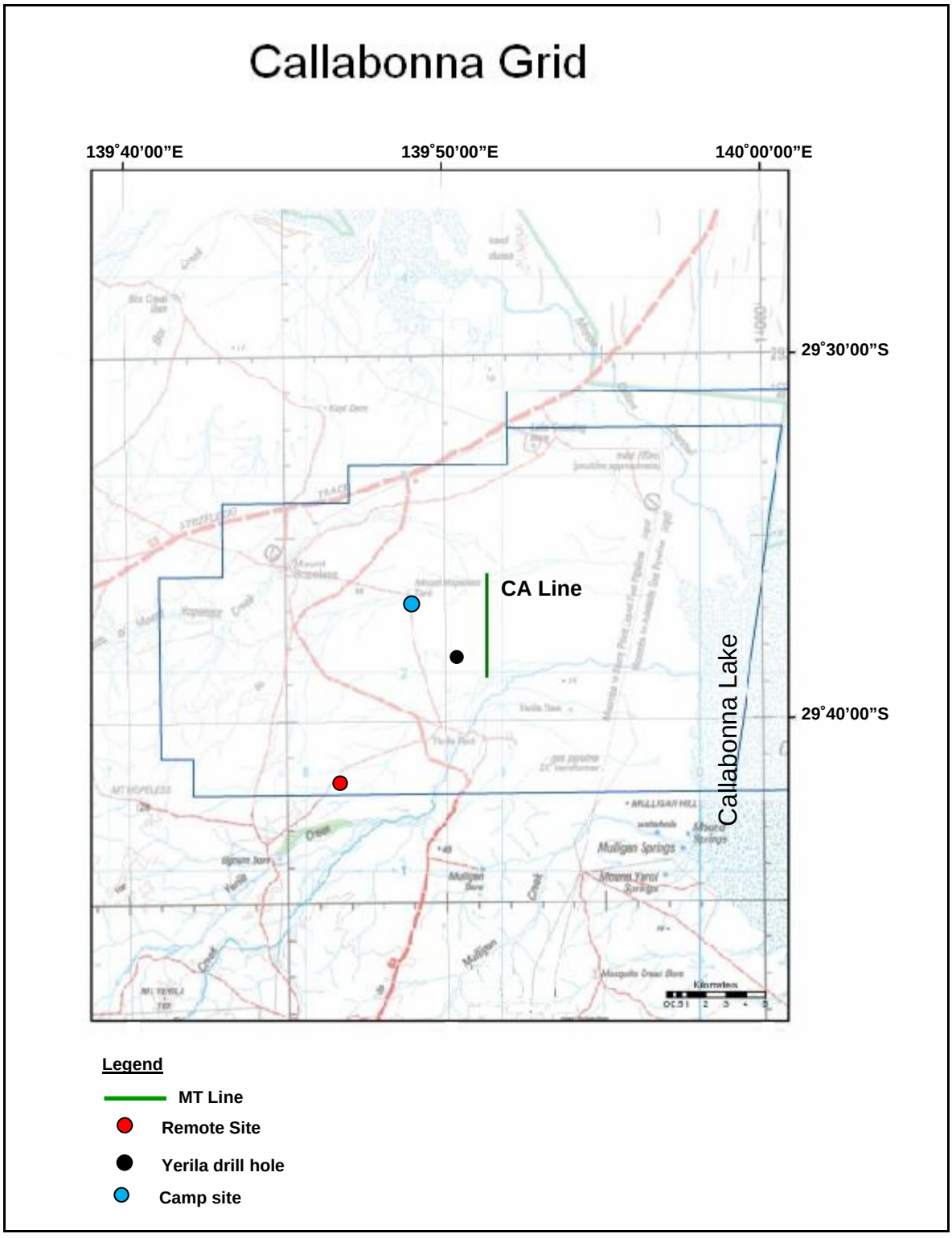

Figure 3: Callabonna Grid General Location Map.

Ferguson Hill Grid

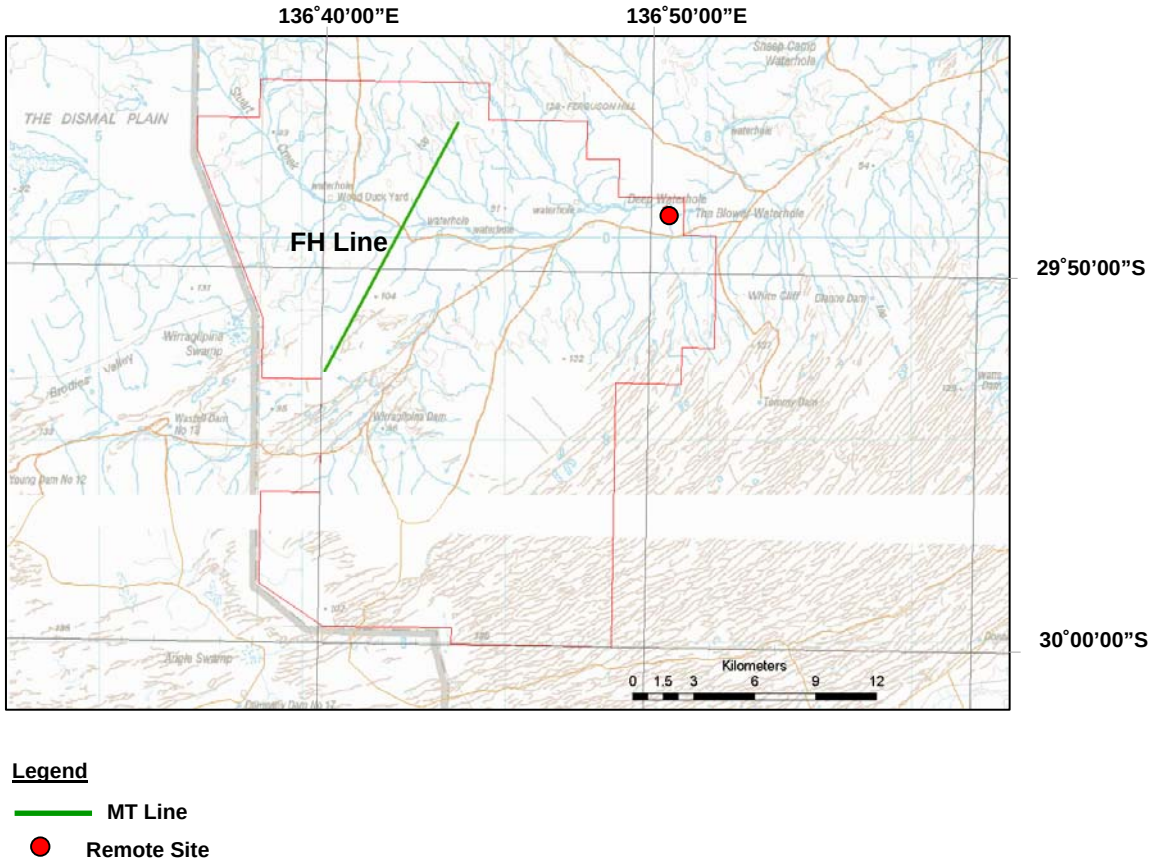

Figure 4: Ferguson Hill General Location Map.

2.2 ACCESS

- **Base of Operations:** Wooltana Home Stead (Paralana Grid)
  Motor home Mitsubishi Canter (Callabonna Grid)
  Stuart Creek Home Stead (Ferguson Hill Grid)
- **Mode of Access to Sites:** Trucks and foot.

2.3 SURVEY GRID

- **Previously established by:** Petratherm Ltd (see Table I).
- **Coordinate Reference System:** Survey Grid Coordinates referenced to UTM Coordinates (see Tables II to IV).
- **Site Direction:** Paralana Grid**:**
  X-orientation at 101deg (east), Y at 11deg (north).
  Callabonna Grid:
  X-orientation at 0deg (north), Y at 270 deg (west)
  Ferguson Hill Grid:
  X-orientation at 29deg (north), Y at 299 deg (west)
- **Site Separation:** 500m
- **Site Location:** GPS surveyed

Grid	Line	Start		End	
		Easting	Northing	Easting	Northing
(WGS 84 – UTM Zone 54J)					
Paralana	PA01	352363	6658674	381519	6652971
	PA02	350056	6661200	354407	6659601
	PA03	347841	6660678	351911	6658874
Callabonna	CA01	389200	6719900	389200	6724900
(WGS 84 – UTM Zone 53J)					
Ferguson Hill	FH01	661085	6693373	667665	6705662

Table I: Proposed MT Lines Location.

3. SURVEY WORK UNDERTAKEN

3.1 GENERALITIES

- **Survey Dates:** 4th November to 8th December, 2007
- **Survey Period:** 34 days
- **Survey Days (read time):** 23 days
- **Preparation day:** 3 days
- **Number of Lines Surveyed:** 5 (see Tables II to VI)
- **Number of Sites Surveyed:** 124 (see Tables II to VI)

3.2 PERSONNEL

- **Project Manager:** Trent Retallick – QG Australia
- **Geophysicists/Interpreters:** Benoît Tournerie – QGL (Toronto, ON)
- **Data Processing (office):** Susanna Scappin – QG Australia
  Joel Stockill (training)
- **Field Operators:** Yatha Hoffman
  Dorian Cooper
- **Field Technicians:** Clinton Efford
  Ashley Smith

3.3 SURVEY SPECIFICATIONS

- **Technique:** Tensor soundings, remote-referenced
- **Station Configuration:** "L" shaped E-field array[2] (Figure 5)
  Ex – East (090deg)
  Ey – North (0deg)
  3 Low Frequencies coils Hx, Hy, Hz
- **Remote Configuration:** "L" shaped E-field array (Figure 5)
  Ex – East (090deg),
  Ey – North (0deg)
  3 Low Frequencies coils Hx, Hy, Hz
- **Remote Reference Measurements**
  1 Hx/Hy set
  1 Ex/Ey set (for verification/monitoring)
- **Dipole Length:** 100 metres
- **Remote Reference Position:** Paralana Grid:
  348532E, 6631011N, elev. 95m (Figure 2)
  Callabonna Grid:
  382442E, 6715115N, elev. 27m (Figure 3)
  Ferguson Hill Grid:
  677955E, 6701341N, elev. 52m (Figure 4)
- **Data Acquisition:** Full-waveform time-series acquisition
  Data processing/output in frequency-domain

[2] See § 2.3 for exact orientation of X and Y on each grid.

- **Frequency bandwidth:** 0.001 Hz to 300 Hz

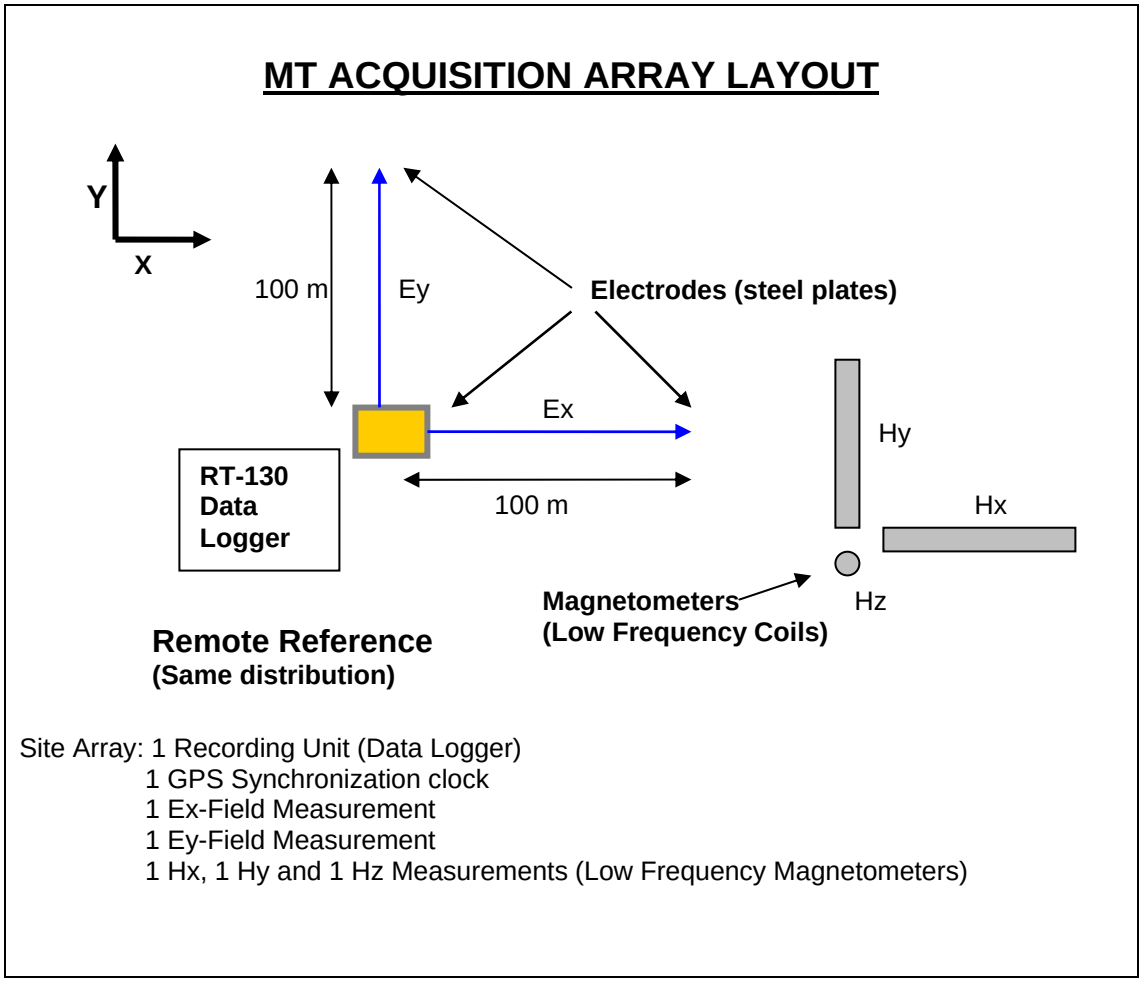

Figure 5: Magnetotelluric Station Survey Layout.

3.4 SURVEY COVERAGE

3.4.1 Paralana Grid

Line 1					
Site	**East UTM**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
	(WGS 84 – UTM Zone 54J)				
PA101	352372	6658663	174	30°11'40.37"S	139°27'59.17"E
PA102	352869	6658564	170	30°11'43.81"S	139°28'17.71"E
PA103	353335	6658484	164	30°11'46.61"S	139°28'35.09"E
PA104	353847	6658387	159	30°11'49.98"S	139°28'54.18"E
PA105	354342	6658296	143	30°11'53.15"S	139°29'12.64"E
PA106	354814	6658211	138	30°11'56.11"S	139°29'30.25"E
PA107	355358	6658093	137	30°12'00.18"S	139°29'50.53"E
PA108	355899	6658045	143	30°12'01.97"S	139°30'10.73"E
PA109	356317	6657900	138	30°12'06.86"S	139°30'26.29"E
PA110	356819	6657798	131	30°12'13.09"S	139°30'45.00"E
PA111	357300	6657721	129	30°12'16.93"S	139°31'02.95"E
PA112	357787	6657609	124	30°12'20.23"S	139°31'21.11"E
PA113	358288	6657514	122	30°12'23.09"S	139°31'39.80"E
PA114	358781	6657432	114	30°12'26.87"S	139°31'58.19"E
PA115	359267	6657322	116	30°12'30.01"S	139°32'16.31"E
PA116	359779	6657232	112	30°12'33.36"S	139°32'35.41"E
PA117	360276	6657135	109	30°12'36.65"S	139°32'53.95"E
PA118	360768	6657040	90	30°12'40.13"S	139°33'12.30"E
PA119	361263	6656939	88	30°12'43.63"S	139°33'30.76"E
PA120	361769	6656838	81	30°12'46.45"S	139°33'49.64"E
PA121	362256	6656757	77	30°12'49.81"S	139°34'07.81"E
PA122	362754	6656660	75	30°12'54.29"S	139°34'26.39"E
PA123	363234	6656528	72	30°12'56.47"S	139°34'44.27"E
PA124	363723	6656467	68	30°12'59.76"S	139°35'02.53"E
PA125	364216	6656372	67	30°13'04.20"S	139°35'20.94"E
PA126	364815	6656242	63	30°13'04.50"S	139°35'43.26"E
PA127	365222	6656238	62	30°13'10.74"S	139°35'58.50"E
PA128	365704	6656052	60	30°13'13.37"S	139°36'16.42"E
PA129	366192	6655977	58	30°13'16.26"S	139°36'34.64"E
PA130	366679	6655894	58	30°13'20.81"S	139°36'52.81"E
PA131[3]	367198	6655760	54	30°13'22.91"S	139°37'12.16"E
PA132	367482	6655699	53	30°13'29.90"S	139°37'22.76"E
PA133	368488	6655496	49	30°13'30.20"S	139°38'00.29"E
PA134	368674	6655489	51	30°13'33.73"S	139°38'07.24"E
PA135	369157	6655386	50	30°12'13.09"S	139°38'25.26"E
				TOTAL	**35 Sites**

Table II: MT Site Coverage for Line 1.

[3] Site PA131, PA132 and PA147 were moved from original position because of proximity of pipe-lines.

Line 1					
Site	**East UTM**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
	(WGS 84 – UTM Zone 54J)				
PA136	369654	6655292	45	30°13'36.97"S	139°38'43.81"E
PA137	370146	6655202	44	30°13'40.09"S	139°39'02.17"E
PA138	370636	6655095	43	30°13'43.75"S	139°39'20.45"E
PA139	371128	6655011	45	30°13'46.67"S	139°39'38.81"E
PA140	371633	6654889	42	30°13'50.82"S	139°39'57.65"E
PA141	372137	6654801	43	30°13'53.87"S	139°40'16.46"E
PA142	372629	6654686	41	30°13'57.79"S	139°40'34.81"E
PA143	373124	6654611	39	30°14'00.41"S	139°40'53.29"E
PA144	373622	6654556	41	30°14'02.39"S	139°41'11.90"E
PA145	374099	6654448	39	30°14'06.08"S	139°41'29.69"E
PA146	374593	6654316	38	30°14'10.55"S	139°41'48.11"E
PA147[3]	374969	6654298	37	30°14'11.27"S	139°42'02.17"E
PA148[4]					
PA149	376079	6654033	32	30°14'20.29"S	139°42'43.58"E
PA150	376559	6653935	33	30°14'23.65"S	139°43'01.49"E
PA151	377067	6653849	31	30°14'26.63"S	139°43'20.46"E
PA152	377567	6653747	29	30°14'30.12"S	139°43'39.12"E
PA153	378053	6653642	31	30°14'33.71"S	139°43'57.26"E
PA154	378551	6653547	31	30°14'36.97"S	139°44'15.85"E
PA155	379065	6653466	29	30°14'39.79"S	139°44'35.04"E
PA156	379549	6653361	28	30°14'43.37"S	139°44'53.10"E
PA157	380025	6653259	27	30°14'46.85"S	139°45'10.87"E
PA158	380525	6653146	25	30°14'50.71"S	139°45'29.53"E
PA159	381018	6653059	25	30°14'53.71"S	139°45'47.93"E
PA160	381509	6652950	26	30°14'57.41"S	139°46'06.26"E
				TOTAL	**59 Sites[2]**

Table II (continued): MT Site Coverage for Line 1.

[4] Site PA148 was not acquired because located too close to pipe-lines.

Line 2					
Site	**East UTM**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
	(WGS 84 – UTM Zone 54K)				
PA201	349992	6661200	197	30°10'16.92"S	139°26'31.50"E
PA202	350135	6660631	191	30°10'35.46"S	139°26'36.54"E
PA203	350546	6660395	207	30°10'43.32"S	139°26'51.78"E
PA204	350881	6660080	180	30°10'53.70"S	139°27'04.14"E
PA205	351426	6660202	172	30°10'49.98"S	139°27'24.60"E
PA206	351943	6660246	170	30°10'48.78"S	139°27'43.92"E
PA207	352459	6660131	161	30°10'52.74"S	139°28'03.18"E
PA208	352921	6660030	159	30°10'56.22"S	139°28'20.40"E
PA209	353427	6659906	156	30°11'00.48"S	139°28'39.24"E
PA210	353921	6659726	149	30°11'06.54"S	139°28'57.60"E
PA211	354410	6659595	146	30°11'10.98"S	139°29'15.84"E
PA212[5]	350100	6660923	208	30°10'25.98"S	139°26'35.40"E
PA213	350348	6660533	211	30°10'38.76"S	139°26'44.46"E
PA214[5]	351681	6660207	167	30°10'49.92"S	139°27'34.14"E
PA215[5]	352205	6660198	164	30°10'50.46"S	139°27'53.70"E
				TOTAL	**15 Sites**

Table III: MT Site Coverage for Line 2.

Line 3					
Site	**East UTM**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
	(WGS 84 – UTM Zone 54K)				
PA303	350546	6660395	199	30°10'46.49"S	139°25'44.71"E
PA304	350881	6660080	189	30°10'52.37"S	139°26'01.51"E
PA305	349652	6659880	185	30°10'59.65"S	139°26'18.11"E
PA306	350081	6659648	180	30°11'07.38"S	139°26'34.03"E
PA307	350535	6659384	204	30°11'16.15"S	139°26'50.86"E
PA308	351022	6659258	200	30°11'20.46"S	139°27'09.01"E
PA309	351483	6659085	193	30°11'26.28"S	139°27'26.15"E
PA310	351923	6658877	183	30°11'33.23"S	139°27'42.50"E
PA311[5]	348969	6660198	191	30°10'49.02"S	139°25'52.74"E
PA312[5]	350309	6659603	177	30°11'08.94"S	139°26'42.54"E
				TOTAL	**10 Sites**

Table IV: MT Site Coverage for Line 3.

[5] Infill sites

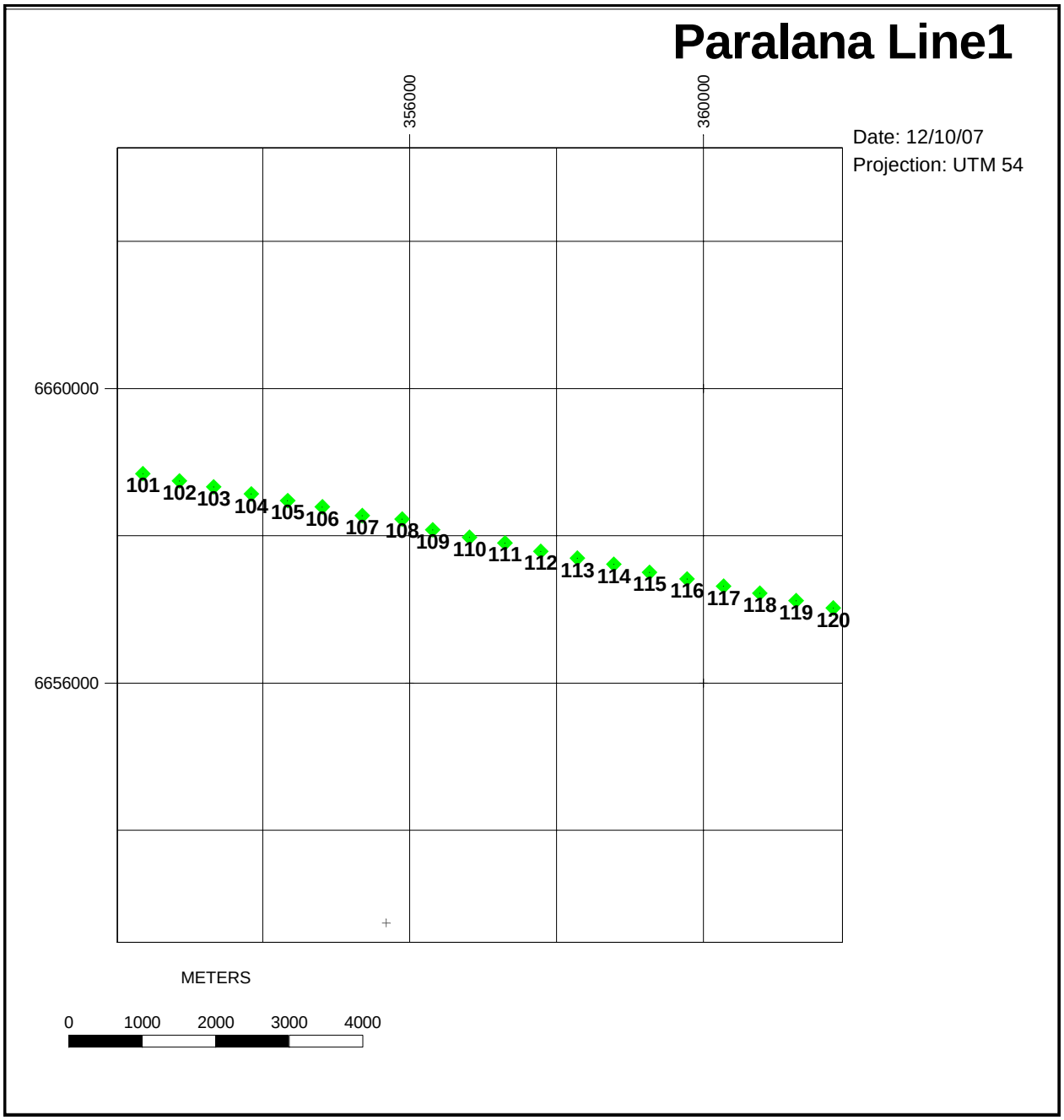

Figure 6: MT Site Location for Line 1 (Paralana Grid); Sites 101 to 120.

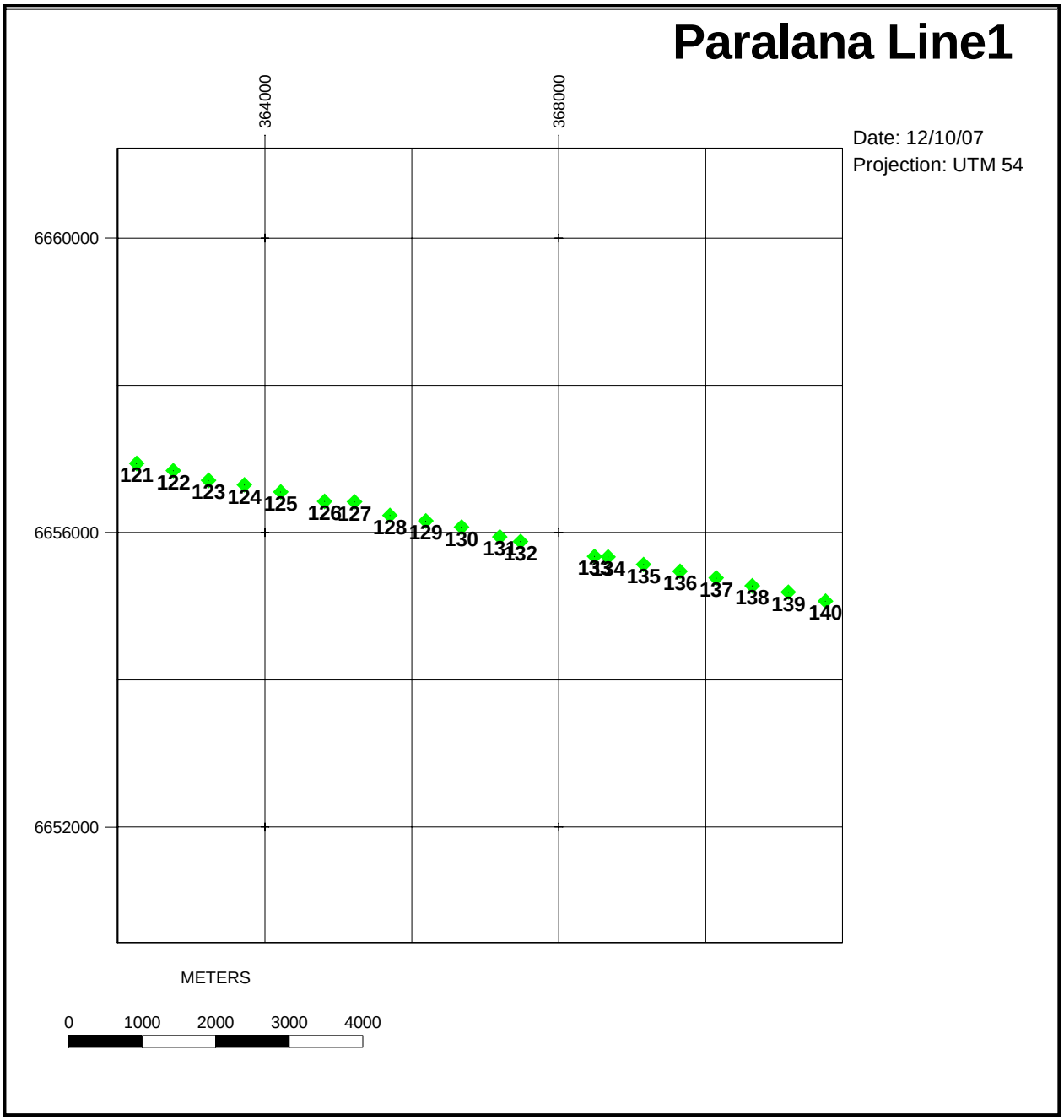

Figure 7: MT Site Location for Line 1 (Paralana Grid); Sites 121 to 140.

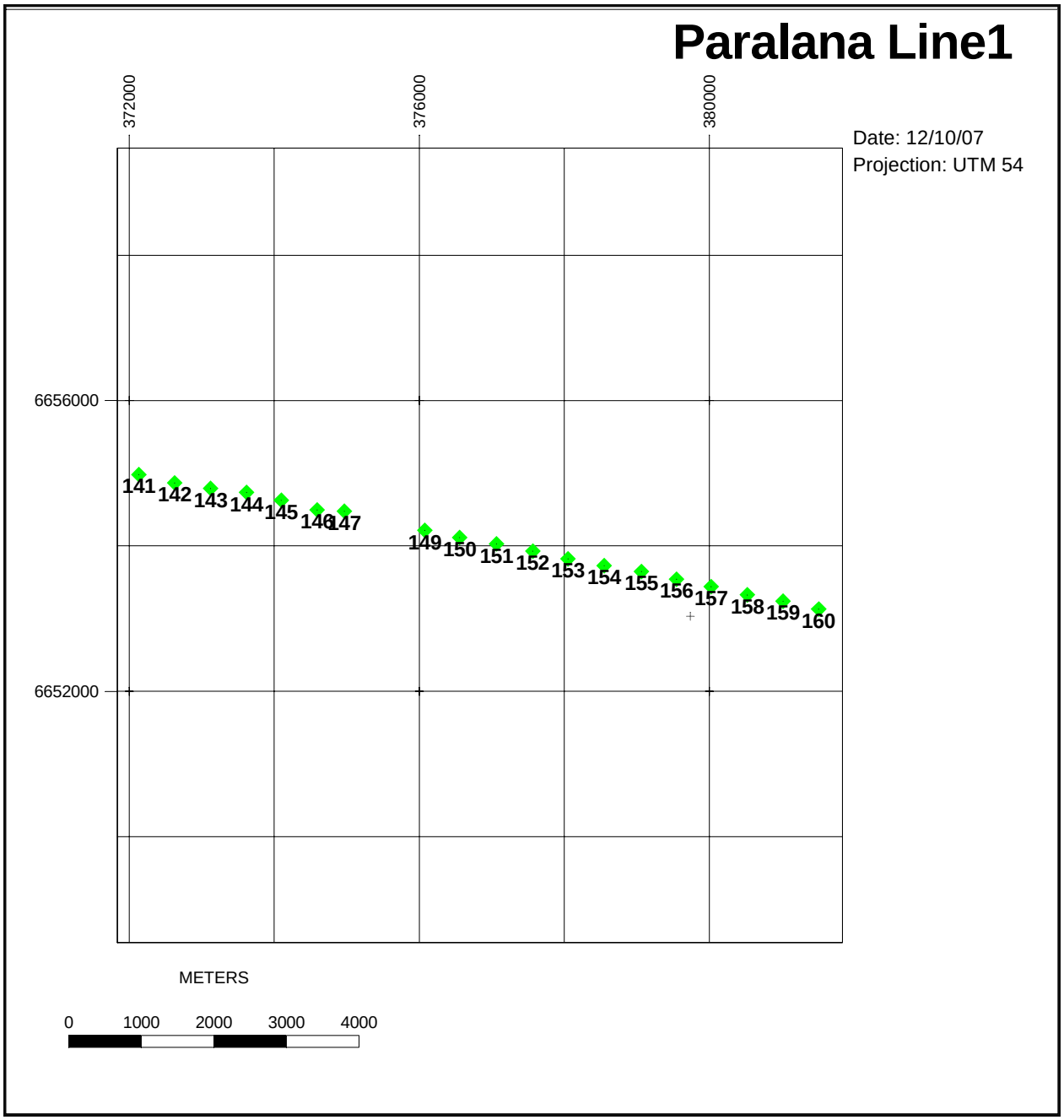

Figure 8: MT Site Location for Line 1 (Paralana Grid); Sites 141 to 160.

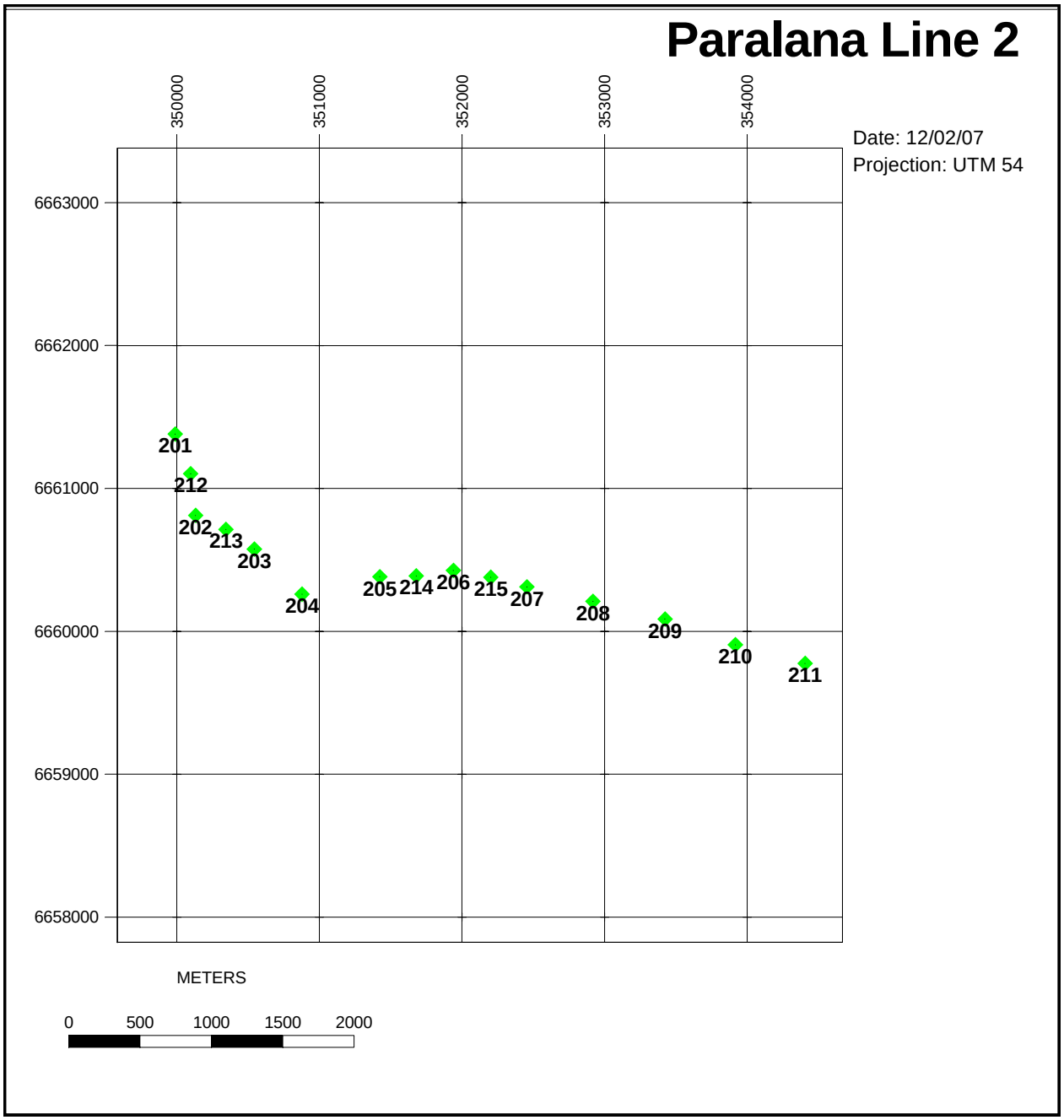

Figure 9: MT Site Location for Line 2 (Paralana Grid).

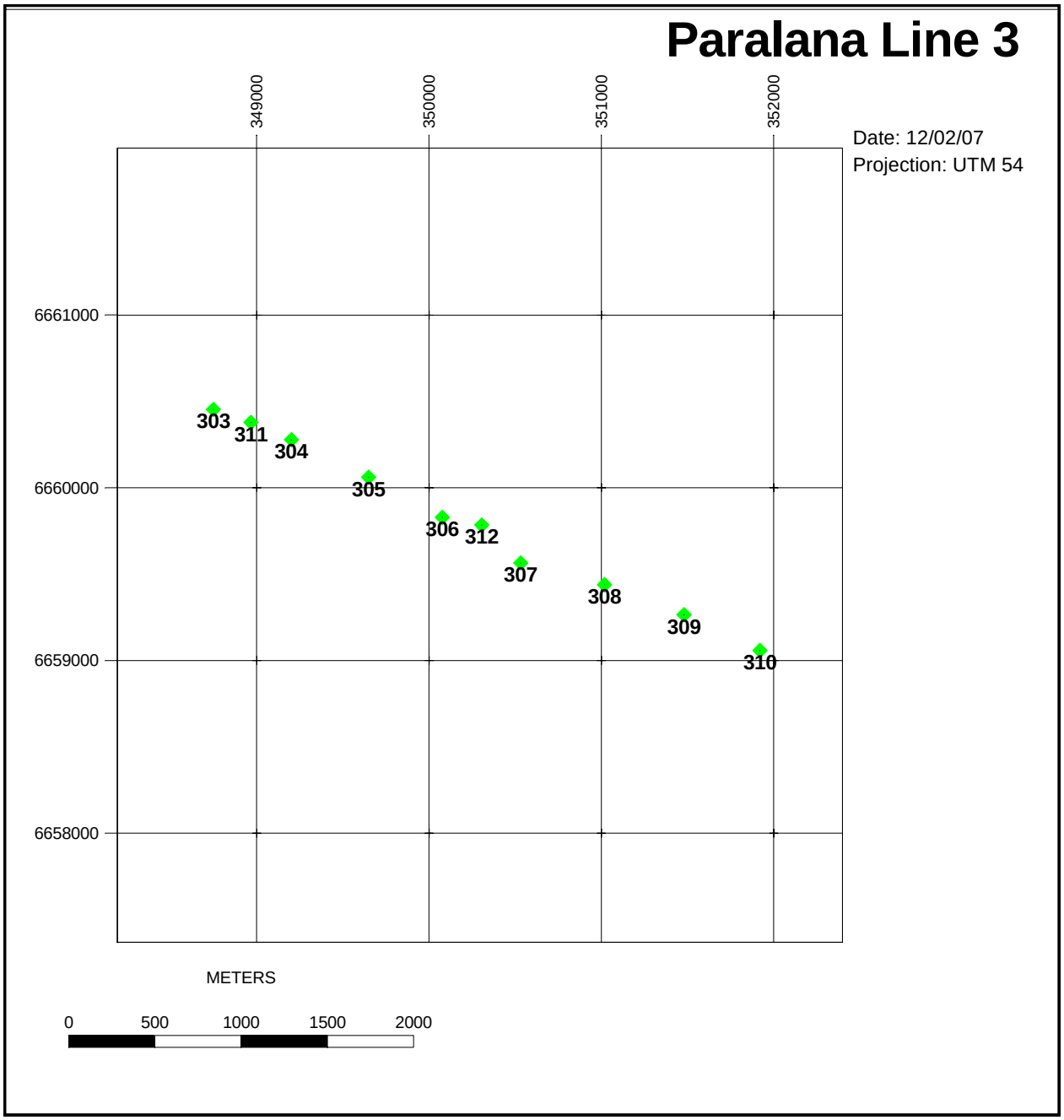

Figure 10: MT Site Location for Line 3 (Paralana Grid).

3.4.2

Callabonna Grid

Line 1					
Site	**East UTM**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
	(WGS 84 – UTM Zone 54J)				
CA01	389209	6719911	12	29°38'45.00"	139°51'19.32"
CA02	389185	6720407	13	29°38'28.86"	139°51'18.60"
CA03	389188	6720910	19	29°38'12.54"	139°51'18.90"
CA04	389189	6721410	17	29°37'56.28"	139°51'19.14"
CA05	389181	6721902	15	29°37'40.32"	139°51'19.02"
CA06	389210	6722410	11	29°37'23.82"	139°51'20.28"
CA07	389183	6722890	12	29°37'08.22"	139°51'19.44"
CA08	389187	6723416	14	29°36'51.12"	139°51'19.80"
CA09	389191	6723906	11	29°36'35.22"	139°51'20.10"
CA10	389181	6724408	9	29°36'18.90"	139°51'19.92"
CA11	389182	6724903	7	29°36'02.82"	139°51'20.16"
				TOTAL	**11 Sites**

Table V: MT Site Coverage for Callabonna Line.

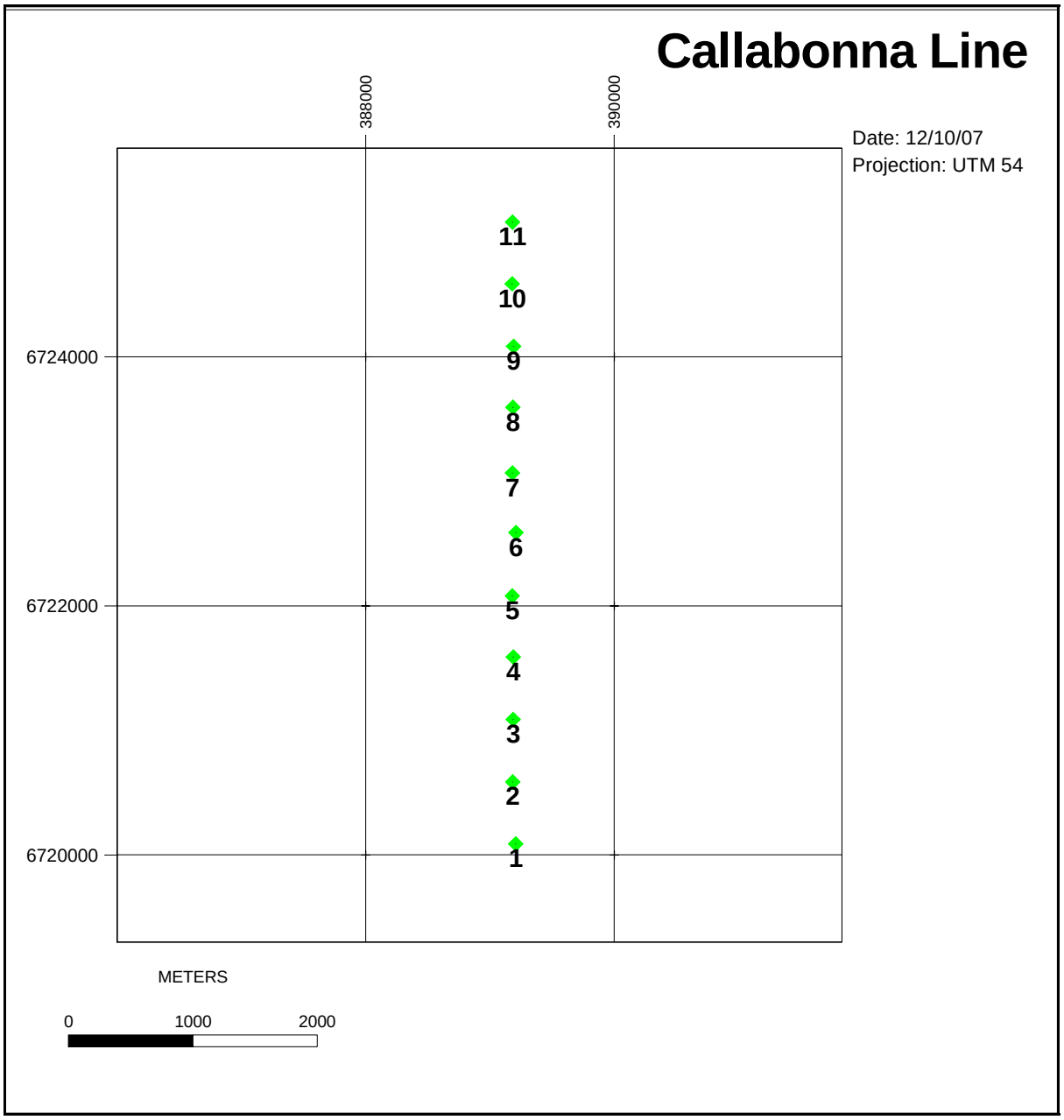

Figure 11: MT Site Location for Callabonna Line.

3.4.3

Ferguson Hill Grid

Line 1					
Site	**East UTM (WGS 84 – UTM Zone 53J)**	**North UTM**	**Elevation (m)**	**Latitude**	**Longitude**
FH01	661078	6693386	88	29°52'46.62"S	136°40'04.74"E
FH02	661322	6693829	82	29°52'32.10"S	136°40'13.56"E
FH03	661553	6694251	84	29°52'18.30"S	136°40'21.96"E
FH04	661801	6694691	83	29°52'03.90"S	136°40'30.96"E
FH05	662018	6695114	82	29°51'50.04"S	136°40'38.82"E
FH06	662245	6695558	81	29°51'35.52"S	136°40'47.04"E
FH07	662495	6696005	92	29°51'20.88"S	136°40'56.10"E
FH08	662728	6696438	86	29°51'06.72"S	136°41'04.56"E
FH09	662978	6696883	83	29°50'52.14"S	136°41'13.62"E
FH10	663204	6697331	89	29°50'37.50"S	136°41'21.78"E
FH11	663424	6697760	82	29°50'23.46"S	136°41'29.76"E
FH12	663664	6698201	82	29°50'09.00"S	136°41'38.46"E
FH13	663909	6698639	82	29°49'54.66"S	136°41'47.34"E
FH14	664133	6699081	79	29°49'40.20"S	136°41'55.44"E
FH15	664377	6699523	78	29°49'25.74"S	136°42'04.26"E
FH16	664609	6699972	75	29°49'11.04"S	136°42'12.66"E
FH17	664842	6700403	71	29°48'56.94"S	136°42'21.12"E
FH18	665098	6700835	67	29°48'42.78"S	136°42'30.42"E
FH19	665308	6701277	76	29°48'28.32"S	136°42'37.98"E
FH20	665553	6701728	78	29°48'13.56"S	136°42'46.86"E
FH21	665785	6702161	80	29°47'59.40"S	136°42'55.26"E
FH22	666006	6702607	79	29°47'44.82"S	136°43'03.24"E
FH23	666254	6703037	80	29°47'30.72"S	136°43'12.24"E
FH24	666490	6703468	79	29°47'16.62"S	136°43'20.76"E
FH25	666701	6703912	80	29°47'02.10"S	136°43'28.38"E
FH26	666963	6704333	80	29°46'48.30"S	136°43'37.92"E
FH27	667202	6704795	83	29°46'33.18"S	136°43'46.56"E
FH28	667420	6705218	84	29°46'19.32"S	136°43'54.42"E
FH29	667664	6705662	93	29°46'04.80"S	136°44'03.24"E
				TOTAL	**29 Sites**

Table VI: MT Site Coverage for Ferguson Hill Line.

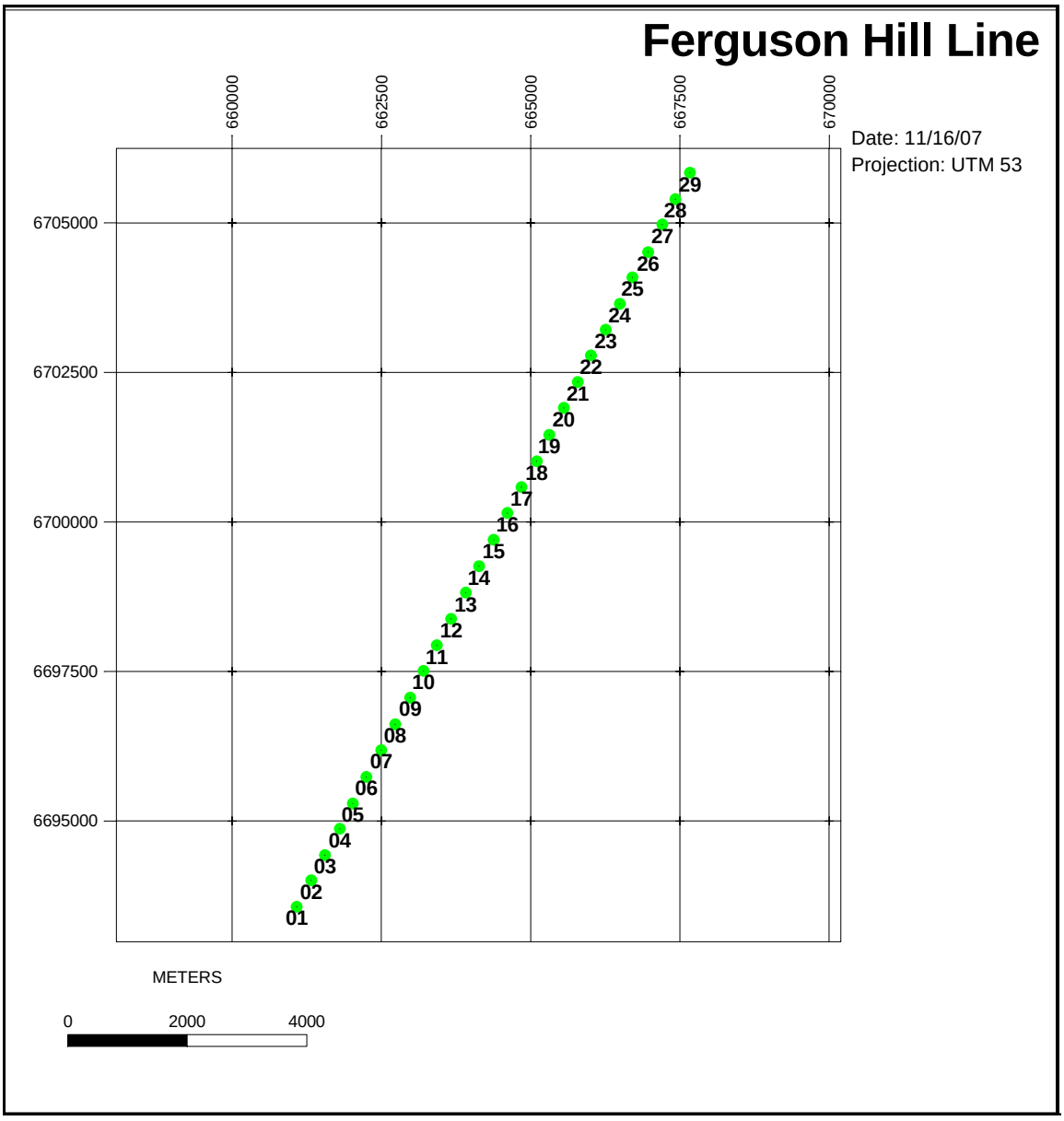

Figure 12: MT Site Location for Ferguson Hill Line

3.5 INSTRUMENTATION

- **Receiver System:** Quantec RT-130 Data Logger, comprising:
  - 6 channels max. per system (5 channels operationally) with internal A/D conversion (24bit @120db, and 6Mb buffer memory).
  - 8 Recording Units (loggers), deployed simultaneously for recording site and remote reference
  - 8 GPS synchronization clocks (10nsec precision /12.3MHz clock-speed)
- **Receiver Coils:** 31 Phoenix model P50, and 9 EMI model BF4 and BF7 (10000sec to 1000Hz) Magnetometers, 3 at each site (Hx, Hy, and Hz)
- **Receiver Electrodes** Ground contacts using steel plates

3.6 PARAMETERS

- **Frequency Bandwidth:** Operating: 0.001 to 1000 Hz
  Effective: 0.001 to 400 Hz
- **Time-series Sampling:** High Range: 1000 samples/sec
  Low range: 20 samples/sec (QuickLay resampling)
- **Remote-Base Synchronization**: GPS clocks (10μsec time-accuracy)
- **Time-Series Stacking:** High Range: ~6912000 samples
  Low Range: ~3000000 samples
- **Sample/Record Time:** High Range: 4 to 6 sub-events @ 4 hrs. and 1 to 2 sub-events @ 15 hrs. per event (total recording and retrieving time approx. 14 to 22 hours)
- **Post-Processing:** using QGI QuickLay version 3.0_Alpha.23

  1) Coherent noise rejection using remote-reference
  2) Proprietary digital filtering (scrubbing)
  3) Coherency sorting
  4) Impedance estimate stacking
- **Final Data Processing:** Edited and un-edited phase & resistivity sounding curves (0.001-300 Hz @ 8 pts. per decade) using Geotools.
- **Final Data Output:** 1) Auto and cross-power spectral estimates
  2) Unrotated (XY & YX) Tensor impedances + errors (apparent resistivities and E/H phase – Tipper Transfer Functions (XrXi & YrYi) – See Figure 13)

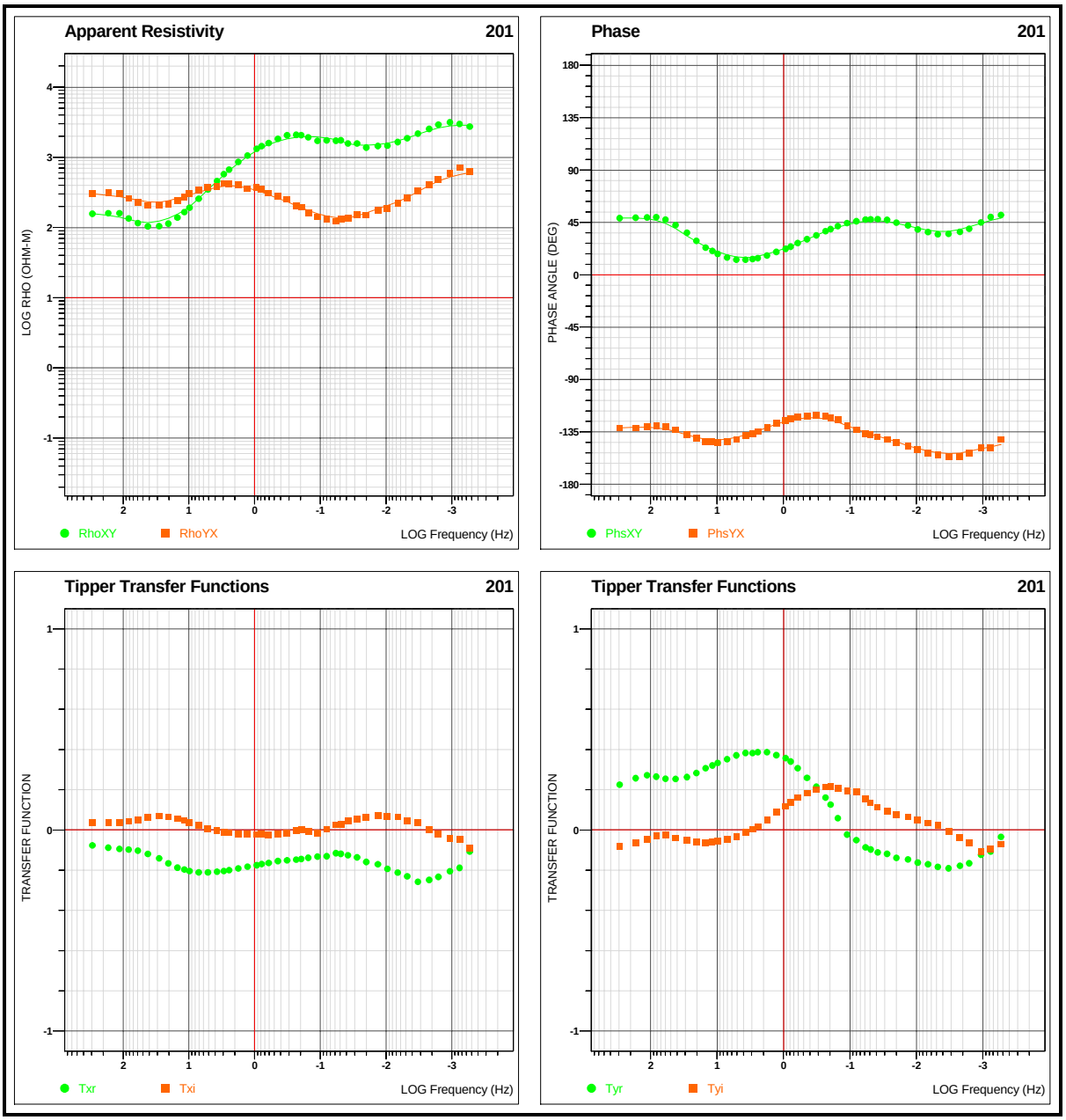

Figure 13: Example of Apparent Resistivity, Phase (XY and YX), Tipper Transfer Function (XrXi & YrYi) Sounding Curves.

3.7 DATA ACCURACY AND REPEATABILITY

- **Data Error:** Apparent Resistivity = <1/20TH decade avg.
  Phase = <3 degrees avg.
- **Parallel Sensor Test:** Low Freq-Range Test for Phoenix model P50 and EMI models BF4 and BF7 (see Figure 14)

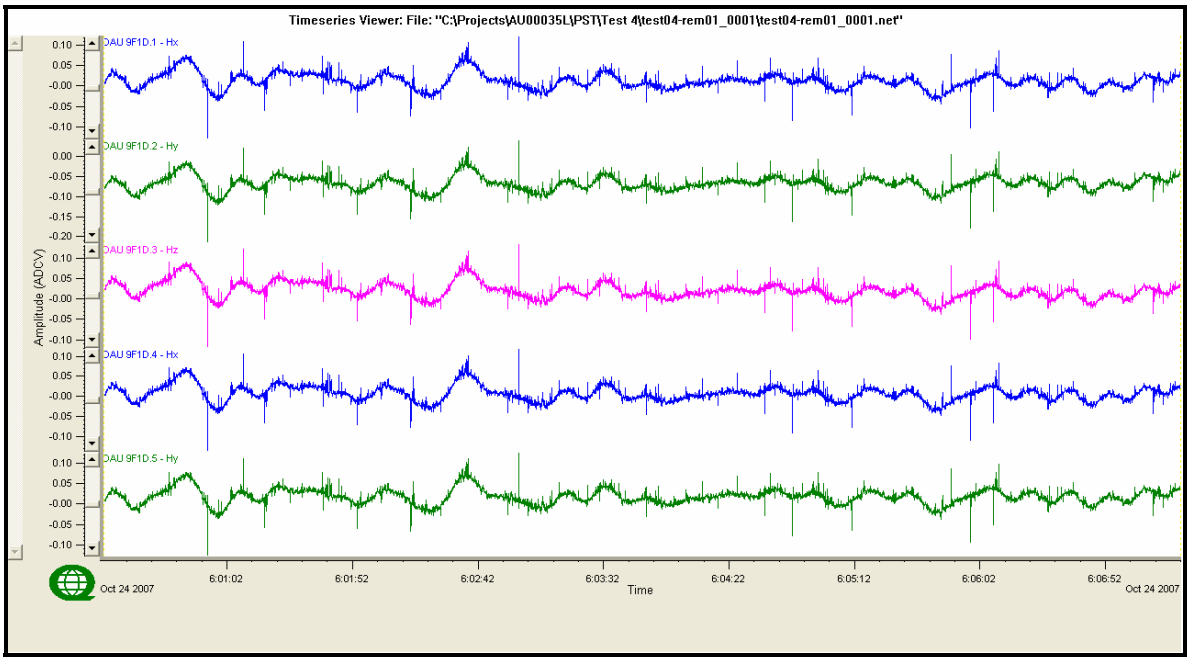

Figure 14: Time Series taken from Parallel Sensor Test [6]

[6] Parallel Sensor Test: all coils are Phoenix P50.

3.8 DATA PRESENTATION

- **Sounding Curves** — MT Apparent Resistivity and Phase (XY and YX), Tipper Transfer Function (XrXi & YrYi) (See Appendix C)
- **Digital**
  - Raw data: — Site and Remote Raw data that contains information on the location and time of the event archived onto external hard drive daily.
  - Processed data: — MT DATA, in .EDI (electronic data interchange) file, created in Geotools™ containing tensor sounding data (XY & YX) for individual stations (sites) in a format conforming to SEG standard for the storage MT data.

RESPECTFULLY SUBMITTED

QUANTEC GEOSCIENCE LTD.

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ENVIRONMENTAL AUDIT OF 2007 CALLABONNA (GEL 157)

MAGNETO-TELLURIC SURVEY

1.0 Introduction

In September 2007 Petratherm Ltd contracted Quantec Geoscience to perform a single line traverse magneto-telluric (MT) survey over GEL 157 Callabonna, located on Mt Hopeless Pastoral Lease approximately 380 km north of Yunta, on the gibber plains north of the Mt Babbage Inlier.

Permission to perform the MT survey was given by PIRSA on the condition that an appropriate Statement of Environmental Objectives (SEO) would be applied to the operations. Petratherm formed the opinion that the proposed Callabonna MT survey operations fell within the intended scope of the existing Statement of Environmental Objectives for Ground-based Geophysical Operations (non-seismic) in South Australia (August 2007) compiled by the Petroleum and Geothermal Group PIRSA. Thus the operations were conducted in accordance and compliance with this SEO.

The magneto-telluric (MT) survey was successfully conducted on GEL 157 over 5 days from the 1st to the 5th December 2007, over a total line length of about 5 km oriented approximately north-south. The main objective for the survey was to provide information on the depth to basement, estimated to be at about 2500m, and on the thicknesses of local stratigraphic units. The start point of the survey was 389200E, 6724900N (GDA94) and the orientation of the line was 000°T. A total of 5km of data were acquired with an average of 6 stations acquired per day, each station having a spacing of 500m, giving a total of 11 stations. A single site setup consisted of an L shaped E field array, with 100m dipoles and Hx, Hy and Hz Low frequency coils, remote referenced. Data was collected at an effective bandwidth of 0.005 to 300 Hz.

In accordance with Section 6 of the SEO, a field inspection and assessment of achievement of the Environmental Objectives was to be carried out after completion of the operations, using methodologies and criteria recommended in the SEO. It was expected that the low impact nature of the magneto-telluric survey should result in favourable assessment against defined conditions and GAS scores of +1 and +2 being achieved for each objective.

2.0 Environmental Objectives and Assessment Criteria

The purpose of an environmental audit is to assess the environmental impact of an existing mining or exploration operation with the aim of helping to safeguard the environment by:

1. Facilitating management review and control of environmental practices;
2. Assessing compliance with company policies and meeting regulatory responsibilities.

This report documents the methodology and findings of the internal audit of the 2007 Callabonna GEL 157 Magneto-telluric Survey operation, with the objective of determining whether the MT survey was conducted in an environmentally responsible manner and compliant with regulatory and company expectations. Assessment of achievement of the Environmental Objectives was undertaken using a number of techniques including 'Defined Conditions' and the 'Goal Attainment Scaling' (GAS) methods. The SEO describes the GAS method as being applicable to objectives able to be assessed against a series of discrete minimal impact outcomes. In this instance the GAS technique has been applied to the assessment of goals associated with Objectives 2, 6 and 8, while the other Objectives are better managed and assessed by identifying and avoiding defined activities or outcomes in Yes/No terms against a list of defined conditions.

The environmental objectives for the magneto-telluric survey are outlined below along with the actions taken to meet the objectives and an assessment of whether the objectives were achieved.

2.1 Objectives Assessed Using Defined Conditions

Objective 1: Minimise disturbance to other land users

Assessment Criteria	Goal	Comments	Outcome Achieved (Y/N)
All reasonable landowner complaints are addressed and resolved. Upon completion of the survey and after any rehabilitation or reparation (if determined prior to survey), the level of impacts on other land users is determined by the absence of existing stakeholder complaints.	No complaints are received	NOIEs were given to all stakeholders. Stakeholders were contacted personally prior to and after survey completed. Existing tracks were used wherever possible. Crew camped at site nominated by land owner & with land owner's permission. No complaints were received No National Parks or other proclaimed areas exist within the area affected.	Y

Objective 3: Avoid disturbance to sites of cultural and heritage significance

Assessment Criteria	Goal	Comments	Outcome Achieved (Y/N)
Survey area scouted by appropriate personnel. Report prepared. Identified sites flagged and avoided. New sites identified reported to appropriate agency.	No sites are disturbed. No complaints are received from stakeholders or the general public. Any sites located	Cultural and Heritage site registers consulted. Local station manager consulted. Area was scouted by appropriate personnel & approved. No sites located. Crew inductions include discussion of responsibilities.	Y

	are recorded and reported.		

Objective 4: Minimise the risk of introduction and/or spread of introduced species and bio-security threats.

Assessment Criteria	Goal	Comments	Outcome Achieved (Y/N)
Weeds, feral animals or plant and animal diseases are not introduced to, or spread within South Australia.	No contamination of the area by new feral or pest species.	All vehicles and equipment were cleaned before arrival and departure from site. No pets or other animals were brought to site.	Y

Objective 5: Minimise the risk of initiation and/or propagation of wildfire.

Assessment Criteria	Goal	Comments	Outcome Achieved (Y/N)
Appropriate plans in place and equipment available to identify hazards, initiate hazard mitigation and response training, fire-fighting equipment available.	No unintended or uncontrolled fires occurred. OH&S requirements were met. No injuries or property damage occurred through fire.	An Emergency Response Plan exists for the area and was explained to crew. Fire-extinguishers were present at camp and in vehicles. Emergency contacts made known to crew and were alerted to the crew's presence and activities. Local station manager aware of crew's movements	Y

Objective 7: Minimise generation of dust

Assessment Criteria	Goal	Comments	Outcome Achieved (Y/N)
Drive at appropriate speed to minimise dust hazard particularly in vicinity of other crews or homesteads.	Dust nuisance is kept at a minimum. No complaints received from stakeholders or general public.	Crews made aware of their responsibilities via crew inductions.	Y

Objective 9: Optimise waste recovery

Assessment Criteria	Goal	Comments	Outcome Achieved (Y/N)
Wastes (except sewerage and grey water) to be segregated, burnt or transported to an EPA waste disposal facility.	No wastes to be left onsite. All wastes to be disposed of appropriately.	Crew camped at site nominated by land owner. All waste removed & disposed of at approved public facility (Innamincka).	Y

2.2 Objectives Assessed Using GAS Technique

Aspects of the following Environmental Objectives are generally of a more physical nature than those discussed above, and thus lend themselves to being assess using the GAS methodology. Goals set in these Objectives relate directly to the physical effect of operations on environmental factors such as soil, vegetation and aesthetic quality, impacts on natural resources, and rehabilitation. These factors can be physically assessed in the field and a GAS score assigned.

2.2.1 Field Observations.

The Callabonna lease is situated in open flat-lying gibber plains to the north of the northern Flinders Ranges, approximately 380 km north of Yunta. The lease is bound to the north east by the Strzelecki National Park and to the east by the Lake Callabonna Fossil Reserve (Figure 1). Note that the MT survey did not impinge upon either the National Park or Fossil Reserve. Access to the area is either along the Strzelecki Track via Lyndhurst, via the main route between Moolawatana Homestead and Yunta, or with permission via the private Epic gas pipeline access road. Access within the lease area is limited to local station tracks which are sparse and poorly mapped, and do not cover large areas of the lease (Figure 1).

Inspection of the MT traverse at Callabonna was conducted on the 5th March 2008 to audit the effects of the magneto-telluric survey operations as part of the requirements for the environmental audit, some twelve weeks after completion of the MT survey. The environmental audit visit was delayed, with the permission of PIRSA, in order to coordinate the audit with other field operations taking place and hence minimise damage to station tracks and the environment. Sites selected for inspection were easily accessible from existing tracks and provided a representative sampling of the environment and terrain. Location data is recorded in GDA94.

Environmental impact of the MT survey operations was generally low. The individual stations were visible, but only minor soil disturbance was evidenced. No waste, materials or equipment was located on site. The area is generally little used and station tracks do not cover much of the tenement as such the survey crew were largely unable to use existing access tracks. As a result the most obvious impact observed were the wheel mark imprints into the gibber, left by the survey crew to access the traverse. The area is in a period of extended drought and no rains have fallen locally in the period since the survey was conducted. It is expected that most of the observed soil disturbance will be largely mitigated with the first rains.

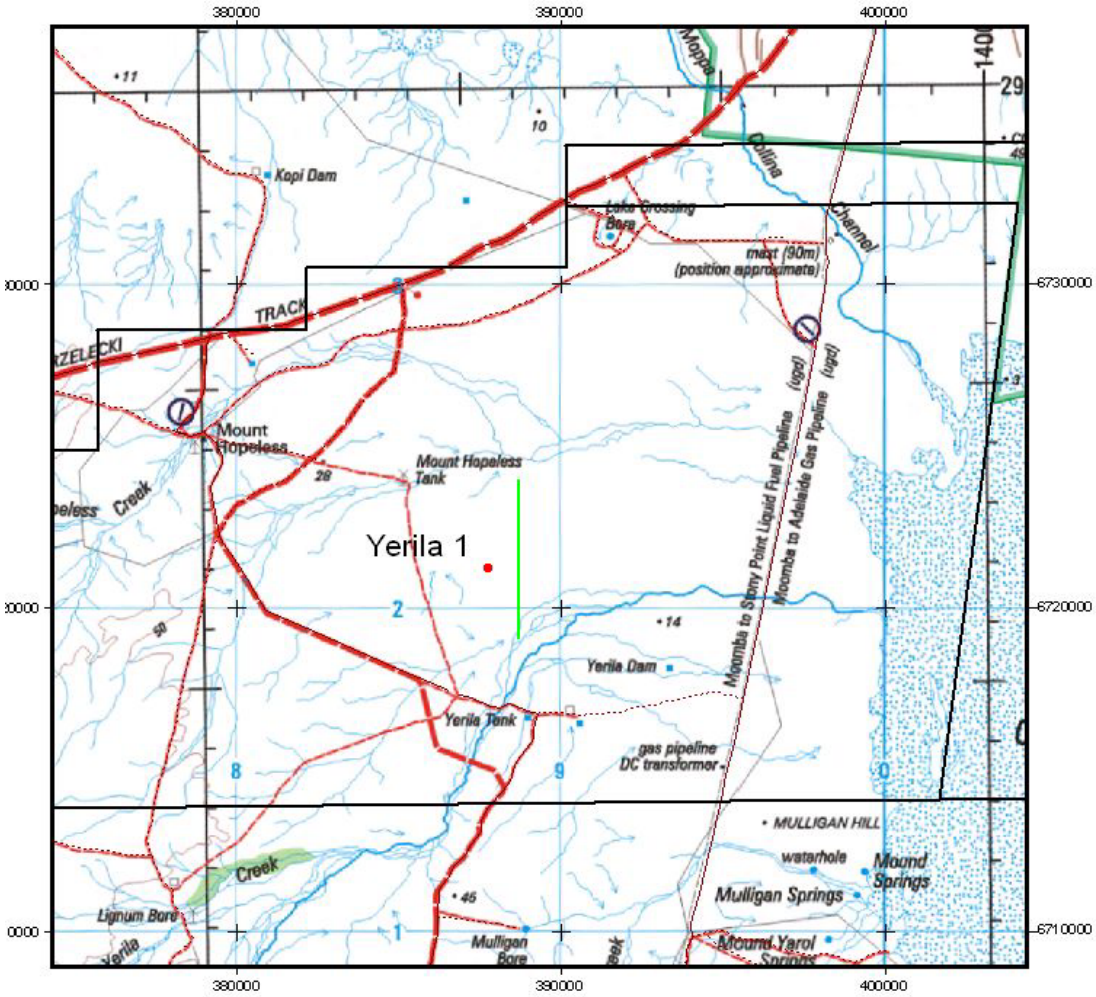


Figure 1. Topographic map of Callabonna (GEL157) showing the GEL boundary in black, the position of the exploration well Yerila-1 as a red circle, and location of the magneto-telluric survey in green.

Figure 2: Wheel marks left by the survey crew leading in to the southern point of the Callabonna MT traverse (view east).

Figure 3. Wheel marks left by the survey crew leading to Station 2 (Location 389185E 6720407N) (view north).

Figure 4. Station 2 (Location 389185E 6720407N) of the Ferguson Hill Magneto-telluric survey. Note the faint wheel marks from the lower left to centre of the photograph.

Figure 5. Wheel marks leading north of station 2 toward stations 3 to 11.

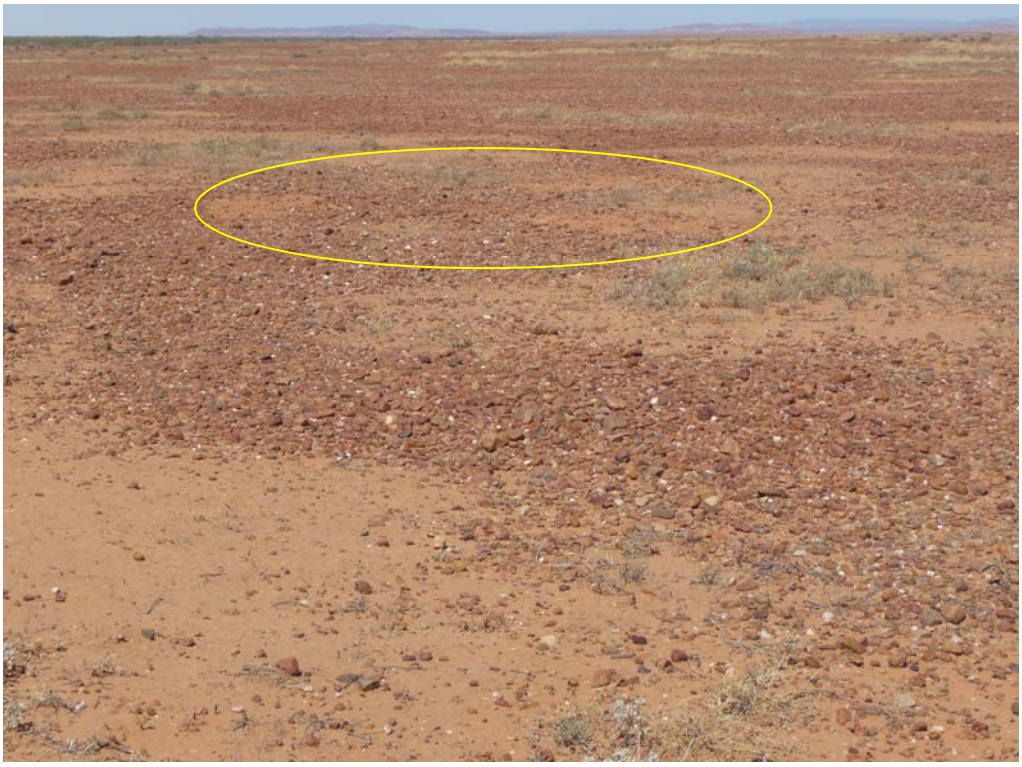


Figure 6. Close up of rehabilitated coil pits at Station 3 (Location 389188E 6720910N).

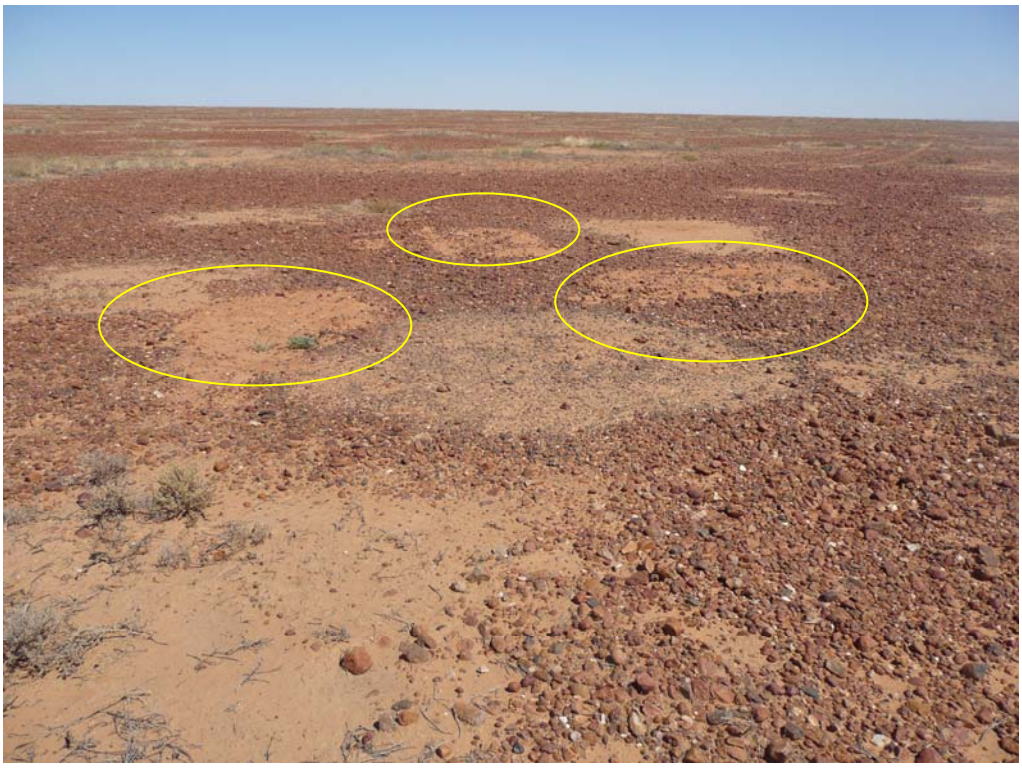


Figure 7. Rehabilitated coil pits at Station 4 (Location 389189E 6721410N).

Figure 8. Wheel marks leading north of station 4 toward stations 5 to 11.

2.2.2 GAS assessment of Objective 2

The GAS technique requires auditors to document and rank each of the expected outcomes of an operation. Scores for each objective are defined as;

-2	much less than expected
-1	less than expected
0	expected
+1	more than expected
+2	much more than expected

Objective 2: Minimise disturbance to native vegetation, fauna and associated wildlife habitats.

Assessment Criteria	Comments	Gas Score
Vehicle access to survey area is to be via existing access tracks or existing seismic lines, except where they may have been rehabilitated.	Existing tracks and seismic survey lines used for access and survey line wherever possible. Inspection of individual stations and lines indicate minimal soil disturbance, however some tracks are visible.	+1
No off traverse driving.	Off traverse driving kept to the minimum necessary to avoid creeks and stands of vegetation	+1
No native vegetation clearance occurs.	No native vegetation or land clearance occurred.	+2
Appropriate measures to contain	Waste disposal and refuelling undertaken at the	+2

and prevent fuel and chemical spillages taken. Spillage response equipment available. Reporting system in place.	base camp. No spillages reported or located. All materials and wastes removed off site at end of survey and disposed of at Innamincka.	

Objective 6: Minimise the visual impacts of geophysical operations

Assessment Criteria	Comments	Gas Score
Locate camp to minimise visual impact.	Crew camped at a site nominated by the land owner. Site not in view of casual road users.	+2
Locate survey traverses to minimise visual impact.	Existing tracks or seismic survey lines used wherever possible. No significant earthworks or vegetation removed.	+1
Remove all equipment and litter.	All equipment & waste removed & disposed of at approved public facility (Innamincka).	+2
Individual stations unmarked	No permanent marking of MT stations is necessary. Inspection of individual stations indicates minimal disturbance to soil or vegetation. Stations only visible by vehicle access wheel marks, operator footprints and faint areas of soil disturbance	+2

Objective 8: Minimise soil disturbance and contamination

Assessment Criteria	Comments	Outcome Achieved (Y/N)
Locate campsites to minimise disturbance and contamination.	Crew camped at established quarters at local homestead. No vegetation removed. Existing tracks or seismic survey lines used wherever possible. Wherever possible survey lines coincident with existing tracks or seismic survey lines. Only survey vehicles directly used in data acquisition accessed the survey lines.	Y
Vehicles to travel at appropriate speed to prevent soil disturbance and dust hazard	Crews made aware of their responsibilities via crew inductions.	Y
Clean up and report all spills and leaks.	No spills reported or located	+2
Dispose of waste appropriately.	All waste removed from survey sites & disposed of at approved public facility (Innamincka).	+2
Only vehicles engaged in data acquisition to traverse survey lines.	Only survey vehicles directly used in data acquisition accessed the survey lines.	Y

3.0 Summary and Conclusion

An internal assessment of achievement of the Environmental Objectives was a condition of activity approval and the SEO under which the MT survey operations were conducted. The assessment performed was based on criteria listed within the Statement of Environmental Objectives for Ground-based Geophysical Operations (non-seismic) in South Australia (August 2007) compiled by the Petroleum and Geothermal Group PIRSA, using both the defined conditions and GAS techniques. The low impact nature of the magneto-telluric survey, resulted in a favourable outcome and GAS scores of +1 and +2 being achieved for each objective. On-site inspection of the survey area and desktop review of the operations has shown that the overall result of the survey was good and within reasonable expectation.

MT Processing Notes
Petratherm Ltd
PARALANA-CALLABONNA-FERGUSON HILL MT PROJECT

1. Association/Logistical Notes

MT Acquisition: Dec. 03-04, 2007
Document Date: Dec. 05, 2007

QuickLay Version: 3.00.Alpha_23

Notes By: Susanna Scappin

1.1.1 Callabonna Grid – Line 1

Sites	Location UTM WGS84 Zone 54J		Magnetic Sensors			Azimuth			
	Northing	Easting	Hx P50	Hy P50	Hz BF7	Hx	Hy	Ex	Ey
Remote	6715115	382442	2129	2130	P50-2112	360	270	360	270
CA01	6719911	389209	2127	2128	9107	360	270	360	270
CA02	6720407	389185	2113	2119	9307	360	270	360	270
CA03	6720910	389188	1980	2118	9104	360	270	360	270
CA04	6721410	389189	2012	2115	7003	360	270	360	270
CA05	6721902	389181	2122	2125	9306	360	270	360	270
CA06	6722410	389210	2016	2111	9602	360	270	360	270

Magnetic Declination: approx.7.6˚E

1.1.2 Notes

Callabonna Line runs N-S for 5Km.

The sites are situated on alluvial flat terrain (fine sand and clay, with stones of different sizes), near salt lake (Callabonna Lake); little low vegetation and some stock in the area.

CA02: open channels on coils and poor wire contact in Ey. The site has been fixed and restarted straight away.
CA05: 12h of good data out of 21.5h. The site was reset up and reacquired.

Strong SE and NE winds all day and night.

2. MT Processing

MT Events

Sample Rate 1000sps

Site	Serial Event @ Site	Serial Event @ Remote Site	Intersecting Event	Notes
CA01	SEvCA01_20071203.0347	SEvCArem02_20071202.0209	CA01 (3:47 to 22:33)	Created 5 4h subevents Created 2 15h subevent
CA02				
CA03	SEvCA03_20071203.0442	SEvCArem02_20071202.0209	CA03 (4:42 to 22:33)	Created 5 4h subevents Created 2 15h subevent
CA04	SEvCA04_20071203.0456	SEvCArem02_20071202.0209	CA04 (4:56 to 22:33)	Created 4 4h subevents Created 2 15h subevent
CA05	SEvCA05_20071202.2347	SEvCArem02_20071202.0209	CA05 (23:47 to 23:52)	Created 3 4h subevents Created 1 11.2h subevent
CA06	SEvCA06_20071202.2322	SEvCArem02_20071202.0209	CA06 (23:22 to 23:33)	Created 6 4h subevents Created 2 15h subevent

General Setup Notes:

- All the events (all sites) were scrubbed with spike rejection turned off
- Processed using Robust processing and Coherency sorting
- Due to the length of the reading 4h subevents at 1000sps were created
- In order to provide as much information as possible for Frequencies below 0.01Hz, subevent(s) of 15hrs record length at 20sps was(were) created for each site and used in the processing

2.1.1 Site CA01

Name: CA01
Date: December 4, 2007

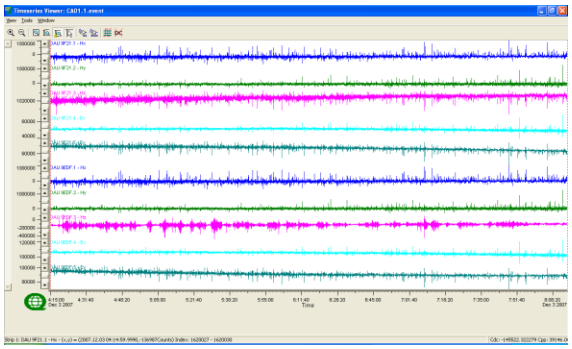
Setup Notes:

- Total of 20.3hrs of data were acquired and 18.75hrs used for processing (intersecting time).

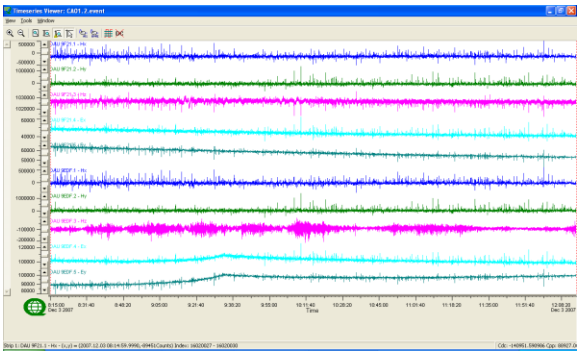
Events in Order	Time Series Notes
CA01.1	Overall good TS.
CA01.2	DC offset in remote electrics (CA01.3)
CA01.3	
CA01.4	
CA01.5	
CA01_20sps.1	
CA01_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	510	360

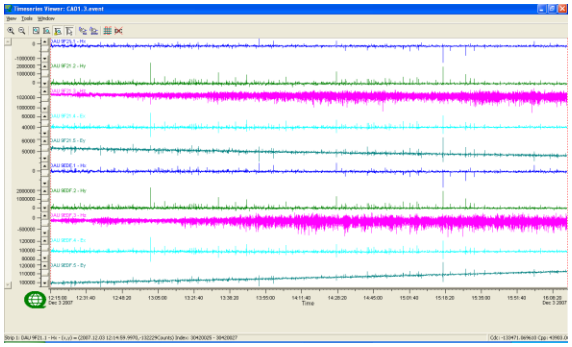
CA01.1



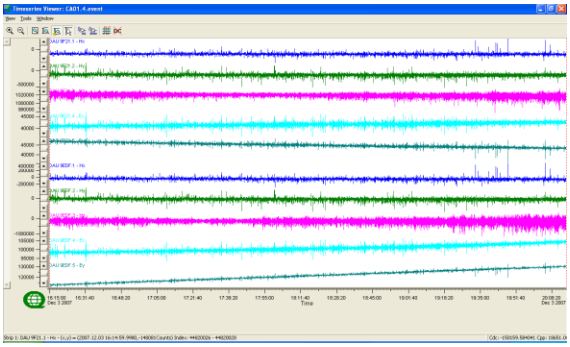
CA01.2



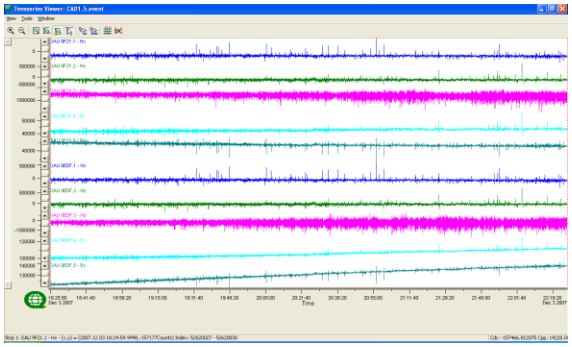
CA01.3



CA01.4



CA01.5

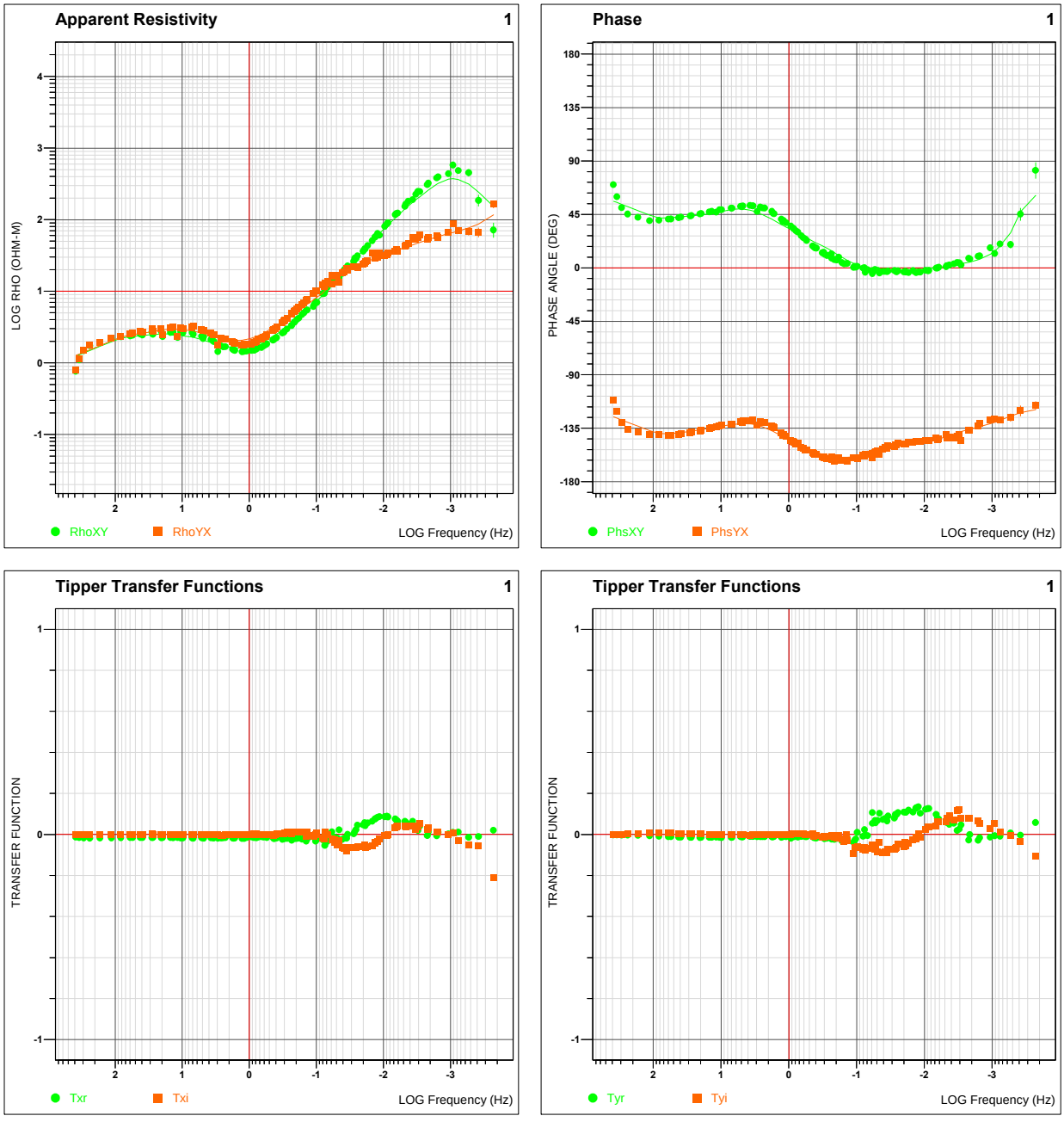


Reviewer Date: December 5, 2007

Comments:

- Good data quality.
- Suspicious pull-up phase for F>250Hz.

Site CA01 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.2 Site CA03

Name: CA03
Date: December 4, 2007

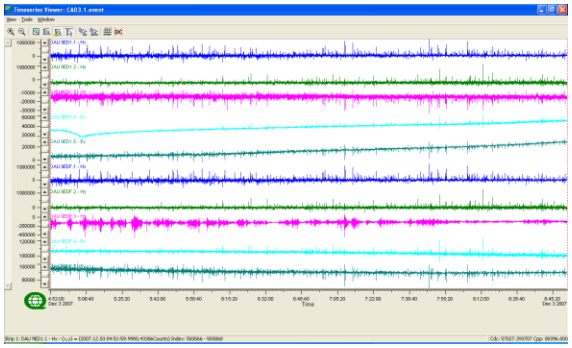
Setup Notes:

- Total of 18.72hrs of data were acquired and almost 18hrs used for processing (intersecting time).

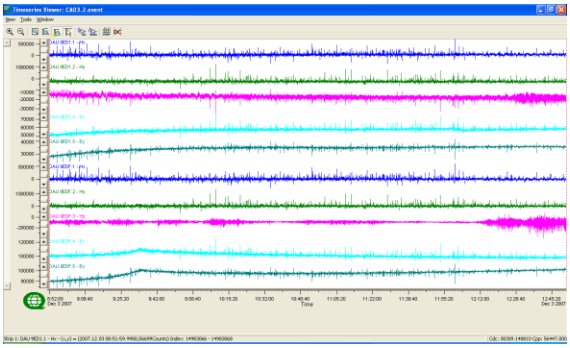
Events in Order	Time Series Notes
CA03.1	Overall good TS. Early DC offset in channel 4 (Ex) for site CA03.
CA03.2	DC offset in electrics at remote site (CA03.2)
CA03.3	
CA03.4	
CA03.5	
CA03_20sps.1	
CA03_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	400	500

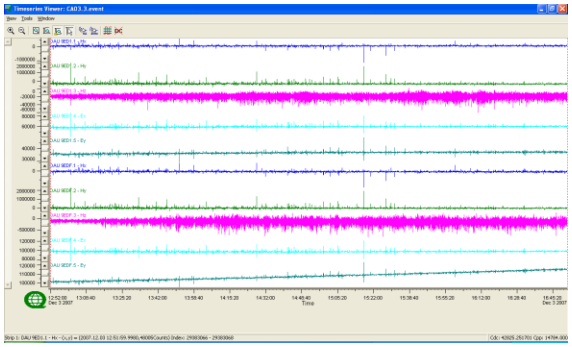
CA03.1



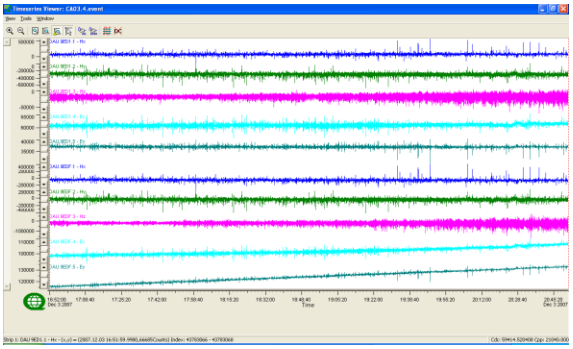
CA03.2



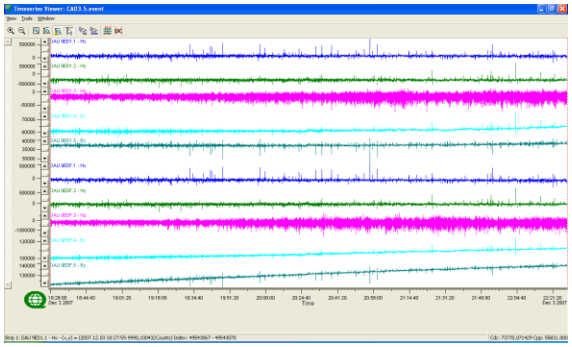
CA03.3



CA03.4



CA03.5

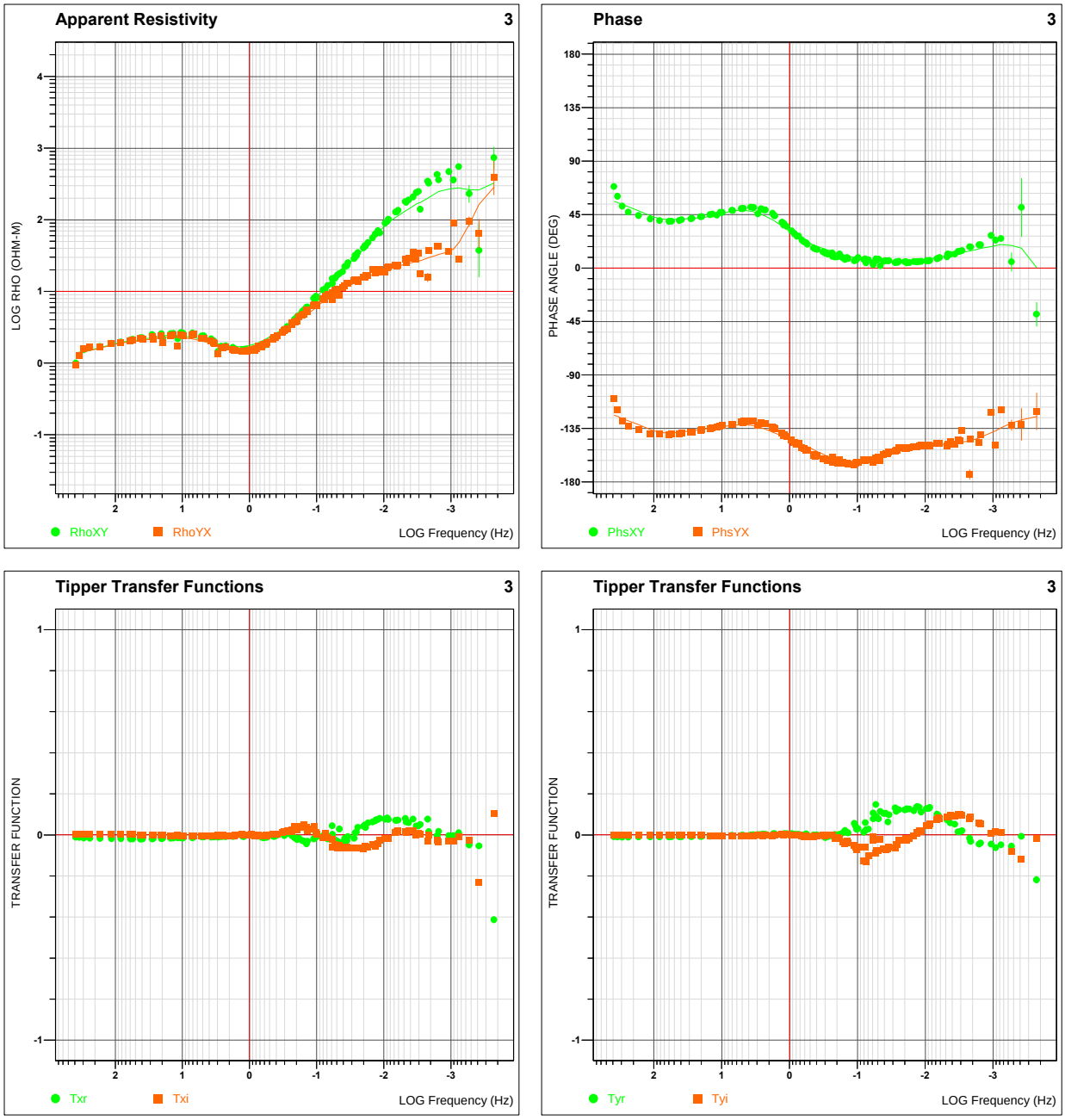


Reviewer Date: December 5, 2007

Comments:

- Overall good data quality.
- Noise in horizontal components around 0.002Hz
- Little noise in the data in the vertical component around 0.006Hz
- Suspicious pull-up phase for F>250Hz.

Site CA03 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.3 Site CA04

Name: CA04
Date: December 4, 2007

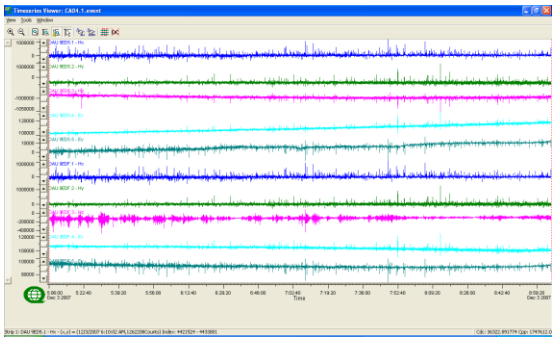
Setup Notes:

- Total of 18.25hrs of data were acquired and 17.5hrs used for processing (intersecting time).

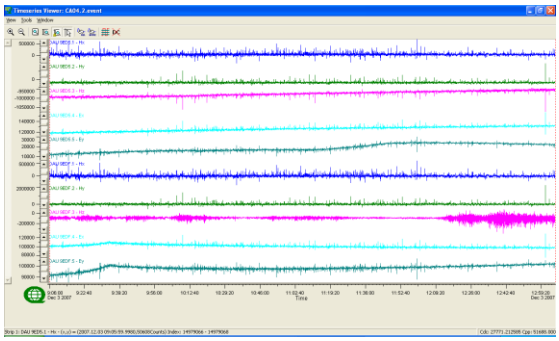
Events in Order	Time Series Notes
CA04.1	Overall good TS. Some drifting in site electrics.
CA04.2	DC offset in electrics at remote site (CA04.2)
CA04.3	
CA04.4	
CA04_20sps.1	
CA04_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	380	420

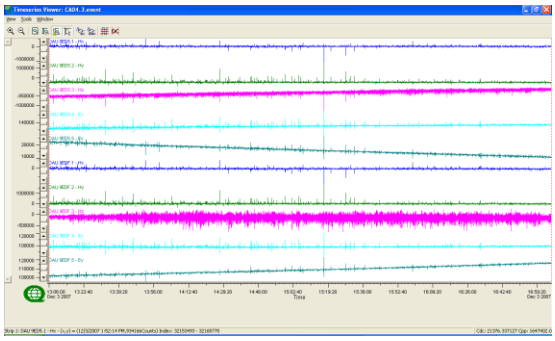
CA04.1



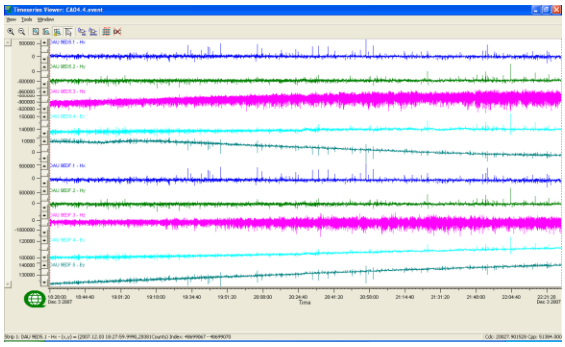
CA04.2



CA04.3



CA04.4

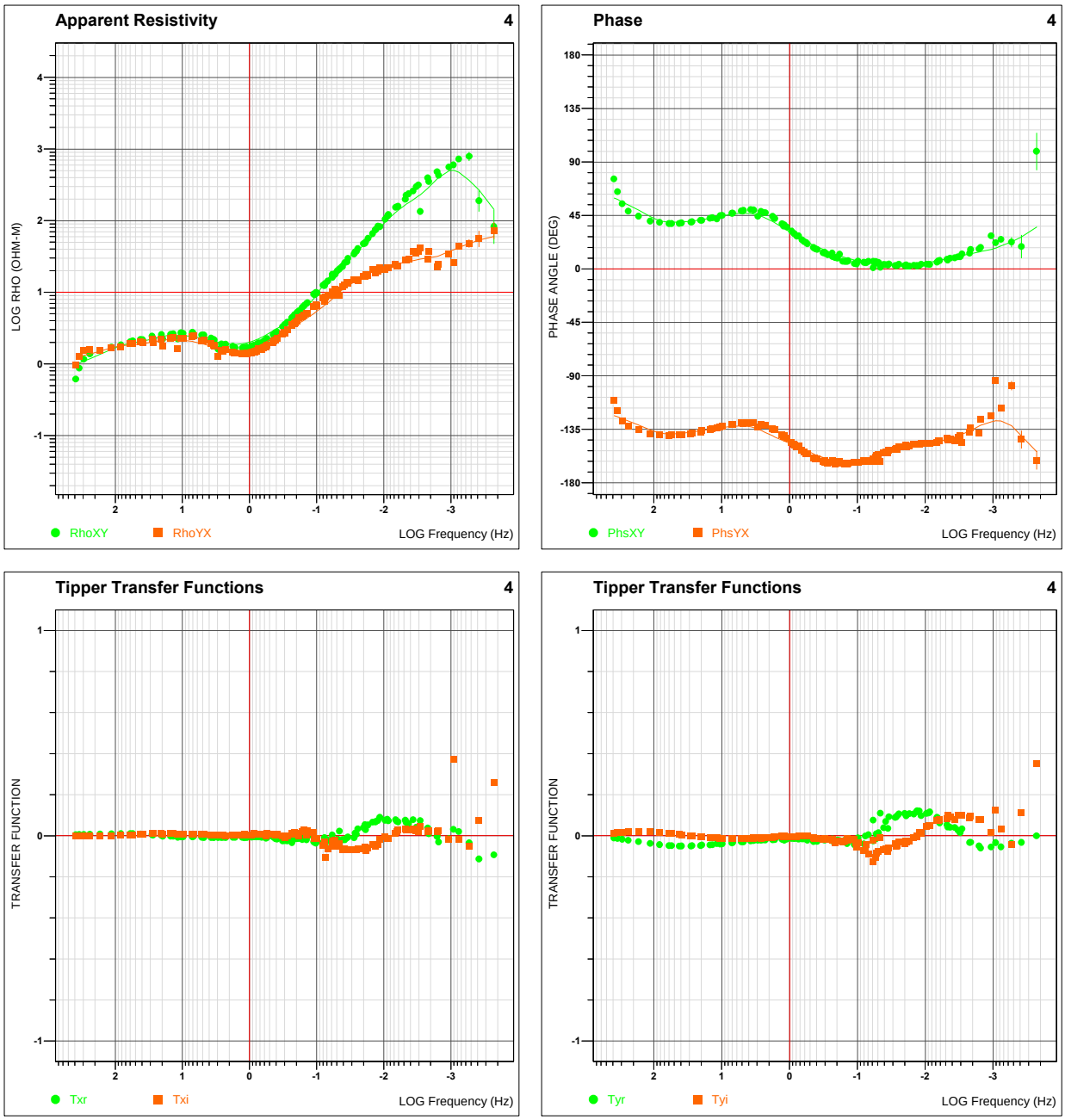


Reviewer Date: December 5, 2007

Comments:

- Overall good quality results.
- Noise in EyHx component <0.003Hz
- Very little noise in the vertical component around 0.007Hz
- Still suspicious pull up phase in F>250Hz

Site CA04 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.4 Site CA05

Name: CA05
Date: December 4, 2007

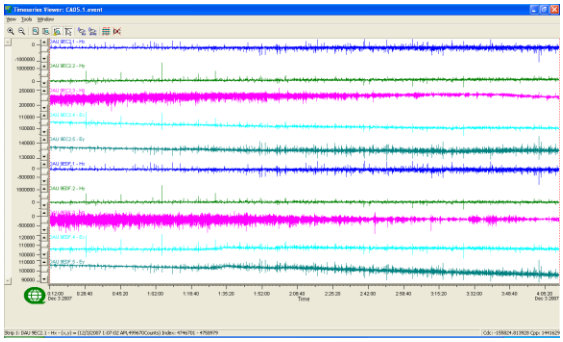
Setup Notes:

- Total of 21.5hrs of data were acquired, only 11.2hrs used for processing (intersecting time), due to bad contact in one of the electrics (Ey)

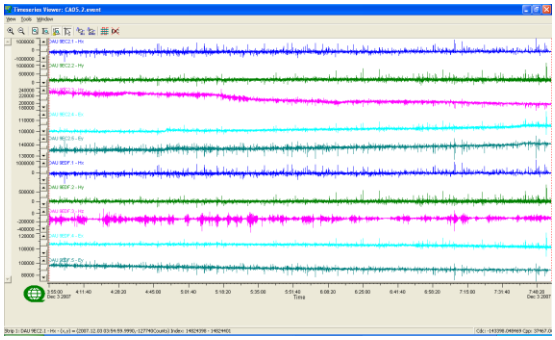
Events in Order	Time Series Notes
CA05.1 CA05.2 CA05.3 CA05_20sps.1	Overall good TS. DC offset in electrics at remote site (CA05.3)

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	400	620

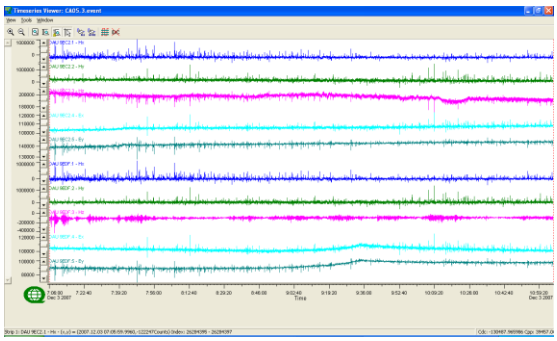
CA05.1



CA05.2



CA05.3

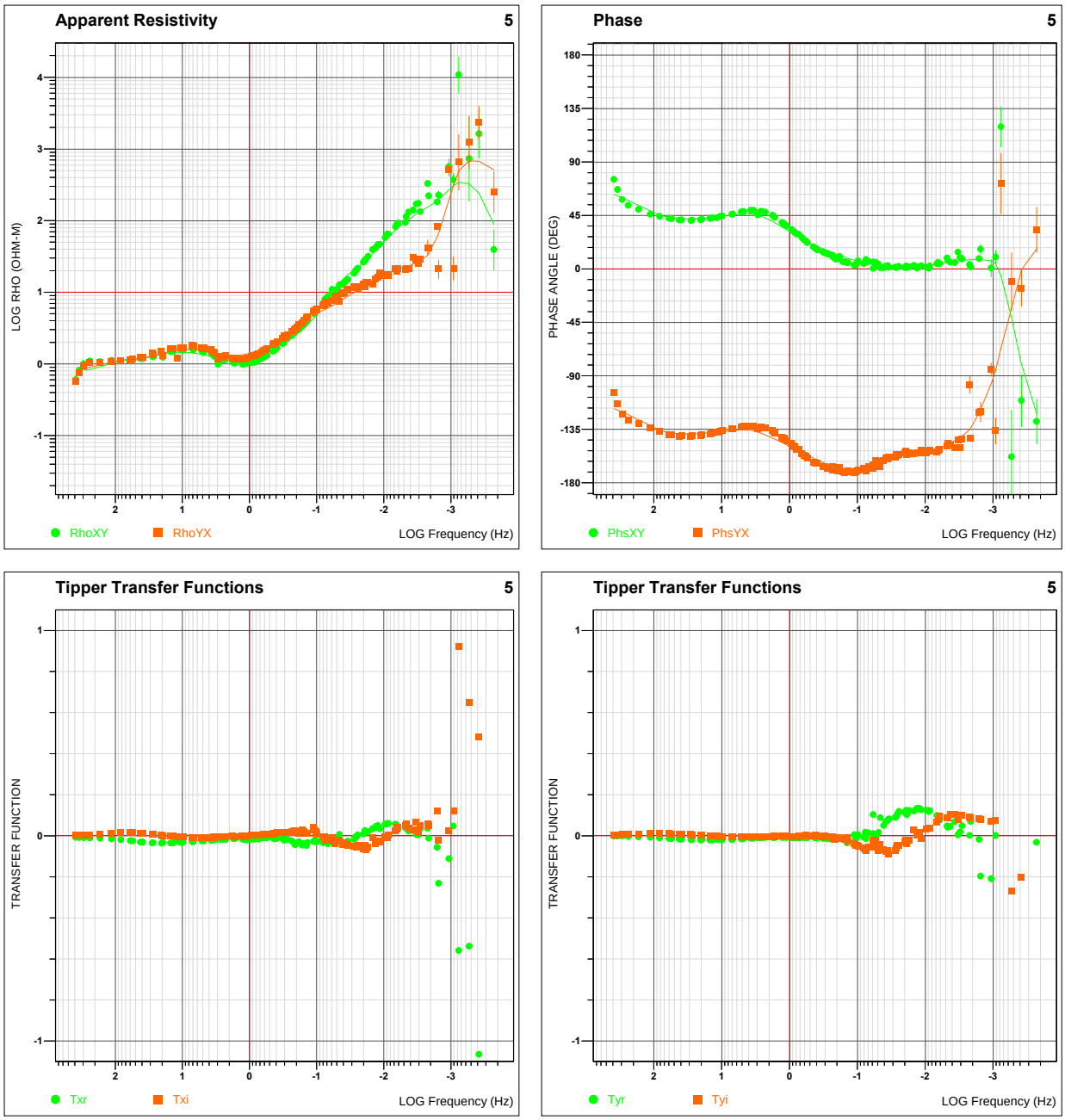


Reviewer Date: December 5, 2007

Comments:

- Overall decent quality results. Noise in all components <0.003Hz.
- The site will be reacquired to collect more data.
- Still suspicious pull up phase in F>250Hz

Site CA05 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.5 Site CA06

Name: CA06
Date: December 4, 2007

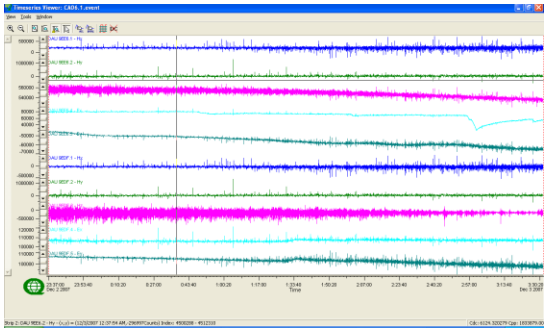
Setup Notes:

- Total of 21.5hrs of data were acquired and used for processing (intersecting time).

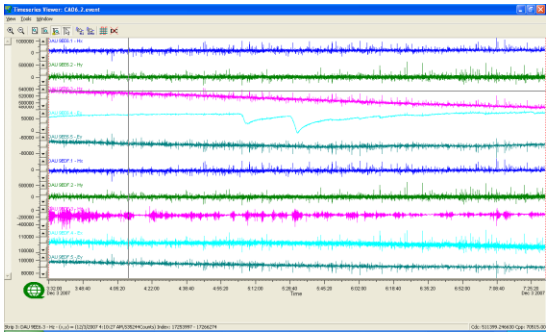
Events in Order	Time Series Notes
CA06.1	Bad DC offsets in the electrics, especially Ex (ch.4).
CA06.2	DC offset in electrics at remote site (CA06.3)
CA06.3	
CA06.4	
CA06.5	
CA06.6	
CA06_20sps.1	
CA06_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	360	320

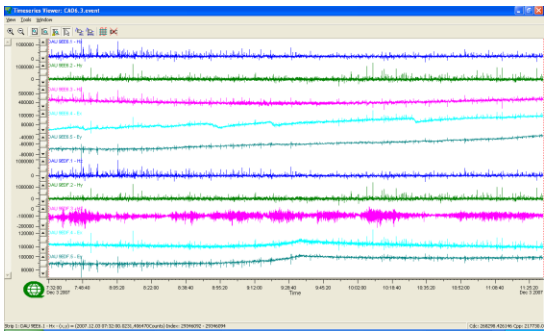
CA06.1



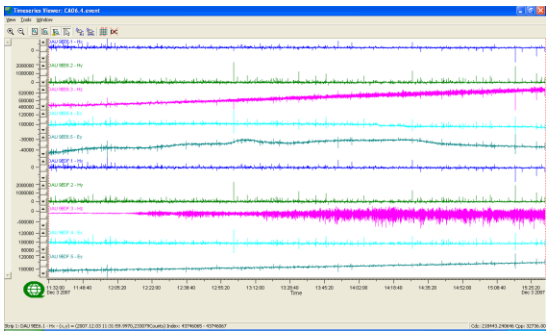
CA06.2



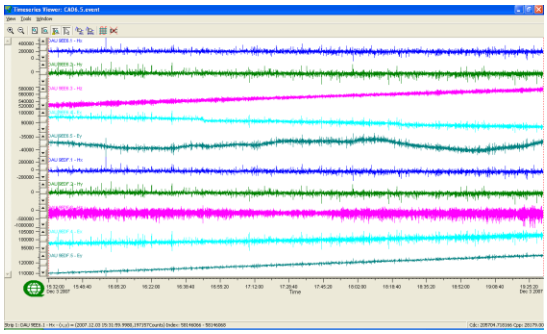
CA06.3



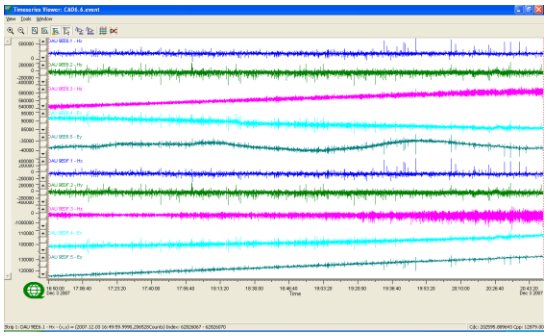
CA06.4



CA06.5



CA06.6

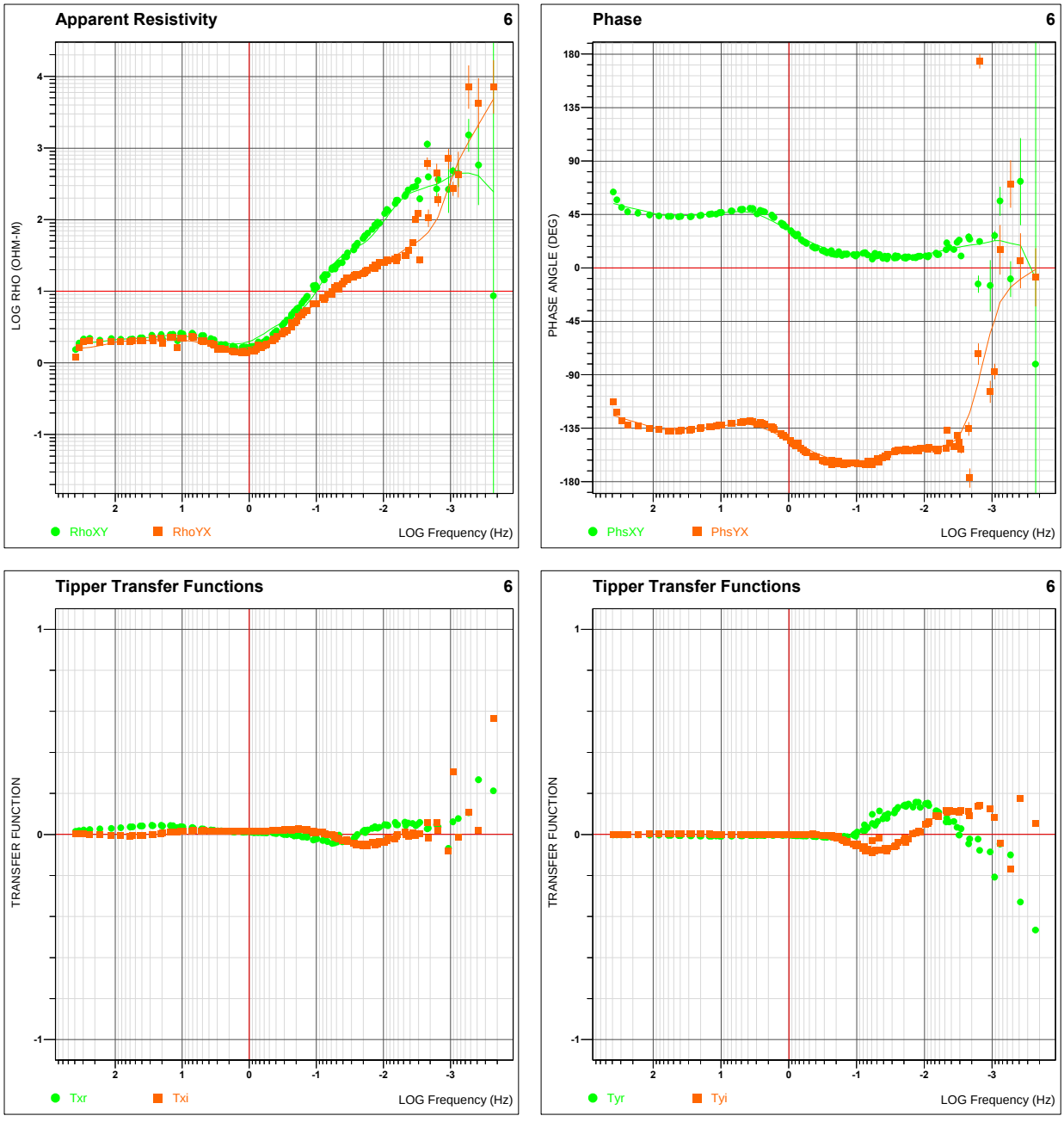


Reviewer Date: December 5, 2007

Comments:

- Good quality results for F>0.004Hz.
  The DC offsets observed in the TS affected the quality of the data <0.004Hz with poor results in all components, especially in the horizontals.
- Suspicious pull up phase in F>250Hz

Site CA06 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



MT Processing Notes
Petratherm Ltd
PARALANA-CALLABONNA-FERGUSON HILL MT PROJECT

1. Association/Logistical Notes

MT Acquisition: Dec. 02-03, 2007
Document Date: Dec. 03, 2007

QuickLay Version: 3.00.Alpha_23

Notes By: Susanna Scappin

1.1.1 Callabonna Grid – Line 1

Sites	Location UTM WGS84 Zone 54J		Magnetic Sensors			Azimuth			
	Northing	Easting	Hx P50	Hy P50	Hz BF7	Hx	Hy	Ex	Ey
Remote	6715115	382442	2129	2130	P50-2112	360	270	360	270
CA01	6719911	389209	2127	2128	9107	360	270	360	270
CA02	6720407	389185	2113	2119	9307	360	270	360	270
CA03	6720910	389188	1980	2118	9104	360	270	360	270
CA04	6721410	389189	2012	2115	7003	360	270	360	270
CA05	6721902	389181	2122	2125	9306	360	270	360	270
CA06	6722410	389210	2016	2111	9602	360	270	360	270

Magnetic Declination: approx.7.6˚E

1.1.2 Notes

Callabonna Line runs N-S for 5Km.

The sites are situated on alluvial flat terrain (fine sand and clay, with stones of different sizes), near salt lake (Callabonna Lake); little low vegetation and some stock in the area.

2. MT Processing

MT Events

Sample Rate 1000sps

Site	Serial Event @ Site	Serial Event @ Remote Site	Intersecting Event	Notes
CA01				
CA02				
CA03				
CA04				
CA05				
CA06				

General Setup Notes:

- All the events (all sites) were scrubbed with spike rejection turned off
- Processed using Robust processing and Coherency sorting
- Due to the length of the reading 4h subevents at 1000sps were created
- In order to provide as much information as possible for Frequencies below 0.01Hz, 1 subevent of 8h record length at 20sps was created for each site and used in the processing

- Problems with equipment settings: the reading started in all 6 units but stopped only few minutes (Spartan unit RAM problem) after.
- All sites will be reset and restarted.

MT Processing Notes
Petratherm Ltd
PARALANA-CALLABONNA-FERGUSON HILL MT PROJECT

1. Association/Logistical Notes

MT Acquisition: Dec. 04-05, 2007
Document Date: Dec. 06, 2007

QuickLay Version: 3.00.Alpha_23

Notes By: Susanna Scappin

1.1.1 Callabonna Grid – Line 1

Sites	Location UTM WGS84 Zone 54J		Magnetic Sensors			Azimuth			
	Northing	Easting	Hx P50	Hy P50	Hz BF7	Hx	Hy	Ex	Ey
Remote	6631011	348532	2129	2130	P50-2112	360	270	360	270
CA02R	6720407	389185	2113	2119	9307	360	270	360	270
CA05R	6721902	389181	2127	2128	9107	360	270	360	270
CA07	6722890	389183	1999	2011	9103	360	270	360	270
CA08	6723416	389187	1981	2200	9104	360	270	360	270
CA09	6723906	389191	2120	2121	7003	360	270	360	270
CA10	6724408	389181	2016	2111	9602	360	270	360	270
CA11	6724903	389182	2122	2125	9306	360	270	360	270

Magnetic Declination: approx.7.6˚E

1.1.2 Notes

Callabonna Line runs N-S for 5Km.

The sites are situated on alluvial flat terrain (fine sand and clay, with stones of different sizes), near salt lake (Callabonna Lake); little low vegetation and some stock in the area.

CA08: contact problems in the electrics after

Strong SE and NE winds all day and night.

2. MT Processing

MT Events

Sample Rate 1000sps

Site	Serial Event @ Site	Serial Event @ Remote Site	Intersecting Event	Notes
CA02R	SEvCA02_20071204.0120	SEvCArem02_20071203.2244	CA02R (1:20 to 21:24)	Created 5 4h subevents Created 2 15h subevent
CA05R	SEvCA05r_20071204.0231	SEvCArem02_20071203.2244	CA05R (2:31 to 21:56)	Created 5 4h subevents Created 2 15h subevent
CA07	SEvCA07_20071204.0300	SEvCArem02_20071203.2244	CA07 (3:00 to 22:23)	Created 5 4h subevents Created 2 15h subevent
CA08	SEvCA08_20071204.0347	SEvCArem02_20071203.2244	CA08 (3:47 to 22:23)	Created 5 4h subevents Created 2 15h subevent
CA09	SEvCA09_20071204.0316	SEvCArem02_20071203.2244	CA09 (3:16 to 22:23)	Created 5 4h subevents Created 2 15h subevent
CA10	SEvCA10_20071204.2353	SEvCArem02_20071203.2244	CA10 (23:53 to 22:23)	Created 5 4h subevents Created 2 15h subevent
CA11	SEvCA11_20071204.0144	SEvCArem02_20071203.2244	CA11 (1:44 to 23:33)	Created 5 4h subevents Created 2 15h subevent

General Setup Notes:

- All the events (all sites) were scrubbed with spike rejection turned off
- Processed using Robust processing and Coherency sorting
- Due to the length of the reading 4h subevents at 1000sps were created
- In order to provide as much information as possible for Frequencies below 0.01Hz, subevent(s) of 15h record length at 20sps was(were) created for each site and used in the processing

2.1.1 Site CA02R

Name: CA02R
Date: December 5, 2007

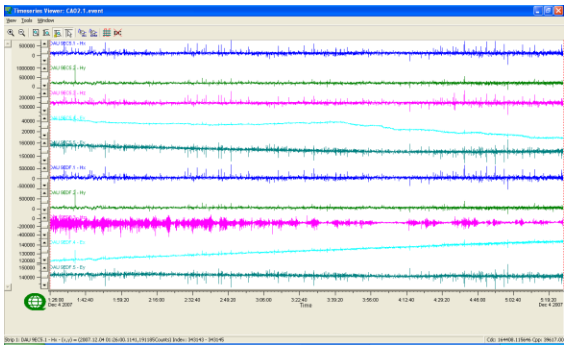
Setup Notes:

- Total of 20hrs of data were acquired and used for processing (intersecting time).

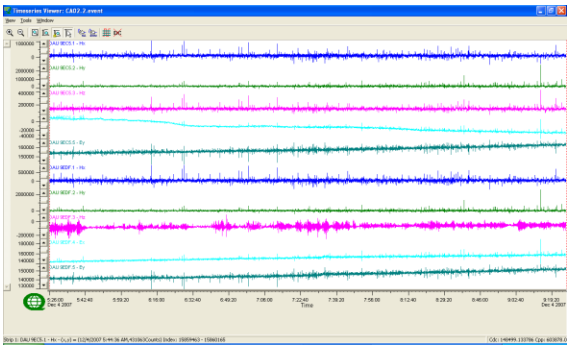
Events in Order	Time Series Notes
CA02.1	Overall good TS. Some drifting in the electrics (both site and remote)
CA02.2	
CA02.3	
CA02.4	
CA02.5	
CA02_20sps.1	
CA02_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	440	480

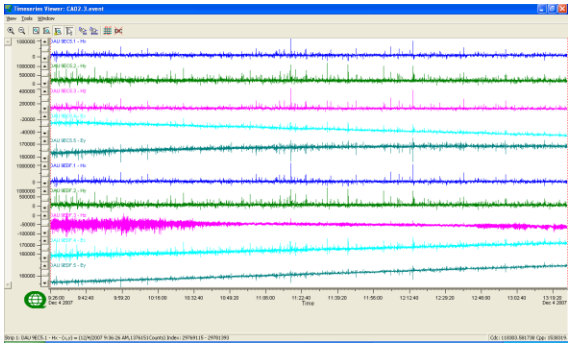
CA02.1



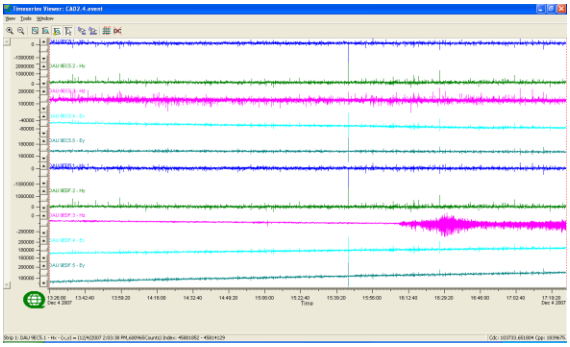
CA02.2



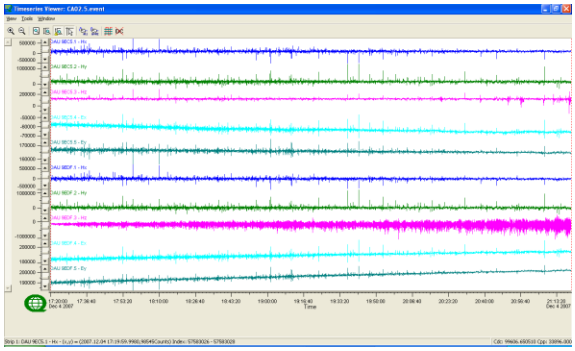
CA02.3



CA02.4



CA02.5

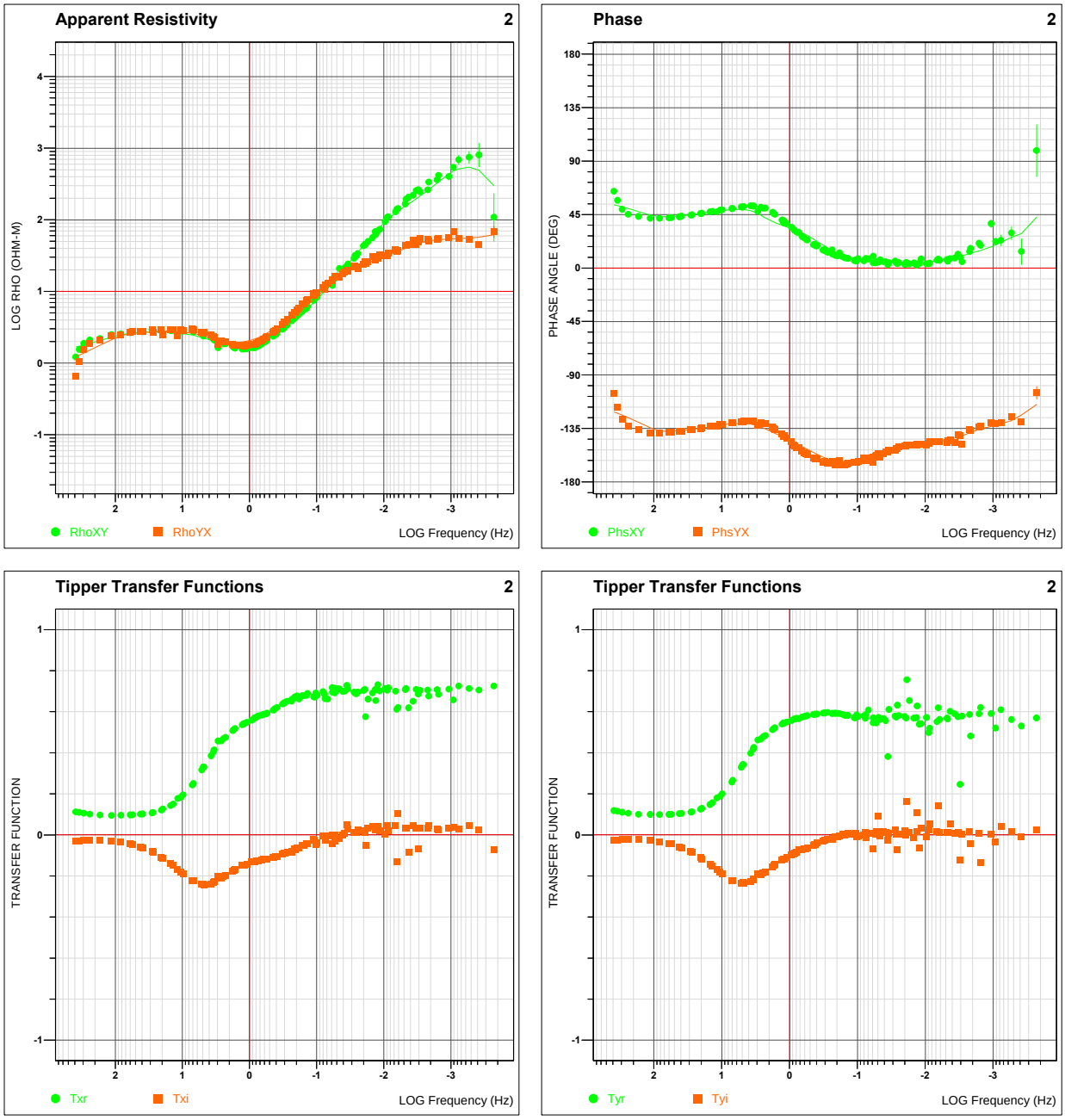


Reviewer Date: December 6, 2007

Comments:

- Good data quality in the horizontal components.
- Weird response (as seen in site PA312) in vertical component. Z coil not vertical, static? I don't think these data are reliable at all.
- Suspicious pull-up phase for F>250Hz.

Site CA02 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.2 Site CA05R

Name: CA05R
Date: December 5, 2007

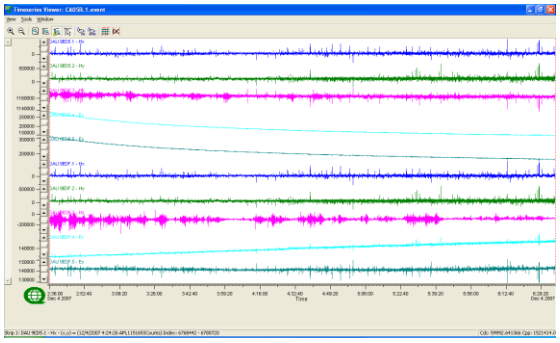
Setup Notes:

- Total of 19.5hrs of data were acquired and used for processing (intersecting time).

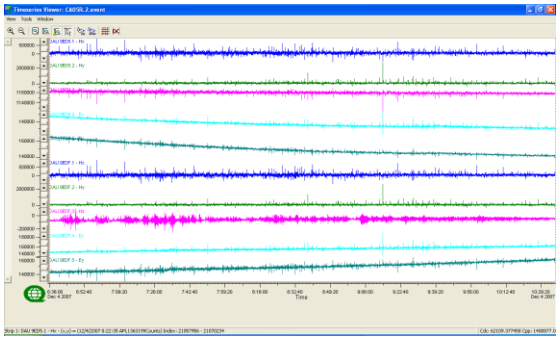
Events in Order	Time Series Notes
CA05R.1	Overall good TS. Overscales caused by close storm (see plot CA05R.1)
CA05R.2	DC offset in channel 4 (Ex) (see plot CA05R.5)
CA05R.3	
CA05R.4	
CA05R.5	
CA05R_20sps.1	
CA05R_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	300	340

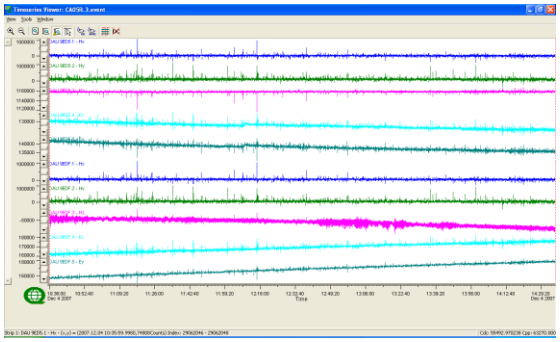
CA05R.1



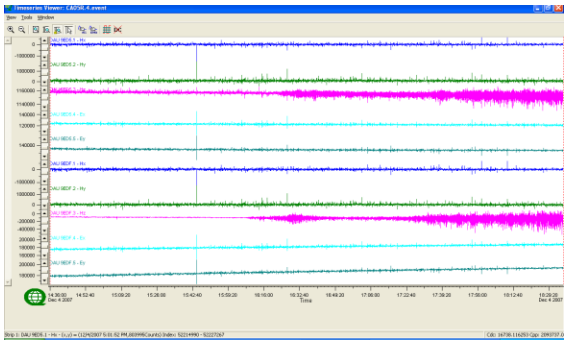
CA05R.2



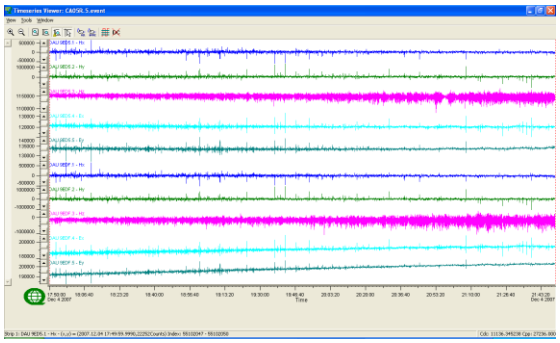
CA05R.3



CA05R.4



CA05R.5

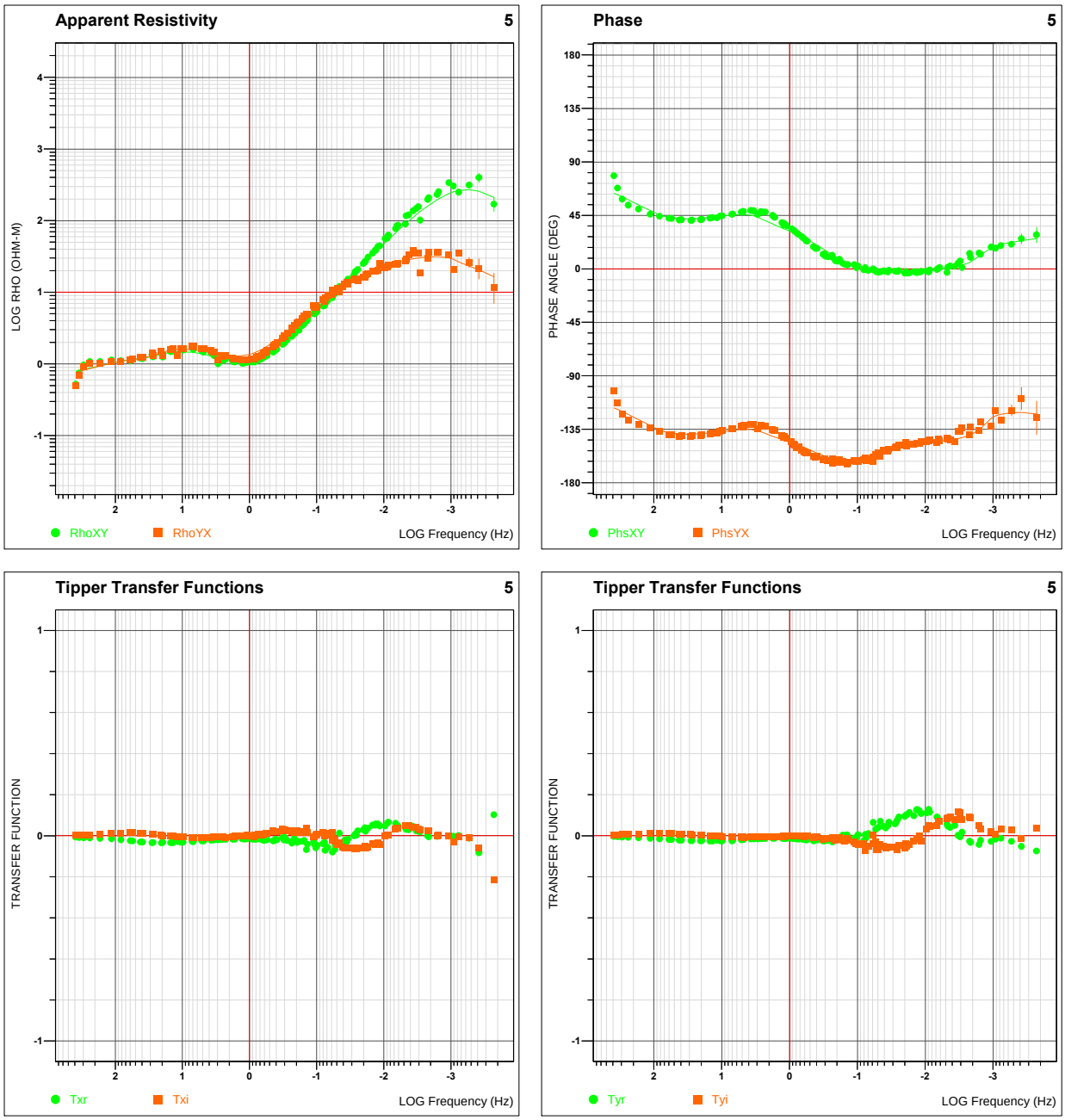


Reviewer Date: December 6, 2007

Comments:

- Good quality results.
- Still suspicious pull up phase in F>250Hz

Site CA05R Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.3 Site CA07

Name: CA07
Date: December 5, 2007

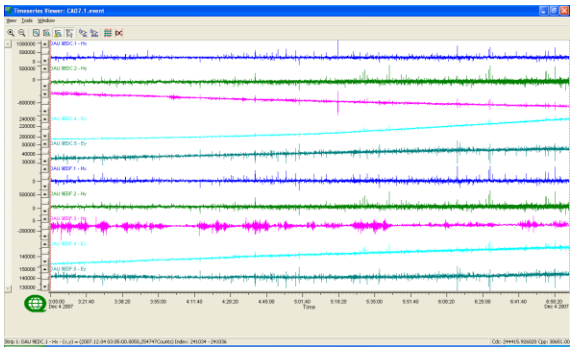
Setup Notes:

- Total of 19.5hrs of data were acquired and used for processing (intersecting time).

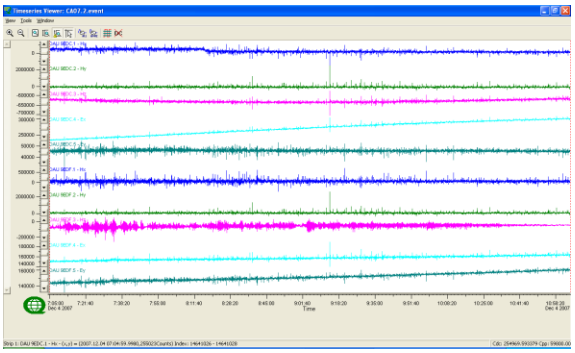
Events in Order	Time Series Notes
CA07.1	Overall good TS.
CA07.2	
CA07.3	
CA07.4	
CA07.5	
CA07_20sps.1	
CA07_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	400	480

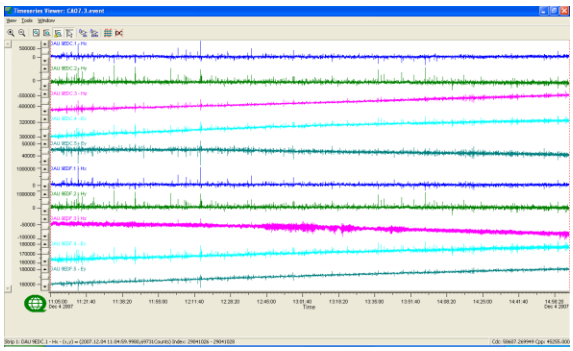
CA07.1



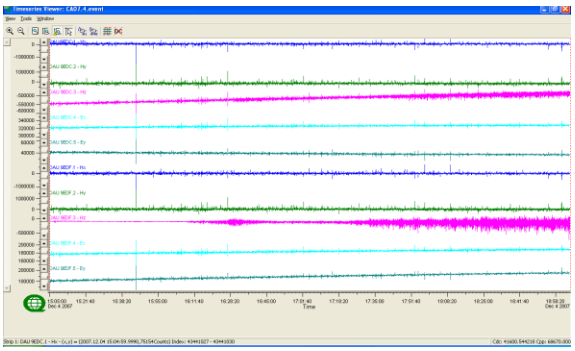
CA07.2



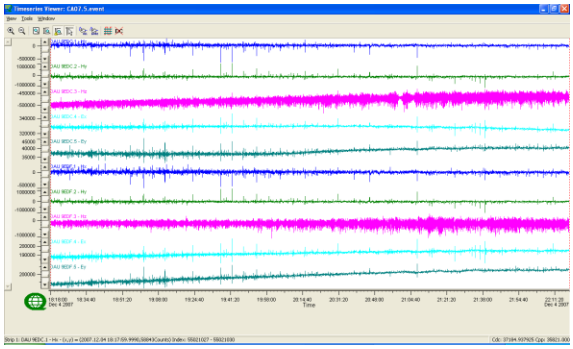
CA07.3



CA07.4



CA07.5

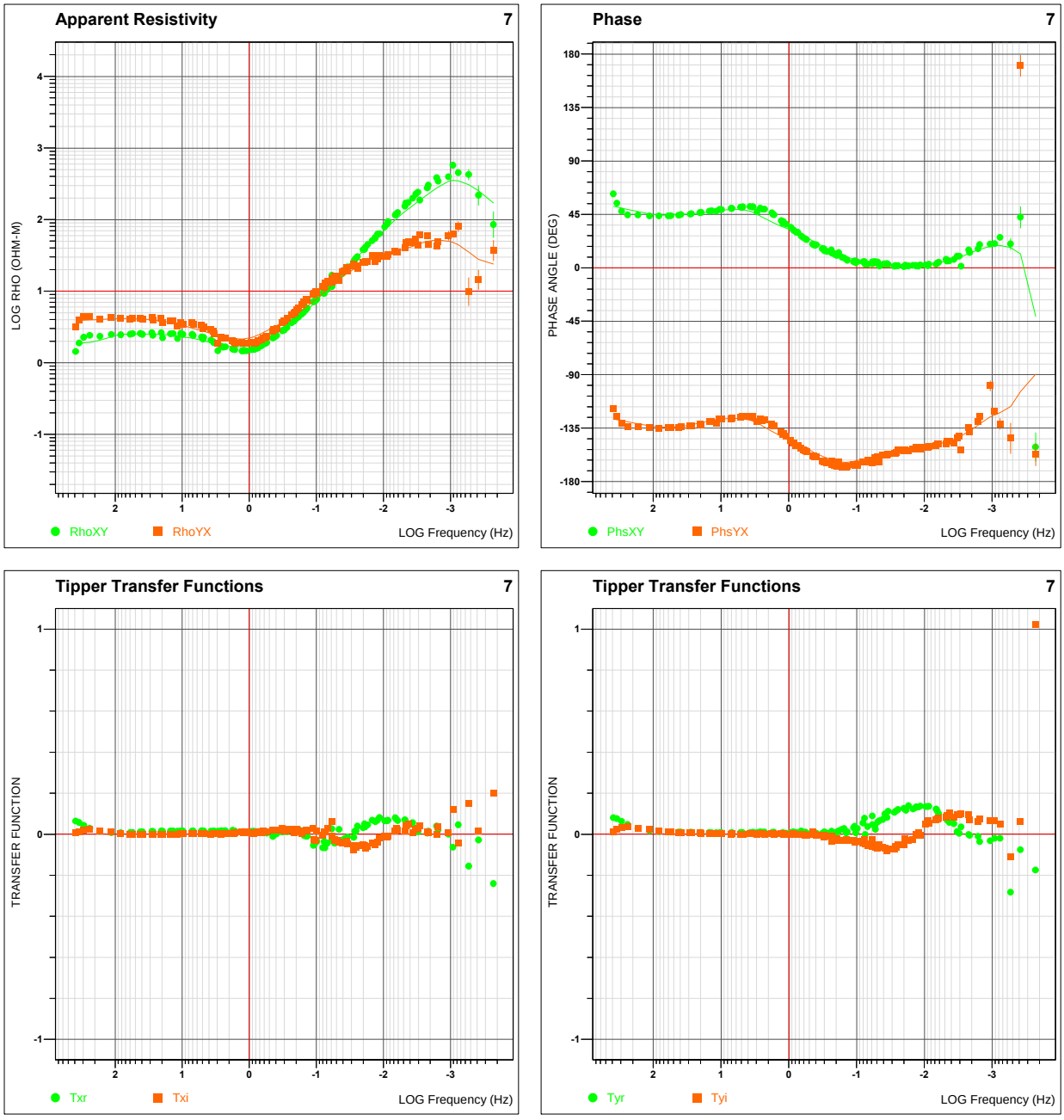


Reviewer Date: December 6, 2007

Comments:

- Overall good data quality.
- Noise in horizontal components <0.002Hz
- Very little noise in the data in the vertical component around 0.008Hz
- Suspicious pull-up phase for F>250Hz.

Site CA07 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.4 Site CA08

Name: CA08
Date: December 5, 2007

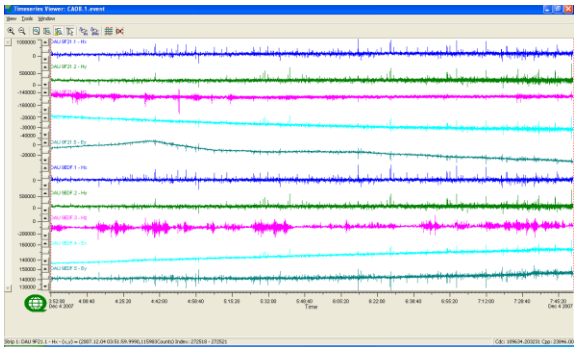
Setup Notes:

- Total of 18.5hrs of data were acquired and 14.5hrs used for processing (intersecting time) due to bad contact in the electrics.

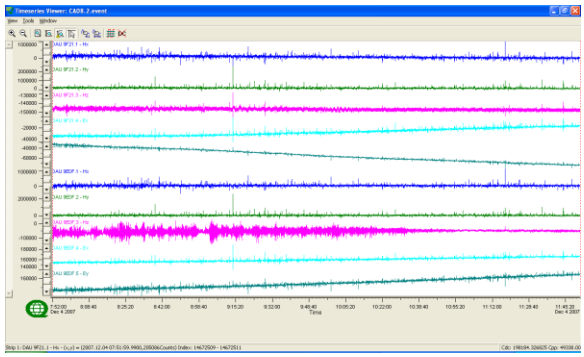
Events in Order	Time Series Notes
CA08.1	Overall good TS up to 16:27GMT when electrics lost contact with plate.
CA08.2	Subvents CA08.3 and CA08.4 overlapping for 3h.
CA08.3	Subevent CA08.5 2h and 9min long.
CA08.4	Some drifting in the electrics at site.
CA08.5	
CA08_20sps.1	
CA08_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	320	390

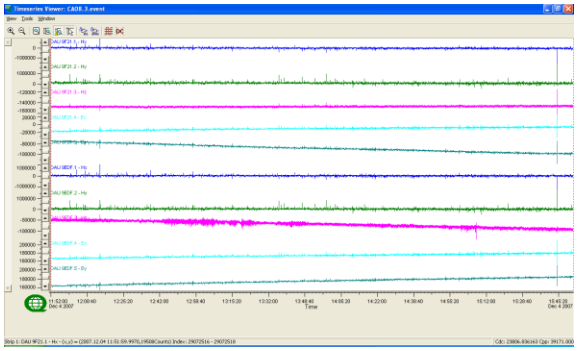
CA08.1



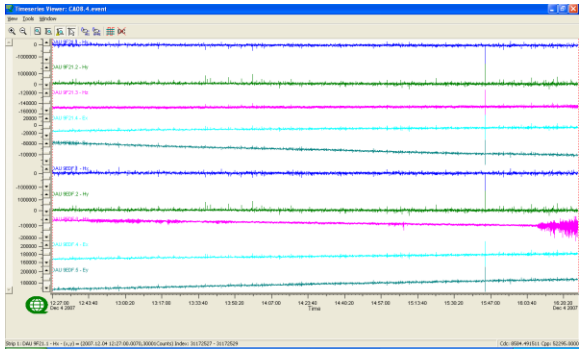
CA08.2



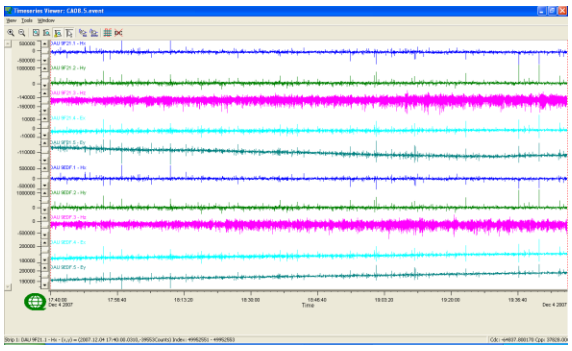
CA08.3



CA08.4



CA08.5

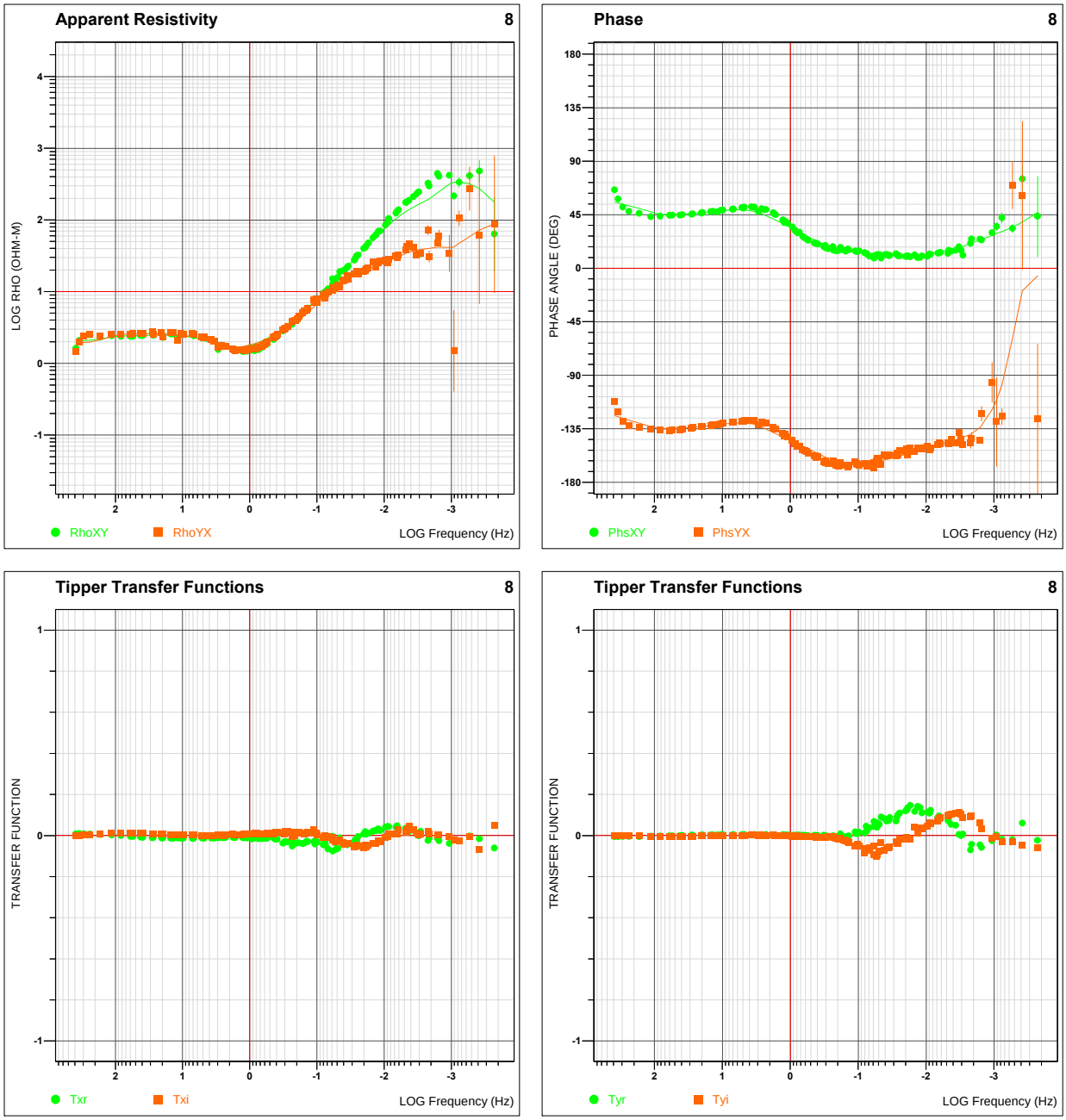


Reviewer Date: December 6, 2007

Comments:

- Overall good data quality.
- Noise < 0.003Hz in EyHx horizontal component.
- Suspicious pull-up phase for F>250Hz.

Site CA08 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.5 Site CA09

Name: CA09
Date: December 5, 2007

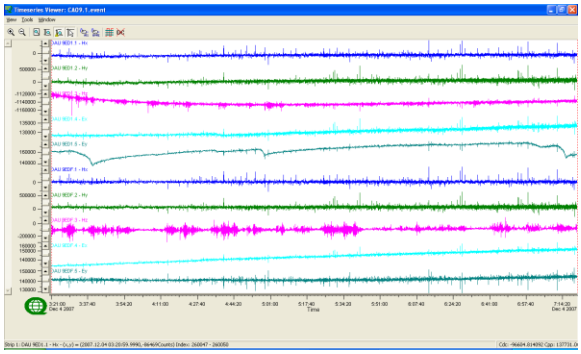
Setup Notes:

- Total of over 20hrs of data were acquired and 19hrs used for processing (intersecting time).

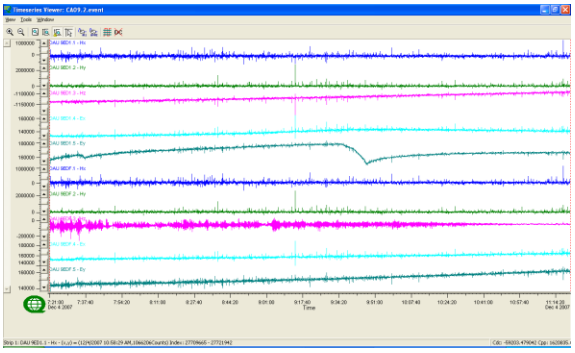
Events in Order	Time Series Notes
CA09.1	Overall good TS. DC offset in ch.5 (Ey) on site CA09 (CA09.1 and CA09.2)
CA09.2	
CA09.3	
CA09.4	
CA09.5	
CA09_20sps.1	
CA09_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	320	290

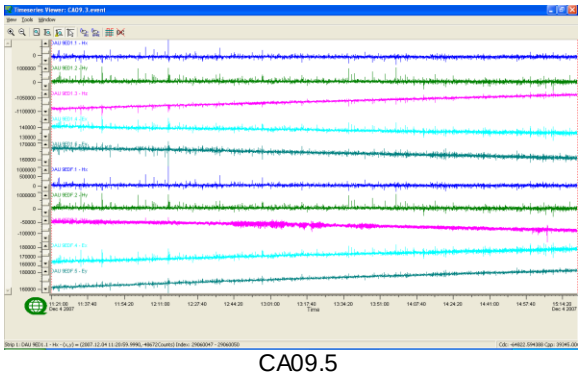
CA09.1



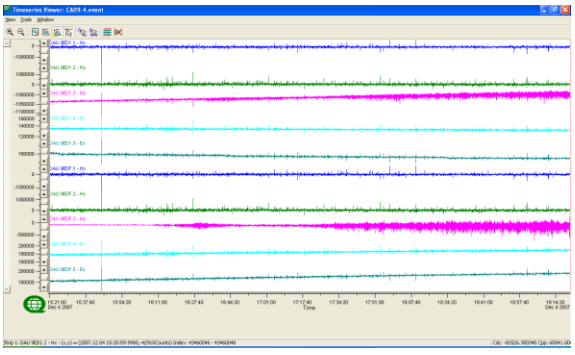
CA09.2



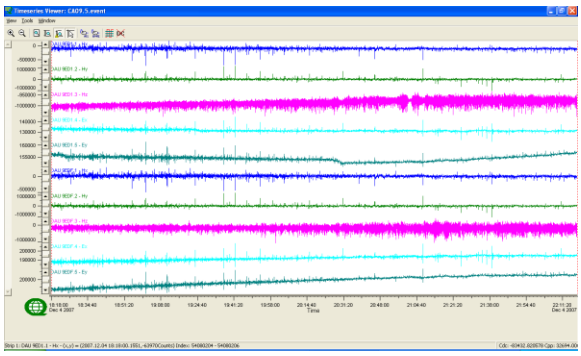
CA09.3



CA09.4



CA09.5

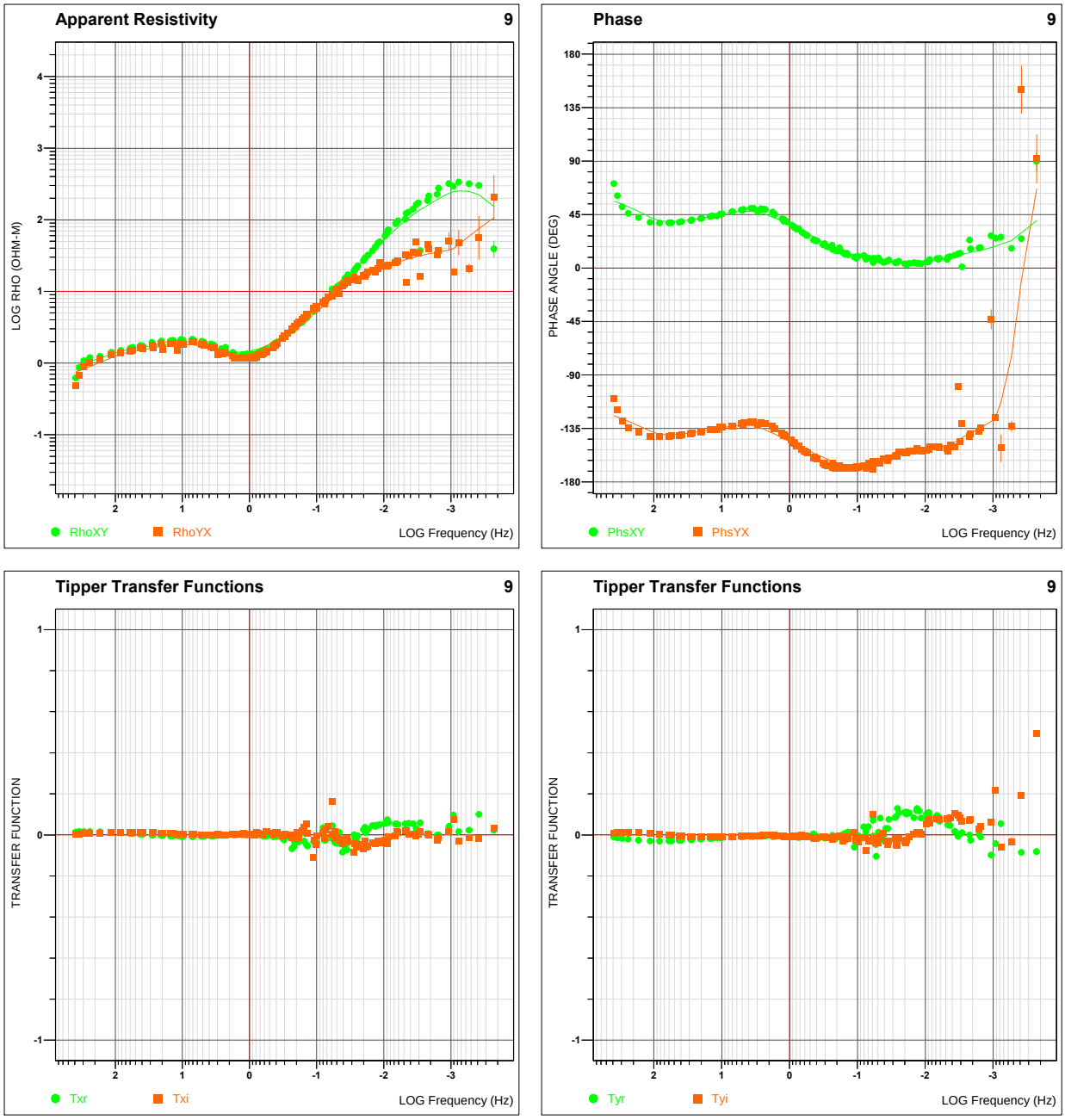


Reviewer Date: December 6, 2007

Comments:

- Overall decent data quality.
- Noise in horizontal components, especially EyHx <0.003Hz
- Noise in the data in the vertical component around 0.08Hz and <0002Hz
- Suspicious pull-up phase for F>250Hz.

Site CA09 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.6 Site CA10

Name: CA10
Date: December 5, 2007

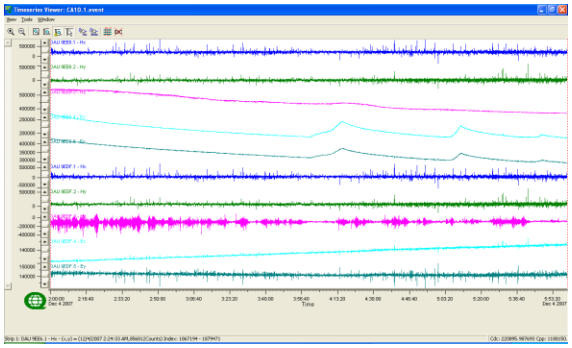
Setup Notes:

- Total of 22hrs of data were acquired and 20.5hrs used for processing (intersecting time).

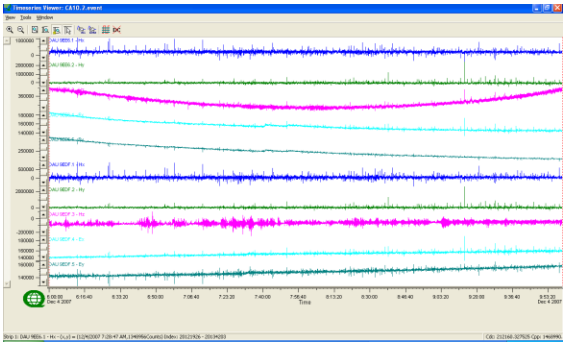
Events in Order	Time Series Notes
CA10.1	Overall decent TS. DC offset in electrics in site and drifting, due to poor contact between plate and wires, or wires and unit cable.
CA10.2	
CA10.3	
CA10.4	
CA10.5	
CA10_20sps.1	
CA10_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	340	360

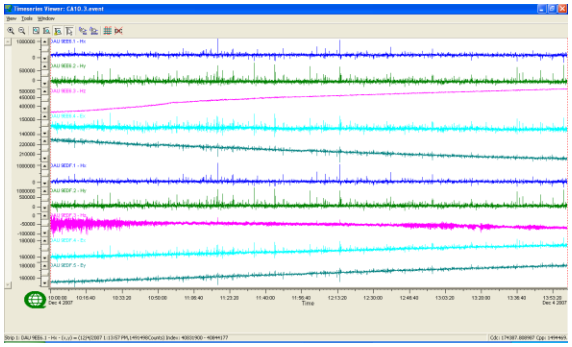
CA10.1



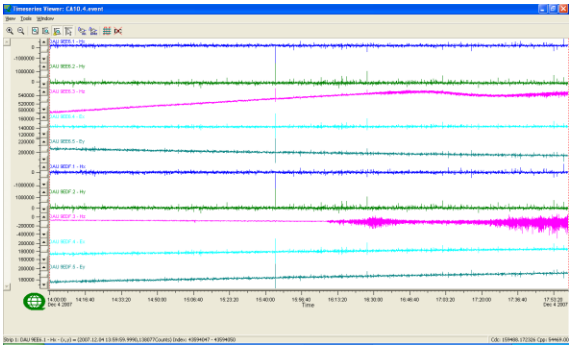
CA10.2



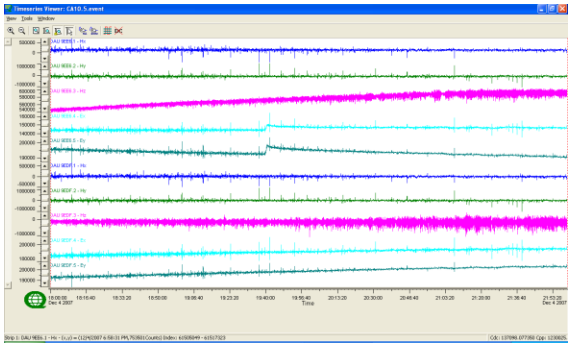
CA10.3



CA10.4



CA10.5

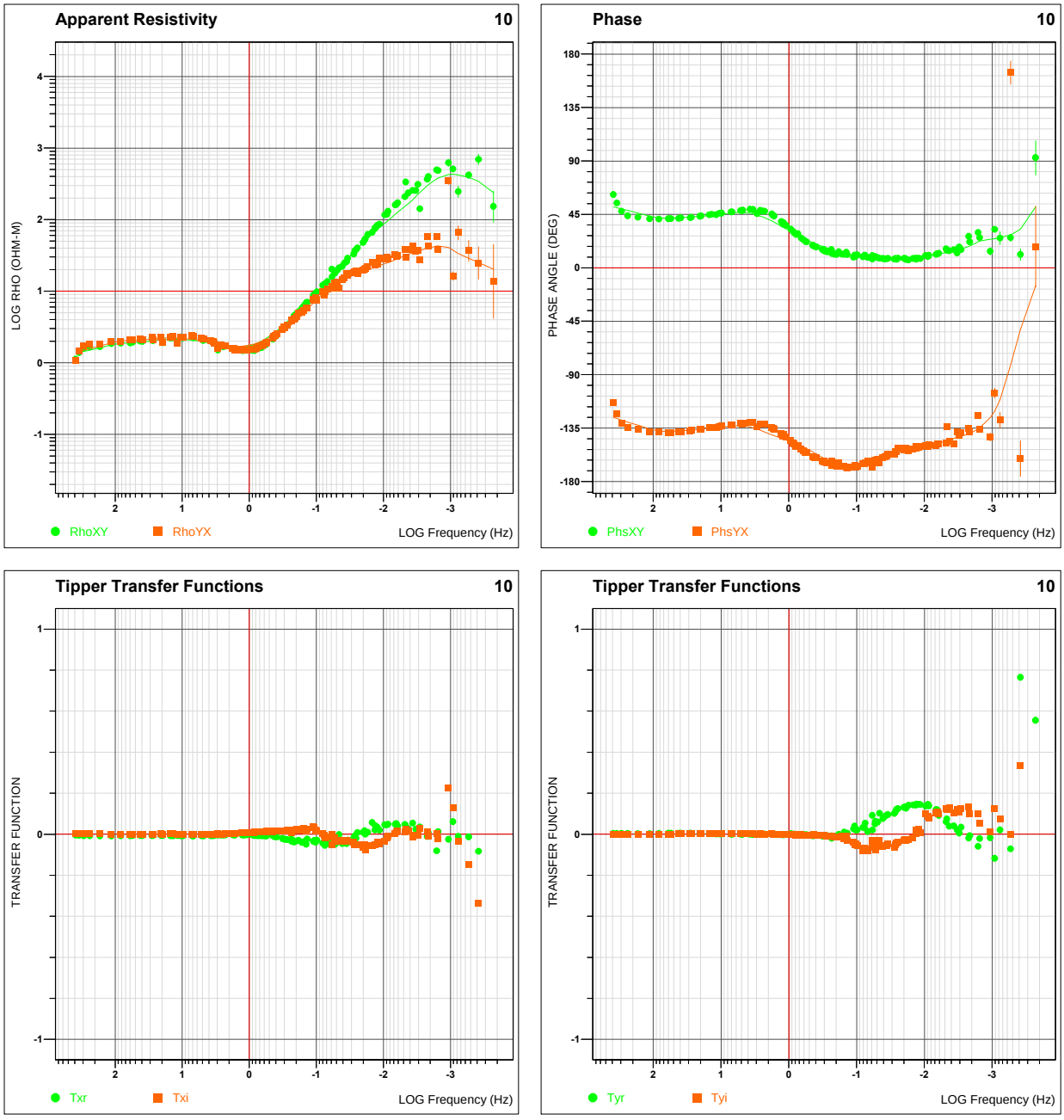


Reviewer Date: December 6, 2007

Comments:

- Overall good data quality.
- Noise in the data <0.002Hz, especially on horizontal components (poor contact in electrics)
- Suspicious pull-up phase for F>250Hz.

Site CA10 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)



2.1.7 Site CA11

Name: CA11
Date: December 5, 2007

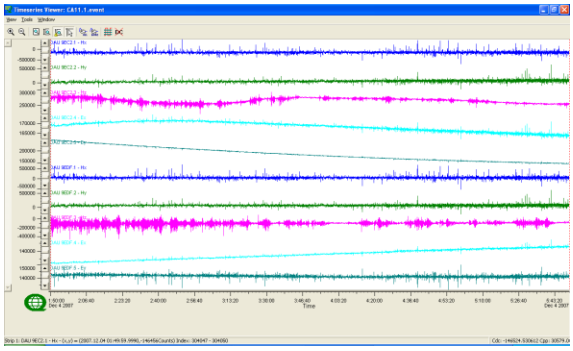
Setup Notes:

- Total of 22.6hrs of data were acquired and 20.6hrs used for processing (intersecting time).

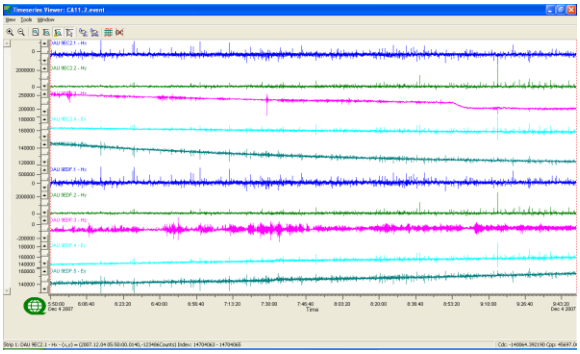
Events in Order	Time Series Notes
CA11.1	Overall good TS. Some drifting in Z coil (ch.3) on site CA11
CA11.2	
CA11.3	
CA11.4	
CA11.5	
CA11_20sps.1	
CA11_20sps.2	

Sensor Impedance Ω	Hx	Hy	Hz	Ex	Ey
	110	110	50	270	1100

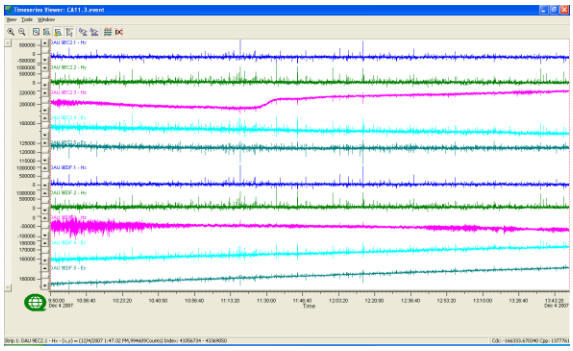
CA11.1



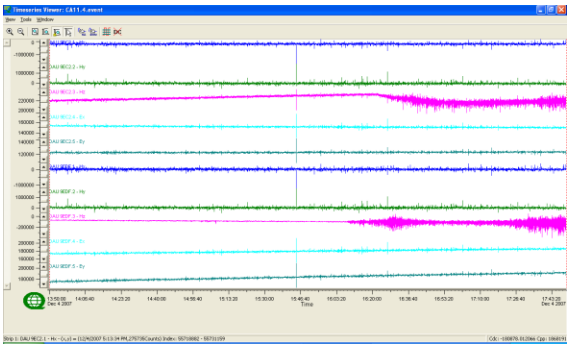
CA11.2



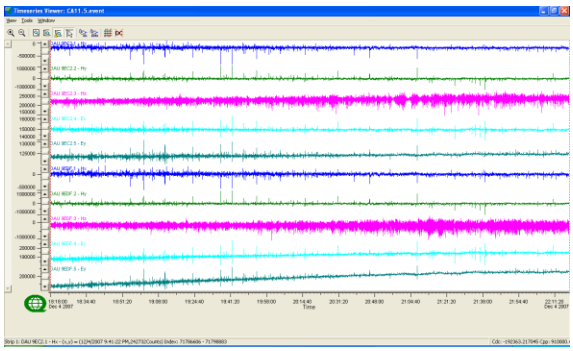
CA11.3



CA11.4



CA11.5



2007 Callabonna Magnetotelluric Survey

Interpretation Report for GEL 157

December 2008

petratherm

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List of Figures

2007 Callabonna Magnetotelluric Survey – CD Contents

2007 Callabonna Magnetotelluric Survey Final Interpretation Report (PDF)

1 Abstract

The 2007 Callabonna Magnetotelluric Survey, conducted by Petratherm Ltd., commenced on the 1st December 2007 and was completed on the 5th December 2007. The MT program was located in GEL 157, Callabonna Geothermal Prospect. This report covers the interpretation of the MT data acquired as shown in figure 1.

The main objective of the survey 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.

Eleven soundings were 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 awarded to Quantec Geoscience Australia; while the data inversion modeling 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.

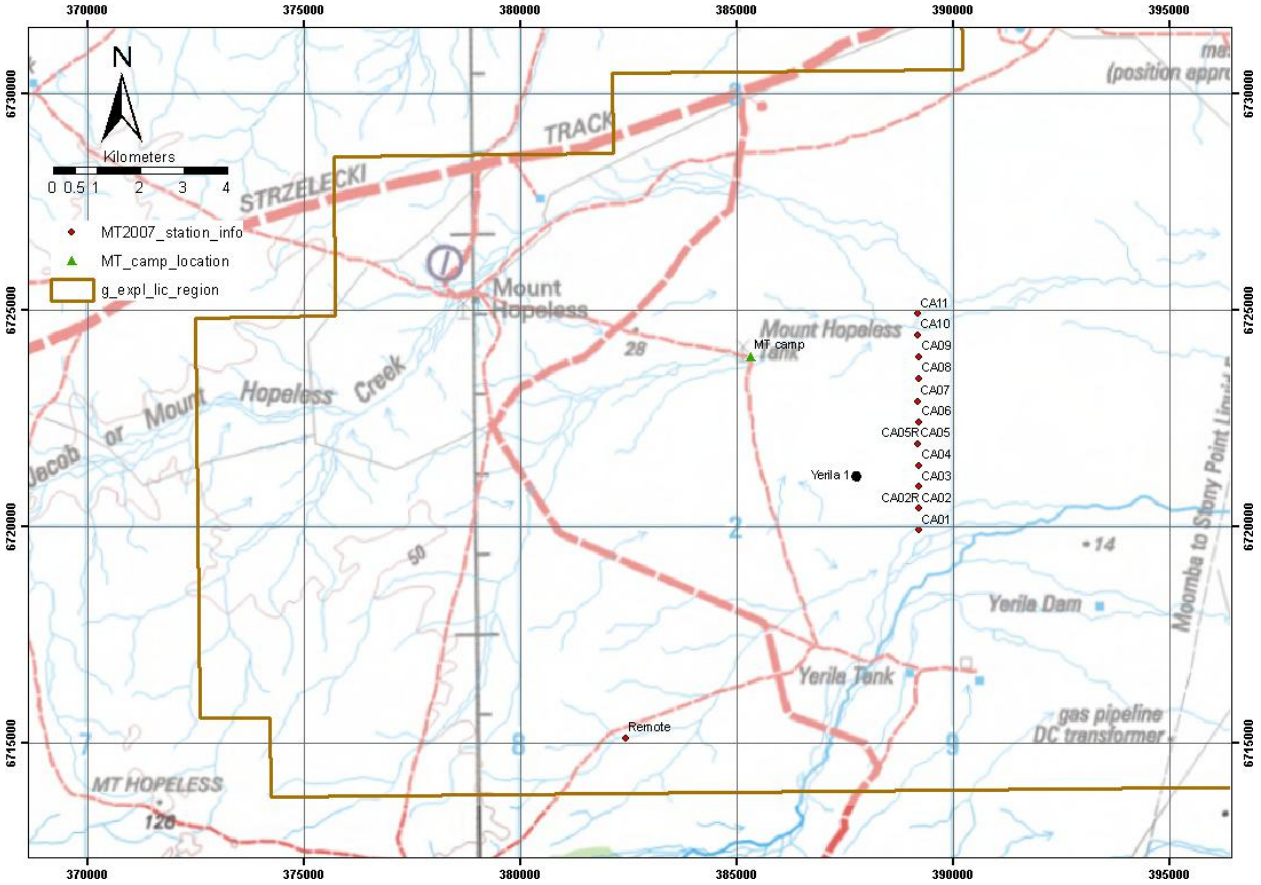

Figure 1 Callabonna MT line and remote reference station.

2 Introduction

GEL 157, Callabonna, is located 89km NE of Arkaroola Village, 164km NE of Leigh Creek, as shown in figure 2. The tenement covers 500 sq km, and was awarded to Petratherm in December 2003. The Callabonna MT survey forms part of the tenement work requirements.

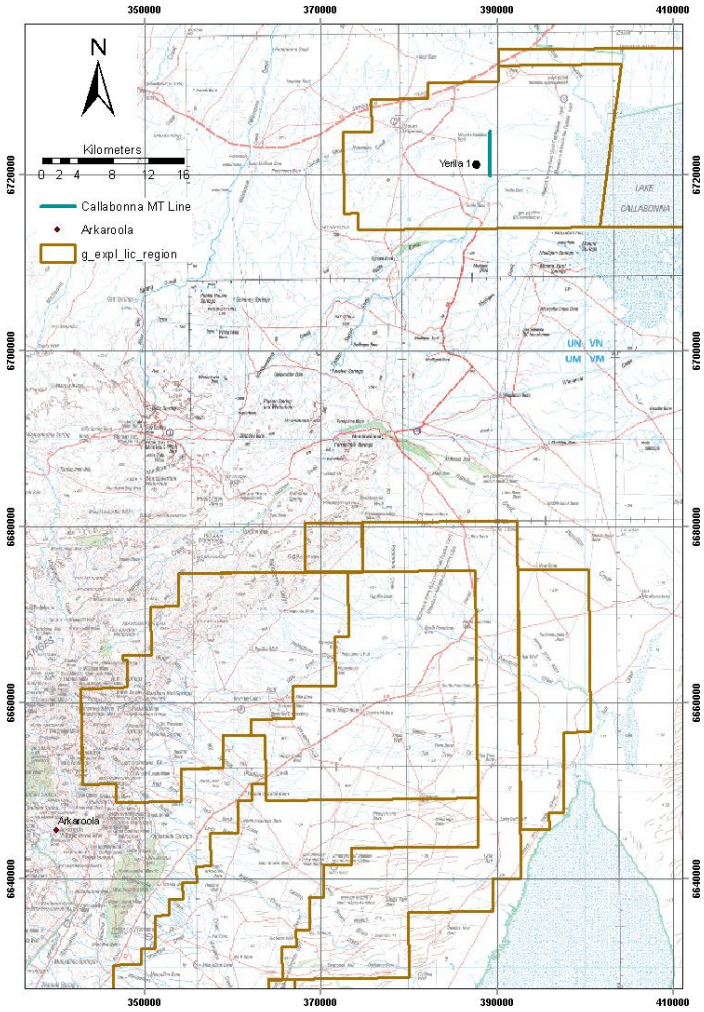

Figure 2 Location of Callabonna tenement GEL 157, with MT transect shown.

Modeling of acquired and exisiting gravity and aeromagnetic data suggested a large batholith beneath 3-5km of sedimentary cover within GEL 157. Drilling of Yerila-1 in August 2005 further tested the geothermal prospectivity of the Callabonna area; however the depth to basement remained unresolved. A magnetotelluric survey commenced in June 2006 to gain insight into the basin architecture and depth to basement across the tenement, however the survey was suspended following a severe thunderstorm which caused damage to the electrical acquisition equipment. As a result Petratherm contracted

Quantec Geoscience Australia to resume the survey along the same survey transect, with the aim of resolving the depth to basement.

3 Data modeling and inversions

Prior to modeling 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 3.

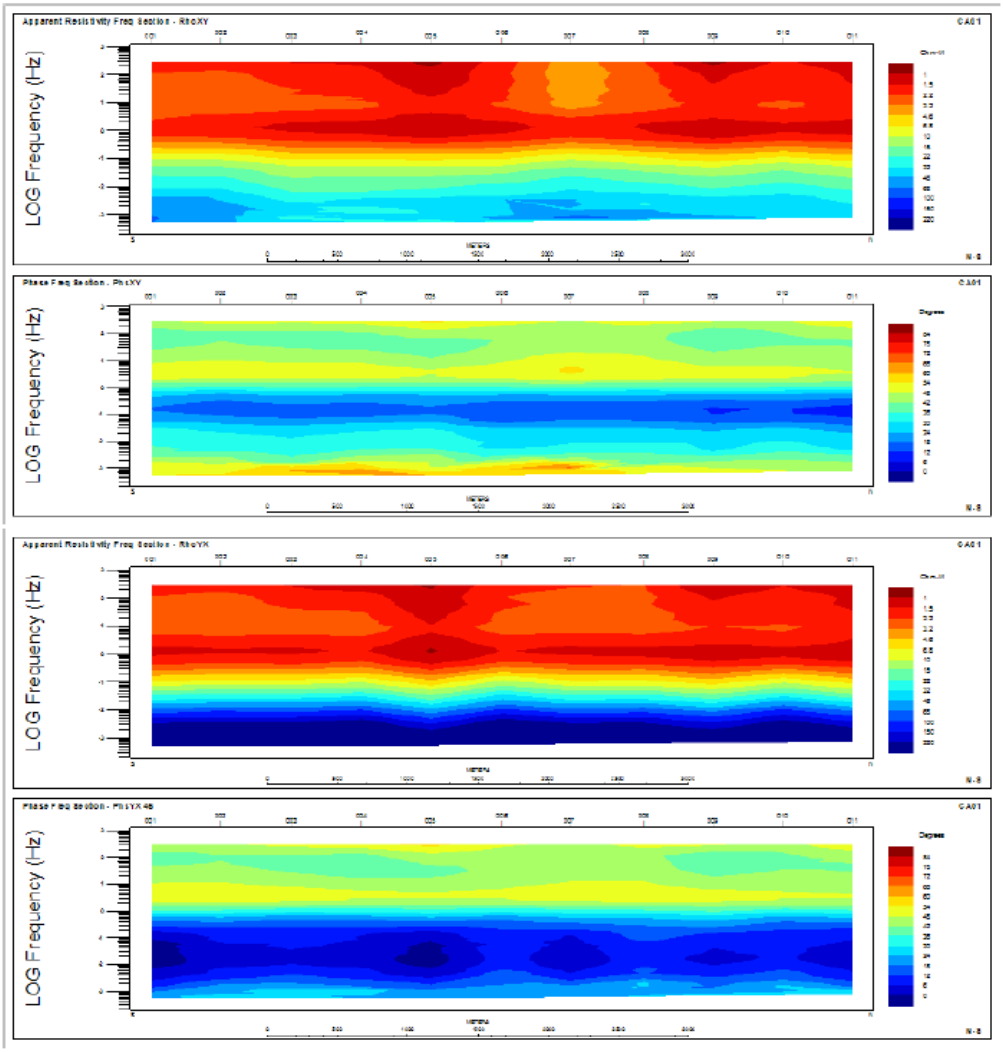

Figure 3 Raw data resistivity and phase profiles.

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.

3.1 Bostick 1D Model

1 D inversions were performed using Bostick and Occam algorithms. The Bostick 1D inversions (figure 4) 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.

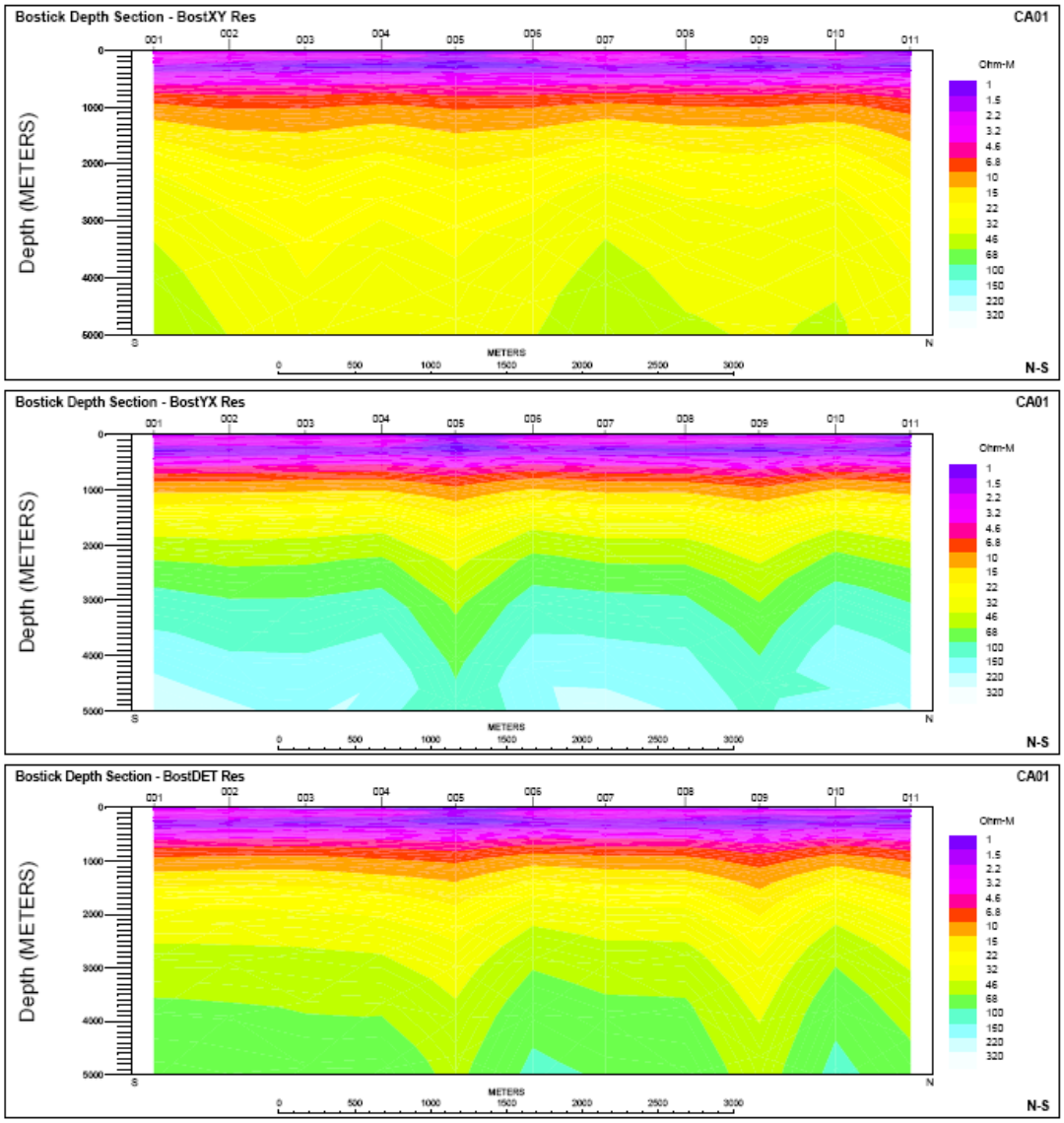

Figure 4 Bostick 1D inversion. a) 1D Cross-line (TE), b) 1D Inline (TM), c) 1D DET (avg)

3.2 Occam 1D Model

The Occam 1D inversion (figure 5) 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.

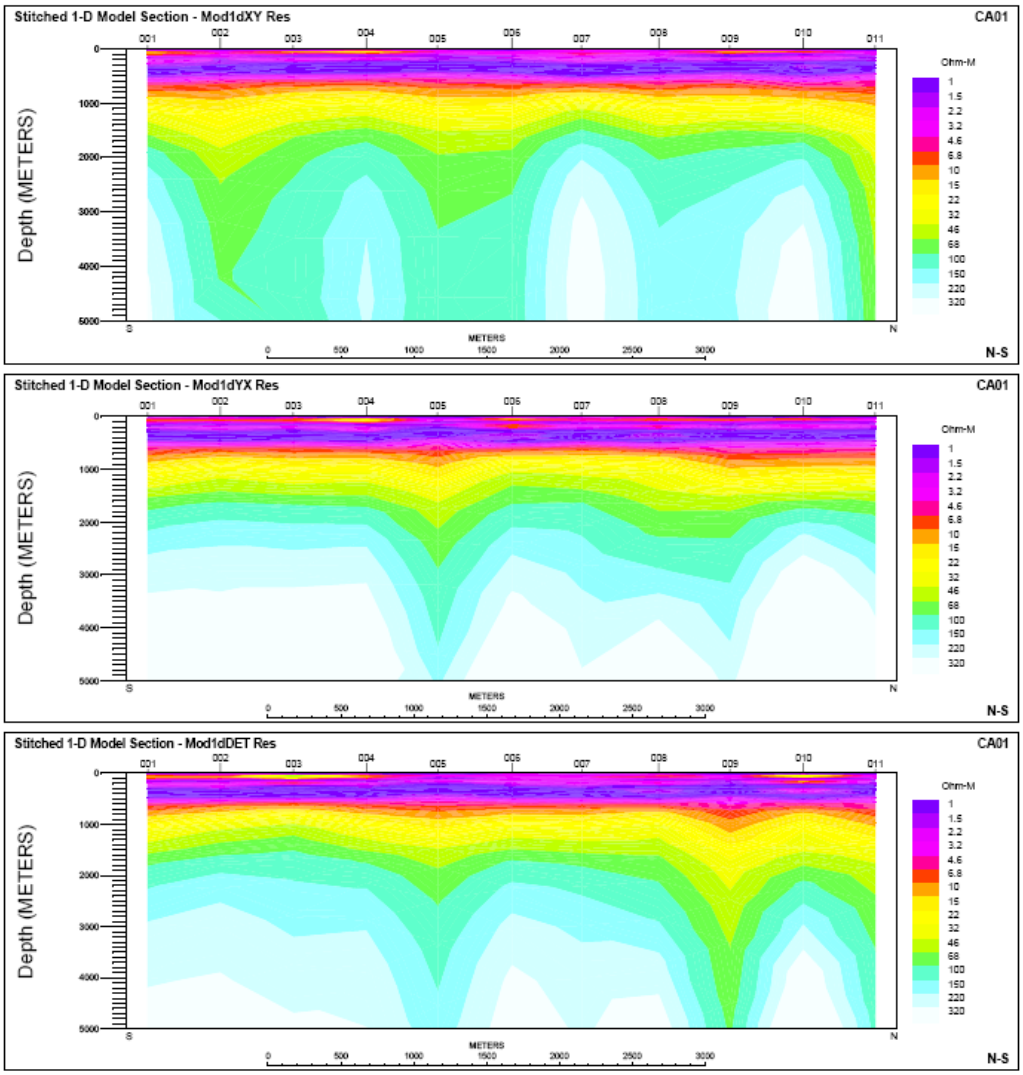

Figure 5 Occam 1D inversion. a) 1D Cross-line (TE), b) 1D Inline (TM), c) 1D DET (avg).

3.3 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 6. 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.

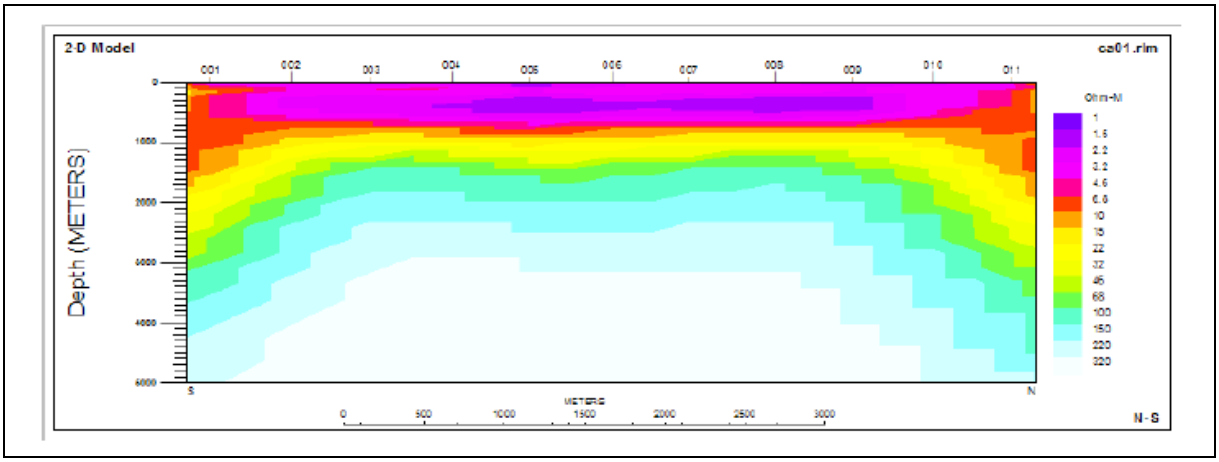

Figure 6 2D RLM resistivity inversion. TM rho/phs, TE phs, half space 100 ohm-m.

3.4 PW 2D Model

The PW 2D model results (figure 7) 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 modeling of the MT data.

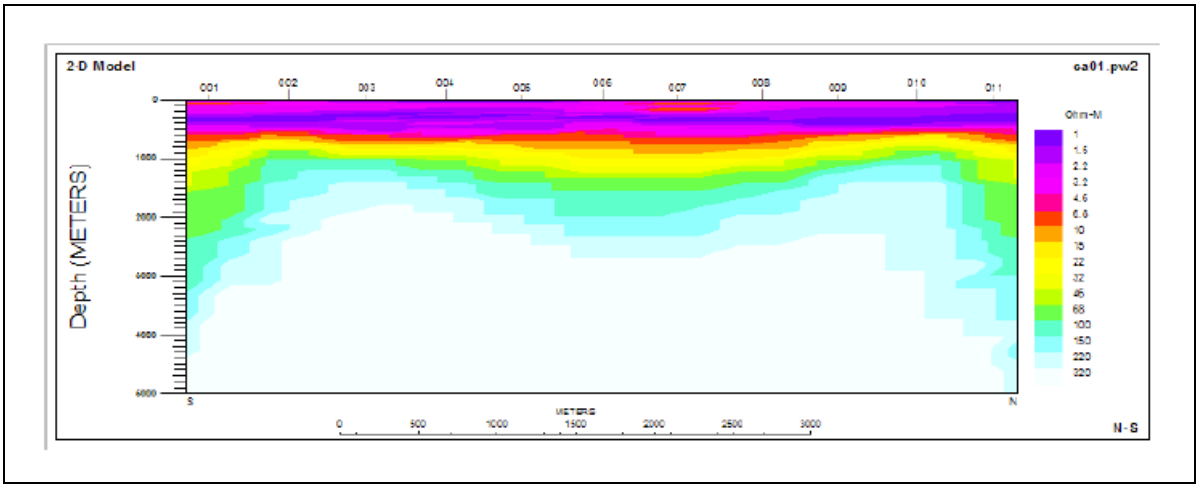

Figure 7 2D PW resistivity inverion. TM rho/phs, TE phs, RLM (final).

4 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.

Reviewer Date: December 6, 2007

Comments:

- Good data quality in horizontal components.
- Noise in the data in the vertical component <0.003Hz
- Suspicious pull-up phase for F>250Hz.

Site CA11 Final Result Sounding Curves (Raw data)
App. Resistivity – Phase – Tipper Transfer Functions (Txr-Txi & Tyr-Tyi)