

West Musgrave, W.A.

Airborne Magnetic, Radiometric
and Elevation Survey

for

Geoscience Australia

Acquisition and Processing Report

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Authorised for release by :

Survey flown: August - September 2002

by



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FAS JOB# 1548

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1. INTRODUCTION

This report provides details of the West Musgrave airborne magnetic, radiometric and elevation survey, carried out east of Warburton in Western Australia. The survey area partially covers the Scott (SG52-6) 1:250,000 map sheet and the Cooper (SG52-10) 1:250,000 map sheet and covers an area of over 46,000 line kilometres. The survey was flown for Geoscience Australia and was undertaken by Fugro Airborne Surveys Pty Ltd.

2. SURVEY DETAILS

2.1 Project Identification

Area Name:	West Musgrave
Contractor:	Fugro Airborne Surveys Pty Ltd
Fugro Job No.:	1548

2.2 Survey Location

The survey location is shown in Figure 1.

Survey boundary coordinates are:

348932E	7206525N	127.500000Long	-25.250000Lat
399292E	7206995N	128.000000Long	-25.250000Lat
399499E	7179308N	128.000000Long	-25.500000Lat
500000E	7179686N	129.000000Long	-25.500000Lat
500000E	7068942N	129.000000Long	-26.500000Lat
350514E	7068069N	127.500000Long	-26.500000Lat
350000E	7112378N	127.500000Long	-26.100000Lat
397004E	7112834N	127.970000Long	-26.100000Lat
396917E	7123910N	127.970000Long	-26.000000Lat
383405E	7123796N	127.835000Long	-26.000000Lat
383120E	7155916N	127.835000Long	-25.710000Lat
357343E	7173387N	127.580000Long	-25.550000Lat
349305E	7173298N	127.500000Long	-25.550000Lat

2.3 Specifications and Tolerances

Approx. line kilometres (including ties)	46,095
Traverse direction	000°-180°
Traverse spacing	400 m
Number of traverses	497
Tie-line direction	090°-270°
Tie-line spacing	4,000 m
Number of tie lines	35
Survey height	60m

Sample Intervals:

Magnetics (aircraft)	10Hz (approx. 7m)
Radiometrics	1Hz (approx. 70m)
GPS positions	1Hz
Radar altimeter	10Hz
Temperature, pressure & humidity	1Hz
Magnetics base station	1 s
Magnetics backup base station	5 s
Crystal size	50.3Lt

Contracted tolerances:

Position accuracy	3m horizontal; 5m height
Radar altimeter accuracy	0.3m
Temperature accuracy	1°C
Pressure accuracy	0.1%

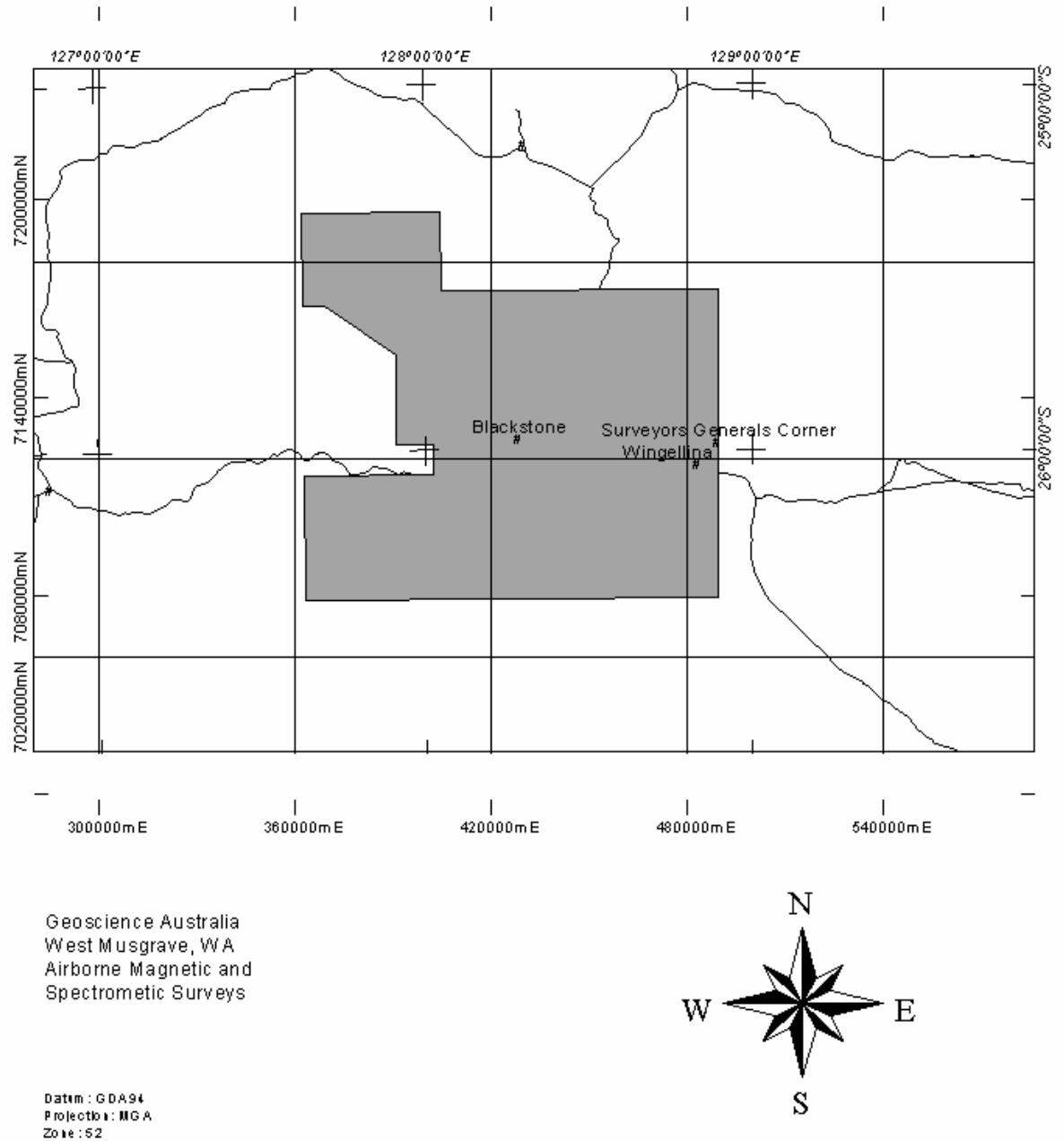
Magnetic base stations:

Noise envelope	0.2nT
Variation	5nT in 5 minutes and less than 1nT from any chord 1 minute long across the diurnal record

Aircraft magnetometer:

Non-geological noise envelope	0.1nT
Variation with heading	1 nT
Terrain clearance envelope	50 to 70m
Ground moisture	10% variation in corrected Th

Figure 1 – West Musgrave Location Diagram



3. PROJECT PERSONNEL

PROJECT SUPERVISION

Rod Pullin – Fugro: data acquisition
Katherine McKenna – Fugro: data processing
Ross Franklin – GA

SURVEY PILOTS

John Sparkman
Ivan Hussein
Max Eichorn

SURVEY OPERATORS

Justin Bombardieri (Crew Leader VH-WAM)
Ian Norcock
Ross Rackham
Brian Gribble

DATA PROCESSING

Sheryl Murphy

4. ACQUISITION

4.1 Aircraft and Equipment

Aircraft Model	Rockwell Shrike Aerocommander 500S
Aircraft Registration	VH-WAM
Aircraft Magnetometer	Geometrics G-822A Caesium vapour
Magnetic Compensator	RMS Instruments Automatic Aeromagnetic Digital Compensator (AADC)
Base station magnetometer	GR823B caesium vapour
Base station magnetometer	Scintrex Envimag
Gamma-ray spectrometer	Exploranium GR820D, 256 channels
Gamma-ray detector	NaI(Tl) crystals; 50.3L;
Altimeter	Sperry AA-210 radio altimeter
Barometer	Rosemount 1241m
Thermometer	Rosemount Model 22000 temperature sensor
Navigation system	Fugro Omnistar in VBS (Virtual Base Station) mode, Ashtech G12 GPS receiver
Flight Track Recording	VHS video tracking camera with wide-angle lens
Data acquisition system	GeoInstruments 2001 digital acquisition system

4.2 Base Stations

Base Station Logs can be found in Appendix A.

GPS Receiver

Model Ashtech G12

The acquired WGS84 GPS positions (latitude, longitude and altitude) were differentially post-processed in the field. Final coordinates reference GDA94, MGA Zone 52

Magnetometers

A GR823B caesium vapour base station magnetometer was used to measure the daily variations of the Earth's magnetic field. The base station was established in an area of low gradient, away from cultural influences. These data were displayed and recorded on a Libretto laptop computer. The base station was run continuously throughout the survey flying period with a sampling interval of 1 seconds and a sensitivity of 0.01 nT.

In addition to the caesium vapour base station, a Scintrex Envimag magnetometer base station recording at 5 second intervals was established primarily as a storm monitor.

The base station data were closely examined after each days production flying to determine if any data had been acquired during periods of out-of-specification diurnal variation.

4.3 Survey Operations

A summary of the acquisition phase is given in Table 1. Full operations report is provided in Appendix B. The survey flight logs are provided as Appendix I.

Date	Aircraft	Base	Comment
August 7, 2002	VH-WAM	Giles, WA	Acquisition Commenced
September 9, 2002	VH-WAM	Giles, WA	Last Day of Acquisition

TABLE 1 – OPERATIONS SUMMARY

4.4 Recorded Parameters

All acquired data are recorded digitally.

The following parameters are recorded at 10 Hz:

<i>Parameter</i>	<i>Resolution</i>	<i>units</i>
Local time	0.1	s
Fiducial number (time after midnight, local)	1.0	unit
Terrain clearance (radar altimeter)	0.01	m
Uncompensated Total Magnetic Intensity (TMI)	0.001	nT
Fluxgates X, Y & Z	0.01	nT
Fluxgate Total Field	0.01	nT
Uncompensated TMI 4 th difference	0.001	nT
Compensated TMI	0.001	nT

The following parameters are recorded at 1 Hz:

<i>Parameter</i>	<i>Resolution</i>	<i>units</i>
GPS time	1.0	s
Latitude	0.0000001	°
Longitude	0.0000001	°
GPS height	0.01	m
Outside air temperature	1.0	°C
Barometric pressure	0.01	hPa
Barometric altitude	0.01	m
Relative humidity	0.001	%
Full 256-channel gamma-ray spectrum	1.0	cps
Spectrometer livetime	0.001	s
Resolution	0.1	%
Number of satellites	1.0	
Position dilution of precision (PDOP)	0.1	
HDOP	0.1	

4.5 Calibrations and System Checks

4.5.1 Radiometric Calibrations

Pre-survey radiometric calibration results are summarised in Table 2. These tests were conducted respectively by flying the dynamic test range at Carnamah, WA, flying over the same altitude over a dry lake near the test range (very low radiation) and taking pad tests at Jandakot Airport, WA on the 28th May 2002.

		VH-WAM
Aircraft Background	TC	28.0
	K	6.0
	U	0.5
	Th	0.1
Cosmic Background	TC	0.8610
	K	0.0481
	U	0.0394
	Th	0.0485
Height Attenuation	TC	0.00725
	K	0.00935
	U	0.00646
	Th	0.00715
Stripping	α	0.247
	β	0.418
	γ	0.762
	a	0.071
	b	0.002
	c	0.001
Air/Ground	Dose	38.54
	K	140.27
	U	15.53
	Th	8.15

TABLE 2 – COEFFICIENTS SUMMARY

4.5.2 Magnetic Compensation

Magnetic compensation sequences were flown before acquisition commenced and after routine maintenance was performed, as required. The resulting coefficients were used for real-time magnetic compensation:

VH-WAM

LOCATION: 25°19'0000 S 128°10'0000 E 10,000ft AMSL

COMPENSATION 1		COMPENSATION 2	
August 7, 2002 (Pre-survey)		August 31, 2002 (Post Maintenance)	
UNC	0.3542	UNC	0.4442
CMP	0.02709	CMP	0.03158
IR	13.1	IR	14.1
NRM	22.4	NRM	24.4

UNC: Standard deviation of uncompensated TMI (nT)

CMP: Standard deviation of compensated TMI (nT)

IR: Improvement ratio (UNC/CMP)

NRM: Vector norm of the interference terms set

4.5.3 Low-level Test Lines

Low-level test lines were flown twice per day at survey height in the same flight configuration as on survey. Average radiometric counts were compared to assess system repeatability, soil moisture effects, etc. The location of the Low-level test line and test line records, resulting statistics and Th graphs are given in Appendix C.

4.5.4 Radiometric Button Checks

Crystal stabilisation using Thorium was undertaken prior to each day's acquisition, and at the end of each day's acquisition. Radiometric counts were recorded by locating the Thorium samples underneath the crystal packs, a distance of 40cm below the aircraft. This process was also conducted with the samples removed to determine background radiation.

Resulting statistics and Th graphs are given in Appendix D.

4.5.5 Radar Altimeter Stacks

Prior to commencement of acquisition, radalt stacks were flown as accurately as possible with reference to the radar altimeter indicator, which was set at a pre-determined height. These were flown over the airstrip at Warakurna, WA. The results are shown in Table 3.

VH-WAM			
Line Number	Target Height (m)	Average Radalt (m)	Average GPS Ht (m)
46600	30	29.8	36.7
46610	60	58.8	63.9
46620	75	75.4	77.4
46630	90	90.3	92.0
46640	150	149.9	151.8
46650	300	298.7	300.8

TABLE 3 – RADAR ALTIMETER STACK RESULTS

4.5.6 Navigation

A navigation repeatability check was performed prior to and following each day's acquisition. The aircraft was parked in the same position each day, to test the navigation repeatability. The results are shown in Appendix E.

4.5.7 Heading Checks

To verify the ability of the compensator to remove any heading errors, a series of heading checks were performed. This consisted of flying over the same point on survey headings at 10000 feet. Results are shown in Table 4.

Line Number	Direction	Fid	Easting (m)	Northing (m)	Diurnally Corrected mag (nT)
5560.1	N	83771	442802.2	7209263.7	54330.2
5561.0	E	84030	442803.4	7209262.6	54329.9
5562.0	S	84497	442802	7209262.5	54330.5
5563.0	W	84858	442802.5	7209263.7	54330.3

TABLE 4 – HEADING CALIBRATIONS

Maximum heading error = 0.6 nT

Central Position = 442802 mE 7209263 mN

5. PROCESSING

5.1 Hardware and Software

All data processing was carried out by Fugro Airborne Surveys Pty Ltd in its Western Australia office in Floreat, Perth.

Hardware	UNIX workstations Pentium PCs (Windows 98) HP Designjet 650C & 2500CP Plotters HP Compact Disc Writer Iomega Zip Drives
Software	Fugro in-house software ERMapper 6.2 (imaging only)

5.2 GPS Positioning

5.2.1 Spheroids, Datums and Zones

The acquired GPS positions (latitude, longitude and altitude) were differentially post-processed in the field. Final coordinates reference GDA94, MGA Zone 52.

The 1 Hz position data was linearly interpolated to coordinate all 0.1 Hz data.

5.2.2 Quality Control

The following position quality control plots were produced:

- flight path
- ground speed
- altitude

5.3 Magnetics

5.3.1 Quality Control

The following quality control plots were produced:

- high-pass magnetic noise
- diurnal variation
- total field
- radar altimeter

This visual aspect of quality control was aided by the determination of statistics (max., min., mean and s.d.) for all parameters for every line.

System spikes were removed from the magnetic data but cultural responses were retained.

5.3.2 Parallax Correction

Parallax error is caused by the physical difference in distance between the various sensors, the electronic delay and software timing in the acquisition system. Hence all variables are subjected to a displacement from the GPS co-

ordinates. If these variables are processed without a position offset a parallax error will occur. The most suitable way to treat this problem is to use the 1 second radiometric data as a base with a zero correction. This will prevent interpolation of important variables (a filtering process). For VH-WAM, the GPS instrumentation is located in the same area as the radar altimeter and the spectrometer, thus, no parallax correction was required for these variables. The magnetometer, however, was found to have a parallax of +6 fids.

5.3.3 Diurnal Correction

The magnetic data were corrected for diurnal variations. The correction formula was:

diurnal corrected TMI = compensated TMI *minus* diurnal *plus* mean diurnal value

Mean Diurnal Value 54530 nT

5.3.4 IGRF Correction

The International Geophysical Reference Field (IGRF) was removed from the data using the 2000 model extrapolated to the survey date 2002.8. The correction formula was:

final corrected TMI = diurnal corrected TMI *minus* local IGRF *plus* IGRF base value.

Inclination	-58.99 degrees
Declination	3.78 degrees
Base Value	55215 nT

5.3.5 Levelling

Tie line levelling produced the final levelled magnetics data.

No polynomials are used in this form of **tie-line levelling** technique, it is a least squares process with varying weights, depending upon local data variability (near the intersections points), gradient and confidence values attributed to data and position.

Constraints are used to control the rate at which adjustments can change along either flight or tie lines, using a single distance parameter, or a wavelength. The **wavelength** is a bending constraint which controls how far along line you allow the adjustments to bend.

A **threshold** is also applied to the line data and is the maximum allowable adjustment at any stage, along line. This parameter is of utmost importance because as well as limiting the adjustments, it is also used to weight the adjustments when they are filtered along line. No reference tie-line is used, all flight and tie lines have equal priority before weights are established.

Rate of allowed variation along line refers to both flight lines and tie lines, and is distance based, so that the greater separation between cross-overs along flight lines and tie lines is correctly compensated for. Data is selected at the cross-overs by application of a non-linear filter of a user selectable length, ie the **filter length** chosen by the user, determines how data is selected at the cross-over points. This filter also establishes the gradient. With magnetic data, this filter is kept reasonably short, but with radiometric data, the filter is kept quite long to compensate for statistical variations.

Wavelength, filter length and threshold are all independent, user-selectable parameters. Levelling is then carried out iteratively, levelling the tie lines and flight lines in turn. Parameters used for tie-line levelling the magnetics data are shown in Table 5.

Area	Wavelength (m)	Filter Length (m)	Threshold (nT)
West Musgrave	50000	100	2

TABLE 5 – MAGNETICS TIE LINE LEVELLING PARAMETERS

No microlevelling was required for the magnetics data.

5.3.6 Gridding & Further Enhancements

A line spline algorithm was used to produce gridded data of 80 metre cell size for all areas. This was achieved using proprietary software.

The TMI gridded data was then reduced to the pole and a first vertical derivative calculated.

5.4 Radiometrics

Radiometric processing closely follows the IAEA publication, "Technical Reports Series No. 323" (1991).

5.4.1 Quality Control

256 channel spectral plots for all flights and source tests were produced. All data were checked for peak stability and count variation.

Statistics for all channels were calculated and checked. Profiles were produced where required. The data were subsequently checked (images, profiles and statistics) after each stage of processing to ensure continued data integrity.

5.4.2 Calibrations and Coefficients

See Section 4.5.

5.4.3 256-Channel Pre-processing

The radiometrics were produced with NASVD smoothing. Using the NASVD technique, the raw spectra were first smoothed using 6 principal components. Eigenvectors and statistics on the NASVD processing results were used for analysis. The 256 channel data were then pre-processed to obtain data for Radon gas background removal.

Radon corrections are performed using the spectral ratio technique, involving detailed curve-fitting techniques to determine the final count values for various peaks of filtered spectral data (using long filters). Corrections are made for the interference to the 0.609MeV and 1.76MeV peaks from adjacent thorium peaks, in an iterative way, before the final peak values are accepted, then the spectral ratios are established. This method is calibrated using the test range data, before the corrections are applied to the data.

Raw count rates used for final processing were extracted by summing the 256 channel data over the IAEA windows centred on the peak locations, to the nearest channel. The IAEA windows are:

Total Count	0.41 to 2.81 MeV
Potassium	1.37 to 1.57 MeV
Uranium (Bi ²¹⁴)	1.66 to 1.86 MeV
Thorium (Tl ²⁰⁸)	2.41 to 2.81 MeV
Cosmic	>3.0 MeV

5.4.4 Final Processing

A Gaussian-damped sinc function filter was applied to height, cosmic and radon channels. These filter lengths are specified in fiducials and were respectively, a filter length of 3 (equivalent to a cut-off wavelength of 90m), a filter length of 9 (equivalent to a cut-off wavelength of 350m), and a filter length of 7 (equivalent to a cut-off wavelength of 280m). Cosmic, aircraft and Radon backgrounds were then removed.

The Potassium, Uranium and Thorium count rates were corrected for Compton scattering (stripped). The coefficients themselves were corrected to the STP

corrected height using theoretical linear corrections for the three primary stripping coefficients.

Corrections to the terrain clearance were made using STP corrected heights and the absorption factors appropriate to the exponentially decreasing count rates with height.

During **micro-levelling**, a de-corrugation levelling is applied, which has similar constraints on the allowed rate of variation of adjustment along line as described for tie-line levelling. Raw adjustments are simply high-pass filtered data perpendicular to flight lines, the cut-off wavelength being four times the line-spacing at a user selectable grid interval along line. The high-pass filter coefficients are a form of cosine roll-off filter, where the roll-on wave number, is equivalent to wave number multiplied by the line separation, and is a dimensionless unit.

In general a high-pass filter of 0.5 is the highest filter equivalent to half of the shortest wavelength, and the line separation. The value chosen for the high-pass filter is the most effective one, which removes most of the 'saw-toothing' in the data, but keeps the overall data integrity. Each grid line is filtered individually, before the constraints are applied along each flight line. The constrained values are the final adjustments to be subtracted from the original data. The most effective parameters used for micro-levelling the Radiometrics are shown below. Further microlevelling was applied using Fugro proprietary software that allows for manual bust removal.

Final levelled airborne gamma-ray counts were then converted to the equivalent ground radioelement concentrations.

Tie-Line Levelling				
Radioelement	Wavelength (m)		Filter Length (m)	Threshold (cps)
Total Count	20000		400	100
Potassium	No		Tie-Line Levelling	Required
Uranium	1500		15	1
Thorium	No		Tie-Line Levelling	Required
Micro-Levelling				
Radioelement	Wavelength (m)	Filter Length (fids)	Threshold (cps)	High Pass Filter
Total Count	2200	15	25	0.125
Potassium	Manual	Microlevelling	Required	
Uranium	Manual	Microlevelling	Required	
Thorium	Manual	Microlevelling	Required	

TABLE 6 – LEVELLING PARAMETERS FOR RADIOMETRIC DATA

5.4.5 Gridding

A minimum curvature algorithm was used to produce gridded data of 80 metre cell size. This was achieved using proprietary software.

5.5 Digital Elevation Model

5.5.1 Processing

The form of the calculation used was:

$$\text{Digital Terrain} = \text{GPS altitude} - \text{Radar Altimeter} - 3.8\text{m}$$

where,

GPS Altitude is flying height above ellipsoid (WGS84),
Radar Altimeter is flying height above ground and,
a 3.8m correction was made to allow for the vertical distance
between the GPS antenna and the radar altimeter.

No system parallax was applied to the Digital Elevation Model. Tie line levelling and further micro-levelling produced the final levelled terrain model.

Details of the levelling procedures used are described in detail in Section 5.4.4. The parameters used for levelling the Digital Elevation Model are shown below.

Further microlevelling was applied using Fugro proprietary software that allows for manual bust removal.

Tie-Line Levelling				
Area	Wavelength (m)	Filter Length (m)	Threshold (m)	
West Musgrave	50000 pass 1	100 pass 1	6 pass 1	
	8500 pass 2	100 pass 2	4 pass 2	
Micro-Levelling				
Area	Wavelength (m)	Filter Length (fids)	Threshold (m)	High Pass Filter
West Musgrave	2200	15	0.4	0.125

TABLE 7 – LEVELLING PARAMETERS FOR DIGITAL ELEVATION MODEL

5.5.2 Australian Height Datum

The terrain surface was subsequently referenced to the AUSLIG 1998 N-values to produce a DEM corrected to the Australian Height Datum. The N-values are calculated and applied separately at each data point using values interpolated from the regular grid values supplied by AUSLIG 1998. The interpolation is done by a form of untensioned bi-cubic spline. The magnitude and statistics of the corrections applied are tabulated in Appendix F.

The final DEM data were compared to published topographic maps, the results are shown in Table 8.

Position (AGD66)	DEM (m AHD)	Published Topo Map (m AHD)	Difference (m)
392000E,7094600N	607	610	-3
445100E,7100600N	700	702	-2
418300E,7123100N	726	728	-2

TABLE 8 – COMPARISON OF DEM WITH PUBLISHED TOPOGRAPHY

5.5.3 Gridding

A line spline algorithm was used to produce gridded data of 80 metre cell size for all areas. This was achieved using proprietary software.

6. PRELIMINARY PRODUCTS

6.1 Preliminary Raw Located Data

- 0.1 second magnetics
- 1.0 second radiometrics (includes 256 channel data)
- 0.1 second digital elevation

Preliminary raw located data is in ASCII format. Descriptions of each are shown in Appendix G.

7. FINAL PRODUCTS

7.1 Final Located Data

- 0.1 second magnetics
- 1.0 second radiometrics
- 0.1 second digital elevation

Final located data is in ASCII format. Descriptions of each are shown in Appendix H.

7.2 Final Gridded Data

Final gridded data was produced in ERMapper format.

- Total Magnetic Intensity (TMI), nT
- TMI Reduced To The Pole (TMI RTP), nT
- 1st Vertical Derivative of TMI RTP (1VD TMI RTP), nT
- Doserate smoothed, nGy/h
- Potassium smoothed, %
- Uranium smoothed, ppm
- Thorium smoothed, ppm
- Digital Elevation Model (DEM), m

APPENDIX A

BASE STATION LOGS

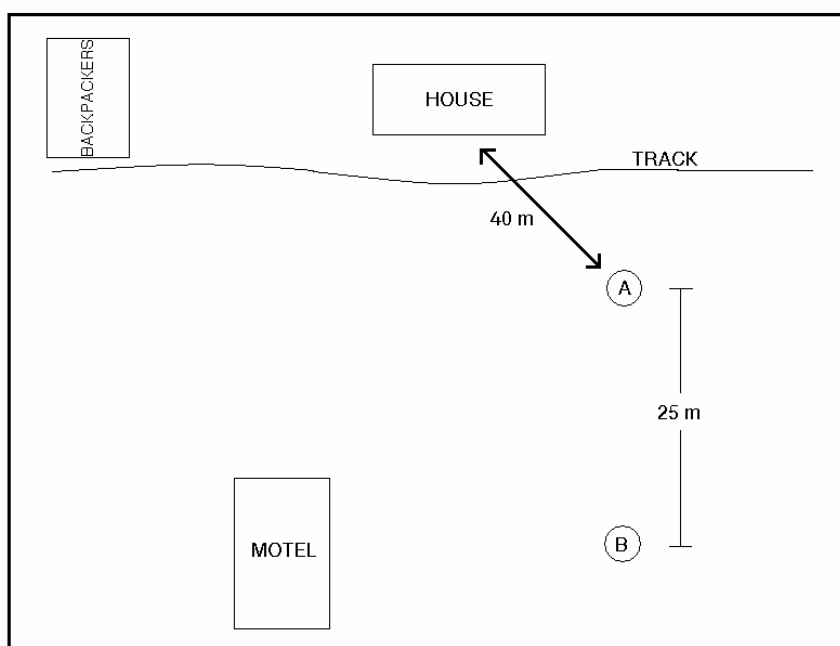
BASE MAGNETOMETERS

A Type Cesium Vapour
 Serial No. Pre amp 9604068
 Cycle Rate 1sec Height 1.5m
 Location 300m S/E of WAM
 Area Gradient (2 metres in each direction)

N _____ nT
 W _____ nT C _____ nT E _____ nT
 S _____ nT

B Type Scintrex Envi Mag
 Serial No. 9411107
 Cycle Rate 5sec Height 1.8m
 Location 500m S/E of WAM
 Area Gradient (2 metres in each direction)

N 54509.9 nT
 W 54509 nT C 54508.4 nT E 54507 nT
 S 54507.1 nT



FUGRO AIRBORNE SURVEYS PTY LTD**FAS-OP-F55****Base GPS / Magnetometer Record**

Job Number	1548	Client	Geoscience Australia	Crew Leader	Brian Gribble
Aircraft	VH-WAM	Area Name	West Musgrave	Completed by	Brian Gribble
Date	7/08/02	Julian Day	219	Signature	

BASE GPS

Calculated Base GPS Co-ordinates	Latitude	25°	02"	35.99742"
	Longitude	128°	18"	07.36333"
	Height	605.711	metres	
	Ellipsoid	GPS		
	Antenna Location	1m pole on SW corner of verandah on west side of house next to mechanics workshop		

Method of Position Determination

- ☐ Differentially processed against; ☐ Averaged, real-time corrected aircraft position
☐ **YES** Trig point

Flight # / Trig stn # **34T1** Date **7/08/02** Sample Duration **1.3** hours

Averaged Aircraft Position or Trig point Location	Latitude	24°	59"	40.91200"
	Longitude	128°	18"	45.79870"
	Height	825.547	metres	
	Ellipsoid			
	St Dev.	0.001	metres (N/A if using Trig)	

APPENDIX B

OPERATIONS REPORT

Week Commencing: **Monday 05-Aug-02**

Job Number: 1548

Total km: 45243.1

Aircraft: VH-WAM

Base: Giles

Country: Australia

Area Name: West Musgrave

Operators: JB, IN

Data Proc:

Crew Leader: Justin Bombardieri

Accom: Warakurna Roadhouse

Pilots: JS, IH

Techs:

Client: Geoscience Australia

Contact #: 08 89567344 Fax 08 89562850

Date	Flight Number	Crew		Time		M/R	Oil		Fuel	This Flight		To Date		Standby (0, 0.5, 1)	Comments
		Plt(s)	Op	T/O	Land	Hrs	L	R	Added	Prod	Refly	Prod	Refly		
Monday	5-Aug-02														
Julian	217														
Day	1														
				Hours Today		0.0				0.0	0.0	0.0	0.0		
Tuesday	6-Aug-02		IH	JS		1.1			306						
			IH	JS		2.0			250						
Julian	218		JS	IH		2.6	1	1	323						Ferry Murray Bridge to Port Pirie Ferry Port Pirie to Coober Pedy Ferry Coober Pedy to Giles
Day	2														
				Hours Today		5.7				0.0	0.0	0.0	0.0		
Wednesday	7-Aug-02	1	JS	BG	9:10	11:14	2.1		338	0.0	0.0				Comp box, manoeuvres & heading check
		2	JS	BG	14:50	17:55	3.1		329	549.4	0.0				First production flt
Julian	219														
Day	3									549.4	0.0	549.4	0.0		
				Hours Today		5.2									
Thursday	8-Aug-02	3	IH	RR	7:43	12:23	4.7		516	889.2	0.0				Flight OK
		4	JS	BG	12:50	17:54	5.1	2	2	541	980.3	0.0			Flight OK
Julian	220														
Day	4									1869.5	0.0	2418.9	0.0		
				Hours Today		9.8									
Friday	9-Aug-02	5	JS	BG	7:32	12:25	4.9		518	847.5	0.0				OK + Manoeuvre checks
		6	IH	RR	13:12	18:06	4.9		527	999.7	0.0				Flight OK
Julian	221														
Day	5									1847.2	0.0	4266.1	0.0		
				Hours Today		9.8									
Saturday	10-Aug-02	7	IH	RR	7:38	12:35	5.0		534	988.3	0.0				Flight OK, Line 1177.0 chopped into 4 pieces?????
		8	JS	BG	13:03	17:47	4.7	1	1	494	988.8	0.0			OK - slight diurnal mag activity
Julian	222														
Day	6									1977.1	0.0	6243.2	0.0		
				Hours Today		9.7									
Sunday	11-Aug-02	9	IH	RR	7:46	12:12	4.4		400	722.6	84.1				Flight OK, Heading Check Within Spec.
															Aircraft return to YPJT for 100Hourly in afternoon
Julian	223														
Day	7									722.6	84.1	6965.8	84.1		
				Hours Today		4.4									
Total Job Hours		44.6	Weekly Totals			44.6	4	6	5076	6965.8	84.1			0.0	
			Total Aircraft Hours				Ltrs/Hr		114			Total Standby		0.0	
			Hours to Next Periodic				Running Avg			995.1 km/day		% Complete		15.4 %	
			Anticipated Hours Next week							156.2 km/hr		km Remaining		38277.3 km	

Survey Equipment Problems:

Week Commencing: **Monday 12-Aug-02**

Job Number: 1548

Total km: 45243.1

Aircraft: VH-WAM

Base: Giles

Country: Australia

Area Name: West Musgrave

Operators: JB, IN

Data Proc: 0

Crew Leader: Justin Bombardieri

Accom: Warakurna Roadhouse

Pilots: JS, IH

Techs: 0

Client: Geoscience Australia

Contact #: 08 89567344 Fax 08 89562850

Date	Flight Number	Crew		Time		M/R	Oil		Fuel	This Flight		To Date		Standby (0, 0.5, 1)	Comments
		Pit(s)	Op	T/O	Land	Hrs	L	R	Added	Prod	Refly	Prod	Refly		
Monday 12-Aug-02															No flights, aircraft at YPJT
Julian 224															
Day 8															
				Hours Today		0.0				0.0	0.0	6965.8	84.1		
Tuesday 13-Aug-02															No flights, aircraft at YPJT
Julian 225															
Day 9															
				Hours Today		0.0				0.0	0.0	6965.8	84.1		
Wednesday 14-Aug-02															No flights, aircraft at YPJT
Julian 226															
Day 10															
				Hours Today		0.0				0.0	0.0	6965.8	84.1		
Thursday 15-Aug-02															No flight, aircraft at YPJT Aircraft return to Giles
Julian 227		JS	JB			5.1				420.0					
Day 11															
				Hours Today		5.1				420.0	0.0	7385.8	84.1		
Friday 16-Aug-02	10	IH	RR	7:48	12:36	4.8			496	949.8	0.0				Flight OK Flight OK
Julian 228	11	JS	JB	14:05	18:20	4.3	2	2	445	800.5	0.0				
Day 12															
				Hours Today		9.1				1750.3	0.0	9136.1	84.1		
Saturday 17-Aug-02	12	JS	JB	7:45	12:45	5.0			509	1030.7	0.0				Flight OK Flight OK
Julian 229	13	IH	RR	13:10	17:55	4.8		1	506	744.0	150.7				
Day 13															
				Hours Today		9.8				1774.7	150.7	10910.8	234.8		
Sunday 18-Aug-02	14	IH	RR	7:38	12:28	4.8	2	2	523	996.5	0.0				Flight OK Flight OK
Julian 230	15	JS	JB	12:55	17:55	5.0		1	513	1058.7					
Day 14															
				Hours Today		9.8				2055.2	0.0	12966.0	234.8		
Total Job Hours		78.4	Weekly Totals			33.8	4	6	2992	6000.2	150.7			0.0	
			Total Aircraft Hours				Ltrs/Hr		89			Total Standby		0.0	
			Hours to Next Periodic				Running Avg			857.2 km/day		% Complete		28.7 %	
			Anticipated Hours Next week							177.5 km/hr		km Remaining		32277.1 km	

Survey Equipment Problems:

Week Commencing: **Monday 19-Aug-02**

Job Number: 1548

Total km: 45243.1

Aircraft: VH-WAM

Base: Giles

Country: Australia

Area Name: West Musgrave

Operators: JB, IN

Data Proc: 0

Crew Leader: Justin Bombardieri

Accom: Warakurna Roadhouse

Pilots: JS, IH

Techs: 0

Client: Geoscience Australia

Contact #: 08 89567344 Fax 08 89562850

Date	Flight Number	Crew		Time		M/R	Oil		Fuel	This Flight		To Date		Standby (0, 0.5, 1)	Comments
		Pit(s)	Op	T/O	Land	Hrs	L	R	Added	Prod	Refly	Prod	Refly		
Monday 19-Aug-02	16	JS	JB	7:35	12:30	4.9			540	963.6					Flight OK Flight OK
	17	IH	RR	13:00	18:08	5.1	1	1	571	1118.1					
	231														
Julian Day	15			Hours Today		10.0				2081.7	0.0	15047.7	234.8		
Tuesday 20-Aug-02	18	IH	RR	7:38	12:48	5.2			562	1045.1	91.2				Flight OK Flight OK
	19	JS	JB	13:15	17:55	4.7	1	1	492	1066.4					
	232														
Julian Day	16			Hours Today		9.9				2111.5	91.2	17159.2	326.0		
Wednesday 21-Aug-02	20	IH	JB	7:40	12:40	5.0			447	1150.1					Flight OK Flight OK John Sparkman pilots day off
	21	IH	RR	13:26	17:31	4.2	12	12	350	758.2	51.1				
	233														
Julian Day	17			Hours Today		9.2				1908.3	51.1	19067.5	377.1		
Thursday 22-Aug-02		JS				4.0			151	0.0	0.0				Aircraft to Alice Springs for spar inspection Flight OK Ivan Hussein pilots day off
	22	JS	JB	13:05	18:00	4.9			516	1123.0					
	234								550						
Julian Day	18			Hours Today		8.9				1123.0	0.0	20190.5	377.1		
Friday 23-Aug-02	23	IH	RR	7:36	12:42	5.1			542	1123.0	0.0				Flight OK Flight OK
	24	JS	JB	13:10	18:05	4.9	2	2	523	1122.9					
	235														
Julian Day	19			Hours Today		10.0				2245.9	0.0	22436.4	377.1		
Saturday 24-Aug-02	25	JS	JB	7:35	12:30	4.9		1	528	1122.8	0.0				Flight OK Flight OK
	26	IH	RR	12:56	18:08	5.2		1	530	1122.7	0.0				
	236														
Julian Day	20			Hours Today		10.1				2245.5	0.0	24681.9	377.1		
Sunday 25-Aug-02	27	IH	JB	7:38	12:54	5.2			558	1122.7	0.0				Flight OK Flight OK
	28	JS	RR	13:20	17:25	4.1	2	2	536	898.1					
	237														
Julian Day	21			Hours Today		9.3				2020.8	0.0	26702.7	377.1		
Total Job Hours		145.8	Weekly Totals			67.4	18	20	7395	13736.7	142.3			0.0	
			Total Aircraft Hours				Ltrs/Hr		110			Total Standby		0.0	
			Hours to Next Periodic				Running Avg			1962.4 km/day		% Complete		59.0 %	
			Anticipated Hours Next week							203.8 km/hr		km Remaining		18540.4 km	

Survey Equipment Problems:

Week Commencing: **Monday 26-Aug-02**

Job Number: 1548

Total km: 45243.1

Aircraft: VH-WAM

Base: Giles

Country: Australia

Area Name: West Musgrave

Operators: JB, IN

Data Proc: 0

Crew Leader: Justin Bombardieri

Accom: Warakurna Roadhouse

Pilots: JS, IH

Techs: 0

Client: Geoscience Australia

Contact #: 08 89567344 Fax 08 89562850

Date	Flight Number	Crew		Time		M/R	Oil		Fuel	This Flight		To Date		Standby (0, 0.5, 1)	Comments
		Pit(s)	Op	T/O	Land	Hrs	L	R	Added	Prod	Refly	Prod	Refly		
Monday 26-Aug-02	29	JS	JB	7:35	12:40	5.1			474	1122.5					Flight OK Flight OK AT2 Crapped out
	30	IH	RR	13:05	17:56	4.9			509	898.0					
	238														
Day	22			Hours Today		10.0				2020.5	0.0	28723.2	377.1		
Tuesday 27-Aug-02						5.5									WAM ferried to Perth for 100 Hrly
	239														
Day	23			Hours Today		5.5				0.0	0.0	28723.2	377.1		
Wednesday 28-Aug-02															WAM 100 Hrly
	240														
Day	24			Hours Today		0.0				0.0	0.0	28723.2	377.1		
Thursday 29-Aug-02															WAM 100 Hrly
	241														
Day	25			Hours Today		0.0				0.0	0.0	28723.2	377.1		
Friday 30-Aug-02		IH	IN			4.5	2	2	460						WAM returned to Giles after 100 Hrly
	242														
Day	26			Hours Today		4.5				0.0	0.0	28723.2	377.1		
Saturday 31-Aug-02	31	JS	JB	7:47	12:30	4.7			486	897.0					Flight OK Check Box Flown Flight OK Time channel contains bad data Diurnal Base Mag B stopped and was restarted (Overheated)
	32	IH	IN	13:20	18:00	4.6	1	2	544	897.0					
	243														
Day	27			Hours Today		9.3				1794.0	0.0	30517.2	377.1		
Sunday 1-Sep-02	33	IH	IN	7:30	12:50	5.3			548	1120.0					Flight OK Flight cut short due strong winds
	34	JS	JB	13:32	15:12	1.7	2	2	222	224.7					
	244														
Day	28			Hours Today		7.0				1344.7	0.0	31861.9	377.1		
Total Job Hours		182.1	Weekly Totals			36.3	5	6	3242	5159.2	0.0			0.0	
			Total Aircraft Hours				Ltrs/Hr		89			Total Standby		0.0	
			Hours to Next Periodic				Running Avg			737.0 km/day		% Complete		70.4 %	
			Anticipated Hours Next week							142.1 km/hr		km Remaining		13381.2 km	

Survey Equipment Problems:

Week Commencing: **Monday 02-Sep-02**

Job Number: 1548

Total km: 45243.1

Aircraft: VH-WAM

Base: Giles

Country: Australia

Area Name: West Musgrave

Operators: JB, IN

Data Proc: 0

Crew Leader: Justin Bombardieri

Accom: Warakurna Roadhouse

Pilots: JS, IH

Techs: 0

Client: Geoscience Australia

Contact #: 08 89567344 Fax 08 89562850

Date	Flight Number	Crew		Time		M/R	Oil		Fuel	This Flight		To Date		Standby (0, 0.5, 1)	Comments
		Pit(s)	Op	T/O	Land	Hrs	L	R	Added	Prod	Refly	Prod	Refly		
Monday	2-Sep-02													1.0	Standby day due strong winds Both pilots day off
Julian	245														
Day	29			Hours Today		0.0				0.0	0.0	31861.9	377.1		
Tuesday	3-Sep-02	35	JS	JB	7:20	12:20	5.0		509	1121.5					Flight OK Flight OK
		36	IH	IN	12:45	18:00	5.3	1	630	1009.5					
Julian	246														
Day	30			Hours Today		10.3				2131.0	0.0	33992.9	377.1		
Wednesday	4-Sep-02	37	IH	IN	7:12	12:20	5.1		532	1122.1					Flight OK Flight OK
		38	JS	JB	12:46	17:58	5.2	2	598	1122.1					
Julian	247														
Day	31			Hours Today		10.3				2244.2	0.0	36237.1	377.1		
Thursday	5-Sep-02	39	JS	JB	7:10	12:10	5.0		478	1121.8					Flight OK Flight OK
		40	IH	IN	12:40	17:45	5.0	2	550	1122.1					
Julian	248														
Day	32			Hours Today		10.0				2243.9	0.0	38481.0	377.1		
Friday	6-Sep-02	41	IH	IN	7:12	12:20	5.1		568	1122.1					Flight OK Flight OK
		42	JS	JB	12:45	17:51	5.1	2	539	1121.8					
Julian	249														
Day	33			Hours Today		10.2				2243.9	0.0	40724.9	377.1		
Saturday	7-Sep-02	43	JS	JB	7:19	12:19	5.0		531	1122.0					Flight OK Flight OK. 50 hourly oil change
		44	IH	IN	12:45	17:45	5.0	11	545	1122.0					
Julian	250														
Day	34			Hours Today		10.0				2244.0	0.0	42968.9	377.1		
Sunday	8-Sep-02	45	IH	IN	7:10	12:45	5.0		562	1122.0					Flight OK Diurnal bad 9 lines scrubed Flight OK
		46	JS	JB	12:42	17:52	5.2		424	1121.9					
Julian	251														
Day	35			Hours Today		10.2				2243.9	0.0	45212.8	377.1		
Total Job Hours		243.1	Weekly Totals			61.0	15	18	6465	13350.9	0.0			1.0	
			Total Aircraft Hours				Ltrs/Hr		106			Total Standby		1.0	
			Hours to Next Periodic				Running Avg			1907.3 km/day		% Complete		99.9 %	
			Anticipated Hours Next week							219.0 km/hr		km Remaining		30.3 km	

Survey Equipment Problems:

Week Commencing: **Monday 09-Sep-02**

Job Number: 1548

Total km: 45243.1

Aircraft: VH-WAM

Base: Giles

Country: Australia

Area Name: West Musgrave

Operators: JB, IN

Data Proc: 0

Crew Leader: Justin Bombardieri

Accom: Warakurna Roadhouse

Pilots: JS, IH

Techs: 0

Client: Geoscience Australia

Contact #: 08 89567344 Fax 08 89562850

Date	Flight Number	Crew		Time		M/R	Oil		Fuel	This Flight		To Date		Standby (0, 0.5, 1)	Comments
		Pit(s)	Op	T/O	Land	Hrs	L	R	Added	Prod	Refly	Prod	Refly		
Monday 9-Sep-02	47	JS	JB	7:18	11:18	4.0		2	460	448.8	143.0				Flight OK Flight OK
	48	IH	IN	11:52	0:00	5.3	1	1	358		1122.0				
Julian	252														
Day	36			Hours Today		9.3				448.8	1265.0	45661.6	1642.1		
Tuesday 10-Sep-02															
Julian	253														
Day	37			Hours Today		0.0				0.0	0.0	45661.6	1642.1		
Wednesday 11-Sep-02															
Julian	254														
Day	38			Hours Today		0.0				0.0	0.0	45661.6	1642.1		
Thursday 12-Sep-02															
Julian	255														
Day	39			Hours Today		0.0				0.0	0.0	45661.6	1642.1		
Friday 13-Sep-02															
Julian	256														
Day	40			Hours Today		0.0				0.0	0.0	45661.6	1642.1		
Saturday 14-Sep-02															
Julian	257														
Day	41			Hours Today		0.0				0.0	0.0	45661.6	1642.1		
Sunday 15-Sep-02															
Julian	258														
Day	42			Hours Today		0.0				0.0	0.0	45661.6	1642.1		
Total Job Hours		252.4	Weekly Totals			9.3	1	3	818	448.8	1265.0			0.0	
			Total Aircraft Hours				Ltrs/Hr		88			Total Standby		1.0	
			Hours to Next Periodic				Running Avg			64.1 km/day		% Complete		100.9 %	
			Anticipated Hours Next week							48.3 km/hr		km Remaining		-418.5 km	

Survey Equipment Problems: _____

APPENDIX C

LOW LEVEL STATISTICS

West Musgrave Test Line Data

Job No.: **1548** _____ Date: **7/08/02** _____
Client: **Geoscience Australia** _____ Julian: **219** _____
Area: **West Musgrave (Giles)** _____ Completed By: **Brian Gribble** _____
Aircraft: **VH-WAM** _____ Signature: _____

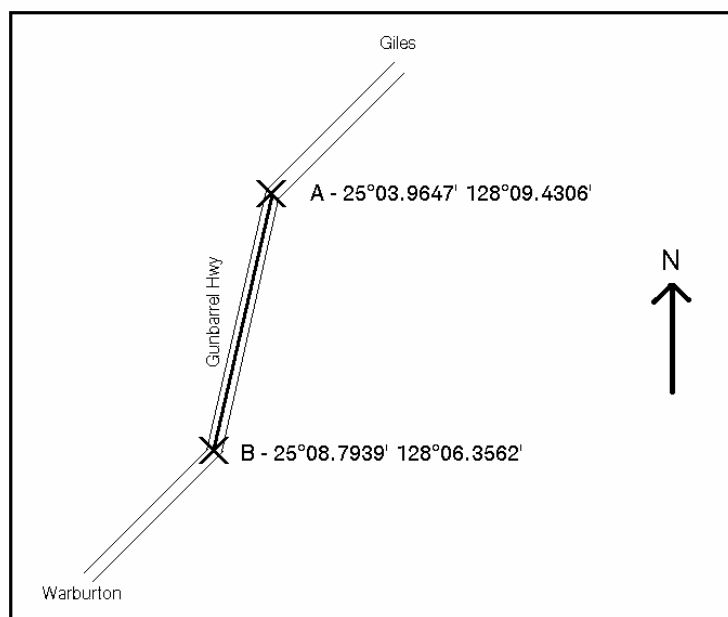
Co – ordinates :

Point A LAT: **25°03.9647 S** _____ Long: **128°09.4306 E** _____
Point B LAT: **25°08.7939 S** _____ Long: **128°06.3562 E** _____

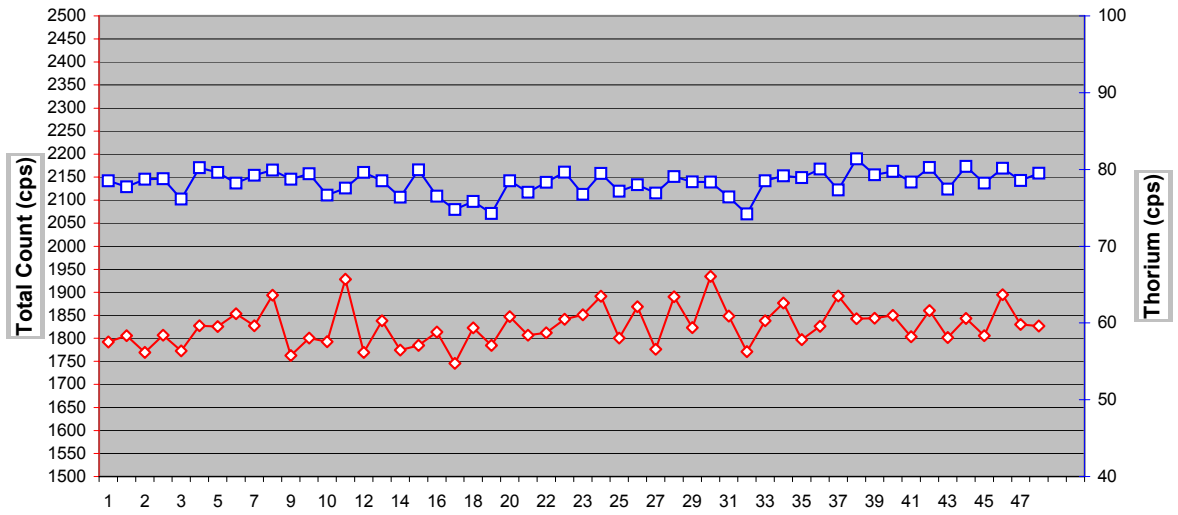
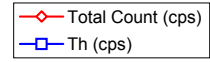
Length: **10.3 km** _____
Bearing A to B: **210°** _____

Location :

Description : On a bearing of 210 between Warburton and Giles.



VH-WAM Testline Monitoring (Thorium & Total Count Cps)



Flt#	Mean TC (cps)	Mean K (cps)	Mean U (cps)	Mean Th (cps)	<u>Var</u>	<u>Var%</u>
1	1792.394	116.4442	55.78417	78.52167	0.00	0.00%
1	1805.736	118.0226	54.15173	77.72881	1.01	1.02%
2	1769.313	117.4714	52.60966	78.73077	0.99	-0.77%
2	1806.795	119.0481	56.25428	78.78077	0.99	-0.58%
3	1772.798	117.1282	55.06013	76.13766	1.03	3.02%
4	1827.440	120.0449	55.20653	80.21877	0.97	-2.79%
5	1825.818	118.9475	58.44483	79.62609	0.98	-1.60%
6	1853.639	118.4437	57.56656	78.23138	1.00	0.39%
7	1827.395	119.5513	58.02443	79.22394	0.99	-0.92%
8	1893.862	121.4491	60.27626	79.93631	0.98	-1.70%
9	1762.6790	116.1104	53.414	78.74429	1.00	-0.04%
9	1800.859	117.7835	54.08642	79.44198	0.99	-0.91%
10	1792.688	114.99390	55.75888	76.65684	1.03	2.77%
11	1928.42	117.2958	64.64174	77.58669	1.01	1.32%
12	1769.537	116.62950	53.60533	79.63035	0.99	-1.37%
13	1837.863	117.6382	58.6255	78.51306	1.00	0.13%
14	1774.5440	114.04160	56.367	76.38782	1.03	2.90%
15	1784.4720	116.9057	53.44228	79.95691	0.98	-1.85%
16	1813.648	114.0008	59.07711	76.50944	1.03	2.68%
17	1745.37	114.1006	53.40383	74.78439	1.05	4.90%
18	1822.786	111.3249	60.5854	75.83787	1.03	3.20%
19	1784.697	114.4502	56.56704	74.28614	1.05	5.20%
20	1847.269	116.0916	61.64191	78.52641	0.99	-0.70%
21	1807.122	120.9392	55.53852	77.03163	1.01	1.26%
22	1812.207	117.8747	57.25227	78.33306	1.00	-0.48%
22	1841.314	116.6628	57.83142	79.64648	0.98	-2.10%
23	1850.954	113.9809	63.09921	76.74127	1.02	1.69%
24	1891.49	120.1275	59.38171	79.47735	0.98	-1.87%
25	1800.344	115.798	56.74936	77.1688	1.01	1.13%
26	1868.799	118.7689	58.74622	77.99924	1.00	0.02%
27	1776.058	118.2822	53.87432	76.9229	1.01	1.42%
28	1890.352	116.6335	61.6412	79.07639	0.99	-1.39%
29	1823.466	121.8566	55.79322	78.40139	1.00	-0.50%
30	1934.516	121.9302	63.69915	78.35841	1.00	-0.43%
31	1848.41	117.0358	59.2615	76.42249	1.02	2.11%
32	1771.075	116.276	54.19217	74.21454	1.05	5.08%

33	1837.863	117.6382	58.6255	78.51306	0.99	-0.80%
34	1876.898	120.9324	58.65734	79.15695	0.98	-1.59%
35	1797.179	117.9423	55.62737	78.92685	0.99	-1.26%
36	1826.431	119.1694	54.41489	80.07201	0.97	-2.64%
37	1892.146	116.0398	64.39812	77.32006	1.01	0.89%
38	1842.58	119.9183	55.72654	81.3746	0.96	-4.15%
39	1843.681	115.0434	60.63313	79.31136	0.98	-1.56%
40	1849.95	117.2888	58.31149	79.76214	0.98	-2.08%
41	1803.248	117.0108	57.24226	78.35294	1.00	-0.27%
42	1860.023	121.7287	58.10531	80.24599	0.97	-2.62%
43	1801.964	114.4489	57.37722	77.43122	1.01	0.98%
44	1843.069	121.8839	55.48183	80.40126	0.97	-2.77%
45	1805.902	117.9581	55.51424	78.22706	1.00	-0.01%
46	1894.78	120.5168	59.72483	80.17534	0.98	-2.44%
47	1830.26	118.5518	56.71105	78.55266	1.00	-0.37%
48	1826.54	119.568	55.69822	79.51295	0.98	-1.57%

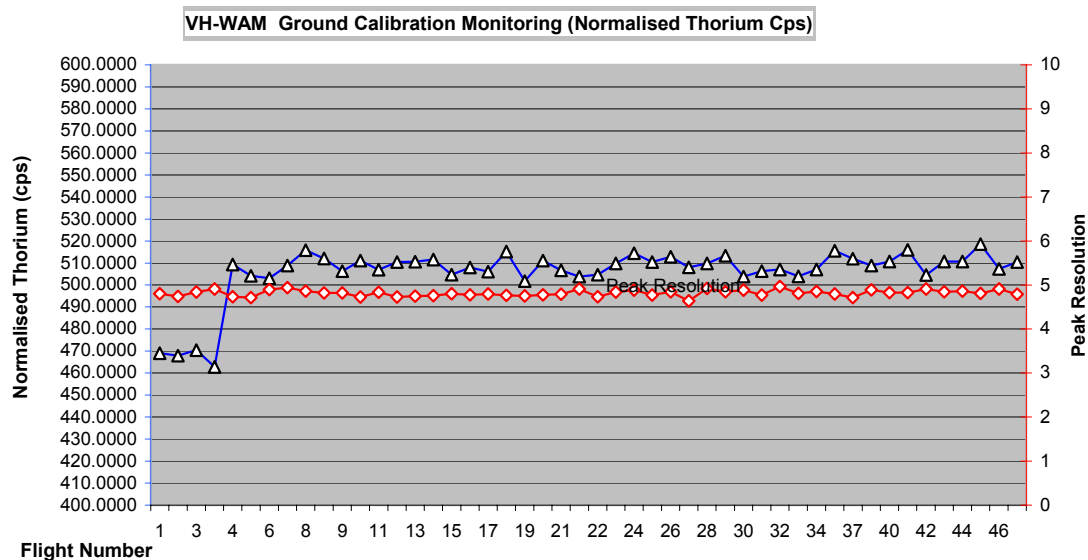
APPENDIX D

BUTTON CALIBRATION DATA

West Musgrave Radiometric Button Calibration Checks for Thorium

Flt#	Peak Posn	Peak Res.	Raw (cps)	B/G (cps)	Normalised (cps)	Full Height Half Mean	Readings	Var	Var%
1	218.9845	4.805341	760.1882	291.1950	468.9930	1.832825	119	0.00	0.00%
2	218.2255	4.739007	757.4924	289.5882	467.9041	1.841773	131	1.00	0.23%
3	219.2169	4.838829	759.9318	289.4882	470.4438	1.793753	121	1.00	-0.42%
4	218.4860	4.911355	752.1335	289.2842	462.8492	1.824220	151	1.01	1.35%
4	219.0349	4.735594	798.5832	289.2842	509.2990	1.879199	151	0.00	H2O reloc
5	219.2095	4.714601	798.4037	294.2126	504.1911	1.866927	117	1.01	1.01%
6	218.3051	4.899041	793.8885	290.7834	503.1052	1.818600	119	1.01	0.72%
7	219.4355	4.938798	799.6852	290.8686	508.8166	1.797345	119	0.99	-0.65%
8	218.3474	4.860732	802.3002	286.5223	515.7779	1.823621	125	0.98	-1.83%
9	219.0549	4.818960	803.4492	291.4285	512.0208	1.805767	119	0.99	-0.74%
9	218.6351	4.819461	797.1813	290.9071	506.2742	1.809769	121	1.01	0.51%
10	218.9755	4.730147	802.7693	291.6758	511.0936	1.831949	119	0.99	-0.51%
11	218.5908	4.834845	795.0761	288.1169	506.9594	1.820338	141	1.00	0.37%
12	219.0189	4.725568	796.1312	285.728	510.4031	1.846582	121	1.00	-0.35%
13	218.9384	4.748715	800.8077	290.289	510.5187	1.824145	121	1.00	-0.34%
14	219.269	4.757421	800.4319	288.8807	511.5511	1.834646	121	0.99	-0.51%
15	218.581	4.806035	795.0826	290.3305	504.752	1.837555	117	1.01	0.87%
16	219.3	4.775305	800.2106	292.3085	507.902	1.856097	125	1.00	0.18%
17	218.4788	4.798205	794.5908	288.5256	506.0652	1.839326	121	1.01	0.53%
18	219.276	4.766976	803.8996	288.7345	515.1649	1.818794	121	0.99	-1.28%
19	218.4448	4.755756	789.3278	287.4851	501.8428	1.837523	121	1.01	1.42%
20	219.0833	4.776714	799.6662	288.6405	511.0256	1.81542	119	1.00	-0.48%
21	218.401	4.793209	796.6886	289.9505	506.738	1.851778	121	1.00	0.39%
22	219.251	4.912383	792.8752	289.0698	503.8054	1.793693	119	1.01	0.95%
22	218.1833	4.733173	793.0733	288.3483	504.7249	1.86692	117	1.01	0.72%
23	219.1212	4.838713	798.0428	288.2499	509.793	1.805244	123	1.00	-0.31%
24	218.5693	4.886625	801.316	286.8096	514.5065	1.802334	117	0.99	-1.21%
25	218.9722	4.771533	799.2449	288.8062	510.4388	1.849175	185	1.00	-0.37%
26	218.5351	4.849658	801.5903	288.7211	512.8693	1.845827	123	0.99	-0.83%
27	219.0967	4.641875	800.58	292.5184	508.0615	1.883551	125	1.00	0.14%
28	218.5367	4.919187	798.4839	288.7189	509.7649	1.800614	117	1.00	-0.20%
29	219.0729	4.846271	800.3145	286.9897	513.3246	1.856176	119	0.99	-0.88%
30	218.491	4.885492	794.6034	290.7398	503.8636	1.821083	127	1.01	1.01%

31	219.2024	4.768926	799.5697	293.2109	506.3588	1.816198	121	1.00	0.48%
32	218.0572	4.964278	798.577	291.4844	507.0927	1.787913	117	1.00	0.32%
33	218.8209	4.810535	793.6050	289.6541	503.9512	1.829619	124	1.01	0.93%
34	217.9217	4.853932	797.3546	290.2683	507.0861	1.862359	123	1.00	0.28%
36	218.5523	4.798303	804.5138	288.9306	515.5833	1.853549	124	0.99	-1.38%
37	219.2031	4.718269	803.5032	291.5164	511.9869	1.86318	117	0.99	-0.65%
38	218.379	4.890143	798.1858	289.3763	508.8095	1.804354	117	1.00	-0.01%
40	218.0134	4.828507	802.0171	291.348	510.6692	1.847229	123	1.00	-0.37%
41	219.2876	4.825175	805.3716	289.4102	515.9616	1.833535	113	0.99	-1.38%
42	218.4606	4.910695	796.326	291.7451	504.5808	1.81925	117	1.01	0.88%
43	219.3166	4.846314	804.2208	293.5576	510.6633	1.799277	117	1.00	-0.35%
44	218.4611	4.858147	800.9396	290.2248	510.7148	1.814213	115	1.00	-0.35%
45	219.1129	4.808129	808.2791	289.7493	518.5299	1.87585	117	0.98	-1.84%
46	218.7512	4.906628	797.261	289.9118	507.3492	1.81835	117	1.00	0.37%
47	219.3277	4.790404	806.4084	295.9503	510.4582	1.810175	121	1.00	-0.25%
48	218.6096	4.898694	796.8637	294.0799	502.7838	1.824649	115	1.01	1.27%



APPENDIX E

NAVIGATION REPEATABILITY CHECKS

FLIGHT	EASTING	NORTHING	GPSALT
1	429038.7	7229713.5	584.28
2	429038.0	7229713.5	584.67
3	429038.3	7229713.0	584.68
4	429038.4	7229713.8	583.43
5	429037.5	7229713.1	583.42
6	429038.4	7229715.7	582.65
7	429037.9	7229714.0	584.34
8	429038.1	7229712.5	584.65
9	429038.4	7229713.0	584.33
10	429037.4	7229712.2	584.82
11	429038.7	7229712.5	584.09
12	429037.2	7229713.0	584.12
13	429038.5	7229713.5	584.13
14	429037.3	7229714.1	584.93
15	429037.3	7229713.0	584.34
16	429037.5	7229713.0	584.28
17	429038.2	7229714.2	585.00
18	429038.7	7229714.6	583.87
19	429037.8	7229713.5	583.90
20	429037.6	7229713.0	584.24
21	429038.5	7229714.0	584.79
22	429039.9	7229714.2	582.63
23	429037.4	7229713.0	584.45
24	429038.4	7229712.7	582.21
25	429037.6	7229712.8	584.59
26	429038.5	7229715.2	584.04
27	429038.0	7229714.5	584.57
28	429037.9	7229713.7	584.83
29	429037.8	7229713.3	584.45
30	429038.5	7229714.4	582.21
31	429038.0	7229713.9	583.88
32	429038.2	7229714.1	583.93
33	429038.0	7229713.5	584.08
34	429037.8	7229714.0	584.43
35	429037.6	7229713.4	584.29
36	429037.8	7229713.9	583.60

37	429037.9	7229713.5	584.83
38	429039.3	7229714.0	584.81
39	429038.5	7229713.7	583.91
40	429038.4	7229714.6	584.23
41	429038.2	7229714.7	584.54
42	429037.6	7229713.9	583.24
43	429037.5	7229713.0	584.04
44	429038.3	7229715.0	583.57
45	429038.4	7229714.1	584.75
46	429038.8	7229713.5	584.83
47	429037.9	7229713.1	584.73
48	429037.9	7229715.2	583.79

APPENDIX F

GEOID-ELLIPSOID SEPARATION STATISTICS

Line	No. Points	Mean GPS Height (Orig)	Std Dev.	Mean GPS Height Correction	Std Dev.	Mean GPS Height Corrected (Final)	Std Dev.
10010	4831	575.66	12.31	-0.11	0.36	575.77	12.45
10050	4941	578.95	12.87	0.03	0.37	578.92	12.99
10020	4871	576.65	13.06	-0.11	0.35	576.76	13.22
10070	4861	579.99	13.19	0.02	0.36	579.97	13.29
10030	4811	577.98	12.86	0.04	0.37	577.93	13
10090	4871	580.83	13.32	0.01	0.36	580.83	13.4
10150	4991	583.01	13.98	-0.01	0.38	583.02	14.08
10110	4931	581.66	13.32	-0.01	0.36	581.66	13.39
10170	4801	585.44	13.67	-0.06	0.36	585.5	13.73
10130	4841	582.83	13.31	-0.03	0.36	582.86	13.36
10190	4891	586.81	13.9	0.04	0.3	586.77	13.93
10250	4841	591.68	13.93	0.05	0.35	591.63	13.97
10210	4791	589.01	13.58	0.08	0.36	588.93	13.64
10270	4861	593.58	14.23	0.04	0.35	593.55	14.27
10230	4791	590.25	13.83	0.07	0.36	590.19	13.88
10290	4841	594.13	14.76	0.02	0.35	594.11	14.77
14970	14861	642.15	49.24	3.25	0.71	638.89	48.64
90350	20331	500.15	32.75	-1.47	1.51	501.62	31.86
10040	6811	483.59	38.57	-1.36	1.32	484.95	37.28
10100	6231	480.4	36.2	-1.53	1.38	481.92	34.86
10060	6841	482.89	39.46	-1.38	1.27	484.27	38.26
10120	6151	480.4	35.34	-1.46	1.38	481.86	34.01
10080	6931	482.5	39.9	-1.59	1.39	484.1	38.61
10140	6221	479.4	34.5	-1.42	1.37	480.82	33.17
10180	6901	476.03	32.62	-1.38	1.36	477.41	31.32
10160	6151	478.99	34.02	-1.37	1.37	480.36	32.71
90340	21151	508.68	39.68	-1.19	1.51	509.87	38.9
14960	16131	644.32	53.25	3.2	0.64	641.12	52.75
14950	15051	644.4	54.26	3.18	0.65	641.22	53.75
90330	20671	515.8	40.78	-0.85	1.52	516.65	39.98
10200	6551	475.85	31.55	-1.3	1.36	477.15	30.24
10260	6371	472.55	28.43	-1.5	1.41	474.05	27.06
10220	6621	474.74	30.19	-1.27	1.35	476	28.9

10280	6381	471.82	27.36	-1.45	1.39	473.27	26.01
10240	6591	473.45	29.22	-1.45	1.3	474.9	27.94
10300	6321	471.16	26.95	-1.42	1.4	472.58	25.58
10360	6461	469.64	25.21	-1.28	1.37	470.92	23.88
10320	6441	470.26	26.44	-1.4	1.41	471.66	25.07
10380	6481	468.99	24.62	-1.23	1.36	470.22	23.29
10340	6291	470.05	25.58	-1.33	1.38	471.37	24.24
90320	20891	524.26	41.11	-0.51	1.53	524.77	40.36
14940	15571	645.15	54.9	3.17	0.66	641.98	54.38
14930	14931	645.77	55.22	3.16	0.69	642.62	54.66
90310	20271	533.21	45.46	-0.18	1.53	533.39	44.67
10400	6821	468.56	24.05	-1.35	1.25	469.91	22.84
10460	6121	467.94	22.37	-1.39	1.39	469.33	21.02
10420	6871	467.75	23.48	-1.49	1.39	469.24	22.12
10480	6161	467.69	22.17	-1.37	1.38	469.06	20.82
10440	6931	467.57	22.94	-1.45	1.39	469.02	21.58
10500	6091	468.21	22.6	-1.31	1.37	469.51	21.27
10560	6891	466.93	21.7	-1.27	1.28	468.2	20.48
10520	6011	467.56	22.06	-1.28	1.38	468.84	20.73
10580	6911	466.92	21.49	-1.47	1.38	468.39	20.16
10540	6101	467.32	21.64	-1.23	1.36	468.56	20.33
11700	6951	485.95	6.65	-1.15	1.15	487.1	5.71
11710	12301	547.12	13.31	0.72	0.26	546.4	13.34
11730	11721	546.79	14.08	0.69	0.27	546.1	14.08
10600	6271	466.61	21.01	-1.43	1.37	468.04	19.69
10660	7111	466.5	20.48	-1.25	1.37	467.75	19.18
10620	6491	466.69	20.72	-1.38	1.38	468.07	19.4
10680	6721	465.09	19.64	-1.26	1.35	466.35	18.36
10640	6381	465.41	20.11	-1.37	1.37	466.78	18.81
10700	6781	465.12	19.95	-1.22	1.35	466.34	18.68
10720	6301	465.28	21.98	-1.21	1.33	466.49	20.78
10780	6711	463.88	19.21	-1.39	1.34	465.28	17.9
10740	6331	464.79	20.66	-1.42	1.28	466.21	19.44
10800	6661	463.86	19.01	-1.35	1.33	465.2	17.72
10760	6261	464.63	20.08	-1.42	1.34	466.05	18.79
10820	6611	463.54	18.64	-1.31	1.32	464.85	17.35
10880	6141	463.18	17.77	-1.2	1.3	464.38	16.5
10840	6661	463.27	18.73	-1.29	1.33	464.56	17.43

10900	6221	463.16	17.53	-1.35	1.18	464.51	16.37
10860	6581	463.22	18.03	-1.22	1.3	464.44	16.75
11750	12081	547.04	14.35	0.7	0.25	546.34	14.35
90010	6921	552.72	10	-0.14	0.29	552.86	10.19
90020	6941	567.32	11.04	-0.06	0.27	567.39	11.22
10920	6331	463.99	17.31	-1.41	1.3	465.4	16.03
11000	6801	464.22	16.83	-1.32	1.29	465.54	15.6
10940	6291	464.53	17.57	-1.39	1.3	465.92	16.34
11020	6721	464.13	16.23	-1.27	1.28	465.4	14.99
10960	6391	464.88	17.28	-1.31	1.29	466.19	16.03
11040	6801	464.37	15.76	-1.23	1.28	465.6	14.51
10980	6421	465.06	17.06	-1.29	1.29	466.34	15.83
11060	6791	464.97	15.31	-1.25	1.19	466.22	14.16
11080	6401	466.17	15.04	-1.41	1.27	467.58	13.81
11160	6941	471.2	16.48	-1.3	1.26	472.5	15.47
11100	6251	466.48	15.18	-1.39	1.27	467.88	13.97
11180	6981	471.17	14.54	-1.27	1.25	472.45	13.47
11120	6381	467.91	15.62	-1.37	1.28	469.29	14.43
11200	6881	472.27	14.4	-1.2	1.24	473.46	13.34
11140	6281	469.62	15.66	-1.31	1.26	470.94	14.56
11220	6831	472.91	15.01	-1.16	1.23	474.08	13.99
11260	6341	474.7	15.18	-1.4	1.23	476.1	14.21
11240	6631	473.97	14.38	-1.38	1.19	475.35	13.41
11790	12331	547.46	15.85	0.7	0.26	546.76	15.85
11810	11361	547.87	16.7	0.69	0.27	547.18	16.69
11280	6421	475.26	15.26	-1.37	1.23	476.64	14.27
11340	6861	476.61	12.45	-1.22	1.23	477.83	11.41
11300	6461	474.85	13.76	-1.35	1.23	476.2	12.69
11360	6681	477.21	12.6	-1.21	1.22	478.42	11.59
11440	6351	478.48	10.69	-1.38	1.18	479.85	9.7
11400	6761	477.69	11.84	-1.34	1.09	479.02	10.98
11460	6311	478.83	10.45	-1.33	1.18	480.16	9.46
11420	6761	477.92	11.54	-1.42	1.2	479.34	10.54
11480	6271	478.95	10.84	-1.28	1.17	480.24	9.84
11540	6731	480.73	9.94	-1.19	1.17	481.93	8.94
11500	6361	479.47	10.33	-1.26	1.19	480.73	9.32
11560	6831	481.1	9.11	-1.24	1.07	482.34	8.21
11520	6141	480.84	10.89	-1.23	1.17	482.07	9.98

11580	6831	481.8	9.23	-1.39	1.16	483.19	8.2
11640	6161	483.42	7.42	-1.28	1.14	484.7	6.41
11600	6771	482.31	8.47	-1.35	1.15	483.66	7.47
11830	11961	549.06	17.29	0.68	0.27	548.38	17.27
11771	12191	547.06	15.21	0.69	0.26	546.36	15.2
11620	6651	482.45	8.24	-1.31	1.15	483.76	7.23
11680	6191	484.61	7.31	-1.2	1.13	485.81	6.34
11660	6571	483.84	7.54	-1.24	1.15	485.08	6.49
11720	6341	485.88	6.91	-1.14	1.13	487.02	5.96
11740	6701	487.44	7.08	-1.35	1.12	488.79	6.19
11820	6271	490.74	5.99	-1.23	1.12	491.97	5.18
11760	6821	488.27	5.75	-1.31	1.13	489.59	4.91
11840	6231	492.62	6.07	-1.2	1.12	493.81	5.41
11780	6801	489.63	6.02	-1.26	1.14	490.88	5.18
11860	6281	493.33	5.74	-1.16	1.11	494.49	5.05
11800	6761	490.16	6.13	-1.24	1.12	491.4	5.31
11880	6251	494.55	5.92	-1.12	1.11	495.67	5.29
11920	6781	497.85	6.18	-1.27	1.13	499.12	5.77
11900	6261	496.29	6.14	-1.25	1.03	497.54	5.75
11850	11261	550.18	17.62	0.68	0.27	549.5	17.61
14920	15261	646.5	55.13	3.15	0.69	643.35	54.58
90290	21411	547.23	55.35	0.57	1.39	546.67	54.46
90280	20781	559.91	68.75	0.92	1.33	558.99	67.66
90270	21481	567.83	70.94	1.14	1.26	566.69	69.89
90260	20481	566.08	63.63	1.37	1.2	564.71	62.65
11870	11911	551.25	18.02	0.74	0.22	550.51	18.03
11890	11491	551.71	18.86	0.73	0.22	550.98	18.86
90250	21601	571.44	91.14	1.5	1.12	569.94	90.16
90240	13921	596.19	73.64	2.06	0.98	594.13	72.76
11940	6441	498.37	6.93	-1.28	1.12	499.64	6.47
11960	6461	500.3	6.67	-1.17	1.12	501.48	6.37
11980	6421	501.59	7.27	-1.21	1.12	502.8	6.94
12000	6551	502.41	7.42	-1.11	1.11	503.52	7.12
12020	6581	503.84	7.9	-1.15	1.11	504.99	7.63
12040	6641	505.32	8.14	-1.06	1.11	506.38	7.87
11910	11791	553.6	19.26	0.72	0.23	552.88	19.25
11690	7061	551.82	7.09	0.53	0.29	551.29	7.03
11670	7211	551.13	7.28	0.51	0.31	550.62	7.22

90030	7201	576.69	14.39	0.02	0.26	576.67	14.57
90040	7391	580.19	21.29	0.14	0.25	580.05	21.5
90050	7041	579.48	23.44	0.24	0.25	579.25	23.63
90060	7501	570.07	21.33	0.45	0.31	569.62	21.61
90070	7021	562.89	14.75	0.6	0.21	562.29	14.93
90080	22071	598.66	44.88	1.28	0.63	597.37	44.31
90090	20111	597.47	39.29	1.3	0.61	596.17	38.74
90100	20731	603.38	34.62	1.43	0.63	601.95	34.03
90110	17921	608.99	32.2	1.5	0.62	607.49	31.64
10750	5331	580.95	16.46	0.22	0.35	580.73	16.5
10770	6001	580.17	17.19	0.22	0.36	579.95	17.24
10790	5641	580.29	17.26	0.21	0.36	580.09	17.3
10810	6051	580.34	16.68	0.22	0.36	580.12	16.76
10830	5731	579.52	17.19	0.18	0.36	579.33	17.27
14910	15881	647.74	52.58	3.17	0.69	644.57	52.01
90301	20961	538.83	46.88	0.19	1.45	538.64	46.17
12060	6651	508.15	9.72	-1.08	1.03	509.23	9.45
12140	6401	517.85	20.12	-1.12	1.11	518.98	19.75
12080	6661	511	12.70	-1.2	1.11	512.21	12.29
12160	6451	522.66	28.81	-1.1	1.1	523.76	28.58
12100	6741	515.09	21.55	-1.15	1.12	516.24	21.15
12180	6491	524.67	29.97	-1.06	1.09	525.73	29.76
12120	6651	517.53	21.38	-1.13	1.11	518.66	20.95
12200	6531	524.75	27.00	-1.03	1.10	525.78	26.63
12220	6761	527.04	27.01	-0.94	1.09	527.98	26.61
12300	6471	535.05	33.64	-1.05	1.10	536.09	33.11
12240	6751	532.17	33.30	-1.12	1.11	533.29	32.89
12320	6411	534.77	33.15	-1.03	1.10	535.80	32.66
11930	11581	554.55	19.33	0.72	0.23	553.82	19.34
11950	11851	555.77	19.37	0.72	0.24	555.06	19.37
12260	6571	531.22	29.22	-1.1	1.13	532.31	28.73
12340	6401	532.37	27.62	-0.98	1.11	533.35	27.18
12280	6581	532.96	31.08	-1.06	1.12	534.02	30.62
12360	6451	531.79	24.4	-0.95	1.10	532.75	23.93
90230	14891	599.4	61.92	2.1	0.93	597.30	61.05
90220	14621	618.38	64.07	2.07	0.90	616.31	63.48
90210	17081	589.18	54.35	1.88	0.90	587.30	53.53
90200	16081	589.02	49.67	1.83	0.89	587.19	48.81

90190	17431	590.06	47.12	1.77	0.87	588.29	46.29
90180	16201	589.19	40.88	1.73	0.86	587.46	40.05
11650	7191	551.31	7.25	0.52	0.30	550.79	7.26
90170	17241	592.05	36.59	1.73	0.84	590.32	35.79
90160	16101	599.46	29.22	1.65	0.77	597.81	28.55
90150	16961	605.22	25.85	1.66	0.74	603.56	25.22
90140	15751	611.19	23.83	1.66	0.70	609.53	23.28
90130	17401	617.1	26.76	1.64	0.68	615.47	26.25
90120	17131	615.18	29.2	1.57	0.66	613.6	28.7
10850	5561	579.13	16.51	0.2	0.35	578.94	16.62
10870	5941	578.51	16.83	0.31	0.34	578.19	16.92
10890	5751	577.72	16.86	0.3	0.34	577.41	16.95
10910	6081	576.68	16.45	0.3	0.35	576.38	16.57
10930	5641	575.98	15.56	0.28	0.34	575.7	15.67
10950	6051	574.66	15.31	0.28	0.35	574.38	15.45
10970	5761	573.21	15.27	0.27	0.35	572.95	15.41
10310	4781	594.28	15.41	0.01	0.35	594.27	15.39
10330	4791	594.58	16.71	-0.01	0.35	594.59	16.65
10350	4771	594.94	16.44	0.02	0.31	594.92	16.42
10370	4751	594.71	15.91	0.13	0.35	594.58	15.82
10390	4871	594.14	15.35	0.11	0.35	594.03	15.25
10410	4761	593.66	14.85	0.1	0.35	593.56	14.71
10430	4771	593.21	13.52	0.09	0.35	593.13	13.39
10450	4741	592.66	12.89	0.07	0.34	592.59	12.74
10470	4841	591.8	12.1	0.07	0.35	591.73	11.97
10490	5031	590.54	11.57	0.06	0.35	590.48	11.43
10510	4951	589.23	11.3	0.05	0.36	589.18	11.17
10530	5041	588.2	11.17	0.17	0.33	588.03	11.04
10550	4991	587.04	10.43	0.18	0.35	586.86	10.33
10570	5071	586.13	10.33	0.16	0.35	585.97	10.26
10590	5081	584.99	10.27	0.17	0.36	584.82	10.27
10610	5261	584.55	10.49	0.15	0.36	584.39	10.49
10630	5061	583.93	10.81	0.15	0.36	583.78	10.82
10650	5241	583.33	11.46	0.13	0.36	583.21	11.48
10670	5191	582.46	12.08	0.13	0.36	582.33	12.11
10690	5421	581.86	12.94	0.18	0.30	581.69	12.93
10710	5261	581.67	14.03	0.25	0.35	581.41	14.06
10730	5451	580.93	15.29	0.24	0.35	580.7	15.33

10990	5821	571.95	15.08	0.28	0.35	571.67	15.24
11010	5931	571.16	14.68	0.25	0.36	570.9	14.83
11030	5941	569.38	14.01	0.36	0.3	569.02	14.12
11050	6041	567.89	14.36	0.37	0.33	567.52	14.5
11070	6061	566.65	14.45	0.36	0.33	566.29	14.6
11150	6111	562.12	14.12	0.34	0.34	561.78	14.3
11090	6071	565.49	14.76	0.35	0.33	565.14	14.92
11170	6251	561.73	14.07	0.34	0.34	561.39	14.26
11110	6101	564.35	15.15	0.35	0.34	564.01	15.32
11190	6251	561.01	14.1	0.37	0.29	560.65	14.29
11130	6121	563.09	14.63	0.34	0.34	562.75	14.8
11210	6281	560.24	14.16	0.44	0.31	559.8	14.32
11230	6371	559.62	13.84	0.42	0.32	559.2	13.99
11310	6441	556.89	12.52	0.41	0.32	556.48	12.72
11250	6371	559.29	13.71	0.42	0.32	558.88	13.87
11330	6461	555.96	11.99	0.4	0.33	555.56	12.19
11270	6391	558.86	13.58	0.41	0.32	558.45	13.75
11350	6511	555.11	11.73	0.39	0.33	554.72	11.94
11290	6441	557.57	13.14	0.41	0.32	557.16	13.31
11370	6511	554.43	11.15	0.49	0.28	553.94	11.31
11390	6691	553.43	10.26	0.48	0.3	552.95	10.41
11470	6701	550.79	6.87	0.47	0.31	550.32	7.04
11410	6621	552.94	9.53	0.48	0.3	552.46	9.68
11490	6711	550.79	6.16	0.46	0.31	550.33	6.35
11430	6671	552.03	8.69	0.47	0.31	551.56	8.84
11510	6711	550.61	5.72	0.45	0.32	550.16	5.92
11450	6621	551.13	7.78	0.47	0.31	550.66	7.93
11530	6731	550.75	5.57	0.51	0.26	550.23	5.74
11550	6861	551.12	6.5	0.54	0.29	550.57	6.69
11610	7121	551.14	7.69	0.54	0.30	550.60	7.78
11570	6841	551.13	6.82	0.54	0.29	550.58	6.99
11590	7031	551.07	7.26	0.54	0.29	550.53	7.39
11970	11401	556.17	19.72	0.71	0.24	555.45	19.72
11321	6251	475.49	13.46	-1.32	1.22	476.80	12.43
11381	6311	477.83	12.14	-1.18	1.20	479.00	11.18
11990	11631	557.05	19.96	0.72	0.24	556.34	19.97
12010	11551	556.31	21.11	0.71	0.25	555.60	21.12
12070	11821	558.12	20.9	0.76	0.21	557.36	20.88

12030	11301	557.43	20.61	0.73	0.21	556.70	20.61
12090	11671	558.84	20.71	0.76	0.21	558.08	20.70
12050	11311	557.97	20.62	0.76	0.21	557.21	20.62
12110	11501	559.08	21.06	0.75	0.22	558.33	21.04
12150	11321	559.73	20.86	0.74	0.23	558.99	20.84
12130	11451	559.34	20.86	0.75	0.22	558.59	20.84
12170	11561	560.73	20.15	0.74	0.23	559.99	20.12
12190	11751	560.93	20.64	0.73	0.24	560.19	20.60
12210	11461	562.12	20.63	0.8	0.20	561.32	20.60
12230	11791	562.82	19.97	0.79	0.20	562.03	19.94
12380	19011	550.31	29.78	0.23	1.06	550.08	29.28
12390	19021	551.95	30.36	0.19	1.08	551.76	29.87
12400	18801	551.57	28.37	0.19	1.11	551.37	27.86
12410	19021	550.46	26.87	0.19	1.10	550.27	26.31
12250	11561	562.6	20.68	0.79	0.20	561.82	20.65
12270	11381	563.63	20.36	0.78	0.21	562.85	20.32
12310	11561	562.69	21.05	0.78	0.21	561.91	21.01
12330	11731	563.14	22.47	0.77	0.21	562.36	22.43
12350	11381	563.83	22.85	0.77	0.22	563.06	22.80
12370	11491	564.08	23.27	0.81	0.18	563.28	23.22
12420	18831	550.71	26.6	0.21	1.08	550.5	26.06
12450	19311	554.7	28.76	0.25	1.03	554.46	28.35
12430	18771	552.81	26.93	0.22	1.06	552.59	26.44
12460	19141	553.88	26.84	0.27	1.03	553.6	26.44
12440	19021	554.58	29.38	0.22	1.05	554.36	28.96
12470	15281	553.74	29.7	0.18	1.12	553.56	29.33
12290	11621	563.23	21.08	0.78	0.21	562.46	21.03
11631	7131	551.01	7.65	0.53	0.3	550.49	7.69
12480	15601	554.67	29.13	0.14	1.19	554.53	28.75
12510	16341	555.44	29.97	0.19	1.14	555.25	29.62
12490	16401	554.76	29.08	0.16	1.17	554.6	28.70
12520	15951	555.21	28.96	0.2	1.14	555.01	28.62
12500	16441	554.47	28.71	0.18	1.15	554.29	28.34
12530	16331	555.69	28.77	0.22	1.11	555.48	28.43
12540	15201	556.84	28.59	0.24	1.11	556.6	28.26
12570	15631	556.59	28.45	0.21	1.15	556.38	28.11
12550	15071	556.71	29.44	0.26	1.1	556.45	29.11
12580	15631	557.26	28.58	0.22	1.13	557.04	28.26

12560	15011	556.86	29.1	0.19	1.17	556.66	28.73
12590	15491	557.49	28.47	0.23	1.13	557.26	28.17
12620	14971	559.51	28.77	0.27	1.09	559.24	28.52
12600	15301	558.24	28.32	0.25	1.11	558	28.05
12630	15011	560.44	29.11	0.28	1.09	560.17	28.87
12610	15221	559.02	28.59	0.27	1.09	558.75	28.34
12640	15281	561.83	29.25	0.26	1.1	561.57	29.05
12680	15411	563.23	27.08	0.3	1.09	562.93	26.96
12650	15121	561.91	28.8	0.25	1.13	561.66	28.62
12690	15571	563.48	26.59	0.33	1.07	563.15	26.49
12660	15411	562.4	28.6	0.27	1.12	562.13	28.46
12700	16321	563.71	27.12	0.33	1.05	563.38	27.02
12670	15591	562.96	28.38	0.29	1.09	562.67	28.25
12710	16321	563.74	26.15	0.33	1.06	563.41	26.05
12720	15761	563.77	25.55	0.35	1.04	563.42	25.46
12730	16151	564.16	25.73	0.31	1.11	563.85	25.63
12740	15031	565.36	26.37	0.33	1.09	565.03	26.26
12770	15461	567.41	27.81	0.37	1.05	567.04	27.66
12750	15401	565.27	26.33	0.34	1.08	564.93	26.20
12780	15601	566.7	26.16	0.39	1.02	566.31	26.03
12810	15121	565.14	25.17	0.37	1.08	564.77	24.98
12790	15651	565.91	24.95	0.41	1.01	565.5	24.81
12820	15241	565.65	25.32	0.39	1.06	565.26	25.09
12800	15321	565.58	25.3	0.43	1.02	565.15	25.13
12830	15061	566.31	26.93	0.39	1.05	565.91	26.66
12760	15241	566.89	28.27	0.35	1.06	566.54	28.15
12840	14831	565.69	25.71	0.41	1.04	565.29	25.39
12870	15701	566.84	26.97	0.45	0.99	566.38	26.64
12850	14871	565.91	26.14	0.42	1.03	565.49	25.80
12880	15771	566.49	25.68	0.49	0.97	566.00	25.35
12860	14831	566.33	26.61	0.43	1.02	565.89	26.25
12890	16221	567.25	26.9	0.44	1.03	566.81	26.55
12920	14821	567.58	27.38	0.47	1.01	567.11	27.00
12900	16351	567.59	27.51	0.45	1.04	567.14	27.15
12930	14951	568.12	27.98	0.48	1.00	567.64	27.60
12910	16281	567.28	27.46	0.45	1.03	566.83	27.11
12940	16081	567.78	26.74	0.51	0.98	567.27	26.36
12980	16091	568.25	25.76	0.49	1.03	567.76	25.28

12950	16341	567.9	26.76	0.51	0.97	567.39	26.34
12990	16391	568.43	26.47	0.51	1.01	567.92	26.03
12960	16351	568.3	27.3	0.54	0.96	567.76	26.88
13000	16431	567.97	24.5	0.53	1	567.44	24.04
12970	16051	568.68	26.25	0.54	0.96	568.14	25.82
13010	16371	568.32	25.39	0.54	0.98	567.78	24.94
13020	16211	569.08	24.3	0.57	0.95	568.51	23.87
13030	16511	569.69	23.93	0.55	0.96	569.14	23.48
13040	15771	570.81	22.3	0.61	0.92	570.2	21.9
13080	16541	573.61	23.53	0.57	0.99	573.04	23.03
13050	16081	572.16	23.73	0.67	0.93	571.49	23.34
13090	16881	575.46	26.79	0.59	0.97	574.87	26.30
13060	15891	572.74	22.99	0.6	0.98	572.14	22.56
13100	17331	575.29	24.95	0.6	0.96	574.69	24.45
13070	15651	572.87	22.21	0.61	0.97	572.26	21.77
13110	17161	575.9	24.55	0.62	0.95	575.29	24.03
13120	15481	577.21	24.54	0.66	0.91	576.56	24.08
13130	16801	578.38	25.31	0.67	0.93	577.71	24.85
13140	14941	579.48	25.07	0.66	0.97	578.82	24.63
13170	16851	580.45	22.62	0.69	0.93	579.76	22.20
13150	15071	578.94	23.22	0.67	0.96	578.28	22.78
13180	16491	580.61	22.35	0.7	0.92	579.91	21.92
13160	15021	578.98	22.33	0.67	0.95	578.31	21.87
13190	16081	581.81	22.67	0.71	0.9	581.10	22.24
13220	15231	582.91	22.26	0.75	0.91	582.17	21.89
13200	16231	583.19	24.44	0.72	0.89	582.47	24.04
13230	15041	583.24	21.7	0.75	0.94	582.49	21.34
13210	16541	583.77	25.18	0.72	0.9	583.05	24.77
13240	15011	584.27	23.31	0.75	0.93	583.51	22.94
13270	16651	585.68	22.31	0.77	0.9	584.91	21.91
13250	15011	584.45	21.3	0.77	0.91	583.68	20.91
13280	16911	585.85	21.75	0.78	0.89	585.07	21.34
13260	14951	584.74	20.7	0.77	0.91	583.97	20.32
13290	16881	586.9	23.23	0.8	0.86	586.10	22.86
13310	14981	588.14	25.34	0.81	0.92	587.33	24.96
13300	16911	587.54	23.08	0.85	0.89	586.69	22.73
13321	15931	588.5	25.76	0.84	0.89	587.66	25.40
13360	17001	584.68	22.07	0.86	0.87	583.83	21.54

13330	16041	588.39	26.37	0.85	0.88	587.55	26.03
13370	16971	584.29	21.88	0.86	0.86	583.43	21.31
13340	15691	586.98	24.32	0.86	0.87	586.12	23.91
13380	16841	583.96	23.12	0.90	0.86	583.06	22.55
13350	15811	586.91	23.95	0.86	0.86	586.06	23.52
13390	16731	583.93	24.28	0.87	0.91	583.06	23.67
14900	15041	648.14	54.78	3.14	0.72	645.00	54.18
14840	15551	654.82	64.17	3.05	0.69	651.78	63.63
14890	15091	649.28	55.15	3.14	0.74	646.14	54.52
14790	15711	649.97	68.37	2.95	0.65	647.02	67.91
14880	15141	650.43	56.46	3.07	0.65	647.36	55.94
14820	15911	650.35	60.21	3.05	0.71	647.31	59.64
14870	15211	651.22	58.84	3.06	0.66	648.16	58.32
14810	15731	650.63	66.82	3.03	0.73	647.61	66.25
14861	15761	656.87	63.65	3.06	0.67	653.81	63.14
14830	16021	651.48	60.7	3.03	0.71	648.44	60.14
14850	15431	657.54	71.02	3.04	0.71	654.49	70.5
14800	16041	650.7	67.33	3.07	0.66	647.63	66.84
14760	15331	649.9	73.37	2.93	0.71	646.97	72.85
14780	15881	651.32	69.83	2.95	0.66	648.37	69.35
14750	15111	642.89	63.59	2.92	0.71	639.97	63.04
14770	15951	651.41	74.47	2.92	0.70	648.49	73.96
14741	15341	642.28	60.57	2.92	0.73	639.36	59.99
14730	15771	640.75	59.25	2.90	0.74	637.85	58.65
14690	15221	637.34	58.53	2.80	0.69	634.54	58.01
14720	15681	641.97	64.56	2.89	0.76	639.08	63.97
14680	15121	638.05	58.89	2.79	0.70	635.25	58.35
14710	16131	640.57	62.28	2.80	0.67	637.76	61.79
14670	15121	635.98	58.09	2.79	0.70	633.19	57.54
14700	16431	638.23	60.11	2.80	0.68	635.44	59.6
14660	14971	633.66	58.82	2.78	0.73	630.88	58.24
14620	16641	629.23	60.19	2.65	0.68	626.57	59.72
13760	17631	567.74	40.86	1.22	0.75	566.51	40.26
14650	14791	633.41	59.44	2.77	0.74	630.64	58.86
14610	15081	630.18	60.88	2.65	0.68	627.53	60.4
14640	14751	632.85	58.29	2.77	0.75	630.08	57.7
14600	14951	631.12	60.59	2.65	0.69	628.47	60.1
14630	15041	630.86	58.53	2.66	0.67	628.2	58.06

14590	14971	633.01	63.67	2.65	0.70	630.37	63.20
14550	14981	630.46	57.97	2.62	0.70	627.84	57.48
14580	15041	631.65	63.88	2.64	0.71	629.00	63.41
14540	14711	629.15	56.48	2.51	0.67	626.64	56.03
14570	15281	629.35	59.39	2.62	0.74	626.72	58.87
13410	15151	585.47	28.31	0.92	0.86	584.55	27.78
13450	15601	585.66	32.24	0.95	0.82	584.71	31.86
13401	7621	596.08	24.21	1.43	0.10	594.66	24.19
13751	8891	540.87	32.97	0.94	0.93	539.93	32.13
13420	15481	585.14	30.25	0.91	0.87	584.23	29.75
13460	15171	585.09	30.88	0.96	0.81	584.12	30.52
13430	15541	585.36	30.79	0.93	0.85	584.44	30.30
13470	15341	585.59	33.25	0.98	0.83	584.62	32.87
13440	15641	584.52	29.40	0.94	0.83	583.58	28.95
13480	15261	582.31	27.74	0.96	0.86	581.34	27.32
13490	15391	581.61	28.93	0.97	0.85	580.64	28.51
14560	15511	632.02	57.37	2.63	0.75	629.39	56.84
14532	15321	630.28	57.37	2.5	0.68	627.78	56.91
14490	15371	625.69	56.3	2.47	0.74	623.22	55.76
14520	15181	627.11	54.32	2.5	0.69	624.61	53.84
14480	15471	627.22	57.45	2.48	0.75	624.74	56.90
14510	15091	624.31	53.30	2.49	0.71	621.82	52.81
14470	15431	627.86	58.33	2.46	0.76	625.40	57.78
14500	15161	626.87	57.40	2.48	0.72	624.39	56.89
14460	15341	630.16	60.98	2.35	0.66	627.80	60.54
14420	15321	622.94	53.45	2.32	0.72	620.62	52.93
13752	7691	601.97	10.94	1.62	0.17	600.35	11.09
13402	9011	574.68	23.22	0.53	1.02	574.14	22.51
13500	15661	583.08	32.80	0.98	0.83	582.10	32.44
13550	15201	578.94	38.06	1.06	0.80	577.88	37.68
13510	15801	582.06	33.80	0.99	0.83	581.08	33.42
13520	15781	581.58	34.73	1.00	0.81	580.58	34.36
13570	14911	571.78	29.67	1.02	0.84	570.75	29.14
13530	15791	581.49	37.50	1.01	0.79	580.48	37.15
13580	14861	571.25	28.78	1.03	0.83	570.21	28.25
13540	15821	580.04	38.78	1.02	0.78	579.02	38.45
14450	14951	630.06	60.65	2.34	0.68	627.72	60.19
14250	15091	600.65	55.07	1.99	0.71	598.65	54.61

14260	14741	602.56	55.87	2.00	0.70	600.57	55.42
14160	15111	596.65	60.62	1.84	0.71	594.81	60.16
14150	14791	595.78	60.40	1.81	0.75	593.97	59.91
14170	15011	593.69	55.76	1.84	0.71	591.85	55.3
14140	14991	595.94	63.96	1.81	0.76	594.14	63.43
14180	14851	592.76	53.37	1.85	0.69	590.91	52.9
14130	15261	595.97	68.00	1.73	0.69	594.23	67.53
14190	14901	595.35	55.14	1.86	0.68	593.5	54.68
13590	15451	572.21	30.33	1.05	0.8	571.16	29.86
13630	15561	571.85	32.57	1.11	0.76	570.74	32.08
13600	15251	572.26	31.27	1.07	0.78	571.19	30.83
13640	15731	570.9	33.31	1.09	0.83	569.8	32.75
13610	15491	571.57	31.79	1.07	0.77	570.5	31.35
13650	15201	569.83	33.04	1.11	0.81	568.72	32.48
13620	15471	571.82	32.56	1.08	0.76	570.74	32.13
13660	15121	569.21	33.03	1.12	0.79	568.09	32.45
13700	15521	566.99	36.24	1.15	0.75	565.83	35.67
13670	15071	568.52	33.21	1.13	0.78	567.4	32.62
14440	15651	627.67	56.64	2.35	0.68	625.32	56.18
14410	15211	622.68	54.33	2.32	0.72	620.37	53.82
14430	15501	625.77	55.69	2.34	0.69	623.43	55.21
14400	15241	621.1	56.17	2.31	0.74	618.80	55.66
14360	15291	613.72	51.76	2.18	0.68	611.54	51.29
14390	15301	620.62	54.33	2.29	0.76	618.33	53.79
14350	15411	612.39	51.87	2.17	0.7	610.22	51.39
14380	15231	618.72	54.28	2.19	0.65	616.53	53.85
14340	15511	610.97	53.14	2.16	0.71	608.81	52.65
14370	15231	616.33	53.53	2.18	0.66	614.14	53.09
14330	15641	610.1	56.27	2.14	0.74	607.96	55.76
14290	15281	605.83	54.80	2.02	0.66	603.82	54.38
14270	15581	603.97	57.87	2.00	0.69	601.97	57.43
14280	15321	607.13	58.21	2.10	0.66	605.12	57.79
14200	15551	595.28	54.88	1.86	0.68	593.42	54.42
14230	15091	597.69	55.04	1.98	0.73	595.70	54.56
14210	15481	598.21	58.00	1.87	0.67	596.34	57.56
14240	15071	597.26	52.50	1.98	0.73	595.28	52.01
14300	15521	606.5	56.68	2.14	0.7	604.36	56.21
14220	14831	597.54	56.51	1.96	0.76	595.58	55.99

13770	15541	567.11	41.92	1.22	0.75	565.89	41.33
13900	15151	587.31	66.38	1.43	0.75	585.88	65.86
13870	15271	577.28	54.58	1.34	0.71	575.94	54.06
13880	14951	580.56	55.66	1.40	0.69	579.16	55.15
13890	15281	581.46	59.7	1.40	0.78	580.6	59.13
13960	15191	593.46	75.38	1.48	0.67	591.98	74.95
13910	15131	587.56	69.38	1.41	0.77	586.14	68.84
13970	15221	593.97	72.91	1.55	0.74	592.43	72.39
13920	15071	587.62	68.25	1.43	0.74	586.19	67.73
13950	15091	590.08	71.22	1.47	0.69	588.61	70.77
13680	15611	568.25	34.38	1.14	0.76	567.11	33.81
13720	15441	567.94	39.72	1.20	0.77	566.73	39.12
13690	15561	567.57	34.79	1.15	0.75	566.42	34.21
13730	15211	567.57	39.75	1.20	0.79	566.37	39.13
13710	15321	567.01	36.71	1.16	0.73	565.85	36.14
13740	15091	567.11	39.94	1.21	0.77	565.89	39.33
13780	15361	568.65	42.45	1.23	0.73	567.42	41.88
13820	15341	575.85	48.46	1.32	0.76	574.53	47.87
13790	15451	568.82	42.83	1.24	0.72	567.58	42.27
13830	15301	576.38	48.94	1.33	0.74	575.40	48.36
14000	16181	589.97	62.69	1.57	0.73	588.40	62.15
14310	14981	606.67	56.24	2.12	0.77	604.56	55.70
14320	16321	612.22	57.63	2.16	0.72	610.60	57.14
14080	15141	591.29	62.91	1.67	0.75	589.63	62.34
14040	16221	592.97	65.44	1.59	0.68	591.37	64.96
14070	15031	592.17	64.56	1.66	0.77	590.51	63.98
14030	15671	592.47	63.89	1.60	0.67	590.87	63.40
14060	15121	591.77	65.67	1.65	0.76	590.12	65.09
14020	15471	591.67	62.28	1.59	0.67	590.70	61.78
14090	15271	589.35	61.56	1.67	0.74	587.68	61.00
14120	15301	596.22	63.66	1.74	0.66	594.49	63.23
14050	15081	592.06	65.99	1.68	0.72	590.37	65.46
14110	15011	593.91	62.17	1.71	0.68	592.2	61.69
14010	15081	588.95	64.54	1.55	0.74	587.4	64.00
14100	15241	592.84	59.15	1.71	0.69	591.12	58.64
13564	15511	574.23	30.73	1.30	0.84	573.2	30.24
13803	15261	571.04	43.85	1.32	0.74	569.71	43.25
13843	15581	576.74	50.6	1.33	0.74	575.41	50.04

13813	15101	571.94	45.99	1.29	0.79	570.65	45.36
13853	15781	577.82	51.17	1.34	0.73	576.48	50.61
13863	15061	577.47	53.14	1.34	0.72	576.13	52.60
13933	15961	590.5	69.12	1.46	0.71	589.40	68.63
13983	15141	592.88	72.17	1.54	0.77	591.34	71.64
13943	15851	590.65	73.16	1.46	0.70	589.19	72.70
13993	14951	590.82	67.81	1.55	0.75	589.28	67.28

APPENDIX G

RAW LOCATED DATA FORMATS

WEST MUSGRAVE MAGNETICS – RAW

COMM Client : Geoscience Australia (GA)
COMM Area : West Musgrave, Western Australia
COMM Project Number : 863
COMM .
COMM AIRBORNE SURVEY SPECIFICATIONS
COMM -----
COMM Date of Survey August - September, 2002
COMM Contractor Fugro Airborne Surveys Pty. Ltd.
COMM . Job Number 1548
COMM Aircraft VH-WAM Rockwell Shrike Aerocommander 500S
COMM Navigation Ashtech G-12 Single Frequency Receivers
COMM . Differentially Post Processed
COMM Acquisition System GeolInstruments 2001 digital
COMM . acquisition system recording
COMM . onto PCMCIA disk
COMM Magnetometer Scintrex CS-2 or Geometrics G822A
COMM Recording Interval 0.1 seconds (approx. 7 m)
COMM Sensitivity 0.001 nT
COMM Compensation RMS ADCII
COMM Base Magnetometers Caesium Vapour (1sec sample rate)
COMM . Proton Precession (2sec sample rate)
COMM .
COMM Nominal Terrain Clearance 60 metres
COMM Line Spacing 400m Flight Lines
COMM . 4000m Tie Lines
COMM Line Direction 000-180 Flight Lines
COMM . 090-270 Tie Lines
COMM .
COMM LINE NUMBERS
COMM Flight Lines 10000-19999
COMM Tie Lines 90000-91999
COMM Low Level Test Lines 80000-89999
COMM . 800000-899999
COMM .
COMM SURVEY AREA (GDA94, MGA52)
COMM 348932E 7206525N
COMM 399292E 7206995N
COMM 399499E 7179308N
COMM 500000E 7179686N
COMM 500000E 7068942N
COMM 350514E 7068069N
COMM 350000E 7112378N
COMM 397004E 7112834N
COMM 396917E 7123910N
COMM 383405E 7123796N
COMM 383120E 7155916N
COMM 357343E 7173387N
COMM 349305E 7173298N
COMM .
COMM Located Data Format ASCII
COMM A space is left between fixed fields so that a field of, for example, 18
COMM should only ever have a maximum of 7 characters in it, even when it is a
COMM null
COMM .
COMM PROJECT is Project Number
COMM FLIGHT is Flight Number

COMM LINE is Line Number
 COMM FIDUCIAL is Fiducial Number
 COMM YYYYMMDD is Date (year/month/day)
 COMM BEARING is Line Bearing (east of north)
 COMM RAW_LONGITUDE is Raw Longitude, GDA94 (uncorrected for parallax)
 COMM RAW_LATITUDE is Raw Latitude, GDA94 (uncorrected for parallax)
 COMM EASTING is Raw Easting, GDA94 MGA52 (uncorrected for parallax)
 COMM NORTHING is Raw Northing, GDA94 MGA52 (uncorrected for parallax)
 COMM ALTIMETER is Radar Altimeter
 COMM PRESSURE is Pressure
 COMM TEMPERATURE is Temperature
 COMM FLUXX is Fluxgate X Component
 COMM FLUXY is Fluxgate Y Component
 COMM FLUXZ is Fluxgate Z Component
 COMM RAWMAG is Uncompensated Magnetics (all sensors)
 COMM COMPMAG is Compensated Magnetics (all sensors)
 COMM DIURNAL is Diurnal Magnetics

WEST MUSGRAVE DIGITAL ELEVATION MODEL – RAW

COMM Client : Geoscience Australia (GA)
 COMM Area : West Musgrave, Western Australia
 COMM Project Number : 863
 COMM .
 COMM .
 COMM AIRBORNE SURVEY SPECIFICATIONS
 COMM -----
 COMM Date of Survey August - September, 2002
 COMM Contractor Fugro Airborne Surveys Pty. Ltd.
 COMM . Job Number 1548
 COMM Aircraft VH-WAM Rockwell Shrike Aerocommander 500S
 COMM Navigation Ashtech G-12 Single Frequency Receivers
 COMM . Differentially Post Processed
 COMM Acquisition System GeolInstruments 2001 digital
 COMM . acquisition system recording
 COMM . onto PCMCIA disk
 COMM Radar Altimeter Sperry AA-210 (self calibrating)
 COMM Recording Interval 0.1 seconds (approx. 7 m)
 COMM Range 0 - 750 meters
 COMM Accuracy +/- 0.5 metres
 COMM Precision 0.3 metres
 COMM .
 COMM Nominal Terrain Clearance 60 metres
 COMM Line Spacing 400m Flight Lines
 COMM . 4000m Tie Lines
 COMM Line Direction 000-180 Flight Lines
 COMM . 090-270 Tie Lines
 COMM .
 COMM LINE NUMBERS
 COMM Flight Lines 10000-19999
 COMM Tie Lines 90000-91999
 COMM Low Level Test Lines 80000-89999
 COMM . 800000-899999
 COMM .

COMM Recording Interval 1.0 second (approx. 70 m)
 COMM Crystal Volume 50.3 litres
 COMM System Resolution < 7%
 COMM .
 COMM Nominal Terrain Clearance 60 metres
 COMM Line Spacing 400m Flight Lines
 COMM . 4000m Tie Lines
 COMM Line Direction 000-180 Flight Lines
 COMM . 090-270 Tie Lines
 COMM .
 COMM STRIPPING COEFFICIENTS
 COMM alfa 0.247 a 0.071
 COMM beta 0.418 b 0.002
 COMM gamma 0.762 c 0.001
 COMM .
 COMM COSMIC COEFFICIENTS
 COMM TC 0.8610
 COMM K 0.0481
 COMM U 0.0394
 COMM Th 0.0485
 COMM .
 COMM BACKGROUND COEFFICIENTS
 COMM TC 28.0
 COMM K 6.0
 COMM U 0.5
 COMM Th 0.1
 COMM .
 COMM HEIGHT ATTENUATION COEFFICIENTS
 COMM TC -0.00725
 COMM K -0.00935
 COMM U -0.00646
 COMM Th -0.00715
 COMM .
 COMM RADON STRIPPING COEFFICIENTS
 COMM TC 14.540
 COMM K 0.799
 COMM Th 0.050
 COMM .
 COMM SPECTRAL RATIOS
 COMM Radon 2.546
 COMM Ground 1.462
 COMM .
 COMM CONCENTRATIONS
 COMM Dose Rate (nGy/h) = [Total Count(cps) / 38.54]
 COMM Potassium (%) = [Potassium Count(cps) / 140.27]
 COMM Uranium (ppm) = [Uranium Count(cps) / 15.53]
 COMM Thorium (ppm) = [Thorium Count(cps) / 8.15]
 COMM .
 COMM LINE NUMBERS
 COMM Flight Lines 10000-19999
 COMM Tie Lines 90000-91999
 COMM Low Level Test Lines 80000-89999
 COMM . 800000-899999
 COMM .
 COMM SURVEY AREA (GDA94, MGA52)
 COMM 348932E 7206525N
 COMM 399292E 7206995N
 COMM 399499E 7179308N

COMM 500000E 7179686N
COMM 500000E 7068942N
COMM 350514E 7068069N
COMM 350000E 7112378N
COMM 397004E 7112834N
COMM 396917E 7123910N
COMM 383405E 7123796N
COMM 383120E 7155916N
COMM 357343E 7173387N
COMM 349305E 7173298N
COMM .
COMM Located Data Format ASCII
COMM A space is left between fixed fields so that a field of, for example, 18
COMM should only ever have a maximum of 7 characters in it, even when it is a
COMM null
COMM .
COMM PROJECT is Project Number
COMM FLIGHT is Flight Number
COMM LINE is Line Number
COMM FIDUCIAL is Fiducial Number
COMM YYYYMMDD is Date (year/month/day)
COMM BEARING is Line Bearing (east of north)
COMM RAW_LONGITUDE is Raw Longitude, GDA94 (uncorrected for parallax)
COMM RAW_LATITUDE is Raw Latitude, GDA94 (uncorrected for parallax)
COMM EASTING is Raw Easting, GDA94 MGA52 (uncorrected for parallax)
COMM NORTHING is Raw Northing, GDA94 MGA52 (uncorrected for parallax)
COMM ALTIMETER is Radar Altimeter
COMM PRESSURE is Pressure
COMM TEMPERATURE is Temperature
COMM RAWTOT is Raw Total Counts
COMM RAWPOT is Raw Potassium Counts
COMM RAWURA is Raw Uranium Counts
COMM RAWTHO is Raw Thorium Counts
COMM RAWCOS is Raw Cosmic Counts
COMM FID_SPEC is Fiducial Number at Start of Spectrum
COMM SAMPLETIME is Sample Integration Time
COMM LOWBOUND is Low Energy Bound of Spectrum
COMM HIGHBOUND is High Energy Bound of Spectrum
COMM LIVETIME is Livetime for Spectrum
COMM RESOLUTION is Spectrum Resolution
COMM RAW256CH is Raw 256-channel radiometric data

APPENDIX H

FINAL LOCATED DATA FORMATS

WEST MUSGRAVE MAGNETICS – FINAL

COMM Client : Geoscience Australia (GA)
COMM Area : West Musgrave, Western Australia
COMM Project Number : 863
COMM .
COMM .
COMM AIRBORNE SURVEY SPECIFICATIONS
COMM -----
COMM Date of Survey August - September, 2002
COMM Contractor Fugro Airborne Surveys Pty. Ltd.
COMM . Job Number 1548
COMM Aircraft VH-WAM Rockwell Shrike Aerocommander 500S
COMM Navigation Ashtech G-12 Single Frequency Receivers
COMM . Differentially Post Processed
COMM Acquisition System Geolnstruments 2001 digital
COMM . acquisition system recording
COMM . onto PCMCIA disk
COMM Magnetometer Scintrex CS-2 or Geometrics G822A
COMM Recording Interval 0.1 seconds (approx. 7 m)
COMM Sensitivity 0.001 nT
COMM Compensation RMS AADCII
COMM Base Magnetometers Caesium Vapour (1sec sample rate)
COMM . Proton Precession (2sec sample rate)
COMM .
COMM Nominal Terrain Clearance 60 metres
COMM Line Spacing 400m Flight Lines
COMM . 4000m Tie Lines
COMM Line Direction 000-180 Flight Lines
COMM . 090-270 Tie Lines
COMM .
COMM LINE NUMBERS
COMM Flight Lines 10000-19999
COMM Tie Lines 90000-91999
COMM .
COMM SURVEY AREA (GDA94, MGA52)
COMM 348932E 7206525N
COMM 399292E 7206995N
COMM 399499E 7179308N
COMM 500000E 7179686N
COMM 500000E 7068942N
COMM 350514E 7068069N
COMM 350000E 7112378N
COMM 397004E 7112834N
COMM 396917E 7123910N
COMM 383405E 7123796N
COMM 383120E 7155916N
COMM 357343E 7173387N
COMM 349305E 7173298N
COMM .
COMM DATA PROCESSING
COMM Processing By Fugro Airborne Surveys Pty. Ltd.
COMM System Parallax Removed
COMM IGRF Removed 2000 Model - extrapolated to 2002.8
COMM Inclination -58.99 degrees
COMM Declination 3.78 degrees
COMM Base Value 55215 nT

COMM Diurnal Corrections Applied Base Value 54530 nT
 COMM . and 54485 nT
 COMM Data Tie Line Levelled
 COMM .
 COMM Located Data Format ASCII
 COMM A space is left between fixed fields so that a field of, for example, 18
 COMM should only ever have a maximum of 7 characters in it, even when it is a
 COMM null
 COMM .
 COMM PROJECT is Project Number
 COMM FLIGHT is Flight Number
 COMM LINE is Line Number
 COMM FIDUCIAL is Fiducial Number
 COMM YYYYMMDD is Date (year/month/day)
 COMM BEARING is Line Bearing (east of north)
 COMM LONGITUDE is Longitude, GDA94 (corrected for parallax)
 COMM LATITUDE is Latitude, GDA94 (corrected for parallax)
 COMM EASTING is Easting, GDA94 MGA52 (corrected for parallax)
 COMM NORTHING is Northing, GDA94 MGA52 (corrected for parallax)
 COMM ALTIMETER is Radar Altimeter
 COMM PRESSURE is Pressure
 COMM TEMPERATURE is Temperature
 COMM PRE_MICRO_MAG is Diurnal and IGRF Corrected and Tie Line Levelled Magnetic
 Data (pre micro levelling) (all sensors)
 COMM FINMAG is Final Magnetic Data (diurnal and IGRF corrected and tie line levelled - no
 microlevelling needed) (all sensors)

WEST MUSGRAVE DIGITAL ELEVATION MODEL – FINAL

COMM Client : Geoscience Australia (GA)
 COMM Area : West Musgrave, Western Australia
 COMM Project Number : 863
 COMM .
 COMM .
 COMM AIRBORNE SURVEY SPECIFICATIONS
 COMM -----
 COMM Date of Survey August - September, 2002
 COMM Contractor Fugro Airborne Surveys Pty. Ltd.
 COMM . Job Number 1548
 COMM Aircraft VH-WAM Rockwell Shrike Aerocommander 500S
 COMM Navigation Ashtech G-12 Single Frequency Receivers
 COMM . Differentially Post Processed
 COMM Acquisition System GeoInstruments 2001 digital
 COMM . acquisition system recording
 COMM . onto PCMCIA disk
 COMM Radar Altimeter Sperry AA-210 (self calibrating)
 COMM Recording Interval 0.1 seconds (approx. 7 m)
 COMM Range 0 - 750 meters
 COMM Accuracy +/- 0.5 metres
 COMM Precision 0.3 metres
 COMM .
 COMM Nominal Terrain Clearance 60 metres
 COMM Line Spacing 400m Flight Lines
 COMM . 4000m Tie Lines
 COMM Line Direction 000-180 Flight Lines

COMM . 090-270 Tie Lines
 COMM .
 COMM LINE NUMBERS
 COMM Flight Lines 10000-19999
 COMM Tie Lines 90000-91999
 COMM .
 COMM SURVEY AREA (GDA94, MGA52)
 COMM 348932E 7206525N
 COMM 399292E 7206995N
 COMM 399499E 7179308N
 COMM 500000E 7179686N
 COMM 500000E 7068942N
 COMM 350514E 7068069N
 COMM 350000E 7112378N
 COMM 397004E 7112834N
 COMM 396917E 7123910N
 COMM 383405E 7123796N
 COMM 383120E 7155916N
 COMM 357343E 7173387N
 COMM 349305E 7173298N
 COMM .
 COMM DATA PROCESSING
 COMM Processing by Fugro Airborne Surveys Pty. Ltd.
 COMM GPS Height interpolated from 1Hz to 10Hz
 COMM Radar Altimeter lightly filtered before calculating the DTM
 COMM Digital Terrain Model (DTM) = GPS Height - filtered Radar Altimeter
 COMM Data Tie Line and Micro Levelled
 COMM DTM corrected to the Australian Height Datum to create DEM
 COMM .
 COMM Located Data Format ASCII
 COMM A space is left between fixed fields so that a field of, for example, 18
 COMM should only ever have a maximum of 7 characters in it, even when it is a
 COMM null
 COMM .
 COMM PROJECT is Project Number
 COMM FLIGHT is Flight Number
 COMM LINE is Line Number
 COMM FIDUCIAL is Fiducial Number
 COMM YYYYMMDD is Date (year/month/day)
 COMM BEARING is Line Bearing (east of north)
 COMM LONGITUDE is Longitude, GDA94 (corrected for parallax)
 COMM LATITUDE is Latitude, GDA94 (corrected for parallax)
 COMM EASTING is Easting, GDA94 MGA52 (corrected for parallax)
 COMM NORTHING is Northing, GDA94 MGA52 (corrected for parallax)
 COMM ALTIMETER is Radar Altimeter
 COMM PRESSURE is Pressure
 COMM TEMPERATURE is Temperature
 COMM FINAIR is Final Aircraft Elevation (Levelled Digital Terrain Model Data (GDA94
 ellipsoid) plus radar altimeter)
 COMM FINDEM is Final Ground Elevation (Levelled Digital Elevation Model Data - Geoid
 Separation Applied (Australian Height Datum))

COMM Client : Geoscience Australia (GA)
 COMM Area : West Musgrave, Western Australia
 COMM Project Number : 863
 COMM .
 COMM .
 COMM AIRBORNE SURVEY SPECIFICATIONS
 COMM -----
 COMM Date of Survey August - September, 2002
 COMM Contractor Fugro Airborne Surveys Pty. Ltd.
 COMM . Job Number 1548
 COMM Aircraft VH-WAM Rockwell Shrike Aerocommander 500S
 COMM Navigation Ashtech G-12 Single Frequency Receivers
 COMM . Differentially Post Processed
 COMM Acquisition System GeolInstruments 2001 digital
 COMM . acquisition system recording
 COMM . onto PCMCIA disk
 COMM Spectrometer Exploranium GR-820 (self calibrating)
 COMM Recording Interval 1.0 second (approx. 70 m)
 COMM Crystal Volume 50.3 litres
 COMM System Resolution < 7%
 COMM .
 COMM Nominal Terrain Clearance 60 metres
 COMM Line Spacing 400m Flight Lines
 COMM . 4000m Tie Lines
 COMM Line Direction 000-180 Flight Lines
 COMM . 090-270 Tie Lines
 COMM .
 COMM STRIPPING COEFFICIENTS
 COMM alfa 0.247 a 0.071
 COMM beta 0.418 b 0.002
 COMM gamma 0.762 c 0.001
 COMM .
 COMM COSMIC COEFFICIENTS
 COMM TC 0.8610
 COMM K 0.0481
 COMM U 0.0394
 COMM Th 0.0485
 COMM .
 COMM BACKGROUND COEFFICIENTS
 COMM TC 28.0
 COMM K 6.0
 COMM U 0.5
 COMM Th 0.1
 COMM .
 COMM HEIGHT ATTENUATION COEFFICIENTS
 COMM TC -0.00725
 COMM K -0.00935
 COMM U -0.00646
 COMM Th -0.00715
 COMM .
 COMM RADON STRIPPING COEFFICIENTS
 COMM TC 14.540
 COMM K 0.799
 COMM Th 0.050
 COMM .
 COMM SPECTRAL RATIOS
 COMM Radon 2.546

COMM Ground 1.462

COMM .

COMM CONCENTRATIONS

COMM Dose Rate (nGy/h) = [Total Count(cps) / 38.54]

COMM Potassium (%) = [Potassium Count(cps) / 140.27]

COMM Uranium (ppm) = [Uranium Count(cps) / 15.53]

COMM Thorium (ppm) = [Thorium Count(cps) / 8.15]

COMM .

COMM LINE NUMBERS

COMM Flight Lines 10000-19999

COMM Tie Lines 90000-91999

COMM .

COMM SURVEY AREA (GDA94, MGA52)

COMM 348932E 7206525N

COMM 399292E 7206995N

COMM 399499E 7179308N

COMM 500000E 7179686N

COMM 500000E 7068942N

COMM 350514E 7068069N

COMM 350000E 7112378N

COMM 397004E 7112834N

COMM 396917E 7123910N

COMM 383405E 7123796N

COMM 383120E 7155916N

COMM 357343E 7173387N

COMM 349305E 7173298N

COMM .

COMM DATA PROCESSING

COMM Processing By Fugro Airborne Surveys Pty. Ltd.

COMM Data processed with noise suppression (NASVD)

COMM System Parallax Removed

COMM Cosmic, Aircraft and Radon Backgrounds Removed

COMM Stripping and Height Corrections Applied

COMM Corrected for Livetime, Pressure and Temperature

COMM Data Tie Line and Micro Levelled if necessary

COMM Levelled Counts Per Second Converted to Ground Concentrations

COMM .

COMM Located Data Format ASCII

COMM A space is left between fixed fields so that a field of, for example, 18

COMM should only ever have a maximum of 7 characters in it, even when it is a

COMM null

COMM .

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COMM NORTHING is Northing, GDA94 MGA52 (corrected for parallax)

COMM ALTIMETER is Radar Altimeter

COMM PRESSURE is Pressure

COMM TEMPERATURE is Temperature

COMM SMOOTH_DOSERATE is Final Corrected, Levelled Dose Rate (NASVD spectral smoothing applied)

COMM SMOOTH_KPCENT is Final Corrected, Levelled Potassium Concentration (NASVD spectral smoothing applied)

COMM SMOOTH_URAPPM is Final Corrected, Levelled Uranium Concentration (NASVD spectral smoothing applied)

COMM SMOOTH_THOPPM is Final Corrected, Levelled Thorium Concentration (NASVD spectral smoothing applied)

APPENDIX I

FLIGHT LOGS