Territory Iron Pty Ltd

North Pine Creek & Francis Creek Surveys, Northern Territory

Surveyed September 2013

GPX Project No 2511

XTEM Airborne Geophysical Survey

Survey Operations and Logistics Report

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1 GENERAL SURVEY INFORMATION

1.1 INTRODUCTION

Between the 26th August and the 10th September 2013 GPX Surveys Pty Ltd performed a XTEM helicopter electromagnetic survey for Territory Iron Pty Ltd over the North Pine Creek & Francis Creek survey areas in Western Australia. The survey was flown using a Eurocopter AS350 BA Squirrel helicopter. This report summarises the procedures, details and equipment used by GPX Surveys in the acquisition, verification and processing of the airborne geophysical data.

Client:	Territory Iron Pty Ltd	
GPX Project Number:	2511	
Survey Area:	North Pine Creek & Francis Creek, W.A.	
Survey Base:	Territory Iron Mine, N.T.	
Mobilisation:	26th - 28th August 2013	
Production:	29th August – 8th September 2013	
De-mobilisation:	9th September – 10th September 2013	
Line km surveyed:	North Pine Creek	850.0 km
	Francis Creek	610.9 km
	Total	**1460.9 km**

1.2 SURVEY SUMMARY

On the 26th / 27th August 2013 the GPX Surveys crew mobilised from Perth to Darwin. On the 28th August, the crew arrived in Pine Creek, visited the Territory Mine and inspected the landing site. On the 29th August, the crew underwent inductions at Territory Iron Mine, assembled the XTEM rig and performed a reconnaissance flight of the survey area. Production began in the North Pine Creek survey block on 30th August and was completed on the 5th September. Production commenced in the Francis Creek block on the 5th September and was completed on the 8th September. All production was completed by the 8th September. Strong winds, which usually built up in the late morning, caused a number of flights to be limited to the early morning. Flights were scheduled to be grounded during blasting at the Territory Iron mine.

The base magnetometer was tested and set up near the Territory Iron Mine.

At the end of flying all the data was sent back to the offices of GPX Surveys for further processing and review.

Dismantling of the rig was carried out on the 9th September and the crew and aircraft departed on the 9th – 10th September 2013.

1.3 SURVEY PERSONNEL

The following personnel were involved on this project:

Project Manager:	Katherine McKenna
Health and Safety Manager:	Robert Blizzard
Field Project Manager:	Ron Creagh
Field Data Processor:	Joe Kita
Technical Assistance:	Mike Barrett
Pilot:	Matt Corbett
Final Data Processing:	Ron Creagh
	Mark Lowe

2 SURVEY SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

The following are the general specifications for the survey:

Minimum line length:	3000 metres
Nominal XTEM ground clearance:	30 - 40 metres
XTEM Method	Time Domain
XTEM Tx Frequency	25 Hz
XTEM NIA	103,200
Magnetometer sample rate:	1200 Hz
Altimeter sample rate:	10 Hz
Base magnetometer sample rate:	1 Hz
Along line sample rate:	3 metres
Helicopter survey speed:	45 – 50 knots

2.2 OVERVIEW MAP

The following map provides an overview of the planned survey areas.

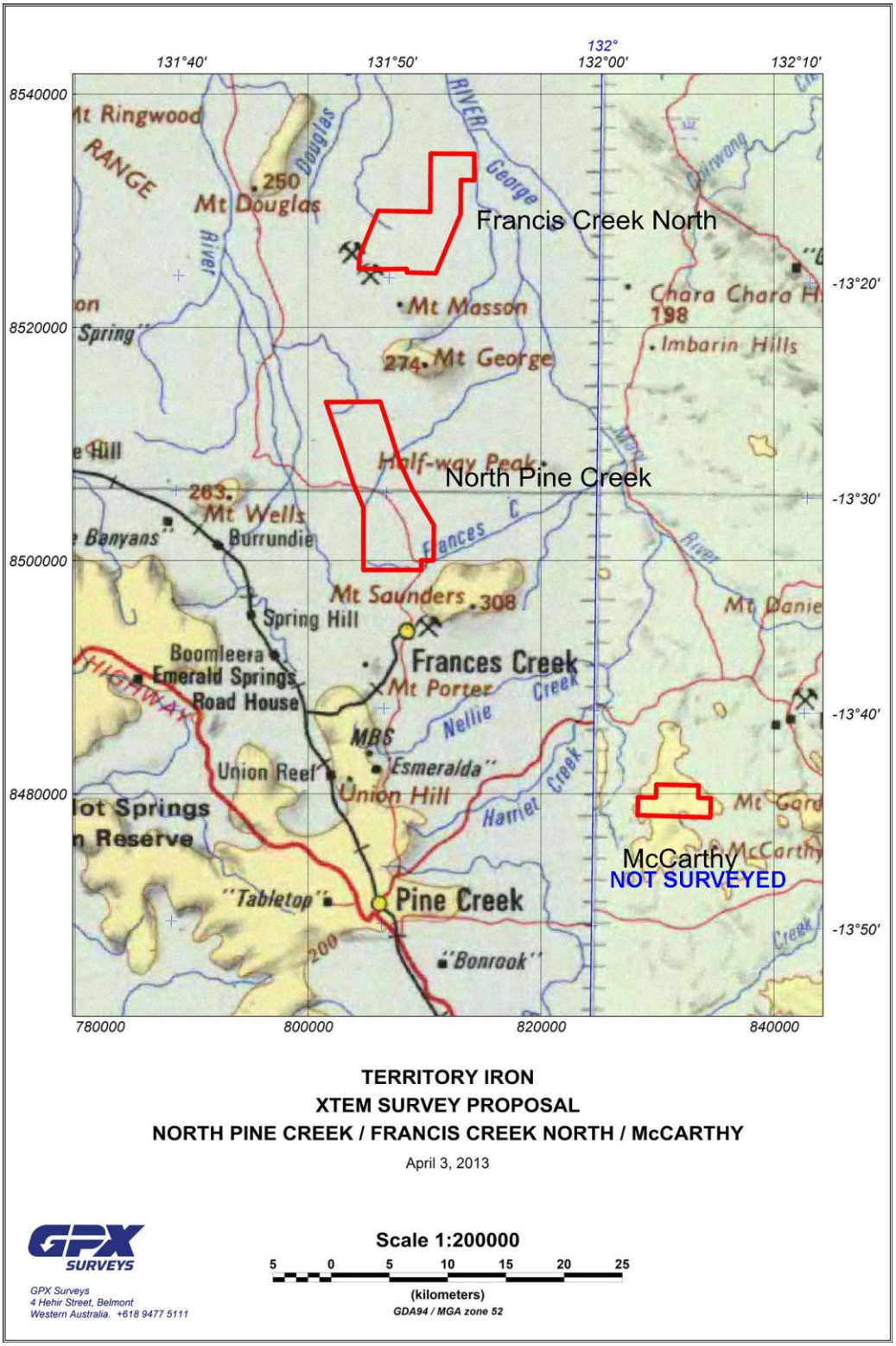


Figure 1: Map of the North Pine Creek and Francis Creek Survey Areas.

2.3 SURVEY AREA SPECIFICATIONS

Boundary Coordinates

The following coordinates are in GDA94 MGA52 and define the boundaries of the North Pine Creek & Francis Creek survey areas:

North Pine Creek

Easting (m)	Northing (m)
804761	8499194.5
809728.2	8499194.5
809729.5	8500019.6
810781.1	8500031.3
810804	8503034.5
808985.6	8506070
807882.6	8508448.5
806814	8511792.2
806193.5	8513619.1
801540	8513584.7
802780.9	8509999.7
803891.4	8506614.9
804763.2	8504508.3

Francis Creek

Easting (m)	Northing (m)
813120.6	8532628.9
813108.5	8529708.2
810975.7	8524637
808490.2	8524705
808480.8	8525001.1
806637.4	8524968.4
804353.9	8525044.2
804435.7	8526166.8
806009.6	8529986.7
810499.7	8529893.4
810542	8534888.8
814278.2	8534861.7
814274	8532613.4

Line Specifications

The line specifications for the North Pine Creek and Francis Creek survey areas are as follows:

Traverse line spacing:	100 m
Traverse line direction:	090 – 270 degrees
Traverse line numbers:	20010 – 21460 (NPC)
	30010 – 31040 (FC)
Tie line spacing:	1000 m
Tie line direction:	000 – 180 degrees
Tie line numbers:	27020 – 27100 (NPC)
	37020 – 37110 (FC)

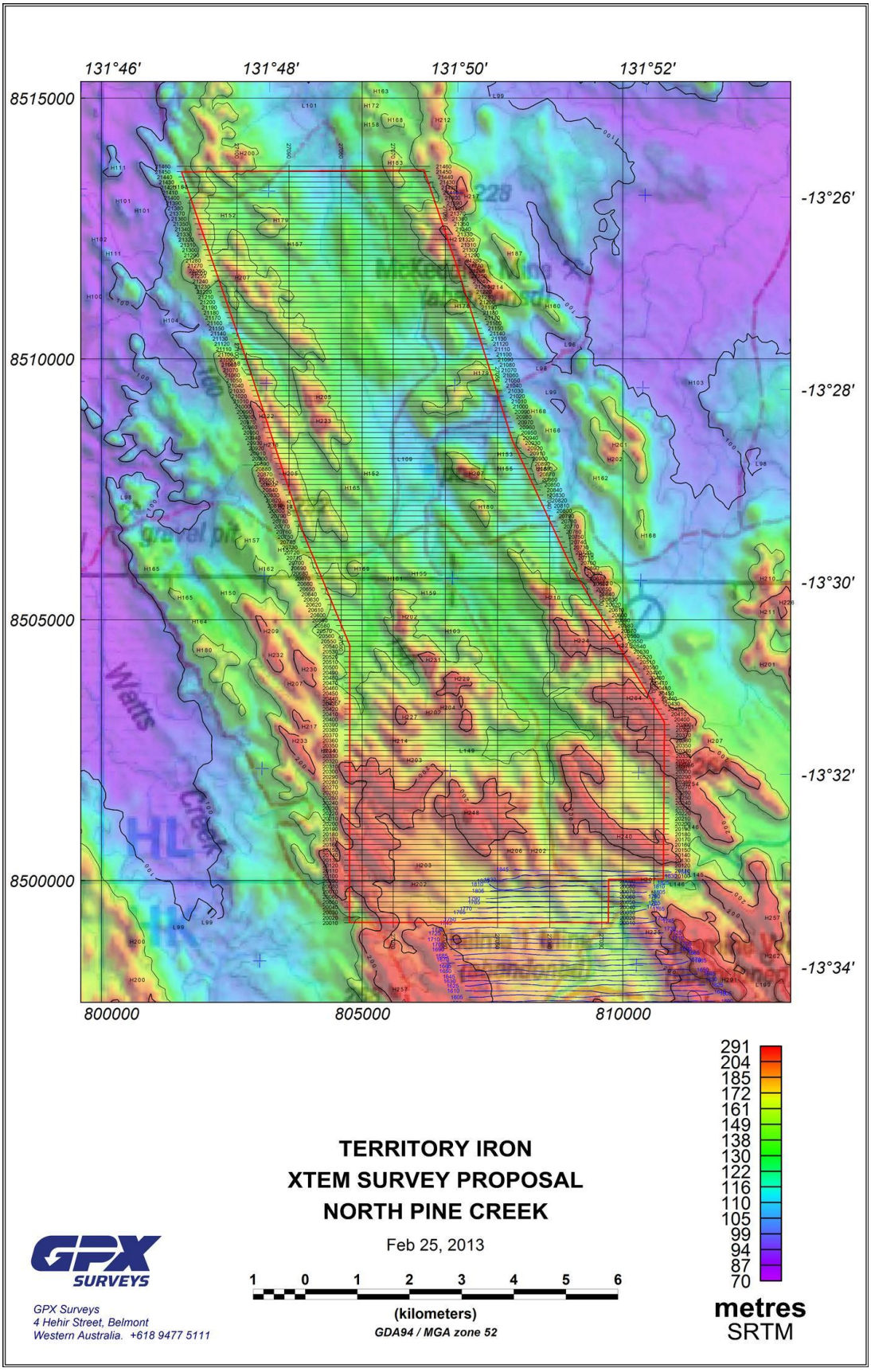


Figure 2: North Pine Creek planned survey area with SRTM.

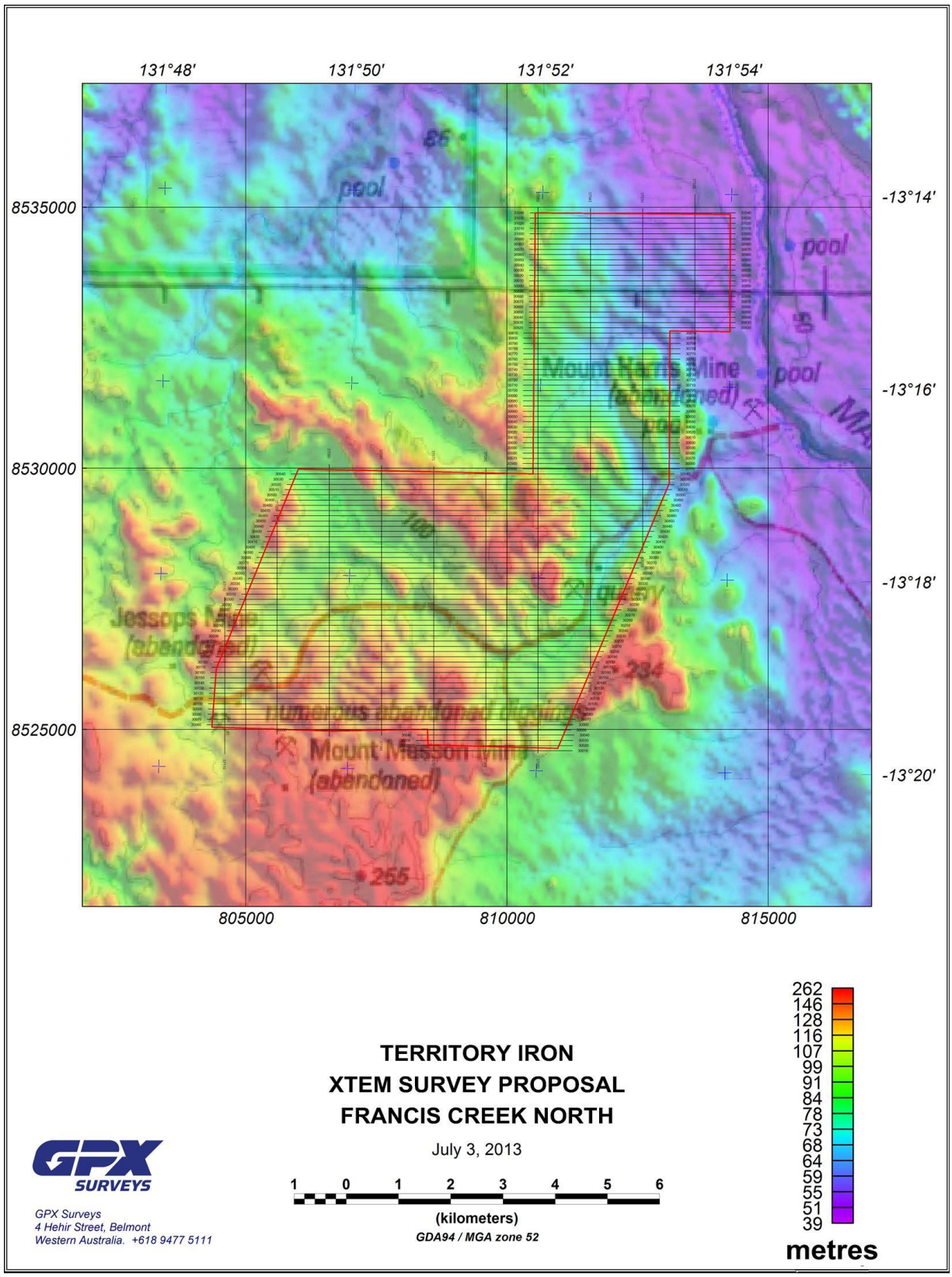


Figure 3: Francis Creek planned survey area with SRTM.

3 EQUIPMENT SPECIFICATIONS

3.1 SURVEY EQUIPMENT SUMMARY

The following survey equipment was used during this project:

Survey Platform:	Eurocopter AS 350 BA Squirrel Helicopter (VH-JTQ)
Data Acquisition and Survey System:	XTEM Airborne EM System
Magnetometer:	Geometrics G-822A Cesium Vapour
Magnetic Base Stations:	GEM Overhauser GSM-19
In-field Computer:	Toshiba Notebook
In-field Software:	Geosoft Oasis Montaj, ChrisDBF

Figure 4: XTEM airborne geophysical system.

3.3 DATA ACQUISITION EQUIPMENT

The data acquisition equipment is a XTEM time domain airborne electromagnetic survey system. XTEM consists of a carbon fibre and plywood frame that is suspended 30m below the helicopter. A transmitter loop is attached to the outside arms of the rig and a receiver coil is located at the centre of the rig. The magnetometer sensor is mounted on the XTEM frame that is located 30m below the helicopter. The rig is flown at a nominal height of 35m above the terrain.

Helicopter survey speed is between 45 and 50 knots and the along line sample interval is between 2 to 5 metres.

Navigation / Flight Control

Navigation control is via a navigation computer that is used to guide the pilot on a pre-defined flight plan which is planned in UTM coordinates. The navigation computer operates using a flashcard that contains the navigation software and flight plan that is displayed on a touch screen.

Aside from the line numbers and coordinates the flight plan file also contains information such as nominal terrain clearance, the datum and a line sequence. Co-ordinates are only entered in the WGS84 datum system which has been implemented to avoid confusion and eliminate possible conversion errors. The pilot can either fly a predetermined line sequence or enter an arbitrary line number.

Real-time Status Monitoring

System information such as transmitter current, receiver status, and GPS status are displayed on the navigation screen to ensure that problems encountered mid-flight can be diagnosed immediately rather than post-flight.

Data Recording

Data is only recorded when the transmitter is operating. Flight information for each line including line number, timing, positioning, raw EM data, GPS and laser is recorded by the EM computer. All information is recorded in binary format and saved on a removable flash card.

Data Retrieval

At the end of each flight the flash card is removed from the EM computer and the data copied to the field laptop. The recorded data is not deleted from the flash disc until the data has been fully processed and verified to be “error free”.

Specifications

The specifications of the XTEM transmitter, receiver and receiver coil are as follows:

Transmitter

Waveform:	25% duty cycle square wave
Pulse on Time:	5 ms (inc. 1ms cosine ramp on)
Pulse off Time:	15 ms
Pulse Current:	300 Amps
Switch on Ramp:	0.75 ms
Switch off Ramp:	45 µs
Tx Loop Area:	340 m^2
Tx NIA:	103,200
Tx Frequency:	25 Hz

Receiver

A-D Circuitry:	24 bit
Sample Time**:**	0 – 12 ms
Sampling**:**	512 Linear channels
Windowed Data:	30 channels

Receiver Coil

Effective NA:	10,000 Square Metres
Bandwidth:	45,000 Hz

EM Data Channel Specifications

NB: Time 0 is at the start of the switch off ramp and all times are in *μ*Sec.

30 Channel Sampling Scheme (45 *μ*Sec ramp)				
Channel	**Begin Time**	**End Time**	**Centre Time**	**Width in Time**
1	101.01	126.26	113.64	25.25
2	126.26	151.52	138.89	25.25
3	151.52	176.77	164.14	25.25
4	176.77	202.02	189.39	25.25
5	202.02	227.27	214.65	25.25
6	227.27	252.53	239.90	25.25
7	252.53	277.78	265.15	25.25
8	277.78	303.03	290.40	25.25
9	303.03	328.28	315.66	25.25
10	328.28	378.54	353.41	50.25
11	378.54	428.79	403.66	50.25
12	428.79	479.04	453.91	50.25
13	479.04	554.29	516.67	75.25
14	554.29	629.55	591.92	75.25
15	629.55	729.80	679.67	100.25
16	729.80	855.05	792.42	125.25
17	855.05	1005.30	930.18	150.25
18	1005.30	1205.56	1105.43	200.25
19	1205.56	1455.81	1330.68	250.25
20	1455.81	1756.06	1605.93	300.25
21	1756.06	2131.31	1943.69	375.25
22	2131.31	2581.57	2356.44	450.25
23	2581.57	3131.82	2856.69	550.25
24	3131.82	3832.07	3481.94	700.25
25	3832.07	4682.32	4257.20	850.25
26	4682.32	5732.58	5207.45	1050.25
27	5732.58	7032.83	6382.70	1300.25
28	7032.83	8608.08	7820.45	1575.25
29	8608.08	10558.33	9583.21	1950.25
30	10558.33	12908.58	11733.46	2350.25

Table 1: Data channel specifications for XTEM.

System Geometry

A simple diagram of the EM system is displayed below:

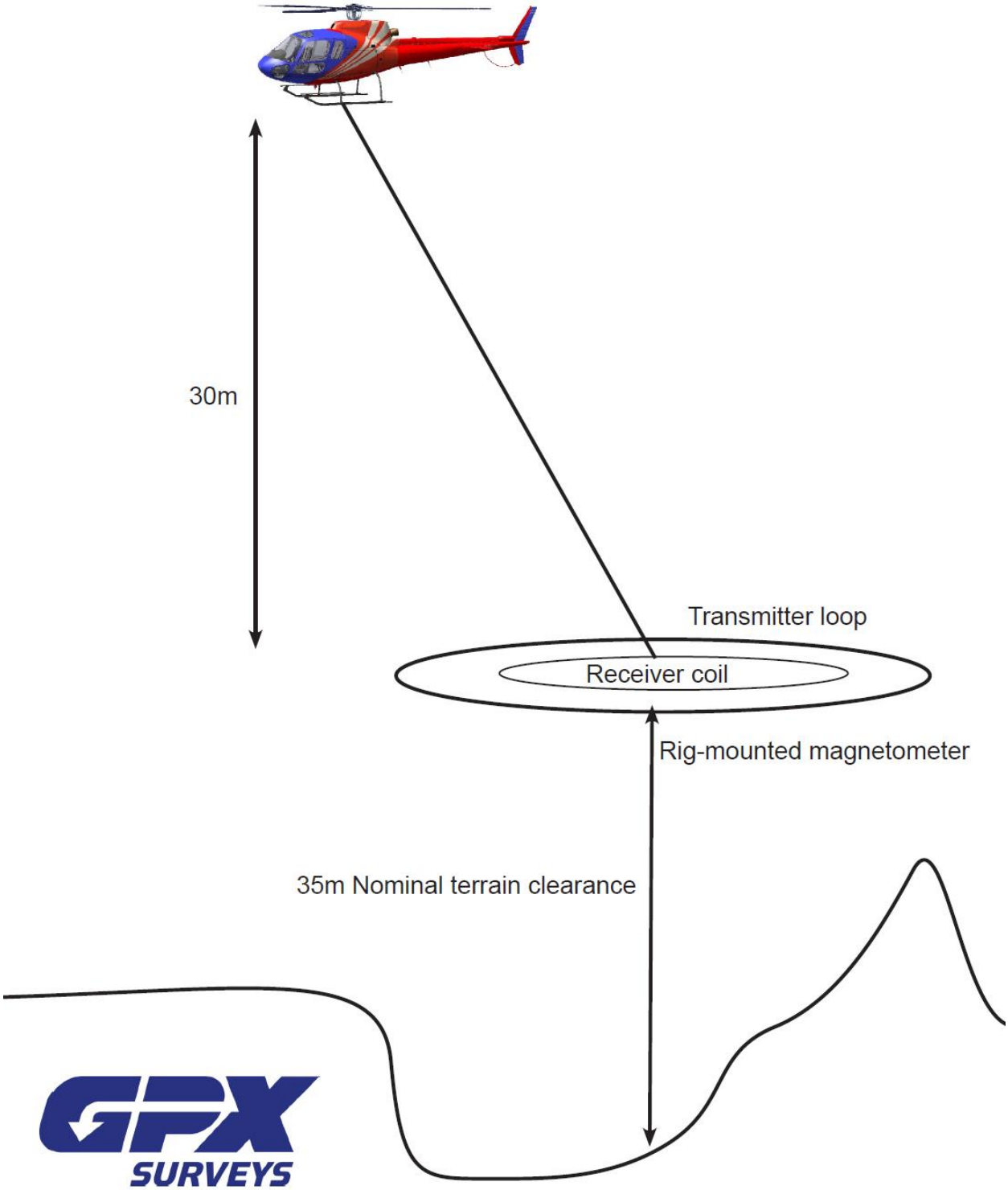


Figure 5: Geometry of the XTEM system.

3.4 MAGNETOMETER

The magnetic values and GPS time is recorded by a TM-6 magnetometer.

Specifications

Sampling rates:	1200 Hz
Noise rejection:	50 Hz
Absolute measurement error:	0.043 nT @ 50000 nT
Range:	30000 to 90000nT
RMS noise:	0.02 nT
Synchronisation:	GPS – PPS (pulse per second)
Data storage:	Removable compact flash card

3.5 MAGNETOMETER SENSOR

The magnetometer sensor is a Geometrics G-822A, which employs an optically pumped cesium-vapour atomic magnetic resonance system that functions as the frequency control element in an oscillator circuit.

Specifications

Operating Range:	20,000 – 100,000 nT
Sensitivity:	Typically 0.001 nT P-P at a 20Hz sample rate
Heading Error:	< 0.1 nT over entire 360º
Output:	Larmour frequency, 3.498572 Hz/nT

3.6 LASER ALTIMETER

The laser altimeter is an Opti-Logic RS800 with a RS-232 output link.

Specifications

Range:	3 – 294 m
Accuracy:	± 1 m
Measurement Rate:	10 Hz

3.7 GPS RECEIVERS

There are 3 GPS receivers and 1 DGPS receiver used for differential corrections.

Navigation GPS Specifications

Model:	Novatel Superstar II
GPS Position update rate:	5 Hz
GPS Input frequency:	L1

Primary EM (Helicopter) GPS Specifications

Model:	Novatel Superstar II
GPS Position update rate:	1 Hz
GPS Input frequency:	L1

Secondary EM (RIG) GPS Specifications

Model:	Novatel Superstar II
GPS Position update rate:	1Hz
GPS Input frequency:	L1

DGPS Specifications

Model:	Hemisphere R120
DGPS Correction signal:	Fugro VBS 65cm service

3.8 BASE MAGNETOMETER

Diurnal activity was monitored using portable GEM Overhauser magnetometers and sampled at 1 Hz. The unit has a built-in GPS receiver.

Specifications

Type:	GEM Overhauser GSM-19
Resolution:	0.01 nT
Sensitivity:	0.02 nT
Absolute Accuracy:	± 0.1nT
Dynamic Range:	10,000 to 120,000 nT
Sampling Rate:	1 hour to 0.5 Hz
Data Storage:	Internal memory
Data Retrieval:	Up to 115,200bps serial transfer

Base Station Location

The base station was set up near the Territory Iron Mine, away from operating equipment, which is 25km North of the Pine Creek, NT.

Location

Longitude (deg.):	13.61085 S
Latitude (deg.):	131.85208 E

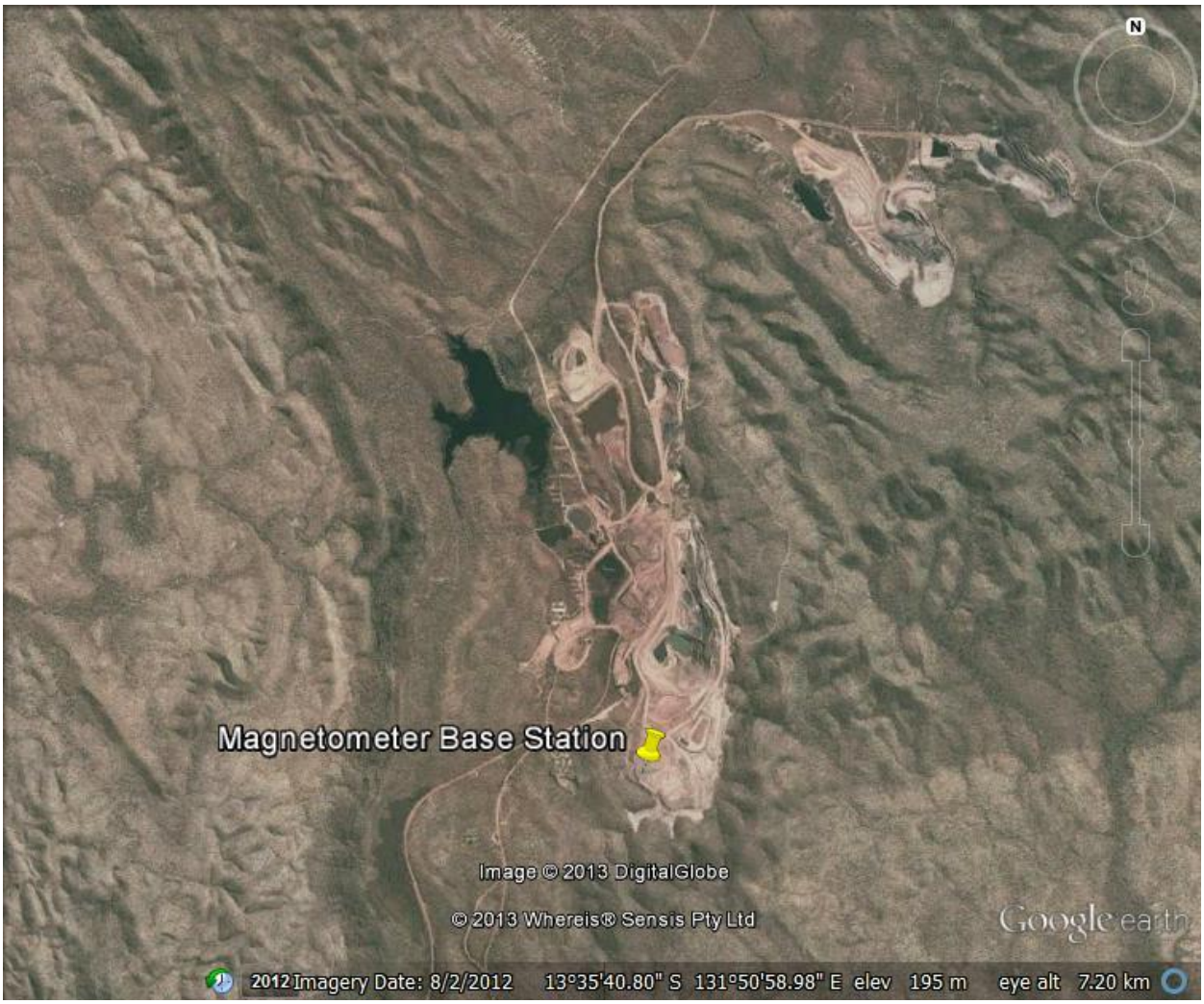


Figure 6: Location of the magnetometer.

4 EQUIPMENT CALIBRATIONS AND DATA ACQUISITION CHECKS

4.1 GROUND TEST

Prior to survey a ground test is conducted. This test ensures the equipment is functioning correctly and that the receiver loop is correctly configured.

4.2 HIGH LEVEL TEST LINE

After successful completion of the ground test a high level test line is flown. The helicopter is flown to 3000ft AGL to measure the background EM response of the aircraft and the rig devoid of any ground effects. The data from this test line is compared to the high level data from previous jobs to check for consistency.

A high level test flight is flown during each survey session which is used to correct the data by removing this background effect from each session using Geosoft processing software.

4.3 SYSTEM PARALLAX TESTS

One of the processing parameters required to process the data was the parallax or offset time between the time the digital reading was taken by the instrument and the time the position fix for the fiducial of the reading was obtained. Each instrument - magnetometer, laser altimeter, EM data recorder - may have a different parallax, so the parallax must be computed for each instrument.

4.4 DAILY TIME SYNCHRONIZATION

All of the base magnetometer, EM and magnetic data acquired by the XTEM system is synchronised to UTC time (Coordinated Universal Time).

5 DATA VERIFICATION AND PRELIMINARY PROCESSING

All data verification and preliminary processing was conducted in the field. At the conclusion of each survey flight the raw EM, position, laser altimeter and magnetic data was transferred onto the field computer for preliminary data processing and data verification. After data verification the field-processed data was transferred via satellite connection to the GPX Surveys ftp site for further verification and processing. Finally the raw data was cleared from the removable cards for the next survey flight.

5.1 EM DATA PROCESSING

The following procedures were performed on the raw EM data:

- Spline removal of bird-swing
- Negative decays paired and reversed
- Filtering and correction of laser altimeter
- Data is stacked to once a second.

5.2 MAGNETIC DATA PROCESSING

The magnetic readings were re-sampled to 50 Hz with each sample containing an array of 24 readings. Adjacent readings were summed to minimise bias from the EM transmissions to produce the 25 Hz magnetic array data. The mid-time array positions were averaged to create the magnetic response.

5.3 DATA VERIFICATION AND CHECKS

General Checks and Verification

The field processed EM, laser, current and magnetic data was checked for noise, spikes and inconsistencies. Any inconsistencies were queried and flagged and discussed with the technicians and senior data processors. If necessary the equipment was checked over and any damages were repaired or replaced. Prior to survey resumption the system was thoroughly tested.

Laser Altimeter Checks

The laser data was checked to ensure a reasonably constant height above the terrain was maintained. If significant deviations were observed the pilot was queried. If the reason was invalid and the section out of contract specification the line or section was reflown.

Flight Path Checks

The flight path was plotted against the flight plan and checked for deviations. Any deviations were queried with the pilot and if the reasoning was invalid and out of contract specification the line or section was re-flown.

Diurnal Data Checks

At the completion of each day's flying the diurnal data was downloaded from the base magnetometer onto the field laptop via a RS-232 serial cable link. The data was plotted

to check for spikes and erroneous activity. If invalid diurnal data occurred whilst survey data was being acquired the affected section was re-flown.

The diurnal data was also checked to see that the change in diurnal readings during the course of the survey did not exceed the specified tolerances. When this occurred the affected survey lines were re-flown.

During the survey acquisition period the diurnal activity was found to be within survey parameters.

The field processed magnetic data was diurnally corrected during final data processing at the offices of GPX Surveys.

Gridding and Inspection

The magnetic data and field processed 30 channel EM data were gridded and displayed on screen. With the aid of sun-angles the gridded data was checked for inconsistencies and errors. Any inconsistencies were flagged and if necessary corrected.

5.4 DATA ARCHIVES

All raw and field processed aircraft data plus the raw diurnal base data were backed up onto an external hard drive at the end of each day's survey. The data is backed up on the servers at the offices of GPX Surveys.

6 FINAL PROCESSING

All final checks, verification and data processing were performed in the offices of GPX Surveys. The final processing of the data follows the same quality control checks that are made in the field however the final data has additional processes performed.

The following software was used for the final data processing:

- Geosoft
- EmaxAir
- ChrisDBF

6.1 FINAL EM DATA PROCESSING

Initial checks on the field data were performed as described in section 5.3.

The following processes were then performed on the data:

- The system response obtained from the high level flights was removed.
- The high level corrected data was run through EmaxAir to generate conductivity depth images (CDIs).
- The EmaxAir depth-slice data is interpolated using in-house software to generate the depth-slice grids.

Final plots of the EM profiles and CDIs were created in Geosoft .MAP format. The CDIs were masked to the first and last depth solution at each station.

6.2 FINAL MAGNETIC DATA PROCESSING

Initial checks on the field data were performed as described in section 5.3.

The following processes were then performed on the data:

- Single reading spikes were manually edited.
- Diurnal readings were removed.
- Data was IGRF corrected.

Diurnal Processing

The raw diurnal data was checked and corrected for spikes. Single reading spikes were manually edited and multiple erroneous readings flagged as invalid.

Diurnal Correction to the Magnetic Data

The synchronized digital diurnal data collected by the base station was first subtracted from the corresponding airborne magnetic readings and the mean diurnal value added back to the channel.

Mean diurnal value

North Pine Creek & Francis Creek:	47000 nT

IGRF Correction to the Magnetic Data

The diurnally corrected magnetic data has been corrected for the regional gradient by subtracting the calculated IGRF (2010 model) computed continuously over the whole area. The calculation of these corrections used the GPS flying height. The mean IGRF value was added back to the data.

Mean IGRF value

North Pine Creek:	46743 nT
Francis Creek:	46612 nT

Levelling

Parallax correction, heading correction have been applied to the data. Tie-line levelling has not been applied. Micro-levelling has not been applied to the line data and has been applied to the gridded data.

Gridding and Inspection

The magnetic data was gridded and grid image enhancements were computed and displayed on screen. These were also viewed with the aid of crossline sun angles and inspected for inconsistencies and errors and appropriate corrections were made if required.

6.3 DIGITAL ELEVATION MODEL

The laser altimeter data was verified as described in section 5.3. After verification the laser height was subtracted from the GPS height to give the elevation of the terrain above the WGS84 spheroid. The DEM data was then adjusted to the Australian Height Datum.

Levelling

Parallax correction and micro-levelling has been applied to the gridded data.

Gridding and Inspection

The DEM data was gridded and grid image enhancements were computed and displayed on screen. These were also viewed with the aid of crossline sun angles and inspected for inconsistencies and errors and appropriate corrections were made if required.

DISCLAIMER

Every effort has been made to make this model a useful general reference. No guarantee can be made that this model is a true representation of height above sea level as it can contain laser altimeter responses from buildings, trees and scrub. Users of the product should be aware of the topographic limitations mapped herewithin. Do not use this DTM for navigation purposes.

7 FINAL GRIDS AND DATA PRODUCTS

Products Delivered on DVD

The following products were delivered. Comprehensive information about the DVD content is in Appendix B.

Final levelled and corrected point located data for North Pine Creek and Francis Creek surveys:

Transient Electromagnetic Data

- Line Number
- Easting
- Northing
- Seconds past midnight
- GPS Altitude
- Laser ground clearance
- Digital Terrain Model
- Current
- Corrected 30 Channel Electromagnetic data

Conductivity Solution Data

- Line
- Easting
- Northing
- Distance
- GPS Altitude
- Laser
- DEM
- Depth Array
- Conductivity Array
- Time Window Array
- Relative Level Array

Depth-slice Solution Data

- Line
- Easting
- Northing
- Distance along line
- Relative level to Spheroid
- Conductivity as specified depths
    - Standard depths 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180

Magnetic Data

- Line
- Easting
- Northing
- Seconds past Midnight

- GPS altitude
- Laser
- Raw Magnetics
- Diurnal
- Diurnally corrected Magnetics
- IGRF
- Final levelled Magnetics

Gridded Data *(ERMapper format)*

- 30 corrected channel data grids
- Depth slice grids at selected depths
    - Standard depths 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180
- Total Magnetic Intensity
- Magnetic RTP
- Magnetic 1st Vertical derivative
- Digital Terrain

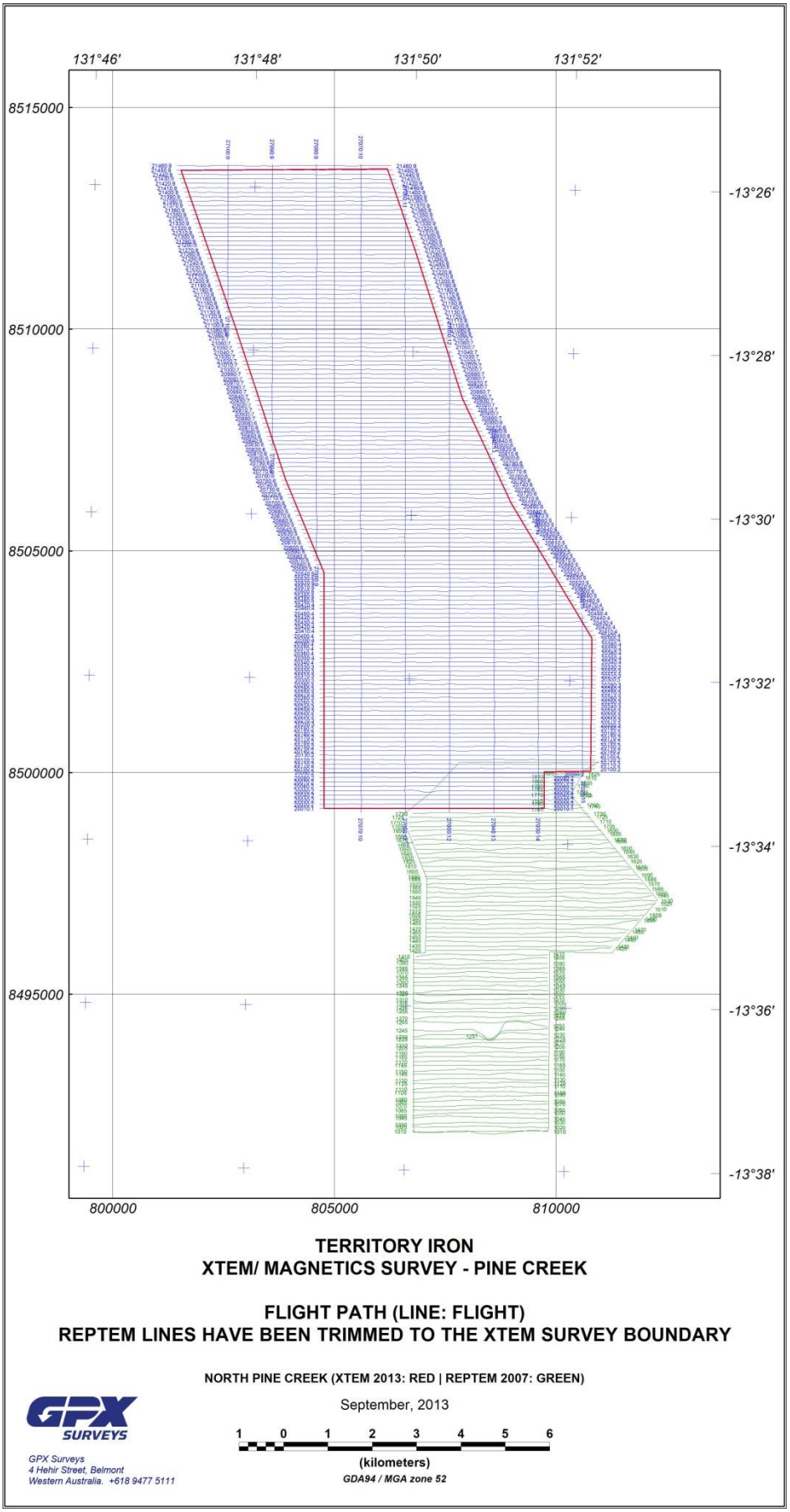
Imaged Data from Grids*(Geotiff format)*

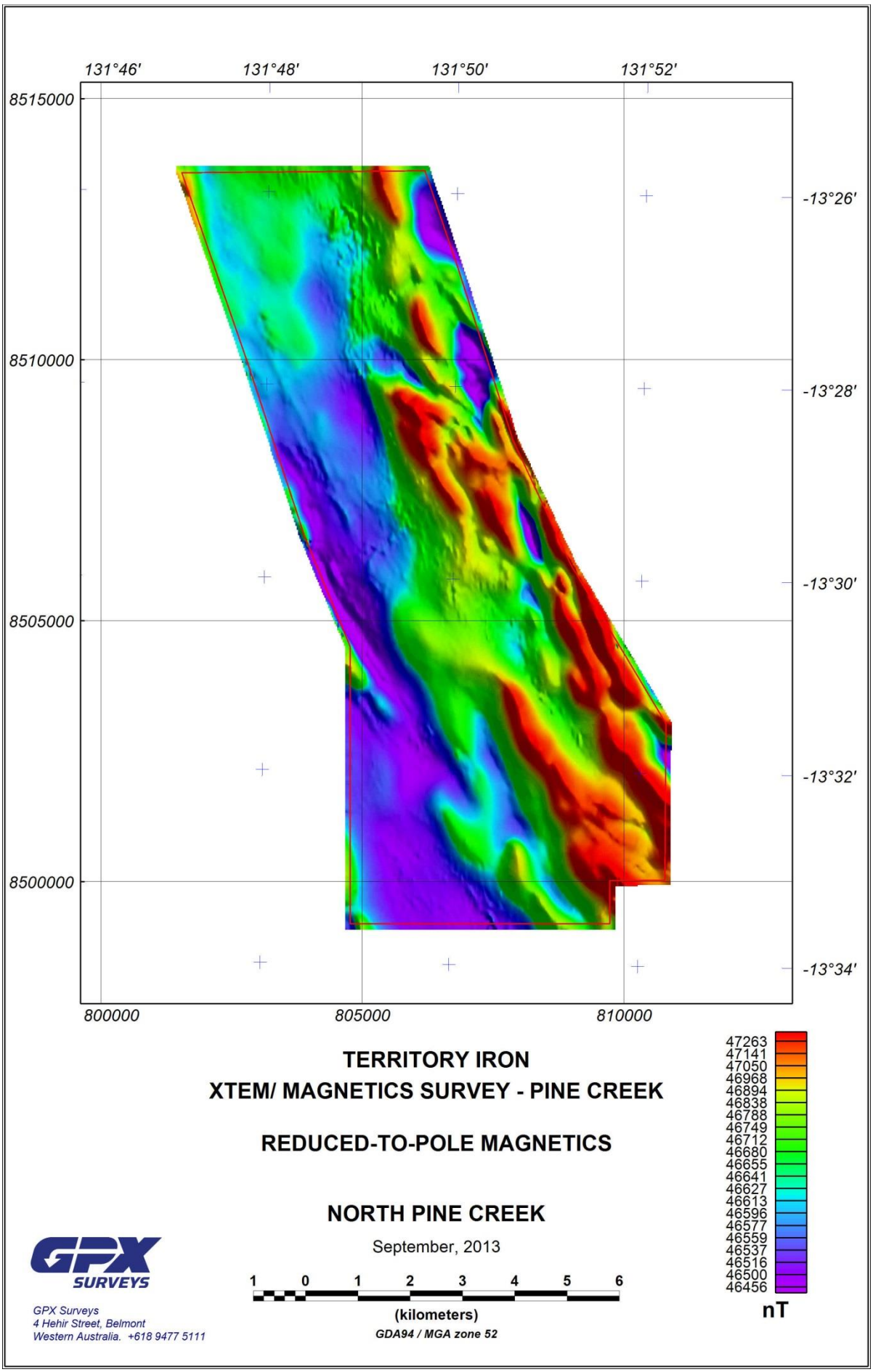
- 30 corrected channel data images
- Depth slice at selected depths
    - Standard depths 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180
- Total Magnetic Intensity
- Magnetic RTP
- Magnetic 1st Vertical derivative
- Digital Terrain

CDI sections *(Geosoft map and PNG formats)*

Cross section CDI solutions for each line, including EM profiles and CDI solutions grid

8 MAPS – NORTH PINE CREEK SURVEY

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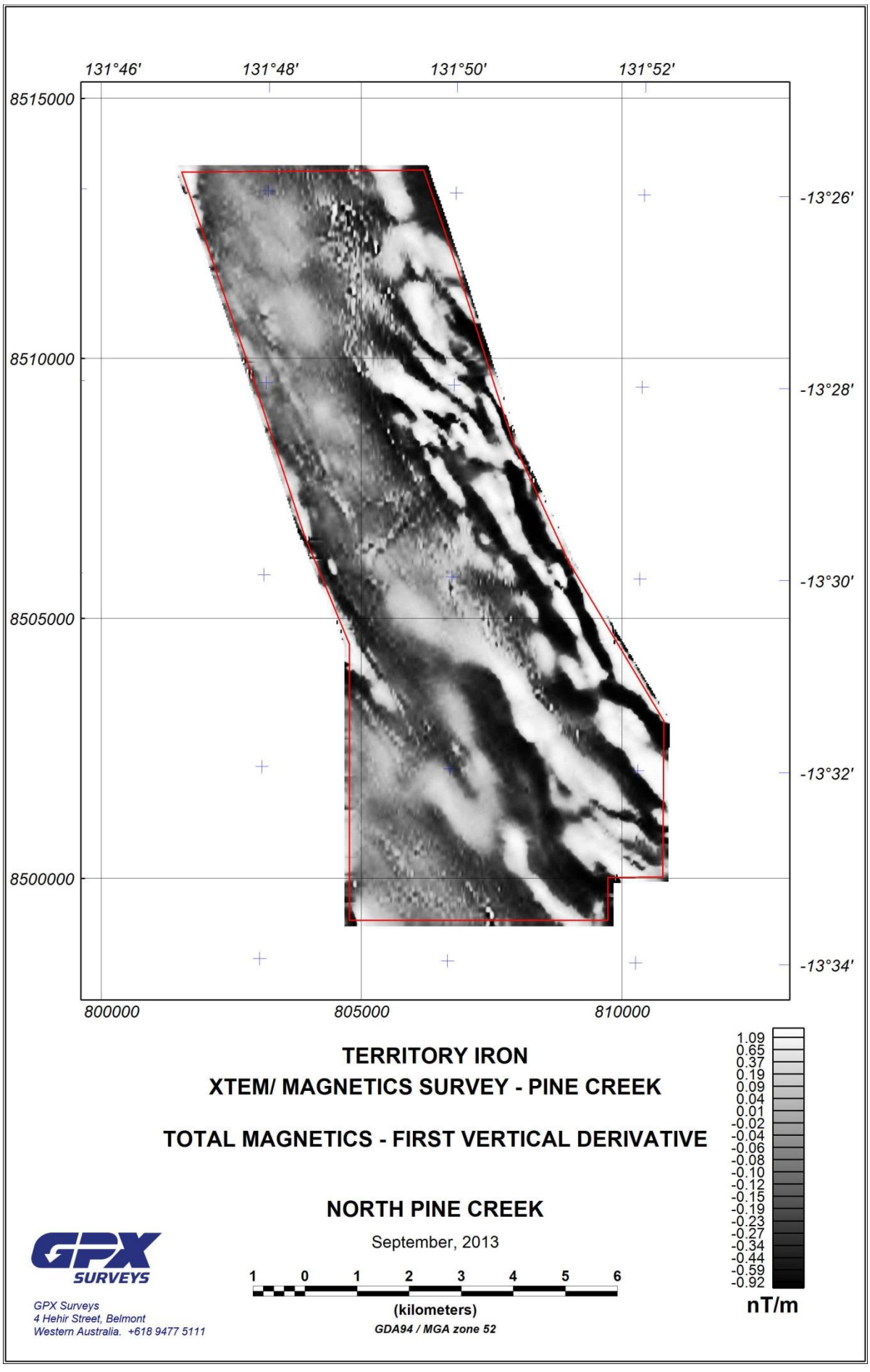
131°48'
131°50'
131°52'
8515000
8510000
8505000
8500000
-13°26'
-13°28'
-13°30'
-13°32'
-13°34'
800000
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
REDUCED-TO-POLE MAGNETICS
NORTH PINE CREEK
September, 2013
47263
47141
47050
46968
46894
46838
46788
46749
46712
46680
46655
46641
46627
46613
46596
46577
46559
46537
46516
46500
46456
nT
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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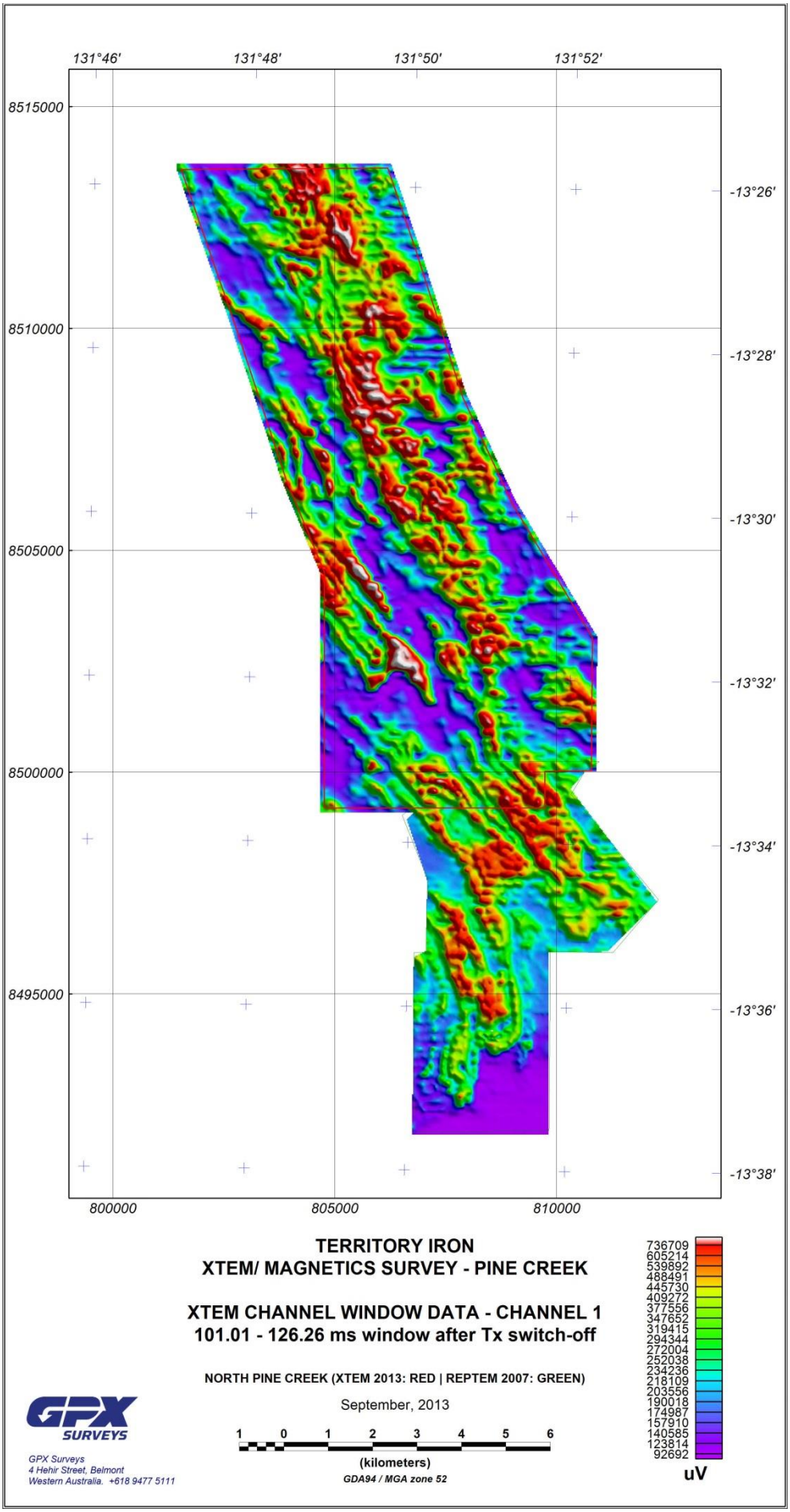
131°48'
131°50'
131°52'
8515000
8510000
8505000
8500000
-13°26'
-13°28'
-13°30'
-13°32'
-13°34'
800000
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
TOTAL MAGNETICS - FIRST VERTICAL DERIVATIVE
NORTH PINE CREEK
September, 2013
1.09
0.65
0.37
0.19
0.09
0.04
0.01
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.15
-0.19
-0.23
-0.27
-0.34
-0.44
-0.59
-0.92
nT/m
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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-13°30'
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-13°34'
-13°36'
-13°38'
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805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 1
101.01 - 126.26 ms window after Tx switch-off
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
736709
605214
539892
488491
445730
409272
377556
347652
319415
294344
272004
252038
234236
218109
203556
190018
174987
157910
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92692
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GPX SURVEYS
GPX Surveys
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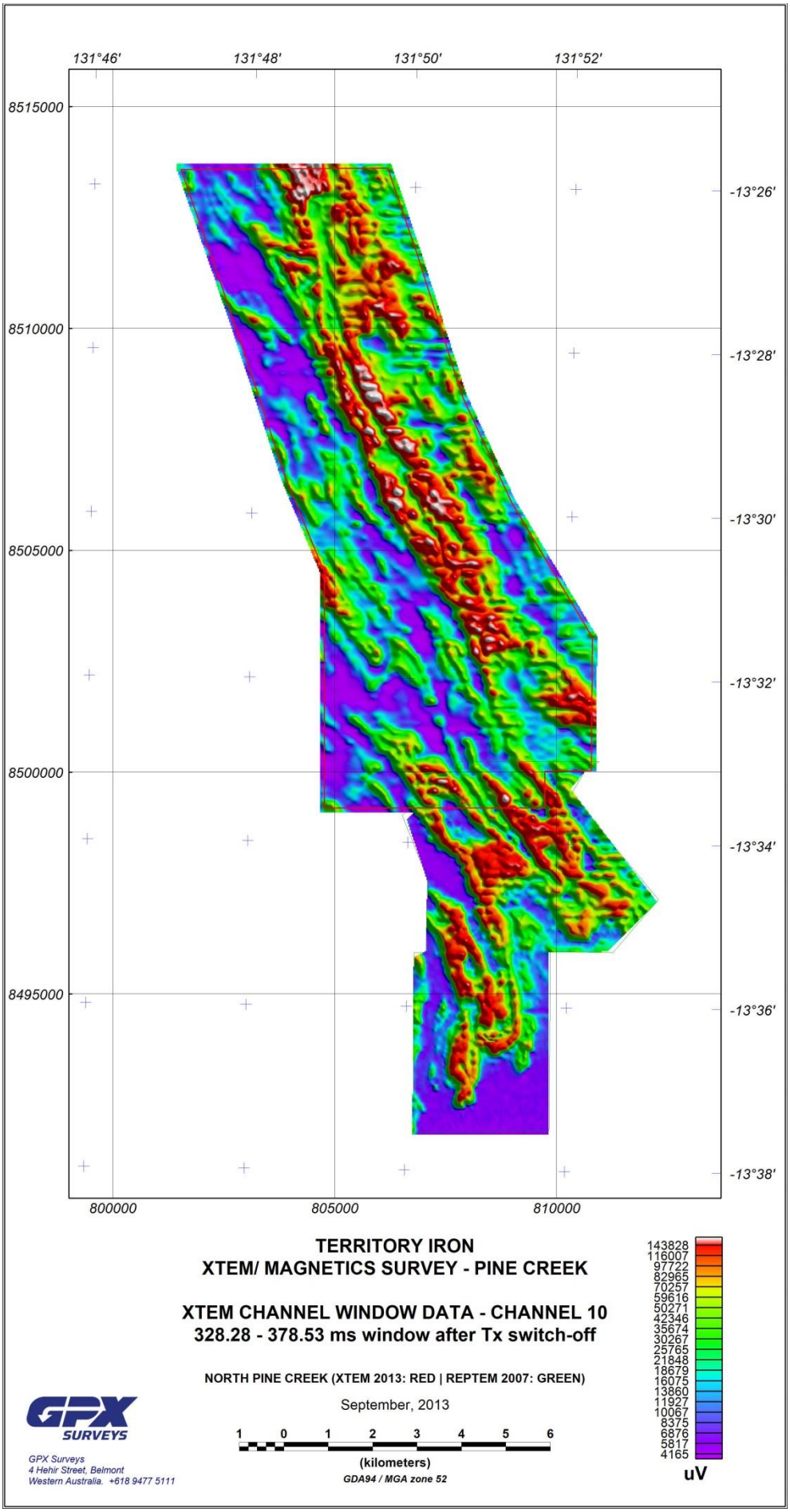
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805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 10
328.28 - 378.53 ms window after Tx switch-off
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
143828
116007
97722
82965
70257
59616
50271
42346
35674
30267
25765
21848
18679
16075
13860
11927
10067
8375
6876
5817
4165
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GPX SURVEYS
GPX Surveys
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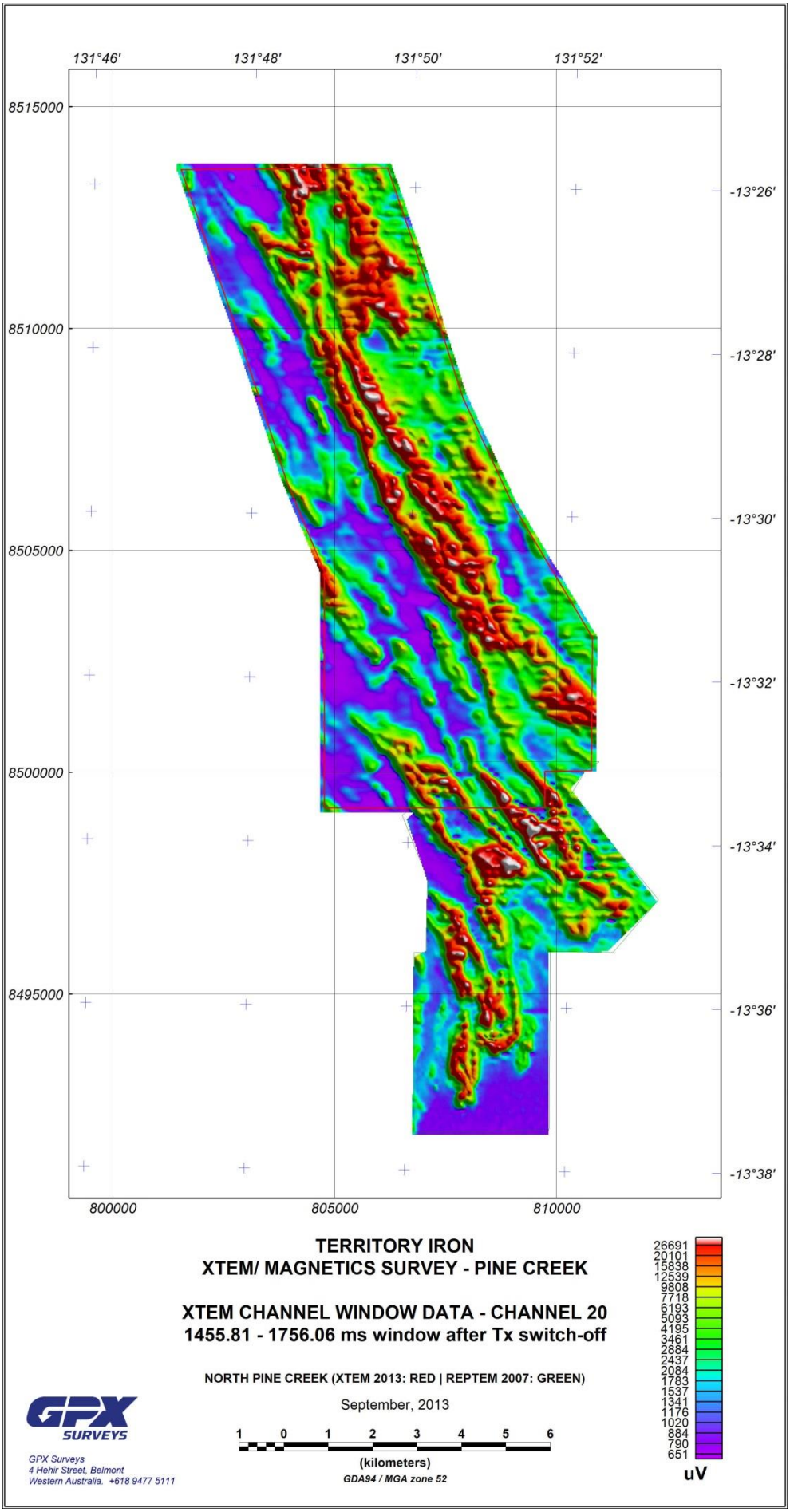
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TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 20
1455.81 - 1756.06 ms window after Tx switch-off
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
26691
20101
15838
12539
9908
7718
6193
5093
4195
3461
2884
2437
2084
1783
1537
1341
1176
1020
884
790
651
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GPX SURVEYS
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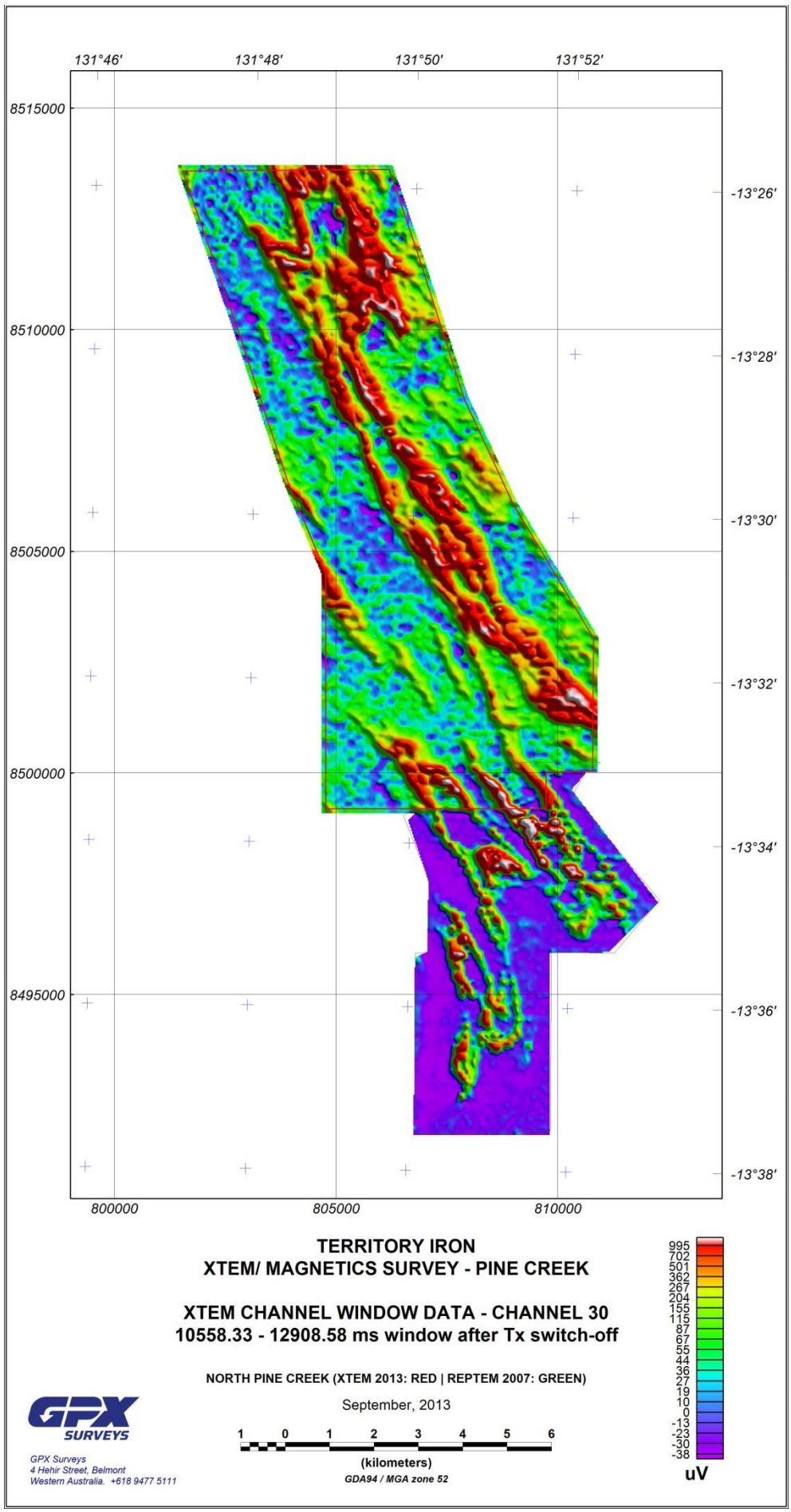
Western Australia. +618 9477 5111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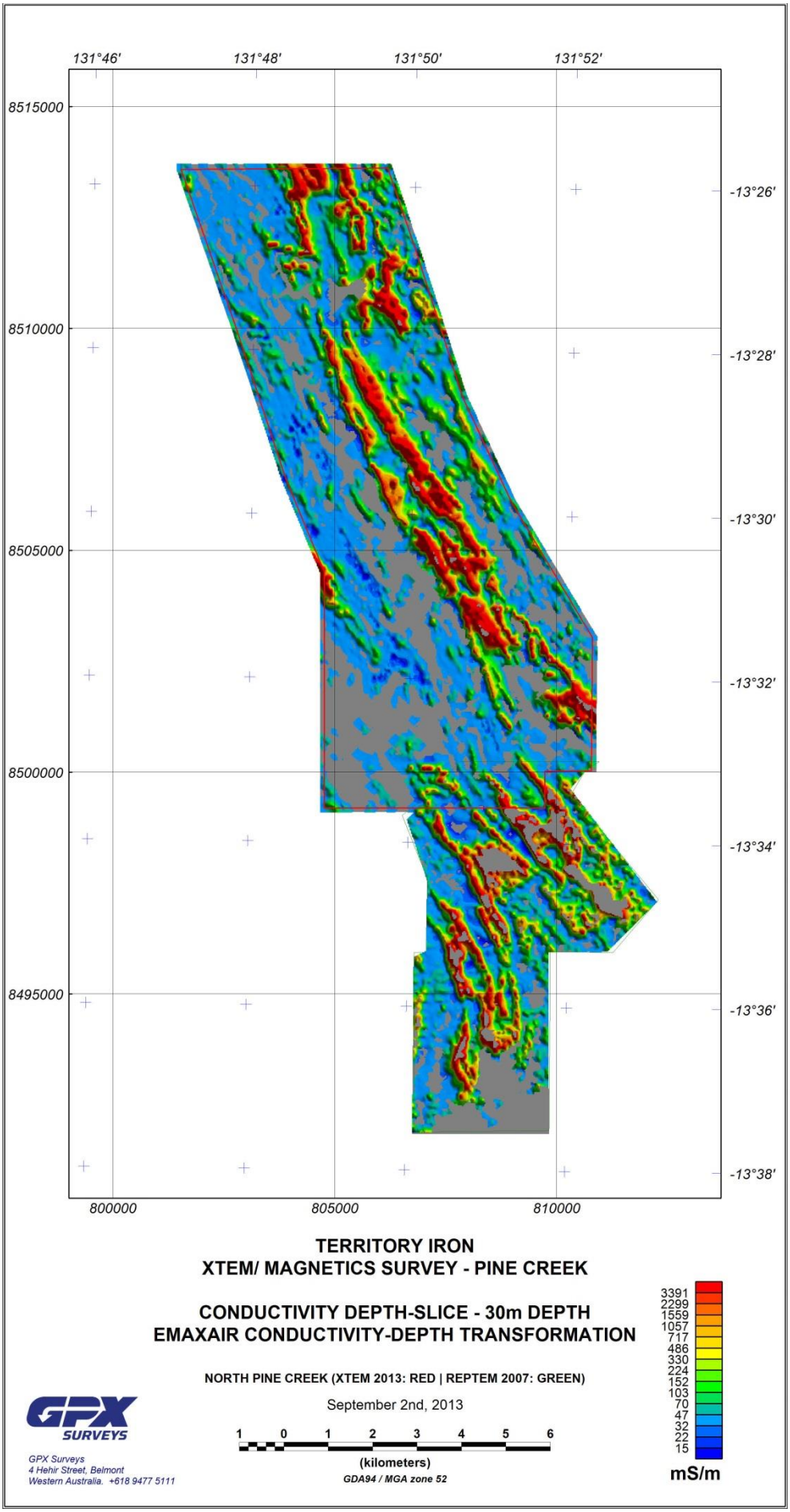
-13°38'
800000
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 30
10558.33 - 12908.58 ms window after Tx switch-off
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
995
702
501
362
267
204
155
115
87
67
55
44
36
27
19
10
0
-13
-23
-30
-38
uV
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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-13°38'
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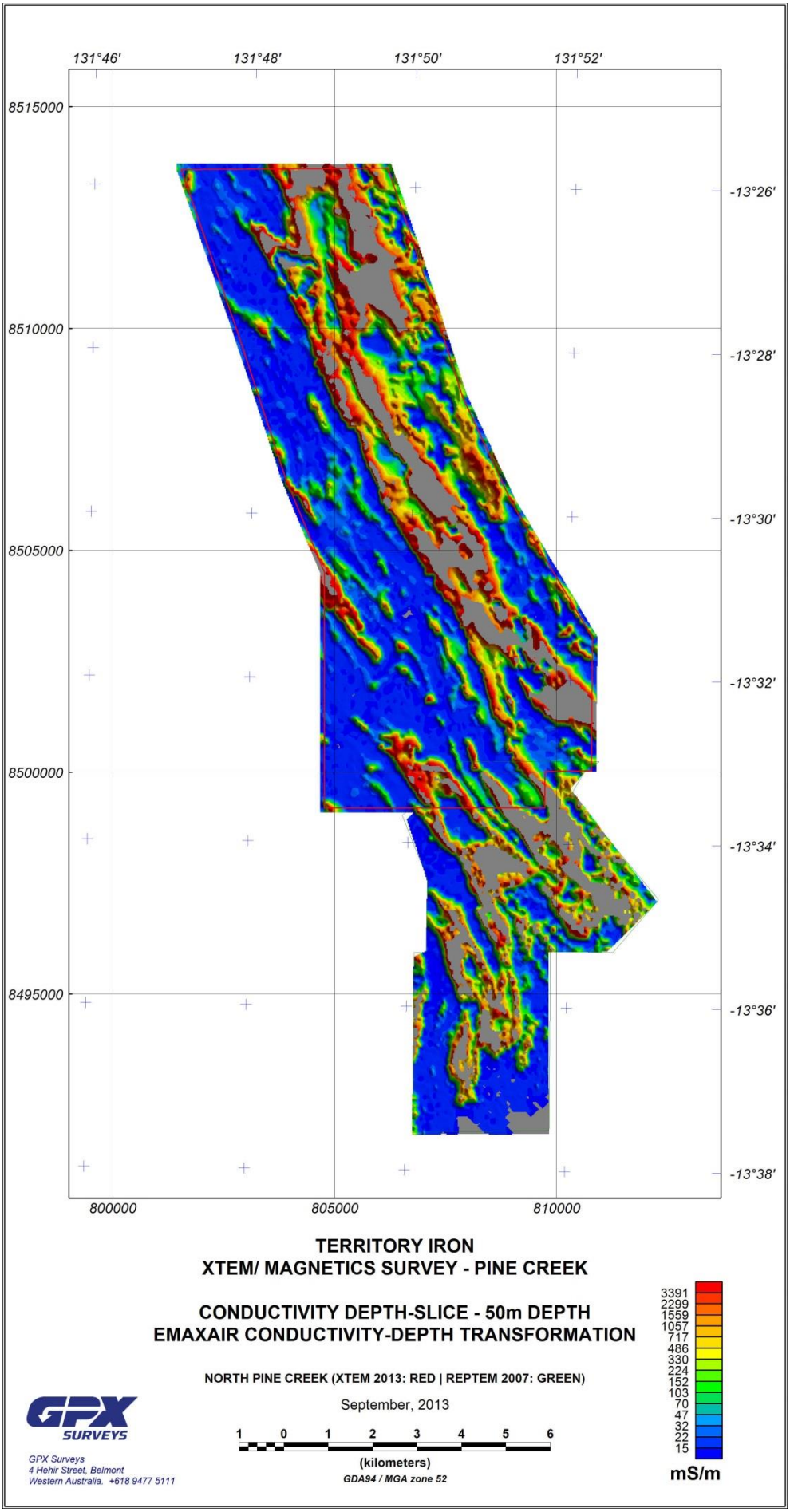
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 30m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September 2nd, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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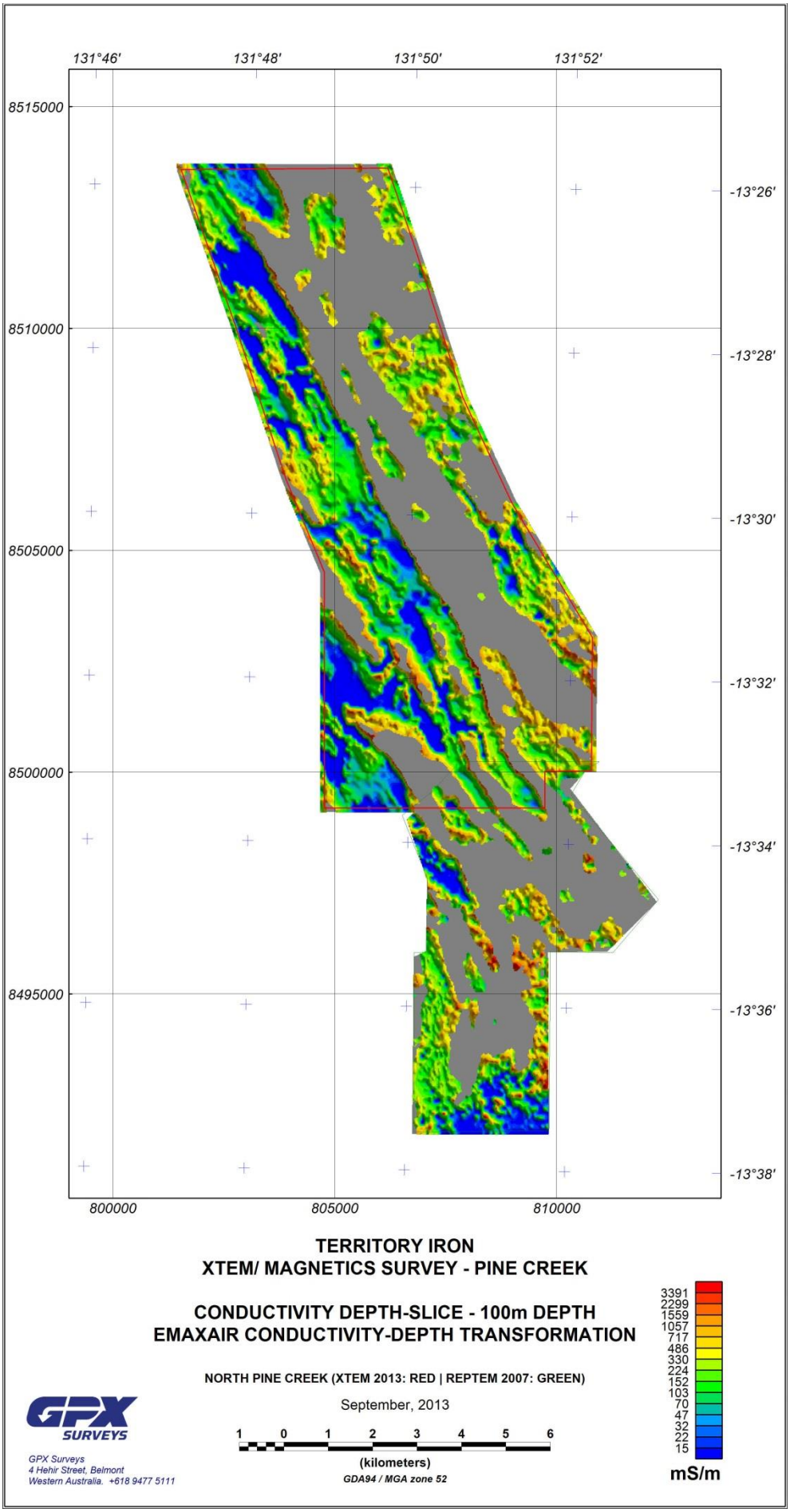
-13°30'
-13°32'
-13°34'
-13°36'
-13°38'
800000
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 50m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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-13°34'
-13°36'
-13°38'
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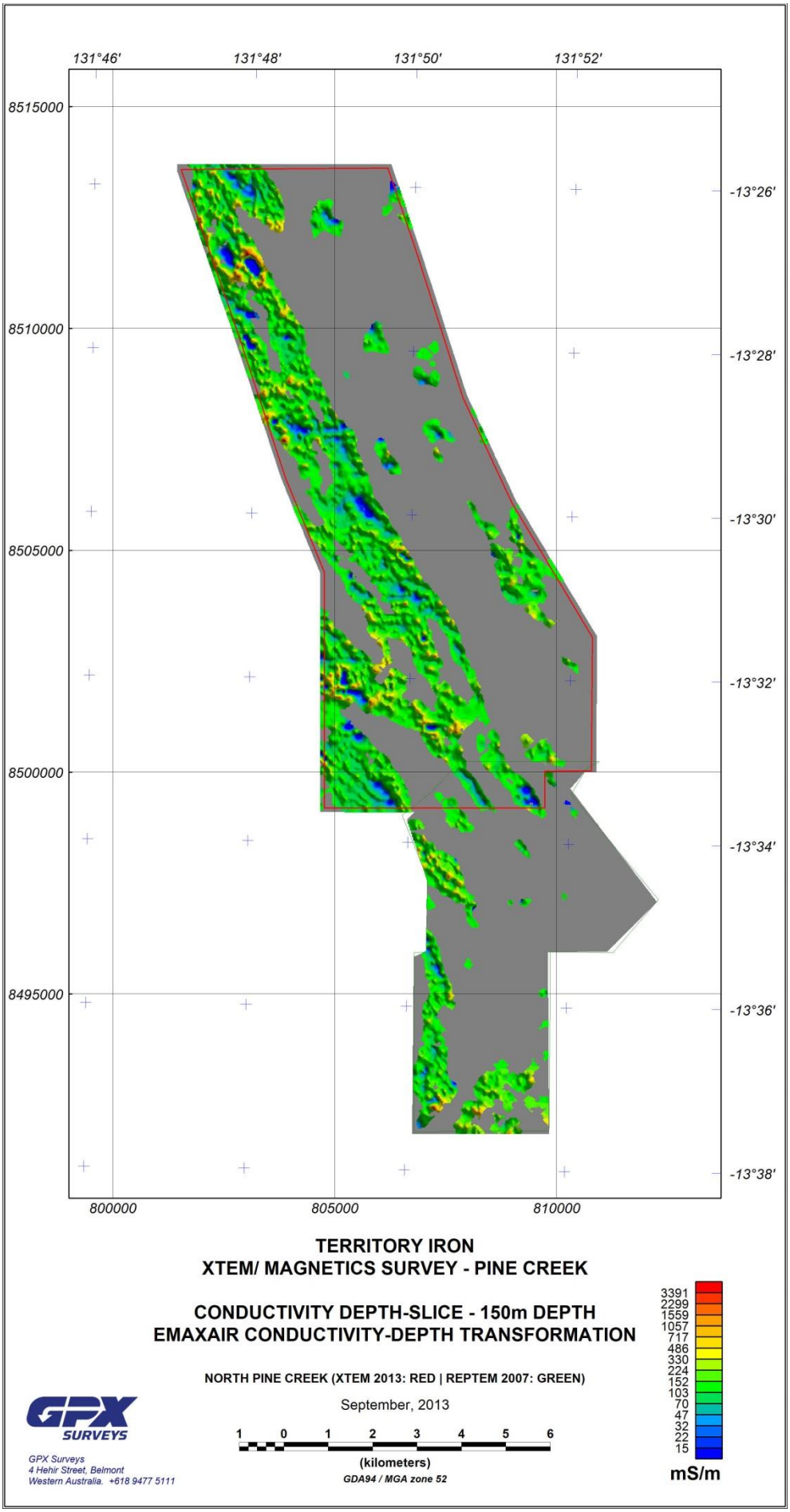
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 100m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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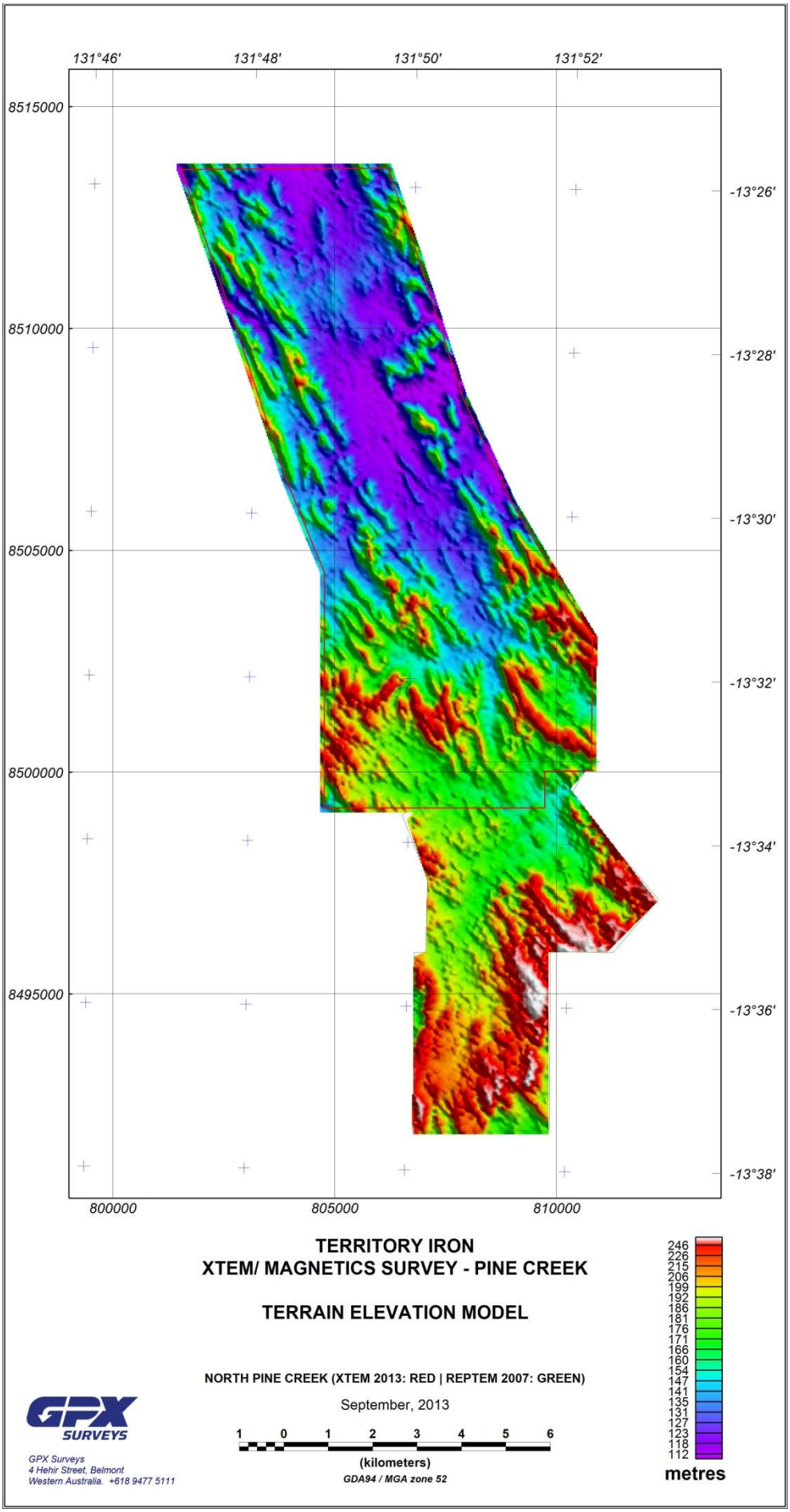
-13°30'
-13°32'
-13°34'
-13°36'
-13°38'
800000
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 150m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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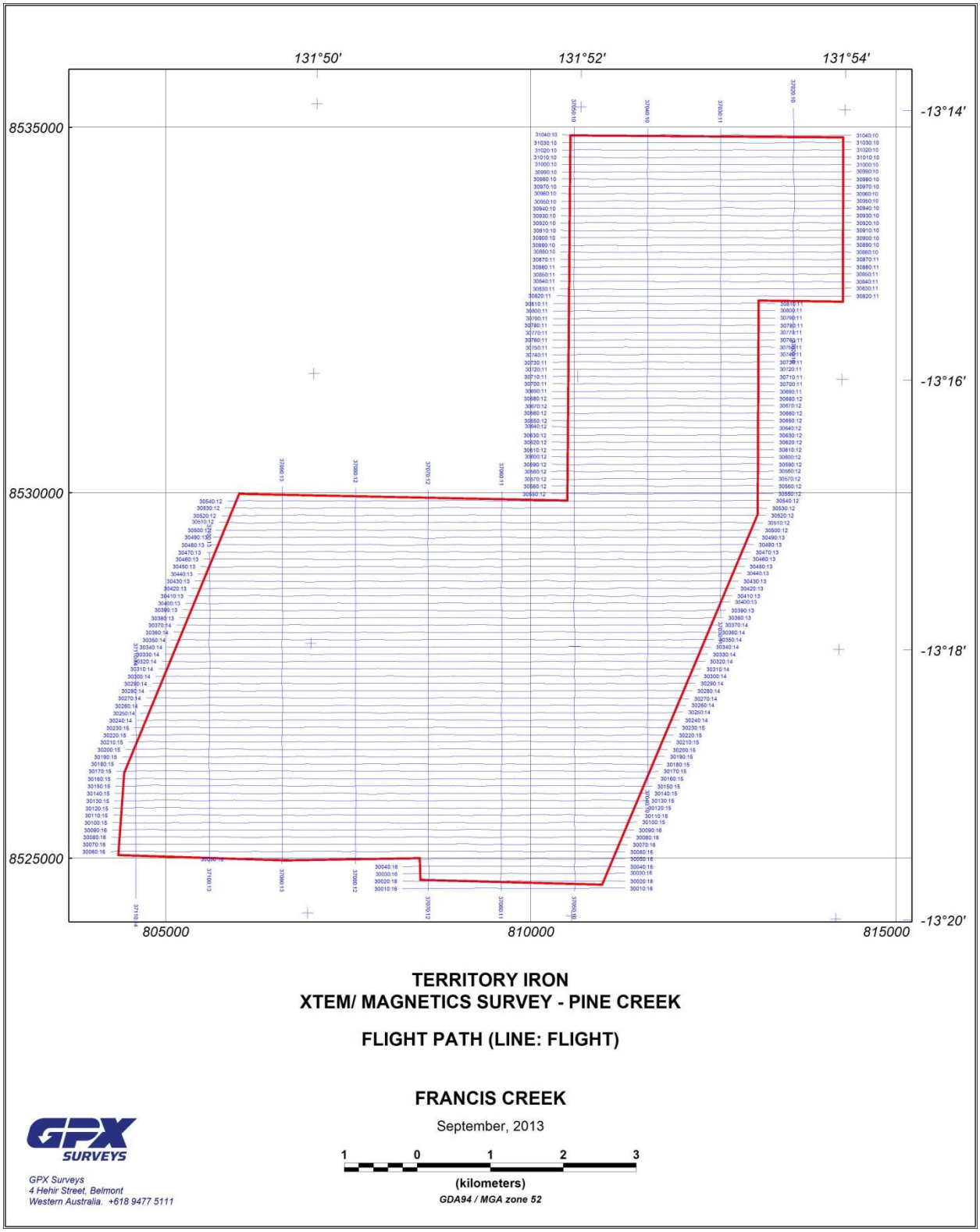
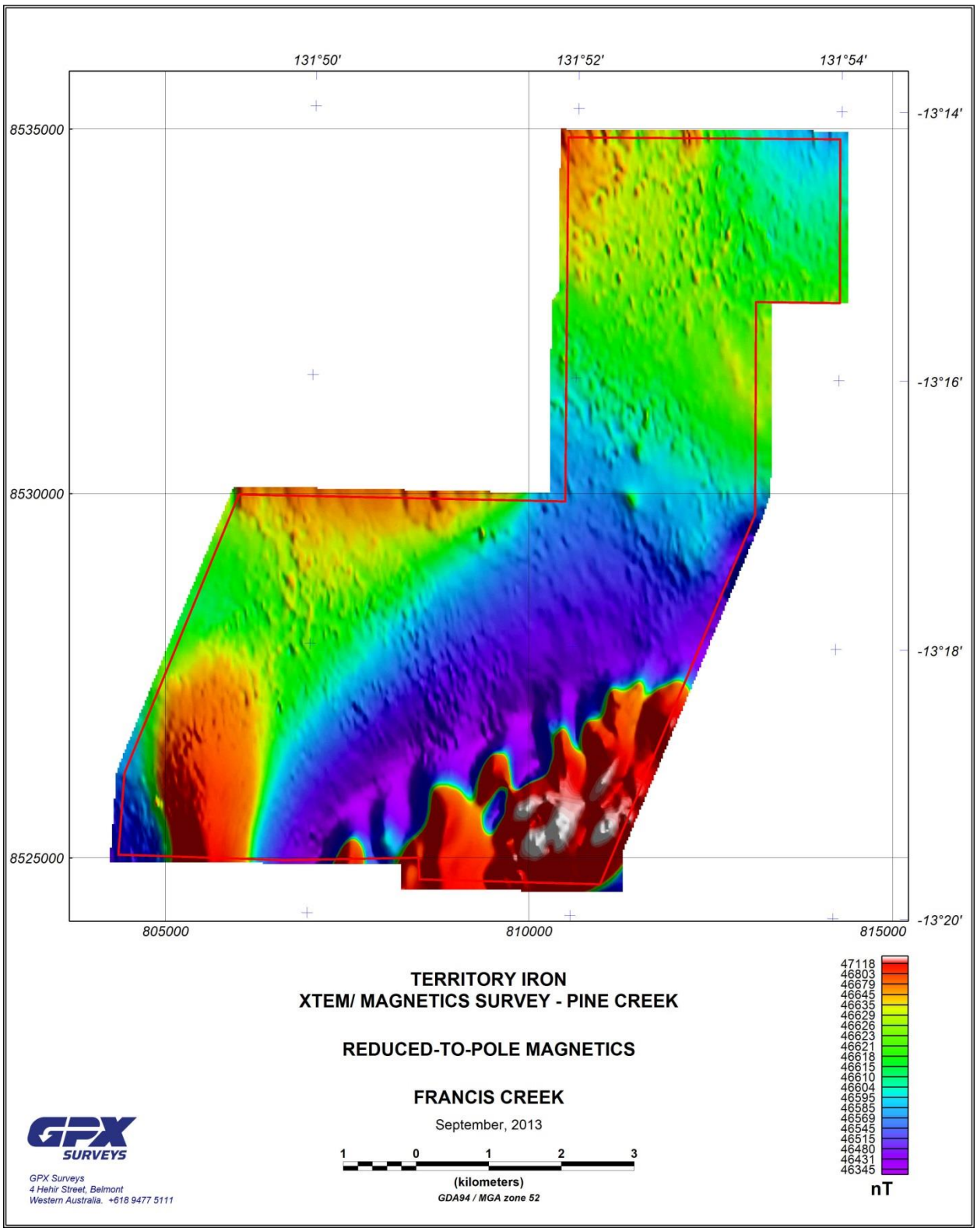
-13°28'
-13°30'
-13°32'
-13°34'
-13°36'
-13°38'
800000
805000
810000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
TERRAIN ELEVATION MODEL
NORTH PINE CREEK (XTEM 2013: RED | REPTEM 2007: GREEN)
September, 2013
1 0 1 2 3 4 5 6
(kilometers)
GDA94 / MGA zone 52
246
226
215
206
199
192
186
181
176
171
166
160
154
147
141
135
131
127
123
118
112
metres
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111

9 MAPS – FRANCIS CREEK SURVEY

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-13°16'
-13°18'
-13°20'
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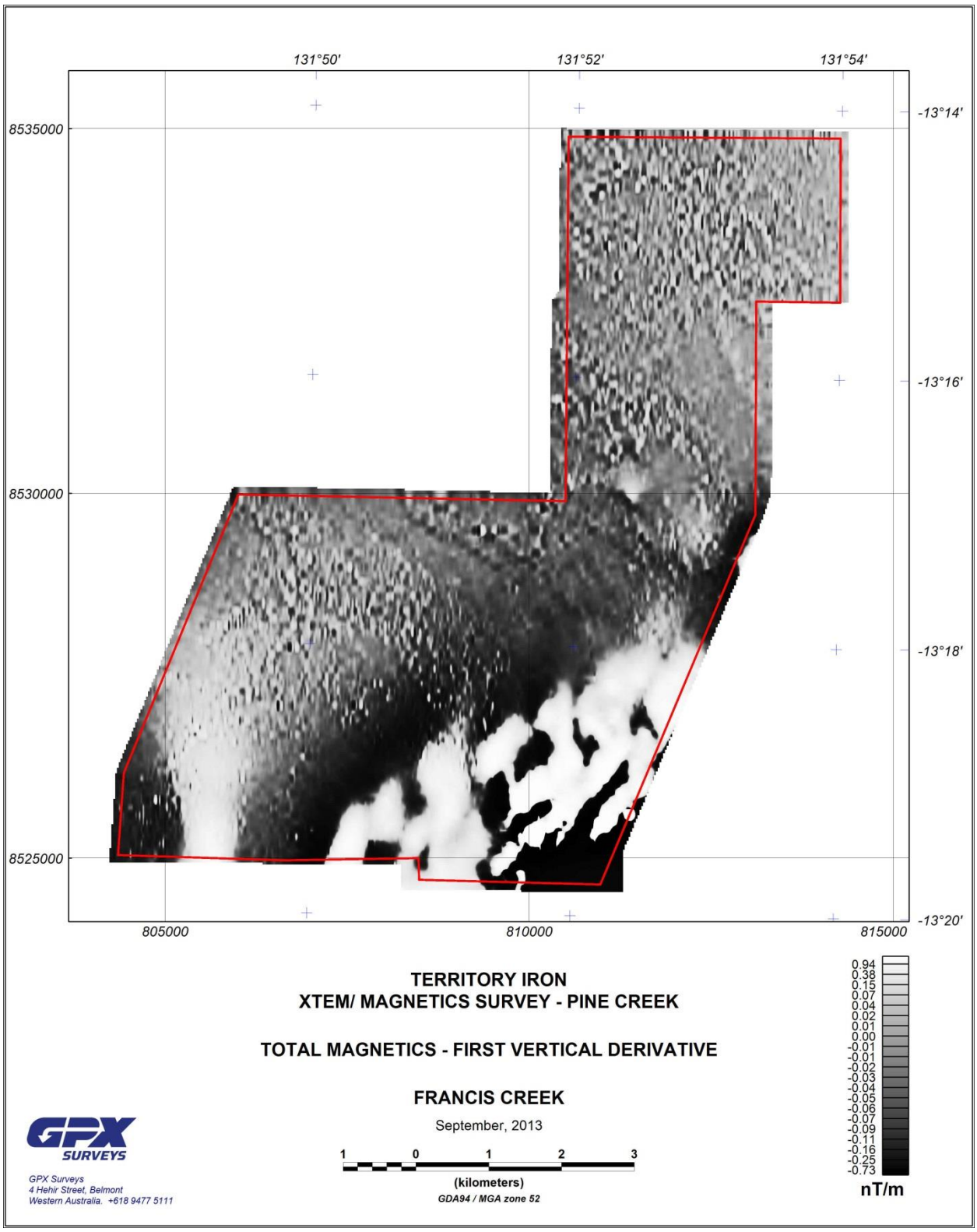
8530000
8525000
805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
REDUCED-TO-POLE MAGNETICS
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
47118
46803
46679
46645
46635
46629
46626
46623
46621
46618
46615
46610
46604
46595
46585
46569
46545
46515
46480
46431
46345
nT
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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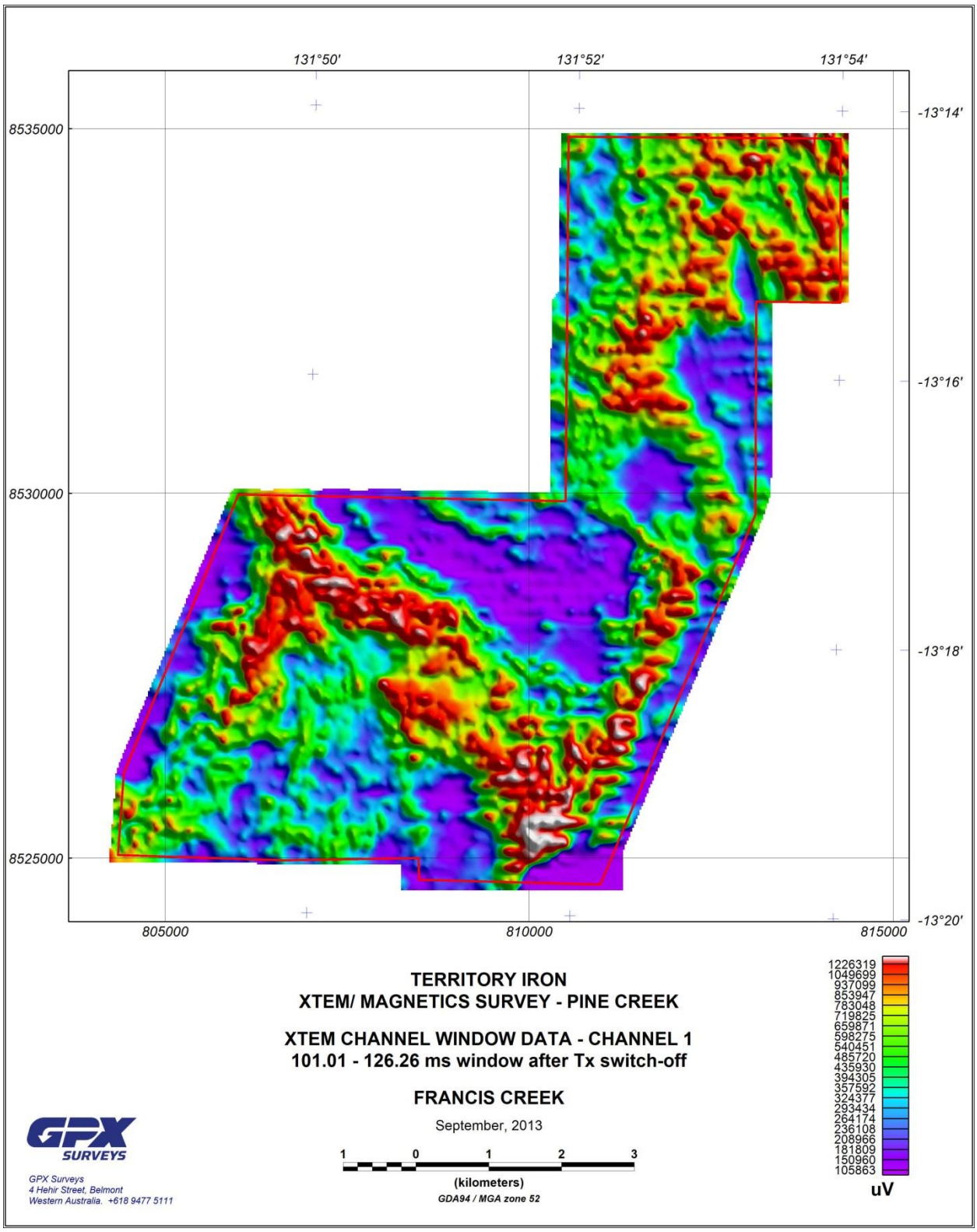
-13°16'
-13°18'
-13°20'
8535000
8530000
8525000
805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
TOTAL MAGNETICS - FIRST VERTICAL DERIVATIVE
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
0.94
0.38
0.15
0.07
0.04
0.02
0.01
0.00
-0.01
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.09
-0.11
-0.16
-0.25
-0.73
nT/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 1
101.01 - 126.26 ms window after Tx switch-off
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
1226319
1049699
937099
853947
783048
719825
659871
598275
540451
485720
435930
394305
357592
324377
293434
264174
236108
208966
181809
150960
105863
uV
GPX SURVEYS
GPX Surveys
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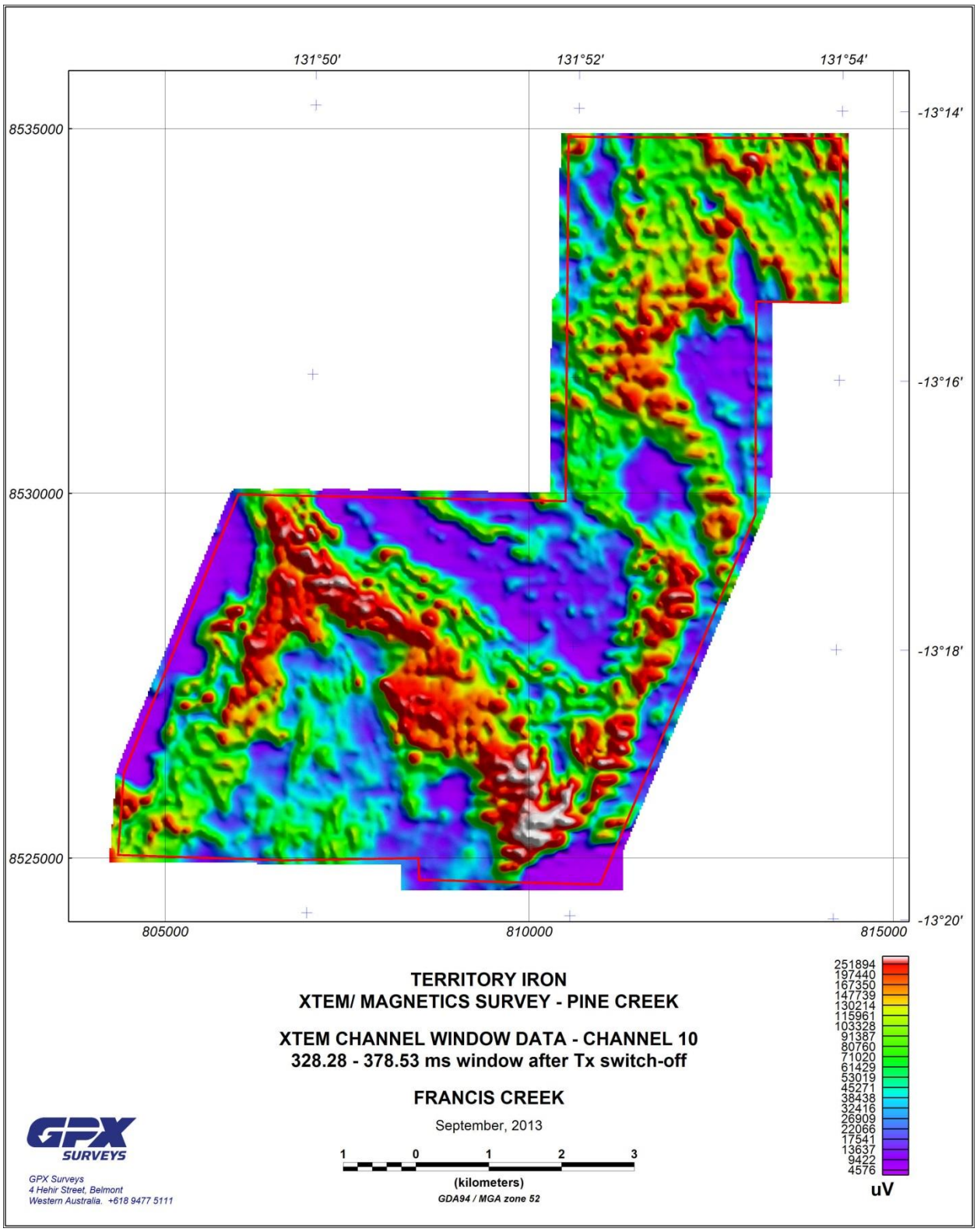
Western Australia. +618 9477 5111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805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 10
328.28 - 378.53 ms window after Tx switch-off
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
251894
197440
167350
147739
130214
115961
103328
91387
80760
71020
61429
53019
45271
38438
32416
26909
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17541
13637
9422
4576
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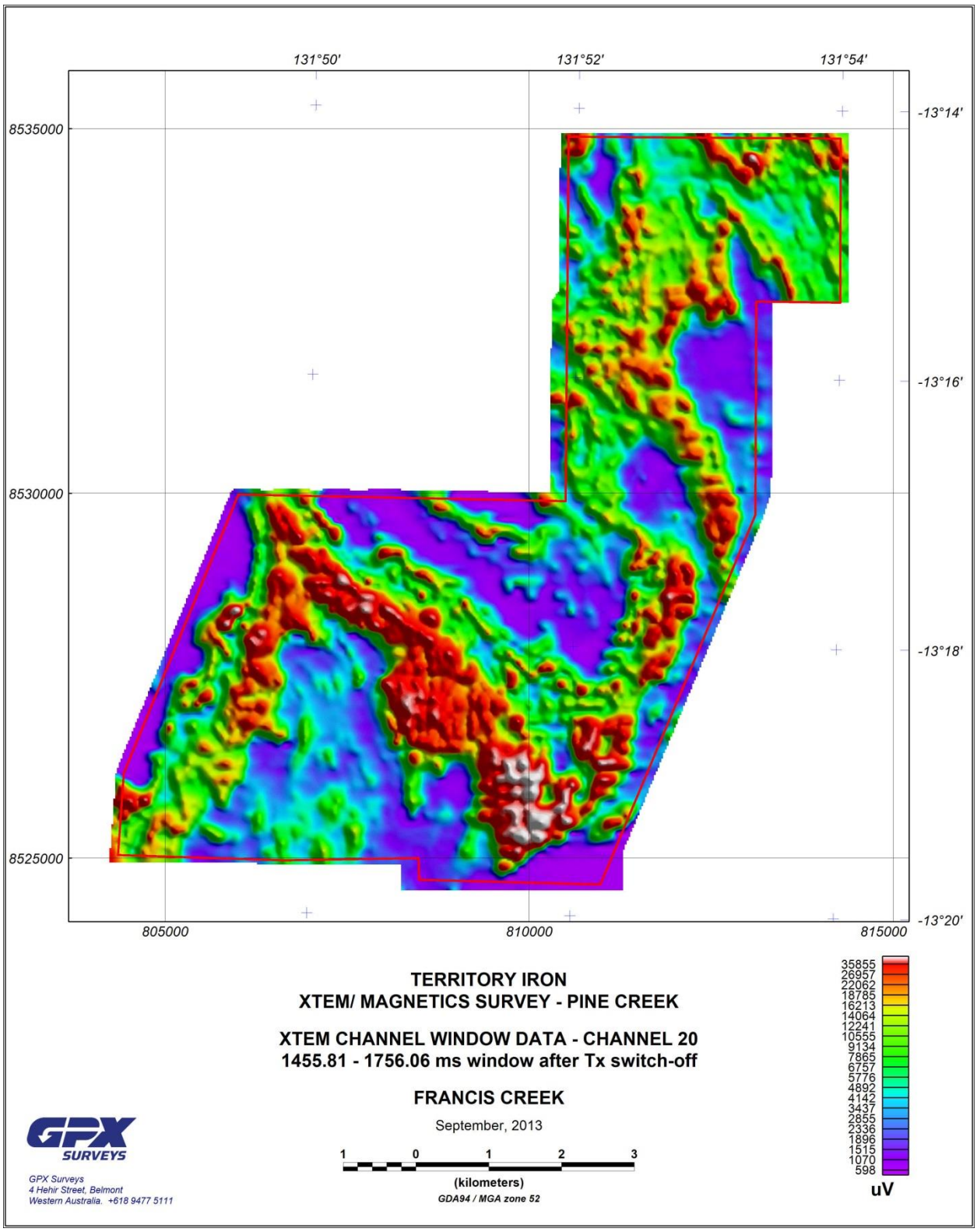
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 20
1455.81 - 1756.06 ms window after Tx switch-off
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
35855
26957
22062
18785
16213
14064
12241
10555
9134
7865
6757
5776
4892
4142
3437
2855
2336
1896
1515
1070
598
uV
GPX SURVEYS
GPX Surveys
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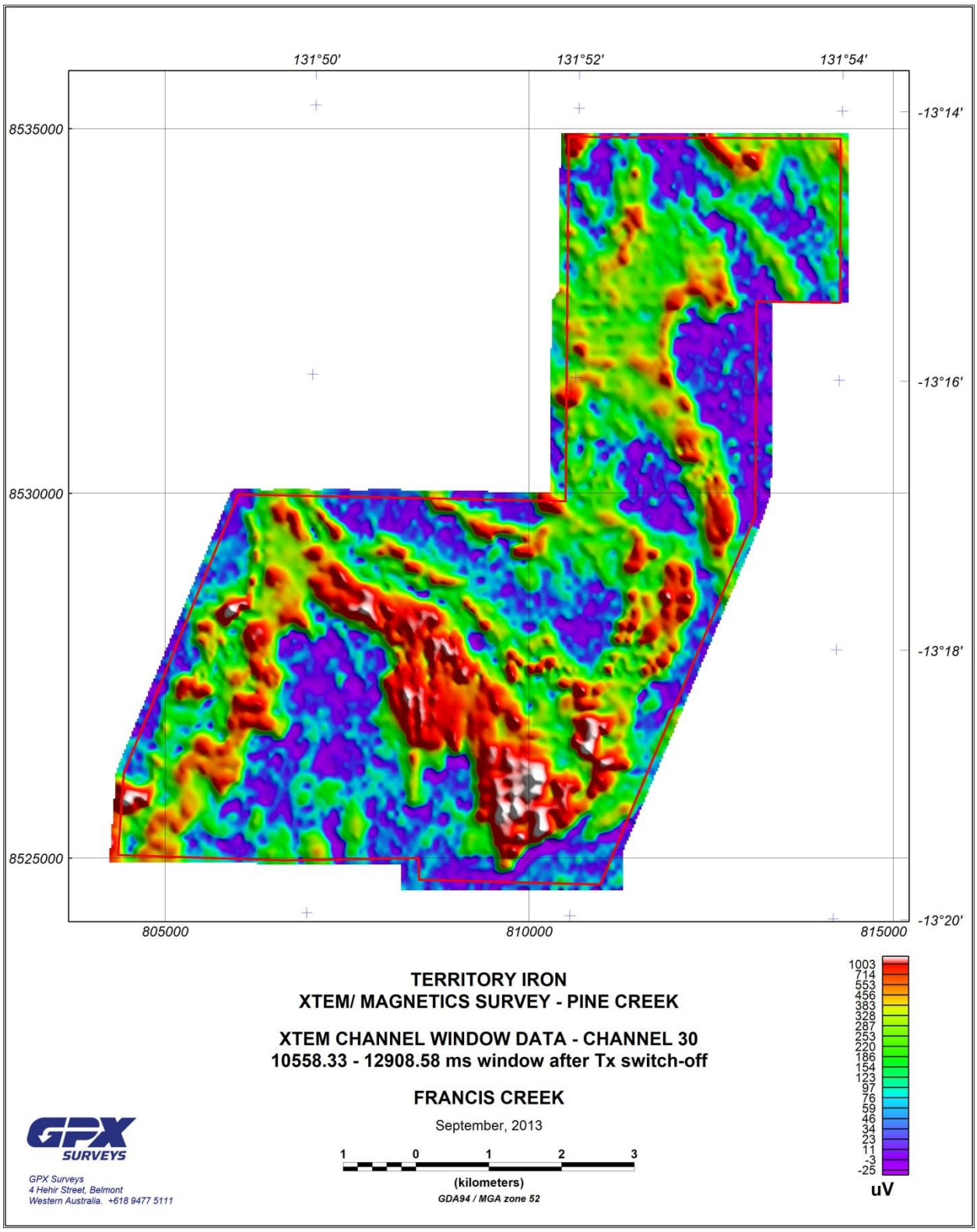
Western Australia. +618 9477 5111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810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
XTEM CHANNEL WINDOW DATA - CHANNEL 30
10558.33 - 12908.58 ms window after Tx switch-off
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
1003
714
553
456
383
328
287
253
220
186
154
123
97
76
59
46
34
23
11
-3
-25
uV
GPX SURVEYS
GPX Surveys
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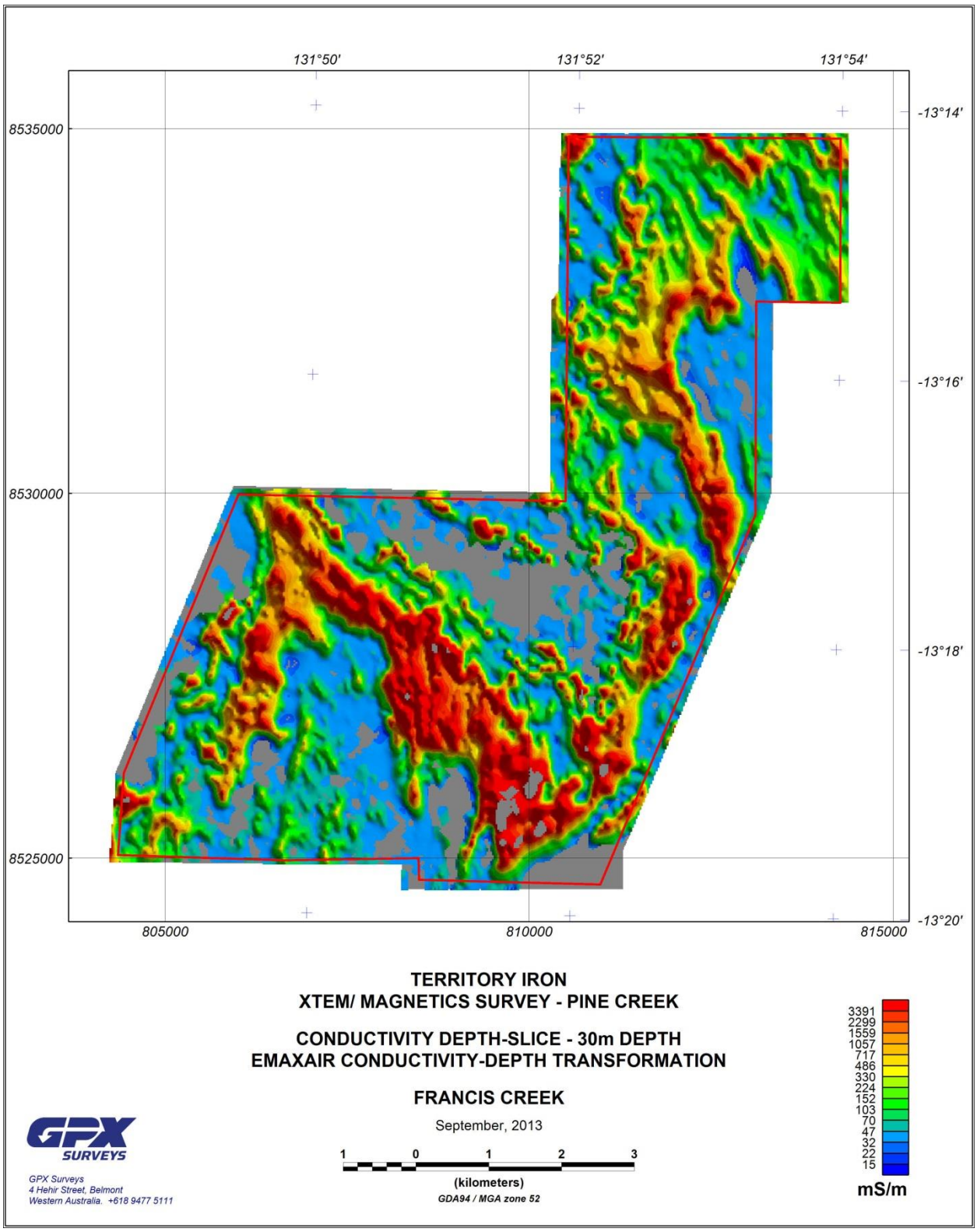
Western Australia. +618 9477 5111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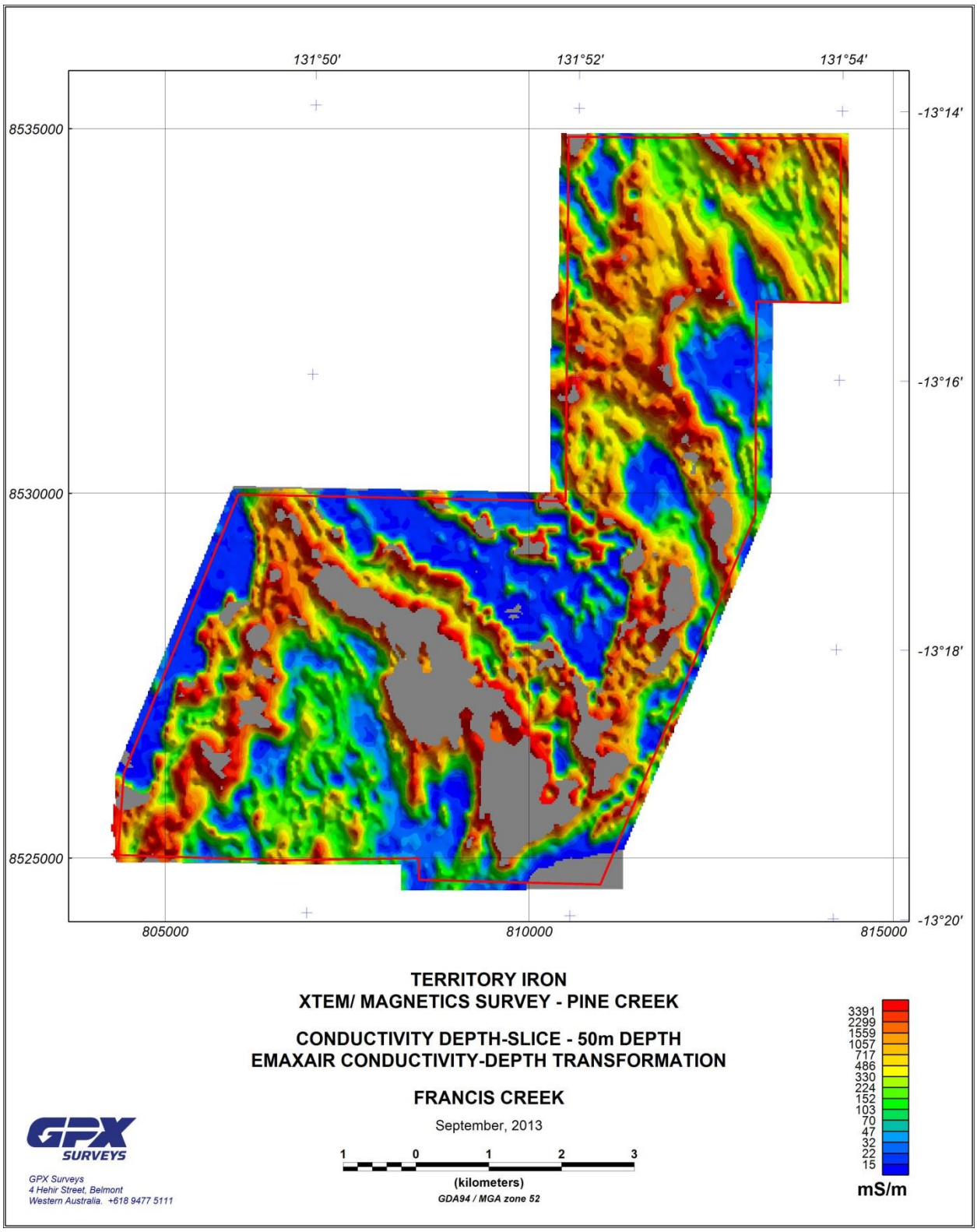
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 30m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 50m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
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32
22
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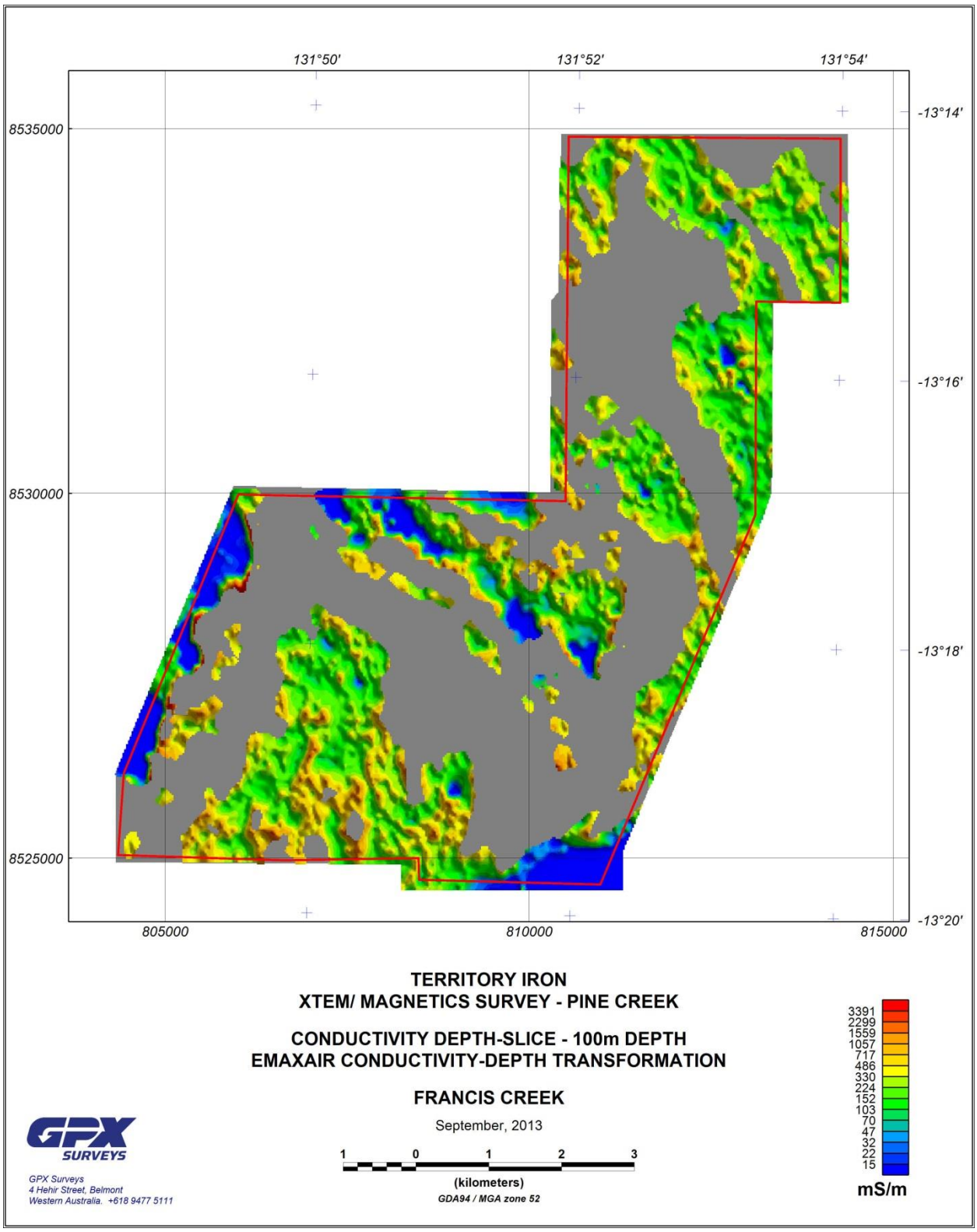
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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-13°14'
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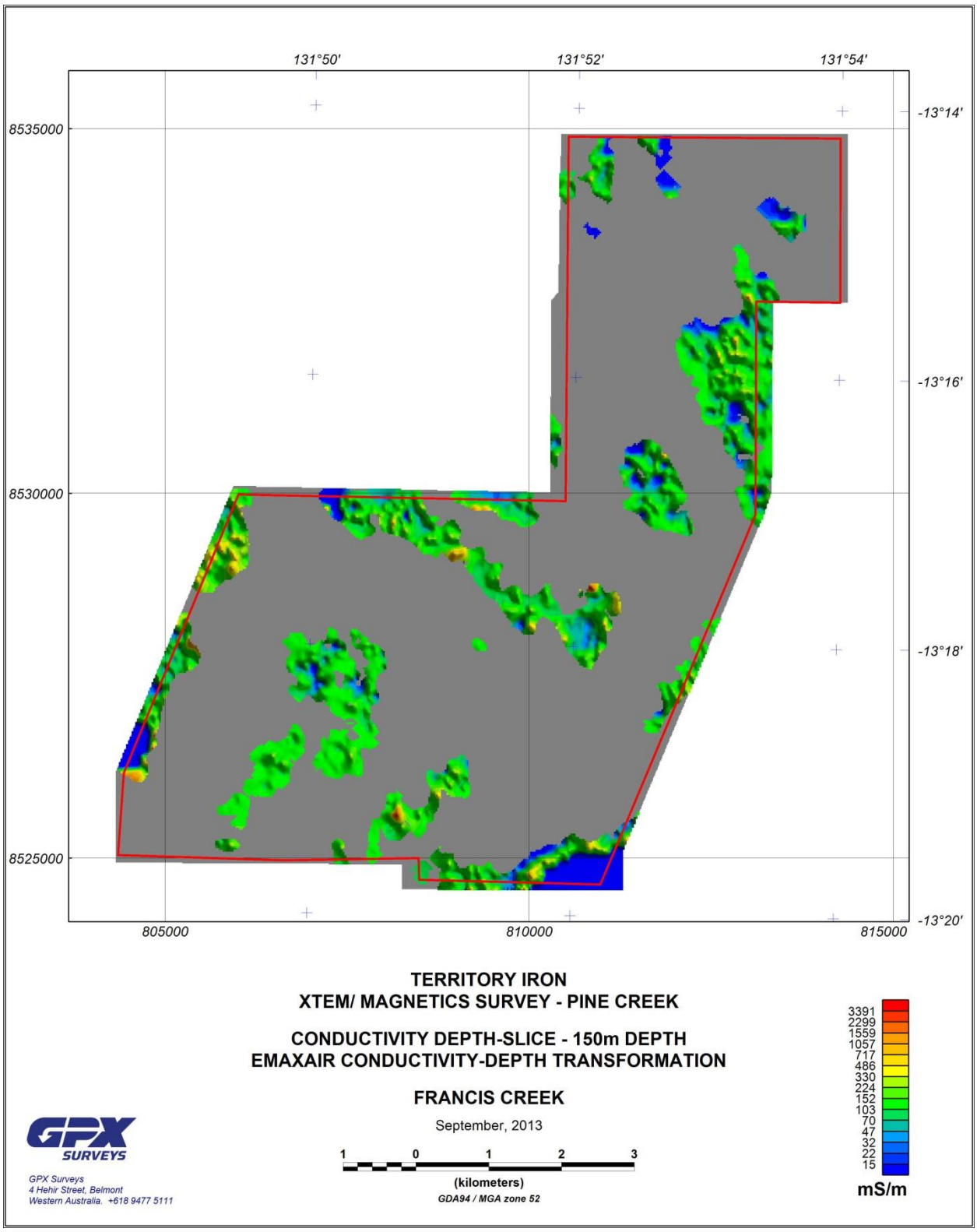
8525000
805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 100m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111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131°54'
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-13°18'
-13°20'
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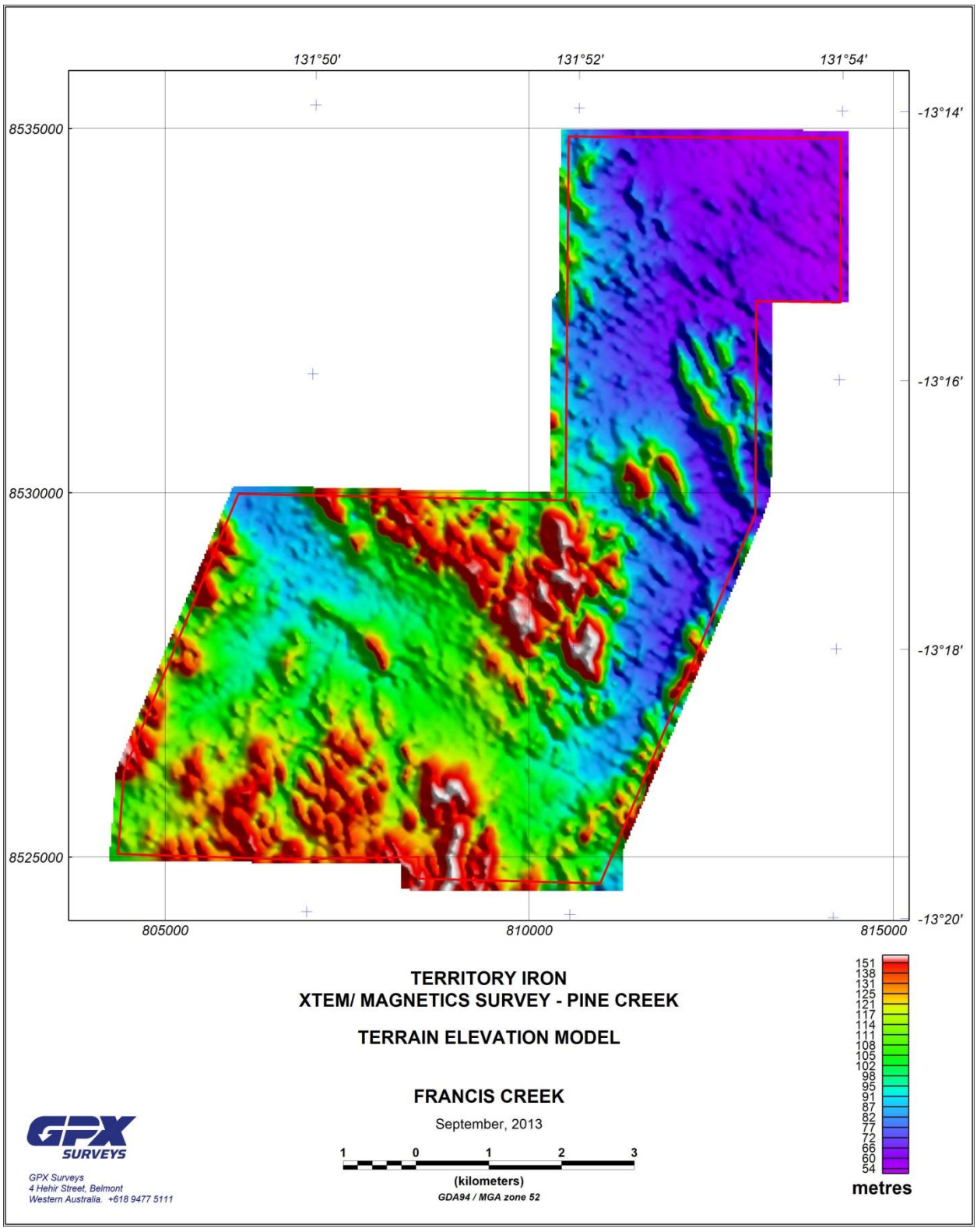
805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
CONDUCTIVITY DEPTH-SLICE - 150m DEPTH
EMAXAIR CONDUCTIVITY-DEPTH TRANSFORMATION
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
3391
2299
1559
1057
717
486
330
224
152
103
70
47
32
22
15
mS/m
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111


131°50'
131°52'
131°54'
-13°14'
-13°16'
-13°18'
-13°20'
8535000
8530000
8525000
805000
810000
815000
TERRITORY IRON
XTEM/ MAGNETICS SURVEY - PINE CREEK
TERRAIN ELEVATION MODEL
FRANCIS CREEK
September, 2013
1 0 1 2 3
(kilometers)
GDA94 / MGA zone 52
151
138
131
125
121
117
114
111
108
105
102
98
95
91
87
82
77
72
66
60
54
metres
GPX SURVEYS
GPX Surveys
4 Hehir Street, Belmont
Western Australia. +618 9477 5111

10 CONTRACTOR INFORMATION

GPX Surveys
A.B.N. 48 110 619 602

4 Hehir St, Belmont,
Western Australia, 6104

Phone + 61 8 9477 5111
Fax + 61 8 9477 5211
Web www.gpxsurveys.com.au

11 APPENDIX A: FIELD WEEKLY REPORTS

WEEKLY SUMMARY REPORT

GPX SURVEYS
Airborne & Ground Geophysics

Client	GPX Job No.	Area(s)	Job Name	Flying Base	Aircraft Type (s)	Crew Contact Phone No	Crew Contact Fax No
Territory Iron	2511	2	North Pine & Francis Creek	Territory Iron Mine	Squirrel	0403602703 (Ron)	NA

Aircraft:	VH-JQT	Project Manager:	Ron Creagh	Processor:	Joe Kita	Technician:	Mike Barrett	Pilot:	Matt Corbett

			Kilometres						Aircraft Time										
	Date	Flt	Prod	Scrub	Reflight	Total Planned	Flown to date	Remain	Prod	Scrub	Turns	Ferry	Cals Daily	Cals Setup	Mob	Total	Hrs to 100 Hrly	Standby Hrs	Standby Reason
Mon	26/08/13		0.0	0.0	0.0	1,454.0	0.0	1,454.0		0.0					0.0	0.0	85.0	8.0	Logistics
Tue	27/08/13		0.0	0.0	0.0	1,454.0	0.0	1,454.0	0.0	0.0		0.0			9.5	9.5	75.5	8.0	Logistics
Wed	28/08/13		0.0	0.0	0.0	1,454.0	0.0	1,454.0	0.0	0.0		0.0			6.3	6.3	69.2	8.0	Logistics
Thu	29/08/13		0.0	0.0	0.0	1,454.0	0.0	1,454.0	1.3	0.0		0.0			0.0	1.3	67.9	8.0	Logistics
Fri	30/08/13	1/2	109.1	0.0	0.0	1,454.0	109.1	1,344.9	2.9	0.0		0.0			0.0	2.9	65.0	5.1	Logistics
Sat	31/08/13	3/4	173.0	0.0	0.0	1,454.0	282.1	1,171.9	3.7	0.0		0.0			0.0	3.7	61.3	4.3	Standby
Sun	01/09/13	5/6	212.1	0.0	0.0	1,454.0	494.2	959.8	4.5	0.0		0.0			0.0	4.5	56.8	3.5	Standby
	Totals:		*494.2*	*0.0*	*0.0*	*1,454.0*	*494.2*	*959.8*	*12.4*	*0.0*		*0.0*			*15.8*	*28.2*		*44.9*	

Chargeable Lost Time (Hrs):	0.0	Non-Chargeable Lost Time (Hrs):	0.0	Previous Week Flown Kilometres:	0.0	Previous Week Hrs to 100 hrly:	85.0

	Date	Julian Day	GPX Crew	Other Crew	Accom' (Rooms)	Vehicles	Aircraft Maint' Hrs	Aircraft Maint' S / U	Equip Maint' Hrs	Equip Maint' S / U	General / Processing / QC Comments	
Mon	26/08/13	238	3	0	3	2					Crew arrived Darwin - picked up vehicles and shipment.	
Tue	27/08/13	239	3	1	4	2					Crew depart for Darwin. Helicopter departed for Broome. 530 ltrs fuel at Newman / 363 ltrs at Meekatharra / 468 ltrs at Broome	0.0
Wed	28/08/13	240	3	1	4	2					Crew arrived in Pine Creek. Crew visiteds mine and inspected the northern landing site. Helicopter arrived late in the day.	0.0
Thu	29/08/13	241	3	1	4	2					Crew Inductions till 10:30. Assemble the rig and recon flight.	0.5 SM
Fri	30/08/13	242	3	1	4	2					Rig completed late morning and a short flight was done to verify system operating normally. One long flight later in day.	1.5
Sat	31/08/13	243	3	1	4	2					2 x flights today, but were limited in time as to maximise the kilometers while still being safely on the ground prior to the mine blast at 2 oclock.	3.5 TBM
Sun	01/09/13	244	3	1	4	2					2 x flights, winds increased in the afternoon and after the 2pm blast it was decided the winds had become too strong and variable.	3.5
	Totals:						*0.0*		*0.0*			*Total Fuel:* 9.0

KEY:
Enter numbers/data into blue marked sections only.
All areas marked in black are self calculating & should not be changed.
Ferry = operations base to survey area & return times.
Mob = (Mob/Demob) initial flying time to project & from project.
YES ← Project Information Form supplied (YES / NO)??

= Safety Meeting (**SM**) / Toolbox Meeting (**TBM**) check box.
= Enter kilometres & hours flown from previous/preceding Weekly Report.
= Information to be entered by GPX Airborne Management.
= Daily fuel upload in litres or drums (per aircraft).
Aircraft/Equipment Maint': **S** = scheduled / **U** = unscheduled.
General/Processing/QC Comments should include basic weather description.

WEEKLY SUMMARY REPORT

GPX SURVEYS
Airborne & Ground Geophysics

Client	GPX Job No.	Area(s)	Job Name	Flying Base	Aircraft Type (s)	Crew Contact Phone No	Crew Contact Fax No
Territory Iron	2511	2	North Pine & Francis Creek	Territory Iron Mine	Squirrel	0403602703 (Ron)	NA

Aircraft:	VH-JQT	Project Manager:	Ron Creagh	Processor:	Joe Kita	Technician:	Mike Barrett	Pilot:	Matt Corbett

			Kilometres						Aircraft Time										
	Date	Flt	Prod	Scrub	Reflight	Total Planned	Flown to date	Remain	Prod	Scrub	Turns	Ferry	Cals Daily	Cals Setup	Mob	Total	Hrs to 100 Hrly	Standby Hrs	Standby Reason
Mon	02/09/13	7	91.8	0.0	0.0	1,454.0	586.0	868.0	2.1	0.0		0.0			0.0	2.1	54.7	5.9	Weather
Tue	03/09/13	8	101.9	0.0	0.0	1,454.0	687.9	766.1	2.4	0.0		0.0			0.0	2.4	52.3	5.6	Weather
Wed	04/09/13	9	106.2	0.0	0.0	1,454.0	794.1	659.9	2.4	0.0		0.0			0.0	2.4	49.9	5.6	Weather
Thu	05/09/13	10	104.7	0.0	0.0	1,454.0	898.8	555.2	2.4	0.0		0.0			0.0	2.4	47.5	5.6	Weather
Fri	06/09/13	11	89.1	0.0	0.0	1,454.0	987.9	466.1	2.4	0.0		0.0			0.0	2.4	45.1	5.6	Weather
Sat	07/09/13	12/13	207.1	0.0	0.0	1,454.0	1,195.0	259.0	4.7	0.0		0.0			0.0	4.7	40.4		
Sun	08/09/13	14/15/16	265.9	0.0	0.0	1,454.0	1,460.9	-6.9	6.2	0.0		0.0			0.0	6.2	34.2		
	Totals:		***966.7***	***0.0***	***0.0***	***1,454.0***	***1,460.9***	***-6.9***	***22.6***	***0.0***		***0.0***			***0.0***	***22.6***		***28.3***	

Chargeable Lost Time (Hrs):	0.0	Non-Chargeable Lost Time (Hrs):	28.3	Previous Week Flown Kilometres:	494.2	Previous Week Hrs to 100 hrly:	56.8

	Date	Julian Day	GPX Crew	Other Crew	Accom' (Rooms)	Vehicles	Aircraft Maint' Hrs	Aircraft Maint' S / U	Equip Maint' Hrs	Equip Maint' S / U	General / Processing / QC Comments	
Mon	02/09/13	245	3	1	3	2					1 x flight, winds increased towards end of first flight. No more flying due winds.	1.5
Tue	03/09/13	246	3	1	4	2					1 x flight. Clear, light winds at start of flight increasing to gusts at the end of first flight, no more flying due winds.	1.5
Wed	04/09/13	247	3	1	4	2					1 x flight, no second flight due to increased gusty winds in the morning.	1.5
Thu	05/09/13	248	3	1	4	2					1 x flight. Last line flown for the Pine Creek Block , move to the Francis Creek Block , Winds picked up, no second flight due winds.	1.5 SM
Fri	06/09/13	249	3	1	4	2					1 x flight in Francis Creek block, no second flight due pick-up of winds after first flight.	2.0
Sat	07/09/13	250	3	1	4	2					2 x production flights.	4.0 TBM
Sun	08/09/13	251	3	1	4	2					3 x production flights and completion of the survey.	4.0
	Totals:						***0.0***		***0.0***		***Total Fuel:***	**16.0**

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Ferry = operations base to survey area & return times.
Mob = (Mob/Demob) initial flying time to project & from project.
YES ← Project Information Form supplied (YES / NO)??

= Safety Meeting (**SM**) / Toolbox Meeting (**TBM**) check box.
= Enter kilometres & hours flown from previous/preceding Weekly Report.
= Information to be entered by GPX Airborne Management.
= Daily fuel upload in litres or drums (per aircraft).
Aircraft/Equipment Maint': **S** = scheduled / **U** = unscheduled.
General/Processing/QC Comments should include basic weather description.

WEEKLY SUMMARY REPORT

GPX SURVEYS
Airborne & Ground Geophysics

Client	GPX Job No.	Area(s)	Job Name	Flying Base	Aircraft Type (s)	Crew Contact Phone No	Crew Contact Fax No
Territory Iron	2511	2	North Pine & Francis Creek	Territory Iron Mine	Squirrel	0403602703 (Ron)	NA

Aircraft:	VH-JQT	Project Manager:	Bob Blizzard	Processor:	Joe Kita	Technician:	Mike Barrett	Pilot:	Matt Corbett

			Kilometres						Aircraft Time										
	Date	Flt	Prod	Scrub	Reflight	Total Planned	Flown to date	Remain	Prod	Scrub	Turns	Ferry	Cals Daily	Cals Setup	Mob	Total	Hrs to 100 Hrly	Standby Hrs	Standby Reason
Mon	09/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		4.0			0.0	4.0	30.2	8.0	Logistics
Tue	10/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		0.0			0.0	0.0	30.2	8.0	Logistics
Wed	11/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		0.0			0.0	0.0	30.2		
Thu	12/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		0.0			0.0	0.0	30.2		
Fri	13/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		0.0			0.0	0.0	30.2		
Sat	14/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		0.0			0.0	0.0	30.2		
Sun	15/09/13		0.0	0.0	0.0	1,454.0	1,460.9	-6.9	0.0	0.0		0.0			0.0	0.0	30.2		
	Totals:		*0.0*	*0.0*	*0.0*	*1,454.0*	*1,460.9*	*-6.9*	*0.0*	*0.0*		*4.0*			*0.0*	*4.0*		*16.0*	

Chargeable Lost Time (Hrs):	0.0	Non-Chargeable Lost Time (Hrs):	16.0	Previous Week Flown Kilometres:	1460.9	Previous Week Hrs to 100 hrly:	34.2

	Date	Julian Day	GPX Crew	Other Crew	Accom' (Rooms)	Vehicles	Aircraft Maint' Hrs	Aircraft Maint' S / U	Equip Maint' Hrs	Equip Maint' S / U	General / Processing / QC Comments	
Mon	09/09/13	252	3	0	3	2					Crew break down of EM rig and packing. R. Blizzard drove to Katherine and delivered empty drums to AUSFuels. Helicopter departed.	
Tue	10/09/13	253	0	0	0	2					Crew departed Pine Creek to Darwin - delivered equipment for shipping and returned hire vehicles.	
Wed	11/09/13	254	0	0	0	0						
Thu	12/09/13	255	0	0	0	0						
Fri	13/09/13	256	0	0	0	0						
Sat	14/09/13	257	0	0	0	0						
Sun	15/09/13	258	0	0	0	0						
	Totals:						*0.0*		*0.0*		*Total Fuel:*	

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YES ← Project Information Form supplied (YES / NO)??

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= Information to be entered by GPX Airborne Management.
= Daily fuel upload in litres or drums (per aircraft).
Aircraft/Equipment Maint': **S** = scheduled / **U** = unscheduled.
General/Processing/QC Comments should include basic weather description.

12 APPENDIX B: SURVEY AND PROCESSING SPECIFICATIONS

12.1 README.TXT

2511 XTEM SURVEY
==========

Surveyed and compiled by GPX Surveys Pty Ltd.
for TERRITORY IRON.

SURVEY SPECIFICATIONS:

Job No.	2511
Area Name	NORTH PINE CREEK / FRANCIS CREEK
Traverse Line Spacing	100m
Tie Line Spacing	1000m
Traverse Line Direction	090-270 Degrees
Tie Line Direction	000-180 Degrees
Terrain Clearance	35 metres
EM System	25Hz XTEM
Navigation	Real-time GPS
Datum	GDA94 MGA52
Survey Date	September 2013

ELECTROMAGNETIC SYSTEM:

The XTEM V1 helicopter borne time-domain electromagnetic system operates at a base frequency of 25Hz with a receiver coil co-axial and co-planar with the transmitter coil (in-loop geometry).

The transmitter waveform is a bipolar 25% duty cycle square wave with: 5mS ON time including a 0.75mS cosine turn-on ramp, excluding 45uS turn-off time.

Transmitter:

Transmitter loop area:	340m^2
Transmitter current:	300 Amps nominal
Moment NIA:	103,200
Exponential turn-on:	Tau: 440 uS

Receiver:

Rx Diameter:	23.4m^2 * 2 turns
Rx Effective Area:	10,000 m^2

30 Channel Windowing Description:

Measurements from end of turnoff ramp (45uS nominal):
Receiver Window Definitions (uS):

The times of receiver windows in microseconds are:

#	Start	Width	Mid
0	101.01us	25.25us	113.64us
1	126.26us	25.25us	138.89us

2	151.52us	25.25us	164.14us
3	176.77us	25.25us	189.39us
4	202.02us	25.25us	214.65us
5	227.27us	25.25us	239.90us
6	252.53us	25.25us	265.15us
7	277.78us	25.25us	290.40us
8	303.03us	25.25us	315.66us
9	328.28us	50.25us	353.41us
10	378.54us	50.25us	403.66us
11	428.79us	50.25us	453.91us
12	479.04us	75.25us	516.67us
13	554.29us	75.25us	591.92us
14	629.55us	100.25us	679.67us
15	729.80us	125.25us	792.42us
16	855.05us	150.25us	930.18us
17	1005.30us	200.25us	1105.43us
18	1205.56us	250.25us	1330.68us
19	1455.81us	300.25us	1605.93us
20	1756.06us	375.25us	1943.69us
21	2131.31us	450.25us	2356.44us
22	2581.57us	550.25us	2856.69us
23	3131.82us	700.25us	3481.94us
24	3832.07us	850.25us	4257.20us
25	4682.32us	1050.25us	5207.45us
26	5732.58us	1300.25us	6382.70us
27	7032.83us	1575.25us	7820.45us
28	8608.08us	1950.25us	9583.21us
29	10558.33us	2350.25us	11733.46us

MAGNETOMETER SYSTEM:

Cesium Vapour Sensor: Geometrics G-822A
Sensor Location: Rig-mounted, 100Ft (33m) Terrain Clearance
Larmor Counter: Gap Geo TM-6
Raw sampling rate: 25Hz Paired 1200Hz Samples

ALTIMETER SYSTEM:

Laser Unit Location: Rig-mounted
Raw measurement interval: 60Hz
Recorded value: Highest value over past 100mS (ie: 10Hz rate)

RADAR ALTIMETER SYSTEM:

Radar Unit Location: Heli-mounted

CONTENTS OF DVD:

\Located_data\ASEG_Format\NorthPineCreek:

NPC_XTEM.DAT: Final 30 channel located data - ASEG Format (Flat ASCII file)
NPC_XTEM.DFN: ASEG definition file
NPC_XTEM.PRJ: ASEG projection file

NPC_REPTEM.DAT: Final 30 channel located data - ASEG Format (Flat ASCII file)
NPC_REPTEM.DFN: ASEG definition file
NPC_REPTEM.PRJ: ASEG projection file

NOTE: Channel emWinS is the High Level background corrected EM.
The RepTEM data has been levelled from it's original 21 channel dataset to the specifications of the XTEM.
Levelling has been applied to allow for the difference in system geometry from selected cross-over lines in the north of the RepTEM survey/ south of the XTEM survey.

NPC_CDI_EmaxAir.DAT: EmaxAir conductivity solutions - ASEG Format (Flat ASCII file)
NPC_CDI_EmaxAir.DFN: ASEG definition file
NPC_CDI_EmaxAir.PRJ: ASEG projection file

NPC_Depthslices_EmaxAir.DAT: Depthslice solutions of the EmaxAir CDI solutions - ASEG Format (Flat ASCII file)
NPC_Depthslices_EmaxAir.DFN: ASEG definition file
NPC_Depthslices_EmaxAir.PRJ: ASEG projection file

NOTE: The North Pine Creek XTEM and RepTEM surveys have been combined in the emaxAir CDI and Depth-slice databases for ease of viewing.

NPC_Magnetics.DAT: Processed final magnetic 25Hz data - ASEG Format (Flat ASCII file)
NPC_Magnetics.DFN: ASEG definition file
NPC_Magnetics.PRJ: ASEG projection file

\Located_data\ASEG_Format\FrancisCreek:

FC_XTEM.DAT: Final 30 channel located data - ASEG Format (Flat ASCII file)
FC_XTEM.DFN: ASEG definition file
FC_XTEM.PRJ: ASEG projection file

NOTE: Channel emWinS is the High Level background corrected EM.

FC_CDI_EmaxAir.DAT: EmaxAir conductivity solutions - ASEG Format (Flat ASCII file)
FC_CDI_EmaxAir.DFN: ASEG definition file
FC_CDI_EmaxAir.PRJ: ASEG projection file

FC_Depthslices_EmaxAir.DAT: Depthslice solutions of the EmaxAir CDI solutions - ASEG Format (Flat ASCII file)
FC_Depthslices_EmaxAir.DFN: ASEG definition file
FC_Depthslices_EmaxAir.PRJ: ASEG projection file

FC_Magnetics.DAT: Processed final magnetic 25Hz data - ASEG Format (Flat ASCII file)
FC_Magnetics.DFN: ASEG definition file
FC_Magnetics.PRJ: ASEG projection file

\Located_data\Geosoft\NorthPineCreek:

NPC_XTEM.gdb: Final 30 channel EM located data
NPC_REPTEM.gdb: Final 30 channel EM located data - Levelled from original 21ch data to XTEM specification 30 window channels.
NPC_CDI_EmaxAir.gdb: EmaxAir conductivity solutions (Combined XTEM/RepTEM surveys)
NPC_Depthslices_EmaxAir.gdb: EmaxAir Depthslice solutions (Combined XTEM/RepTEM surveys)
NPC_Magnetics.gdb: Processed final magnetic 25Hz data

\Located_data\Geosoft\FrancisCreek:

FC_XTEM.gdb: Final 30 channel EM located data
FC_CDI_EmaxAir.gdb: EmaxAir conductivity solutions

Depthslices_EmaxAir.gdb: EmaxAir Depthslice solutions
Magnetics.gdb: Processed final magnetic 25Hz data

\images\CDI\GeosoftMaps:

EM profiles and CDI with terrain for each line - Geosoft .MAP format
These files can be viewed using the Geosoft free viewer available at
See note 1 below.

\images\CDI:

EM profiles and CDI with terrain for each line 'PNG format files'
See note 2 below.

\images\Channel:

GEOTIFF format images of the final 30 channel EM grids.
The North Pine Creek Channel grids are merged XTEM/ Levelled RepTEM.

\images\DEM:

GEOTIFF format image of the final DEM grid.
The North Pine Creek Eelvation Model grids are merged XTEM/ Levelled RepTEM.

\images\Depthslices:

GEOTIFF format images of the Depthslice grids.
The North Pine Creek Depth-slice grids are merged XTEM/ Levelled RepTEM.
Greyed out regions show 'no solution' at the given depth.

\images\Magnetics:

GEOTIFF format images of the final Magnetic grids.

\grids\CDI:

CDI solutions in Geosoft GRD format.

\grids\Channel:

Final 30 channel EM grids in ER Mapper format.
The North Pine Creek Channel grids are merged XTEM/ Levelled RepTEM.

\grids\DEM:

Final DEM grid in ER Mapper format.
The North Pine Creek DEM grids are merged XTEM/ Levelled RepTEM.

\grids\Depthslices:

Conductivity depth slices with name convention
of dnnn.erd where nnn is the depth of the conductivity slice.
The North Pine Creek Channel depth-slice grids are merged XTEM/ Levelled RepTEM.

\grids\Magnetics:

Final Magnetic grids in ER Mapper format.

LOCATED DATA HEADER DESCRIPTION:

XTEM/ REPTEM.LDT:

Line: Line number
X: Easting (GDA94 MGA52)(metres)
Y: Northing (GDA94 MGA52)(metres)
SPM: Seconds past midnight (local time)
GPSALT: GPS altitude of the rig (metres)
Laser: Rig clearance from the ground (metres)
DEM: Digital Elevation Model, WGS84 (metres)
Current: Transmitter current (amps)
emWinS[*]: High Level corrected EM response, channels 1-30 (uV)
Magnetics: Total Magnetic Intensity (nT) -- see note 3 below.

CDI_EmaxAir.LDT

Line: Line number
X: Easting (GDA94 MGA52)(metres)
Y: Northing (GDA94 MGA52)(metres)
GPSALT: GPS altitude of the rig (metres)
Laser: Rig clearance from the ground (metres)
DEM: Digital Elevation Model (metres)
Depth[*]: Depth below surface (30 Channel Array) (metres)
Cond[*]: Conductivity (30 Channel Array) (mS/m)
Time[*]: Time (30 Channel Array) (uS)
RL[*]: Relative Level to WGS84 spheroid (30 Channel Array) (metres)

Depthslices_EmaxAir.LDT

Line: Line number
X: Easting (GDA94 MGA52)(metres)
Y: Northing (GDA94 MGA52)(metres)
Dist: Distance along line (metres)
RL: Relative Level to WGS84 spheroid (metres)
[_10 - _180]: Conductivity at specified depth (mS/m)

Magnetics.LDT(25Hz data)

Line: Line Number
X: Easting (GDA94 MGA52)(metres) -- see note 4 below.
Y: Northing (GDA94 MGA52)(metres) -- see note 4 below.
SPM: Seconds past midnight (local time)
GPSALT: GPS altitude of Sensor (metres) -- see note 4 below.
Laser: Ground clearance of the magnetic sensor (metres) -- see note 5 below.
RMG1: Raw magnetics channel (nT)
Diurnal: Filtered diurnal data (nT)
MagD: Diurnally corrected magnetics data (nT)
IGRF: Calculated IGRF values (nT)
Magnetics: Final magnetics channel (nT)

MAGNETIC PROCESSING NOTES - NORTH PINE CREEK (XTEM/MAG SURVEY)

The magnetic data has a parallax of 1 seconds added to the data.

The magnetic data has been diurnally and IGRF (2005) corrected.

The magnetic data has not been tie line levelled.

The magnetic data has not been microlevelled.

The diurnally corrected magnetics has a mean diurnal base value of 47000 nT added back to the data.

The final magnetics has a mean IGRF base value of 46743 nT added back to the data.

MAGNETIC PROCESSING NOTES - FRANCIS CREEK (XTEM/MAG SURVEY)

The magnetic data has a parallax of 1 seconds added to the data.

The magnetic data has been diurnally and IGRF (2005) corrected.

The magnetic data has not been tie line levelled.

The magnetic data has not been microlevelled.

The diurnally corrected magnetics has a mean diurnal base value of 47000 nT added back to the data.

The final magnetics has a mean IGRF base value of 46612 nT added back to the data.

Notes:

(1)These files can be viewed using the Geosoft free viewer available at http://www.geosoft.com/pinfo/free/montajviewer.asp (as of Jan 2010)

(2)Viewable in most graphics viewers.

(3)Interpolated from Magnetics database.

(4)The GPS and magnetic sensor are both rig mounted. The GPS data is interpolated from the TEM database.

(5)The laser is rig mounted and the laser channel is interpolated from the TEM database.

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