



Partial Relinquishment Report

EPM 15197 – Rollinson

Mount Windsor Volcanics Project

For the period

30 August 2006 to 24 September 2009

Tenure Holder: Liontown Resources Limited

Tenement Manager: Liontown Resources Limited

Author: G J Hall

Date: October 2010

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## SUMMARY

The Rollinson tenement (EPM 15197) is part of Liontown Resources Limited's (LRL) Mount Windsor Volcanics Project (MWVP) and is located approximately 40 km south of Charters Towers, north Queensland within the Thalanga Province.

This is a partial relinquishment report for EPM 15197 and covers exploration activities carried out on the relinquished area for the period 30 August 2006 - 24 September 2009.

The tenement was originally granted to Uranium Equities Limited (UEL) who then sold the tenement in 2006 on to Base Resources Limited which subsequently became LRL. Tenure transfer of EPM15197 from UEL to LRL was approved on 20 August 2009.

The tenement is underlain by the Cambro-Ordovician Mount Windsor Volcanics – a sequence of rhyolitic to dacitic volcanic and volcanoclastic rocks with minor andesite – which are host to the Thalanga and Highway-Reward VHMS related Zn-Pb-Cu-Au-Ag and Cu-Au mines. The project area is located between the major gold mines at Pajingo and Mt Leyshon. The tenements were acquired to target VHMS style base metal and gold mineralisation, and epithermal style or granite breccia hosted gold mineralisation.

Exploration activities carried out on the relinquished ground included (reporting year in brackets):

- Compilation and evaluation of data (2006-2007);
- Collection of open-file data (2007-2008);
- Review of historical geophysical data (2007-2008);
- Evaluation of regional geology (2007-2008);
- Processing of aeromagnetic/radiometric survey data (2007-2009);
- Acquisition of IKONOS satellite imagery (2007-2009);
- Interpretation of regional aeromagnetic/radiometric data (2008-2009);
- Identification of exploration targets (2008-2009);
- Acquisition of aerial photography for the MWVP (2008-2010);

From 2006-2009 the area relinquished for EPM 15197 has been subject to a substantial amount of data compilation and review as part of LRL's MWVP. When the tenement was first granted the exploration focus was on base metal exploration but this focus has now changed to gold. Therefore, the portions relinquished that were identified from John McIntyre's 2008-2009 work as VHMS targets have not been further investigated by fieldwork/sampling and remain untested.

In terms of gold exploration no targets were identified in the relinquished area and therefore, no fieldwork/sampling was carried out.

Much of this ground is extensively covered by Campaspe Formation so geophysical methods and drilling beneath the regolith cover is required to further exploration.

## 1 INTRODUCTION

This is the 2nd partial relinquishment report for the Rollinson tenement (EPM 15197) and covers the period 30 August 2006 - 24 September 2009.

EPM 15197 has been under various companies' management since it was granted in 2006. Prior to April 2010 it was part of Liontown Resources Limited's (LRL) Mount Windsor Volcanics Project Project (MWVP).

### 1.1 Location

The tenement is located approximately 40 km south of Charters Towers, north Queensland (Figure 1), within the Thalanga Province.

The tenement area falls within the Charters Towers (SF55-02) 1:250 000 map sheet, and the Homestead (8057) 1:100 000 map sheet.

Access to EPM 15197 is via the Flinders Highway to Balfes Creek then south along a local station track for approximately 25 km. The area is typically flat with a few sparsely vegetated, gently undulating slopes. The Campaspe River flows through the southern-most tenement blocks.

### 1.2 Tenure

EPM 15197 was part of LRL's MWVP. LRL acquired the MWVP ground from UEL (previously Bullion Minerals Limited) following successful floating and ASX listing of LRL in December 2006.

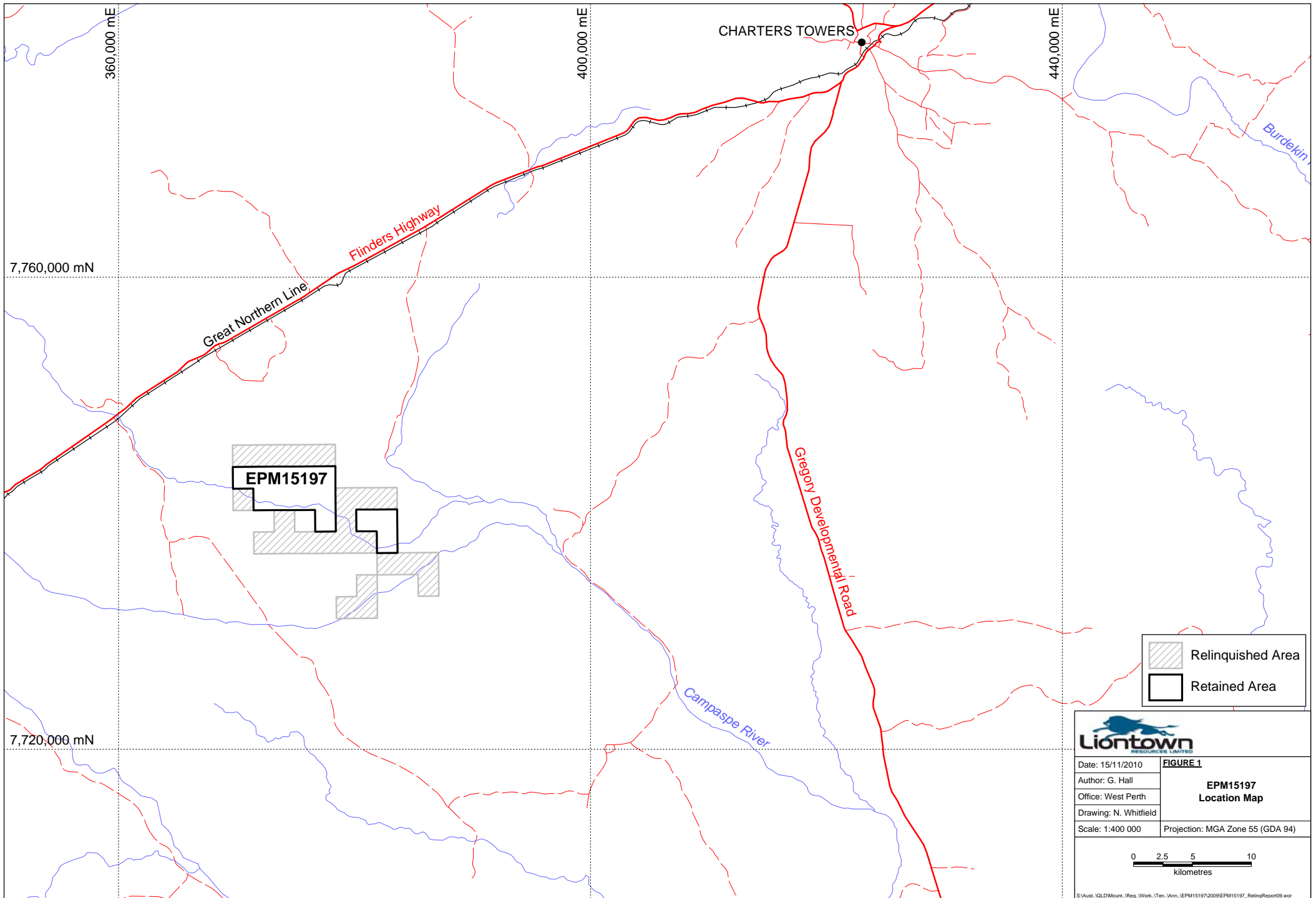
EPM 15197 was originally applied for by Bullion Minerals Limited (BML) on 23 August 2005 and comprised ~157 km<sup>2</sup> (49 sub-blocks) when granted on 30 August 2006. By this stage the tenement was granted to Uranium Equities Limited (UEL) who then sold the tenement in 2006 on to Base Resources Limited which subsequently became LRL. Tenure transfer of EPM15197 from UEL to LRL was approved on 20 August 2009.



On 16 October 2008, 12 sub-blocks were relinquished from the tenement after an application to vary the relinquishment area was accepted (25% relinquished instead of 50%). On 24 September 2009 another 24 sub-blocks were relinquished.

Table 1 shows tenement details for the 2009-2010 year (4th year of tenure) and Figure 1 shows the current tenement outline and the relinquished area. Table 2 shows the details of the relinquished sub-blocks.

Table 1. Tenement details for EPM 15197

<i>Tenement</i>	<i>Holder</i>	<i>Grant Date</i>	<i>Expiry Date</i>	<i>Sub-Blocks/km<sup>2</sup></i>	<i>Rent (excl GST)</i>	<i>Expenditure Commitment</i>
EPM 15197	Liontown Resources Limited	30/08/06	29/08/11	13/41.8	\$4,403.00	\$50,000



	Relinquished Area
	Retained Area



Date: 15/11/2010	<b>FIGURE 1</b>
Author: G. Hall	<b>EPM15197 Location Map</b>
Office: West Perth	
Drawing: N. Whitfield	
Scale: 1:400 000	Projection: MGA Zone 55 (GDA 94)

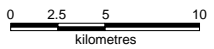


Table 2. Relinquished sub-block details for EPM 15197

<i>BIM Code</i>	<i>Block Number</i>	<i>Sub-blocks</i>
CLER	310	Q, R, S, T, U
CLER	382	A, H, M, N, O, P
CLER	383	A, B, C, F, L, M, S, T, U, W, Z
CLER	455	A, B

### 1.3 Philosophy and Objectives

The MWVP area is targeted for gold and base metal deposits. Ground selection of EPM 15197 was based on the following geological concepts:

- Similarities in magnetic character to the mapped Mt Windsor Volcanics, with prospectivity for Zn-Pb-Cu-Ag-Au and Cu-Au deposits;
- Presence of magnetic bullseyes, possibly similar in nature to the intrusions adjacent to the Mt Leyshon gold deposits; and
- Proximity to regional structural trends believed to control the emplacement of Permo-Carboniferous deposits and associated gold mineralisation.

## 2 REGIONAL GEOLOGY

Figure 2 shows the regional geology of the MWVP and the stratigraphy is discussed below.

Basement rocks in the area comprise Neoproterozoic to early Cambrian metasediments and orthogneisses of the Cape River and Charters Towers metamorphics.

The Seventy Mile Range Group overlies these basement rocks and was deposited during the late Cambrian in a fault-controlled basin. The base of the Seventy Mile Range Group comprises the Puddler Creek Formation which is made up of sandstone, greywacke and basalt. The Puddler Creek Formation is conformably overlain by massive rhyolitic volcanics of the Cambrian-Ordovician Mount Windsor Formation and the Trooper Creek Formation comprising rhyolitic-andesitic lavas and volcanoclastic materials near the top of the unit. The top unit of the Seventy Mile Range Group is the Rollston Range Formation, which conformably overlies the Trooper Creek Formation but does not outcrop and has previously been logged as a rhyolitic dacite: it is magnetic.

During the deposition of the Seventy Mile Range Group, Cambrian-Ordovician intrusions were emplaced. Typically these are granodiorites and have been dated at 490 +/- 6 Ma (Bain and Draper, 1997).



After the deposition of the Seventy Mile Range Group, intrusive activity began, accompanied by numerous deformation events. The first of these intrusives were Ordovician granodiorites in the eastern part of the project area. This was followed by mid-Ordovician to Silurian intrusives (Ravenswood Batholith). The intrusive suite comprises granodiorites, gabbros, and tonalites. During the late Silurian to early Devonian, banded muscovite granodiorites and massive biotite adamellites belonging to the Lolworth Igneous Complex, were emplaced and exist in the northwest of the project area.

Following this intrusive activity during the early Permian, the Mount Leyshon Complex was emplaced. It comprises igneous breccias, quartz trachytes, and rhyolitic porphyries.

From the late Permian to the early Triassic, sediments of the Galilee Basin were deposited in a northwest-trending basin.

During the Pliocene the Campaspe Formation comprising conglomerates, sandstones, and pebbly sandstones was deposited. These lithologies can have thicknesses of up to 120 m.

Bedrock geology of the area is shown in Figure 2 (based on GIS data from Department of Natural Resources and Mines' Geoscience and Resources Database on 18 November 2003).

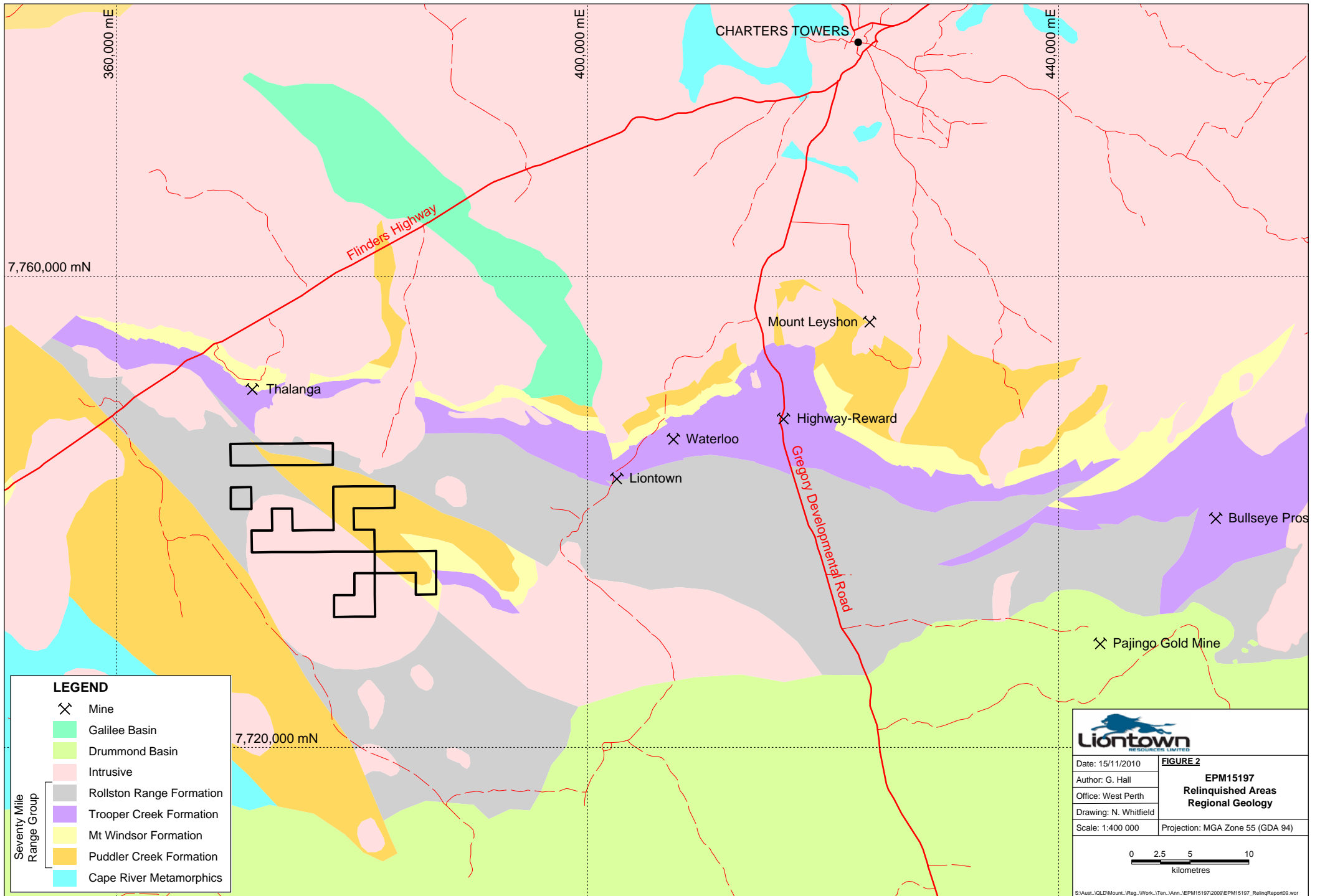
## 2.1 Regolith

The northern part of the MWV Project area is dominated by subcrop and outcrop and the DTM indicates that it is relatively hilly with incised drainage. The far southeastern part of the project area shows extensive laterisation, commonly with a striped profile and mesa landforms.

In the south, the majority of the area is covered by Campaspe Formation over which modern fluvial deposits are common.

## 2.2 Structure

The northern part of the Mount Windsor Volcanics is dominated by an east-west trending granitic ridge (Lolworth Batholith). The Seventy Mile Range Group drapes off this ridge and has a moderate southerly dip. A mylonitic boundary has been mapped as the boundary between the Seventy Mile Range Group and the Charters Towers Metamorphics. Syn-sedimentary faulting is associated with base metal mineralisation and is preserved within the Seventy Mile Range Group as marked changes in thickness of stratigraphic units. These syn-sedimentary faults commonly lie at the boundaries of or within the Cambrian-Ordovician intrusives that exist within the Seventy Mile Range Group.



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Date: 15/11/2010	<b>FIGURE 2</b>
Author: G. Hall	<b>EPM15197 Relinquished Areas Regional Geology</b>
Office: West Perth	
Drawing: N. Whitfield	
Scale: 1:400 000	Projection: MGA Zone 55 (GDA 94)

0 2.5 5 10  
kilometres

S:\Aust\_VQ\DIMount\_1\Reg\_1\Work\_1\Ten\_1\Ann\_1\EPM15197\2009\EPM15197\_RelinqReport09.wor

Four deformation events have been interpreted in the area (Whitnall, et al., 2003). D1 is rarely seen and is only found by a change in the S0/S2 lineation. D2 is represented by a steeply dipping, east-west striking schistosity. This fabric is prevalent within the Seventy Mile Range Group. D3 forms strong east-northeast striking magnetic lineaments that extend into the Seventy Mile Range Group. It is thought that these lineaments exhibit south-side upwards movement. The fourth (D4) and final deformation event represents shallow to moderately dipping east-northeast faults that have played an important role in the localisation of gold at Charters Towers.

### 3 SUMMARY OF EXPLORATION ACTIVITIES FOR 2009-2010

Exploration activities carried out on the relinquished ground included (reporting year in brackets):

- Compilation and evaluation of data (2006-2007);
- Collection of open-file data (2007-2008);
- Review of historical geophysical data (2007-2008);
- Evaluation of regional geology (2007-2008);
- Processing of aeromagnetic/radiometric survey data (2007-2009);
- Acquisition of IKONOS satellite imagery (2007-2009);
- Interpretation of regional aeromagnetic/radiometric data (2008-2009);
- Identification of exploration targets (2008-2009);
- Acquisition of aerial photography for the MWVP (2008-2010);

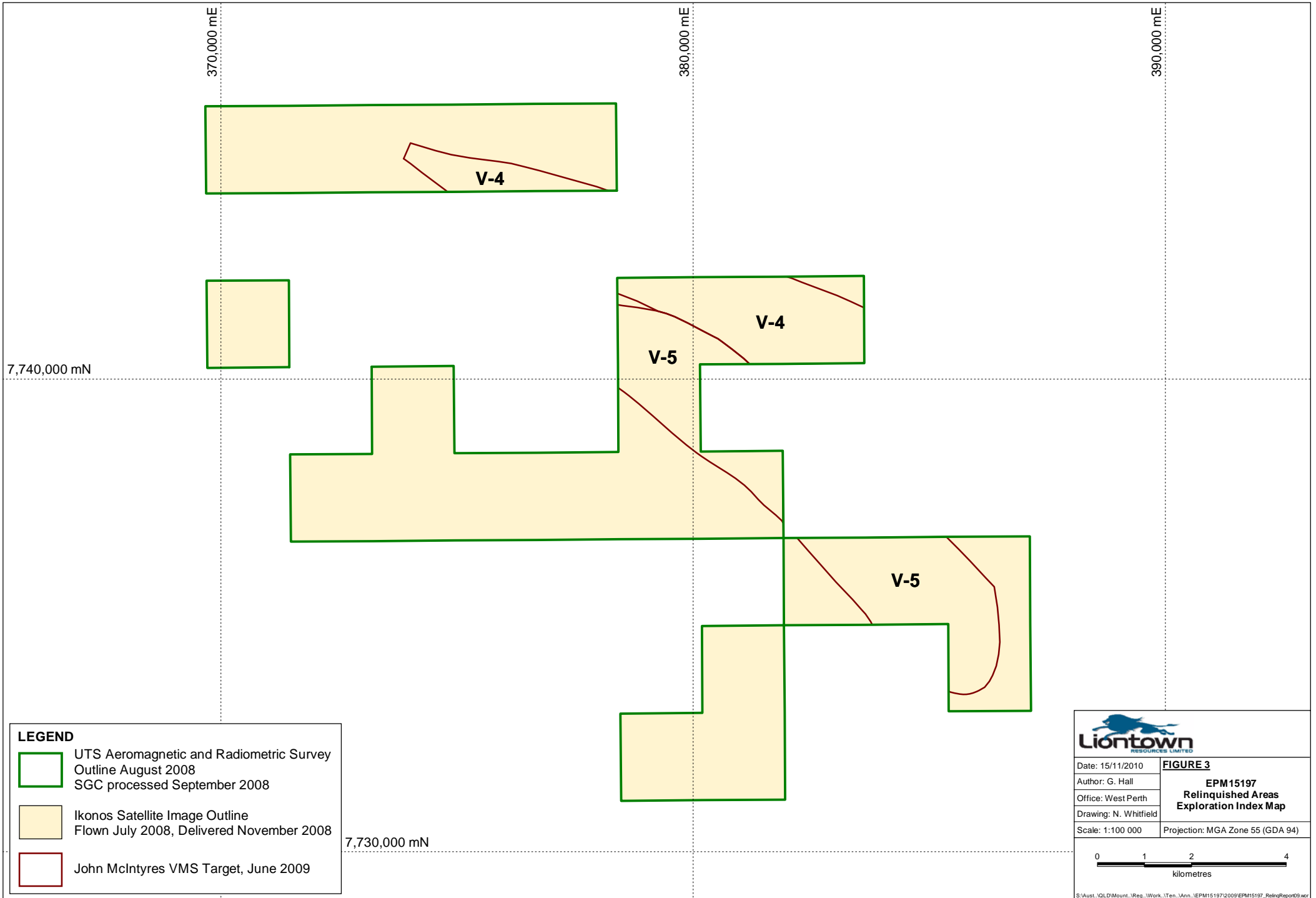
Details of these activities are presented in the following sections and appendices, and a summary of data polygons where appropriate are shown in Figure 3.

#### 3.1 Data Compilation and Evaluation (2006-2007)




In the 2006-2007 year historical geological data for the MWVP was compiled, validated and evaluated. The following geological summary was given in the annual report.

##### 3.1.1 Regional Setting

Basement rocks in the area comprise Neo-Proterozoic to Early Cambrian metasediments and orthogneisses belonging to the Cape River and Charters Towers metamorphics. The Seventy Mile Range Group overlies basement rocks and was deposited during the Late Cambrian in a fault-controlled basin. The base of the Seventy Mile Range Group comprises the Puddler Creek Formation which is made up of sandstone and greywackes and basalts. The Puddler Creek Formation is conformably overlain by massive rhyolitic volcanics belonging to the Cambro-Ordovician Mt Windsor Formation and the Trooper Creek Formation comprising dacite, andesite, rhyolitic lavas and volcanoclastic sediments at the top of the unit. The Rollston Range Formation conformably overlies the Trooper Creek Formation but does not outcrop but has been previously logged as a rhyolitic dacite and is magnetic. During the deposition of the Seventy Mile Range Group Cambro-Ordovician intrusions were emplaced. Typically these are granodiorites and have been dated at  $490 \pm 6$  Ma (Bain & Draper, 1997).



**LEGEND**

-  UTS Aeromagnetic and Radiometric Survey Outline August 2008  
SGC processed September 2008
-  Ikonos Satellite Image Outline  
Flown July 2008, Delivered November 2008
-  John McIntyres VMS Target, June 2009

**Liontown**  
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Date: 15/11/2010	<b>FIGURE 3</b>
Author: G. Hall	<b>EPM15197</b>
Office: West Perth	<b>Relinquished Areas</b>
Drawing: N. Whitfield	<b>Exploration Index Map</b>
Scale: 1:100 000	Projection: MGA Zone 55 (GDA 94)

0 1 2 4  
kilometres

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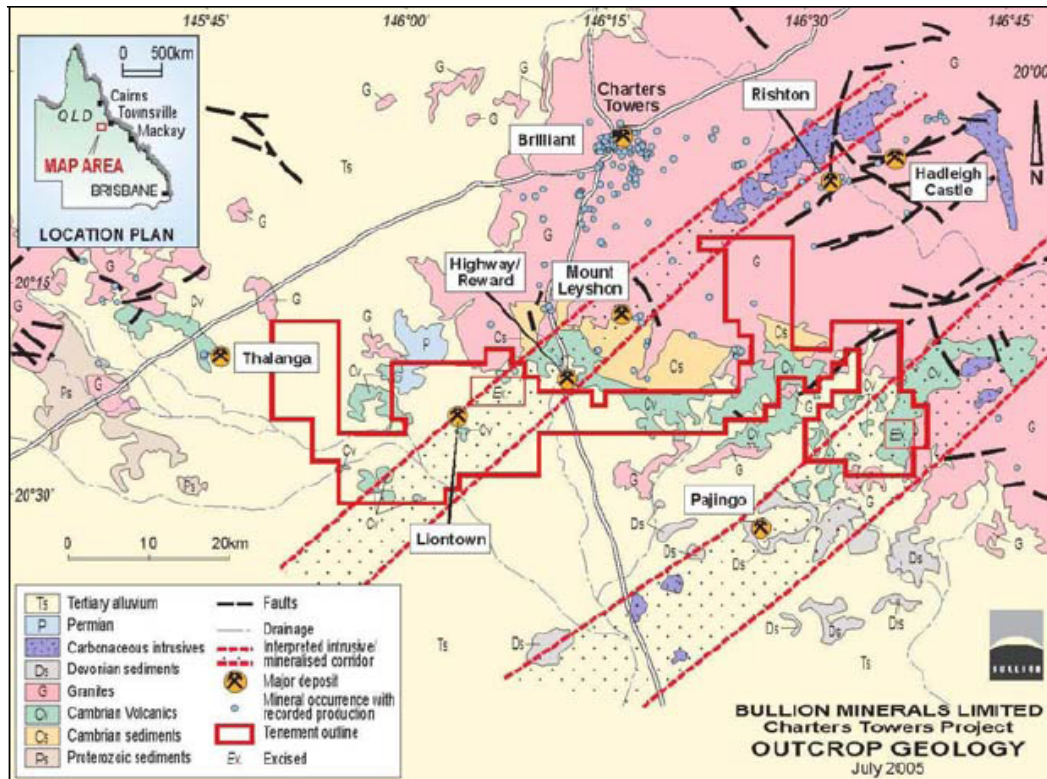


Figure 4. Regional geological map of the Mount Windsor Volcanics region.

After the deposition of the Seventy Mile Range Group, intrusive activity began accompanied by numerous deformation events. The first of these intrusives was Ordovician granodiorites that exist in the eastern part of the project area. This was followed by Mid-Ordovician to Silurian intrusives that belong to the Ravenswood Batholith. The intrusive suite comprises granodiorites, gabbros, and tonalites. During the Late Silurian to early Devonian banded muscovite granodiorites and massive biotite adamellites were emplaced and belong to the Lolworth igneous complex that occurs in the northwest of the area.

Following this intrusive activity, during the Early Permian the Mount Leyshon Igneous Complex was emplaced and comprises igneous breccias, quartz trachytes and rhyolitic porphyries.

From the Late Permian to Early Triassic sediments belonging to the Galilee Basin were deposited in a northwest-trending basin. During the Pliocene the Campaspe Formation was deposited comprising conglomerates, sandstones, and pebbly sandstones that outcrop in the tenement area and can reach depths of up to 120 m.

Figure 4 shows the interpreted regional geology from 2005.

### 3.1.2 Structure

The northern part of the MWVP is dominated by an east-west trending granitoid ridge belonging to the Lolworth Batholith. The Seventy Mile Range Formation drapes off this ridge and has a moderate southerly dip. A mylonitic boundary has been mapped as the boundary between the Seventy Mile Range Formation and the Charters Towers Metamorphics. Syn-sedimentary faulting is associated with base metal mineralisation and is preserved within the Seventy Mile Range Formation as marked changes in thickness of stratigraphic units. These syn-sedimentary faults commonly exist at the boundary between the Cambro-Ordovician intrusives below the Seventy Mile Range Formation.

There are 4 deformation events that have been interpreted in the area (Whitnall et al., 2003). D1 is rarely seen and is only found by a change in the S0/S2 lineation. D2 is represented by a steeply dipping, east-west striking schistosity. This fabric is prevalent within the Seventy Mile Range Formation. D3 forms strong east-northeast striking magnetic lineaments that extend into the Seventy Mile Range Formation. It is thought these lineaments exhibit south-side upwards movement. The fourth and final deformation event represents shallow to moderately dipping east-northeast faults that have played an important role in the localisation of gold at Charters Towers.

### 3.2 Open-file Data Collection (2007-2008)

An open-file report search was carried out during the reporting year. Table 3 lists all the previous EPMs which have covered parts of the current EPM 15197, the Company Report (CR) numbers of reports on the Department of Mines and Energy's QDEX system, and the title of the report.

Exploration for base (Zn, Pb, Cu) and precious metals (Au, Ag) in the current EPM 15197 tenement area began in 1969 with Nickel Mines Ltd (EPM 670) who defined a broad target (Area 1) which is coincident with part of EPM 15197. No significant anomalism or mineralisation was found during their programs.

The extensive Tertiary and Quaternary sedimentary and regolith cover in this district has been a significant impediment to all exploration efforts. Future success will be dependent upon selection of appropriate exploration methodologies.

Table 3. Previous exploration EPM and open-file report numbers

<i>EPM Number</i>	<i>CR Number</i>	<i>Company</i>	<i>Title</i>
670	4185	Nickel Mines Ltd	FINAL REPORT, A-P 670M
1017	4500	Jododex Australia Pty Ltd	REVIEW OF EXPLORATION DURING THE YEAR ENDED 31.12.72, SEVENTY MILE RANGE AREA, QLD, A TO P 1016M, 1017M, 1074M, ANNUAL REPORT TO QLD DEPT ON MINES.
1017	4743	Jododex Australia Pty Ltd	JODODEX AUSTRALIA PTY LTD, RELINQUISHMENT REPORT, A TO P 1016M, 1017M, & 1074M, S. OF CHARTERS TOWERS.
1590	6172	Le Nickel (Australia) Exploration Pty Ltd	ANNUAL REPORT 1976, BRACEBOROUGH, A-P 1590M
1544	5487	Le Nickel (Australia) Exploration Pty Ltd	THALANGA A-P 1544M, QLD, QUARTERLY REPORT FOR PERIOD ENDED 31.12.75.

1544	5731	Le Nickel (Australia) Exploration Pty Ltd	THALANGA A-P 1544M, QLD, ANNUAL REPORT 1975.
1544	5974	Le Nickel (Australia) Exploration Pty Ltd	HOMESTEAD A-P 1544M, QLD, QUARTERLY REPORT FOR THE PERIOD ENDING 31.03.77.
1544	6174	Le Nickel (Australia) Exploration Pty Ltd	ANNUAL REPORT 1976, HOMESTEAD, A-P 1544M, QLD.
1544	6341	Penarroya (Australia) Pty Ltd	HOMESTEAD A-P 1544M, QLD, ANNUAL REPORT 1977.
1544	7095	Penarroya (Australia) Pty Ltd	FINAL REPORT ON RELINQUISHED SECTION OF HOMESTEAD, A-P 1544M, QLD.
1590	6384	Penarroya (Australia) Pty Ltd	BRACEBOROUGH A-P 1590M, ANNUAL REPORT 1977.
1590	6776	Penarroya (Australia) Pty Ltd	BRACEBOROUGH, A-P 1590M, QLD. FINAL REPORT ON AREA RETAINED UNDER A-P 2014M.
1590	7094	Penarroya (Australia) Pty Ltd	FINAL REPORT ON RELINQUISHED SECTION OF BRACEBOROUGH, A- P 1590M, QLD
2014	6777	Penarroya (Australia) Pty Ltd	HOMESTEAD A-P 1544M, QLD. FINAL REPORT ON THE AREA RETAINED UNDER A-P 2014M.
2014	7050	Penarroya (Australia) Pty Ltd; Electrolytic Zinc Company of Australasia Ltd; Dampier Mining Company Ltd	BALFES CREEK A-P 2014M QLD, REPORT FOR PERIOD 19.9.78-17.3.79.
2014	7643	Penarroya (Australia) Pty Ltd; Electrolytic Zinc Company of Australasia Ltd; Dampier Mining Company Ltd	A-P 2014M BALFES CREEK QLD REPORT FOR THE PERIOD 18.03.79- 17.19.79.
2014	7644	Penarroya (Australia) Pty Ltd; Electrolytic Zinc Company of Australasia Ltd; Dampier Mining Company Ltd	BALFES CREEK A-P 2014M, QLD, RELINQUISHMENT REPORT FOR THE PERIOD ENDING NOVEMBER 1979.
2014	7781	Penarroya (Australia) Pty Ltd; Electrolytic Zinc Company of Australasia Ltd; Dampier Mining Company Ltd	BALFES CREEK A-P 2014M, QLD. REPORT FOR PERIOD 18.9.79-17.3.80.
2014	10074	Penarroya (Australia) Pty Ltd; BPH Minerals Ltd; Electrolytic Zinc Company of Australasia Ltd	FINAL REPORT ON THE RELINQUISHED SECTION OF BALFES CREEK, A-P 2014M, QLD.
2571	8837	Esso Exploration and Production Australia Inc.	SIX MONTHLY REPORT ON A-P 2571M FOR THE PERIOD ENDED 8.3.81
2571	10320	Esso Exploration and Production Australia Inc.	MOUNT MISERY A-P 2571M, SIX MONTHLY REPORT FOR PERIOD ENDING 09.03.82.
2571	11469	Esso Exploration and Production Australia Inc.	MT MISERY, RELINQUISHMENT REPORT, 28.07.82.
3221	13236	Penarroya (Australia) Pty Ltd, BHP Minerals Ltd, Electrolytic Zinc Company of Australasia Ltd	REPORT ON RELINQUISHED SECTIONS OF THE BALFES CREEK, A-P 3221M, QLD, TO 4.10.83 (1505/16).
3699	13995	CRA Exploration Pty Ltd	A-P 3699M, BRACEBOROUGH, QLD, REPORT FOR SIX MONTHS ENDED 4.09.84, (C.P.A.E. REPORT NO. 12959).
3699	14528	CRA Exploration Pty Ltd	BRACEBOROUGH, A-P 3699M, QLD, FINAL REPORT INCLUDING REPORT FOR SIX MONTHS OF TENURE 5.09.84-4.03.85 &

			REPORT ON AREAS RELINQUISHED 4.02.85 (CRAE REPORT 13312).
3729			No reports
3798	19482	Pancontinental Mining Ltd, Outokumpu Oy	A-P 3798M, BOLFES CREEK, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS RELINQUISHED ON 16.08.88.
3798	21615	Pancontinental Resources (Base Metals) Pty Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	A-P 3798M (BOLFES CREEK), 4430M (SUNRISE SPUR), 5166M (POLICEMAN CREEK), PARTIAL RELINQUISHMENT REPORT ON SUB-BLOCKS RELINQUISHED ON 22/9/89
3798	23326	Pancontinental Resources (Base Metals) Pty Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	EPM 3798 (BOLFES CREEK), 4430 (SUNRISE SPUR), 5166 (POLICEMAN CREEK), MOUNT WINDSOR PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS RELINQUISHED ON 22/9/91
3798	24351	Pancontinental Resources (Base Metals) Pty Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	EPM 3798 (BOLFES CREEK), 4430 (SUNRISE SPUR), 7676 (ROCKY CREEK), 8103 (BRACEBOROUGH), MOUNT WINDSOR PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS RELINQUISHED ON 22/9/92
4115	16504	Battle Mountain (Australia) Inc./Pajingo Gold Mine Pty Ltd	A-P 4115M, TRAFALGAR, REPORT ON AREA RELINQUISHED 14.10.86.
4115	16505	Battle Mountain (Australia) Inc./Pajingo Gold Mine Pty Ltd	A-P 4115M, TRAFALGAR, PAJINGO PROJECT, QLD, AUSTRALIA, SECOND SIX MONTHLY REPORT FOR PERIOD ENDED 14.10.86.
4115	16506	Battle Mountain (Australia) Inc./Pajingo Gold Mine Pty Ltd	A-P 4115M, TRAFALGAR, REPORT FOR SIX MONTHS ENDED 14.04.86.
4115	17358	Battle Mountain (Australia) Inc./Pajingo Gold Mine Pty Ltd	A-P 4115M (TRAFALGAR), PAJINGO PROJECT, QLD, AUSTRALIA, FINAL REPORT.
4915	18214	Pan Australian Mining Ltd	ROCKY CREEK, A-P 4915M, SIX MONTHLY PROGRESS REPORT FOR THE PERIOD ENDED 6.03.88.
4915	19540	Pan Australian Mining Ltd	A-P 4915M, ROCKY CREEK, FIRST RELINQUISHMENT REPORT, FOR THE PERIOD ENDED 6.09.88.
4915	19818	Pan Australian Mining Ltd	ROCKY CREEK, A-P 4915M, SECOND SIX MONTHLY PROGRESS REPORT FOR THE PERIOD ENDED 6.09.88.
4915	20705	Pan Australian Mining Ltd	A-P 4915M, ROCKY CREEK, FINAL REPORT FOR THE PERIOD 7/9/87 TO 6/9/89
5508			No reports
5861			No reports
7189			No reports
7414			No reports
7507	23274	Nord Resources (Pacific) Pty Ltd, ACM Gold	EPM 7415, 7507, MOUNT TRAFALGAR - MOUNT REDAN JOINT VENTURE, WORK CONDUCTED PERIOD ENDING 31/7/91
7675	24351	Pancontinental Mining Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	EPM 3798 (BOLFES CREEK), 4430 (SUNRISE SPUR), 7676 (ROCKY CREEK), 8103 (BRACEBOROUGH), MOUNT WINDSOR PROJECT, PARTIAL RELINQUISHMENT



			REPORT FOR SUB-BLOCKS RELINQUISHED ON 22/9/92
7675	25900	Pancontinental Mining Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	EPM 4430 (SUNRISE SPUR), 7675 (ROCKY CREEK), 8103 (BRACEBOROUGH), 9277 (CELEBRATION), MOUNT WINDSOR PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS RELINQUISHED ON 22/9/93
8103	24351	Pancontinental Mining Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	EPM 3798 (BALFES CREEK), 4430 (SUNRISE SPUR), 7676 (ROCKY CREEK), 8103 (BRACEBOROUGH), MOUNT WINDSOR PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS RELINQUISHED ON 22/9/92
8103	25900	Pancontinental Mining Ltd, Outokumpu Australia Pty Ltd, Agip Australia Pty Ltd	EPM 4430 (SUNRISE SPUR), 7675 (ROCKY CREEK), 8103 (BRACEBOROUGH), 9277 (CELEBRATION), MOUNT WINDSOR PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS RELINQUISHED ON 22/9/93
8481	24307	Mt Leyshon Gold Mines Ltd	EPM 8481, TRAFALGAR, REPORT FOR THE TWELVE MONTHS ENDED 10/11/92
8481	25035	Mt Leyshon Gold Mines Ltd	EPM 7170 (HORSE CREEK), 7606 (CHARLEY-CLARKE), 7685 (WINDSOR EIGHT MILE), 8481 (TRAFALGAR RANGE), 8482 (SEVENTY MILE RANGE, 8629 (TROOPER CREEK EAST), 8816 (CLARKE EAST), 8839 (CLARKE CROSSING), 8889 (TWO MILE CREEK), COMBINED SUMMARY EXPLORATION
9250	25855	Mt Leyshon Gold Mines Ltd	EPM 9250, CLARKE, REPORT FOR THE TWELVE MONTHS ENDED 10/5/94
10257	28002	Mt Leyshon Gold Mines Ltd	EPM 10257, CLARKE, ANNUAL AND TOTAL RELINQUISHMENT REPORT FOR THE PERIOD ENDED 10/5/95
10380	28376	Mt Leyshon Gold Mines Ltd; Normandy Exploration Ltd	EPM 10380, DEADMAN CREEK, LANDSBERG PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS SURRENDERED NOVEMBER 1996
10380	28446	Mt Leyshon Gold Mines Ltd; Normandy Exploration Ltd	EPM 10150 (BETTS CREEK), 10380 (DEADMAN CREEK), LANDSBERG PROJECT, ANNUAL REPORT FOR THE TWELVE MONTHS ENDED 10/5/96
10380	29587	Normandy Mt Leyshon Ltd; Normandy Exploration Ltd	EPM 10380, DEADMAN CREEK, LANDSBERG PROJECT, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS SURRENDERED NOVEMBER 1997
10380	30372	Normandy Mt Leyshon Ltd; Normandy Exploration Ltd	EPM 10150 (BETTS CREEK), 10380 (DEADMAN CREEK), LANDSBERG PROJECT, COMBINED ANNUAL REPORT FOR THE PERIOD ENDING 4/7/97
10380	30414	Normandy Mt Leyshon Ltd; Normandy Exploration Ltd	EPM 10150 (BETTS CREEK), 10380 (DEADMAN CREEK), LANDSBERG PROJECT, COMBINED ANNUAL EXPLORATION REPORT FOR THE PERIOD ENDING 4/7/98
10380	30701	Normandy Mt Leyshon Ltd; Normandy Exploration Ltd	EPM 10380, DEADMAN CREEK, PARTIAL RELINQUISHMENT REPORT FOR SUB-BLOCKS SURRENDERED 12/12/98
10380	31477	Normandy Mt Leyshon Ltd; Normandy Exploration Ltd	EPM 9251 (TOWERS), 9693 (BARRINGTON), 10150 (BETTS CREEK), 10380 (DEADMAN CREEK), 11162 (BASALT RIVER), COMBINED ANNUAL AND FINAL

			REPORT FOR THE PERIOD JULY 1993 TO JUNE 1999
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### 3.3 Review of Historical Geophysical Data (2007-2008)

During the reporting year, historical geophysical data covering the Mount Windsor Volcanics Project area was forwarded to Southern Geoscience Consultants (SGC) for review. The data on these disks was originally collected or compiled by RGC who started to compile and review the data back in 1995. Figure 5 shows the historical airborne geophysical surveys found in the review.

Two of the historical airborne surveys covered parts of EPM 15197. The surveys were Rocky Creek and Braceborough. The data for these surveys were stitched together and presented to LTR as a working aeromagnetic data-set.

An open-file gravity survey by Australian Geological Survey Organisation (AGSO) was also recognized as having been carried out over the tenement area in 1996 as part of the Australian National Gravity Data Project (Charters Towers).

An edited version of SGC's report is presented as Appendix 1 (Morrell, 2008).

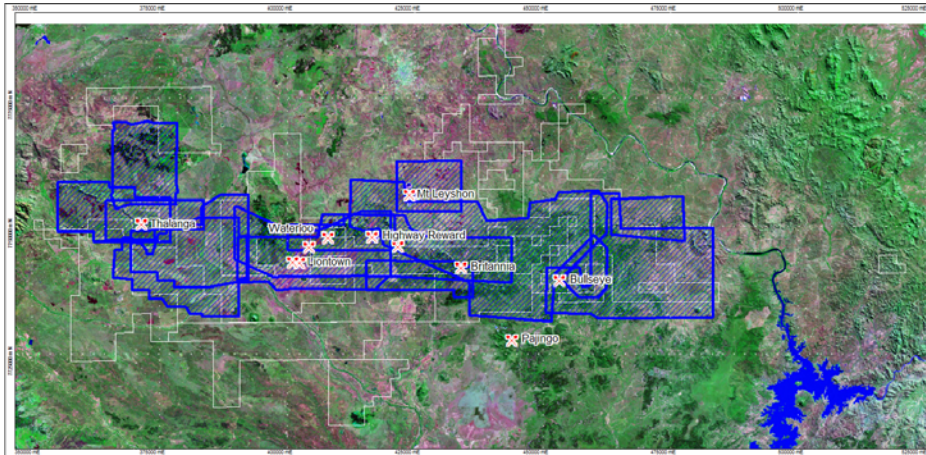


Figure 5. Location of historical aerial geophysics surveys (Morrell, 2008)

### 3.4 Regional Review and Evaluation (2007-2008)

By February 2008 a review of the targets and prospects of the MWV Project had been completed. Fifty one targets and prospects have been reviewed, summarized and ranked. None of the targets fell within EPM 15197.

### 3.5 Aerial Geophysical Survey (2007-2009)

An airborne survey using a Fletcher fixed wing aircraft was carried out by UTS Geophysics commenced on 27th July 2008 and was completed on 4 August 2008 – see Figure 3 for survey location. The Department of Mines and Energy survey number is 1240. The survey involved over 7,600 line kilometres of 100 m spaced line data at a 30-40 m flight height over EPM's 15102, 15192 and 15197. The programme collected TMI, radiometrics and DEM data. Survey specifications are shown in Table 4 and the full logistics report presented in Appendix 2.

Data was processed by Southern Geoscience Consultants from August-September 2008 and a list of MapInfo files was provided to LRL - Appendix 3 lists the files.

Table 4. Survey data acquisition specifications

<i>Project Name</i>	<i>Line Spacings</i>	<i>Line Direction</i>	<i>Tie Line Spacings</i>	<i>Tie Line Direction</i>	<i>Sensor Height</i>	<i>Total Line Km</i>
Mount Windsor Volcanics	100 m	000-180	1000 m	090-270	30 m	7,622

### 3.6 IKONOS Satellite Imagery (2007-2009)

Colour IKONOS satellite imagery of the area of LRL's granted tenures (including the entire area of EPM 15192) at 0.8m resolution, was captured on 11 July 2008 and supplied by AAMHatch Pty Ltd. The day of capture was cloud free and covered the entire tenement area. The imagery was supplied to LRL as 3-band Geotiff and ECW formats with corresponding georeference files.

The image will be used to support regional soil sampling, regolith and geological mapping, and other exploration planning requirements.

Ground survey control points for geo-referencing the image were captured with DGPS in September 2008.

Figure 6 shows the IKONOS image. Further information and metadata details are presented in Appendix 4.

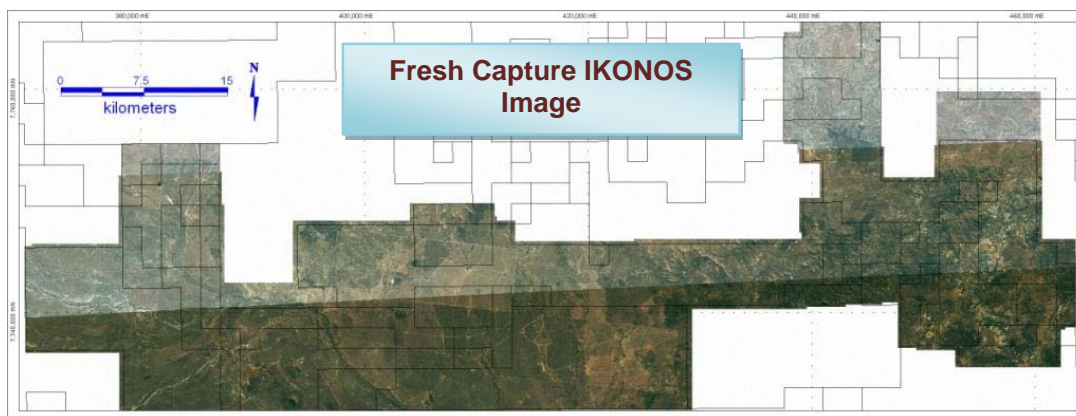


Figure 6. Fresh capture IKONOS Image

### 3.7 Aeromagnetic/Radiometric Interpretation (2008-2009);

In April 2009 John McIntyre completed a solid geological interpretation and ranking of possible gold/VHMS targets within the MWV district. His report is still draft format so relevant parts of this report are summarised in the following sections.

### 3.7.1 Solid Geological Interpretation

The interpretation across the project area is based on a new regional aeromagnetic and radiometric dataset, compiled from new data collected by LRL, plus historical mapping and some open-file data. A solid geology model through the Seventy Mile Range Group and granitoids in the Ravenswood Batholith was created.

The aims of the interpretation were to:

- identify gold exploration targets, based on both Carbo-Permian intrusive or epithermal models, and Siluro-Devonian granite-hosted Charters Towers style models; and
- identify VHMS style Cu-Zn-Pb-Ag-Au targets, principally in extensions or repeats of the critical Trooper Creek Formation within the Seventy Mile Range Group.

The targets are based on a solid geology interpretation. Basement to the sequence has been recognised in the Brook and Medicine Creek Complexes, included as xenoliths in the Batholith. Historically identified stratigraphic units in the Seventy Mile Range Group have been mapped across the project area, with the addition of a new unit, the Brumby Well Formation (mapped as dominantly basaltic and andesitic volcanic rocks), located above the Rollston Range Group.

Significant thrust stacking of stratigraphy has been identified across the southern part of the project area, creating repetition of Seventy Mile Range Group stratigraphy, and in particular, repetition of Mount Windsor Volcanics and Trooper Creek Stratigraphy in thrust-bound blocks.

The granitic portions of the Batholith have been subdivided into either basement complexes, or intrusions related either to the Ordovician Macrossan Province, the Siluro-Devonian Pama Province, or the Carbo-Permian Kennedy Igneous Province. In addition to granitic material a series of mafic igneous intrusions have been identified, over a larger area than surface mapping has previously indicated.

Numerous possible Carbo-Permian intrusions (or intrusion-related alteration zones) have been identified, and represent high-priority gold exploration targets for Mt Leyshon/Kidston/Mt Wright style intrusion-related or breccia-hosted gold deposits. The intrusions have been identified on the basis of the presence of:

- either a remanently magnetised intrusion, or magnetite-bearing alteration system around an intrusive body; or
- a positive magnetic anomaly, located along apparently Permo-Carboniferous age structures; or
- Topographic features associated with altered felsic intrusives.

A series of magnetic, demagnetised and/or potassic alteration zones have been outlined.

### 3.7.2 Structural Geological Interpretation

Six generations of structures have been identified, although often with subsequent generations reactivating earlier structures. The deformation events include, from the oldest:

- DX Deformation associated with basement complexes, not outlined in the interpretation;
- DES Extensional basin forming event controlling deposition of the Seventy Mile Range Group;
- D1 A series of generally NNE trending structures controlling the location of Ordovician granitoids- some possibly generated in or coeval with DES;
- D2 Generally south dipping, thrusts, producing repetition in the Seventy Mile Range Group;
- D3 A series of NNE trending faults, apparently reactivation of earlier D2 thrusts; and
- D4 Structures controlling deposition in the Drummond Basin and associated with the emplacement of Carbo- Permian intrusives. Note that the C-P intrusives may be emplaced in a later event (D5), but which has generally reactivated D4 structures.

### 3.7.3 Recommendation

The interpretation has covered the western two thirds of the extent of LRL's granted tenements or tenement applications, originally chosen because this area contained the most detailed aeromagnetics. The interpretation should be extended to the eastern third of the tenement area. Several known Carbo-Permian intrusions have been mapped in this area, including one with possible caldera fill sediments (the Scartwater Formation), and is associated with extensive anomalous gold in historical rock chip sampling.

## 3.8 Exploration Targeting (2008-2009)

From his aeromagnetic/radiometric data compilation and interpretation John McIntyre generated a number of exploration targets: gold and VHMS targets were identified for the eastern and central area of LRL's MWVP. On the relinquished area of EPM 15197, no targets for Permo-Carboniferous intrusion-related gold deposits were identified.

As a secondary focus, 2 blocks of stratigraphy prospective for VHMS style Cu-Zn-Pb-Ag-Au mineralisation were also identified within the tenement area: V-4 and V-5. A portion of these target areas have been relinquished without any work being done on them as this is not the primary exploration focus at this time, see Figure 3.

## 3.9 Aerial Photography (2008-2010)

The following aerial photographs for the MWVP listed in Table 5 were acquired as scans to fill gaps in the previously acquired Ikonos imagery and to provide stereoscopic coverage around targets checked in the initial field reconnaissance programme:

Table 5. Acquired aerial photographs for the MWVP

<i>100K Map Sheet</i>	<i>Run</i>	<i>Photos</i>	<i>Quantity</i>
Charters 8157/99	Run 7	73-79	7
	Run 8	22-29	8
	Run 9	227-231	5
	Run 10	177-180	4
	Run 12	67-77	11
	Run 13	26-35	10
	Run 14	173-183	11
Pajingo 8156/99	Run 1	120-136	17
Milray 8056/2003	Run 1	98-100	3
Ravenswood 8257/99	Run 11	120-124	5
	Run 12	80-84	5
	Run 13	17-22	6
	Run 14	187-192	6

The photos were delivered in two parts: Part 1 has been loaded onto the LRL server; Part 2 was collected and loaded in August 2009. The coverage does not cover all of the Project area, principally just holes in the Ikonos coverage over the granted tenements at this stage. No digital aerial photography was located on the CT server.

Flight Diagrams for the Milray, Homestead, Pajingo, Charters Towers, Harvet Home and Ravenswood 100K map sheets have been acquired, and copied to the data loading bay on LRL's Perth computer system.

#### 4 CONCLUSIONS

The area relinquished for EPM 15197 has been subject to a substantial amount of data compilation and review as part of LRL's MWVP. When the tenement was first granted the exploration focus was on base metal exploration but this focus has now changed to gold. Therefore, the portions relinquished that were identified from John McIntyre's 2008-2009 work as VHMS targets have not been further investigated by fieldwork/sampling and remain untested.

In terms of gold exploration no targets were identified in the relinquished area and therefore, no fieldwork/sampling was carried out.

## 5 REFERENCES

Bain, J. H. C. and Draper, J. J. (eds.), 1997: North Queensland geology, Australian Geological Survey, Bulletin 240/Queensland Geology 9.

Camuti, K., 2005: Bullion Minerals Limited Charters Towers Project Exploration data compilation August 2005. Unpublished Report for Bullion Minerals Limited.

Cody, A. D., 2010: Mount Windsor Volcanics Project geological and geochemical prospectivity, June 09 -January 2010, Report for Liontown Resources Limited by Terra Search Pty Ltd, pp47, unpublished.

Gunter, J., 2007: Mount Windsor Volcanics Project, NE Queensland open file data compilation update. Unpublished Report for Liontown Resources Limited.

Hall, G. J., 2010: Annual Report, Mount Windsor Volcanics Project EPM 15197 – Rollinson, for the period 30 August 2008 to 29 August 2009, Liontown Resources Ltd, unpublished.

Whitnall, I. W., Hutton, L. J., and Blight, R. L., 2003: North Queensland gold and base metal study, stage 2 data release – Charters Towers GIS, Geological Survey of Queensland, Department of Natural Resources and Mines, digital data released on CD-ROM.

## **APPENDIX 1**

### Historical Geophysical Data Compilation Report



**Liontown Resources Ltd**  
**MT WINDSOR VOLCANICS PROJECT**  
**Memo: Historical Geophysical Data Compilation**  
**February 2008**

**A. MORRELL**



**SOUTHERN GEOSCIENCE CONSULTANTS**

**SGC Report No. 1804**

<i>PROJECT NAME</i>	<i>MT WINDSOR VOLCANICS</i>
<i>CLIENT</i>	<i>LIONTOWN RESOURCES LIMITED</i>
<i>COUNTRY</i>	<i>AUSTRALIA</i>
<i>PROVINCE / STATE</i>	<i>QLD</i>
<i>METHOD KEYWORDS</i>	<i>IP; DHEM; AEROMAGNETICS; RADIOMETRICS; GRAVITY; EM; GROUND MAGNETICS; VERTICAL ELECTRICAL SOUNDINGS</i>
<i>COMMODITY</i>	<i>COPPER; LEAD; ZINC</i>
<i>1:100 000 MAP SHEET</i>	<i>HOMESTEAD (8057); CHARTERS TOWERS (8157); RAVENSWOOD (8257)</i>
<i>1:250 000 MAP SHEET</i>	<i>CHARTERS TOWERS (SF5502)</i>



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## Memorandum

**To: Doug Jones**  
**Level 2, 1292 Hay Street**  
**West Perth, WA 6005**

**From: Anne Morrell**

**Cc: James Patterson**

**Project: Mt Windsor Volcanics data compilation**

**Date: 14/02/2008**

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Doug,

Please find following a report on the results of the compilation of historical RGC data.

Kind regards,

Anne Morrell

### **INTRODUCTION**

Three discs of historical data were received from Liontown Resources. The data consisted primarily of geophysical work carried out by RGC in the mid 1990s on their properties in the greater Mt Windsor Volcanics area which includes the Thalanga, Highway-Reward and Liontown projects. SGC were commissioned to re-compile the data and, in particular, focus on locating historical IP data from the Liontown area. The survey locations were reported in a Terra Search compilation for Bullion Resources in 2005 and rumoured to have been digitised and modelled by RGC in the mid 1990s.

The results of this data compilation are presented here together with recommendations for further work. A digital copy of the re-compiled data accompanies this report and includes attributed GIS layers of the recovered ground and airborne geophysical survey outlines.

### **DATA COMPILATION AND DIRECTORY STRUCTURE**

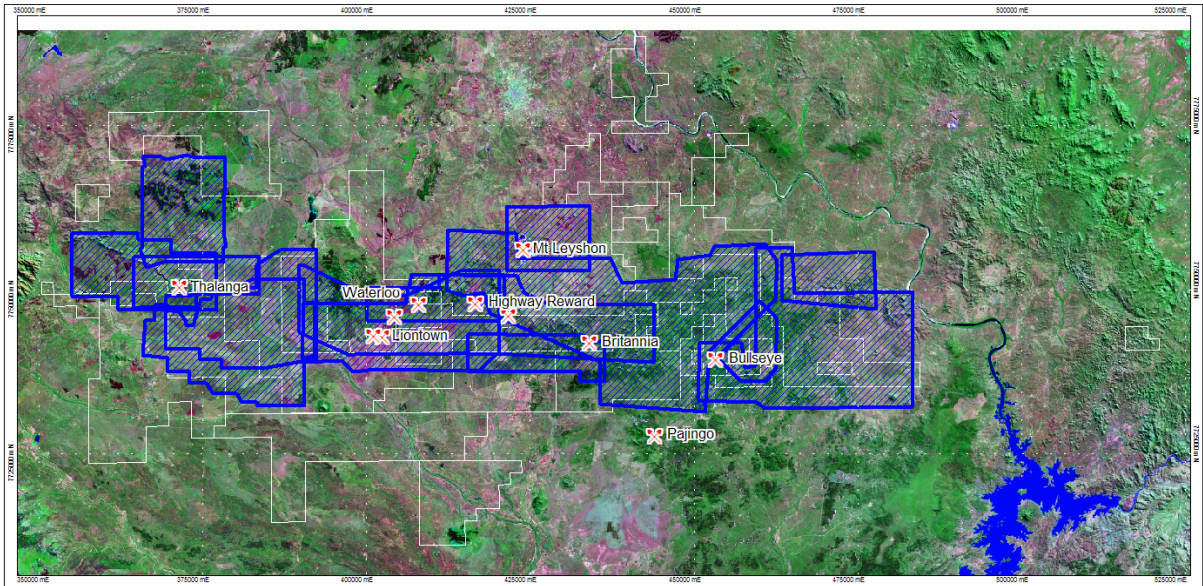
Data from the discs were systematically sorted through and identified. The data have been re-compiled by project area and then by method and data type. Aeromagnetic and other regional datasets form their own directories. The directory structure and folder contents are summarised in Table 1.

No further documentation or digitising to GIS has been carried out on data from the Thalanga, Highway Reward and Pentland projects as these fall outside of the Liontown tenement areas; this has been carried out on Liontown/Mt Windsor Volcanics data only and is discussed in the following sections.

## **GEOPHYSICAL DATA – MT WINDSOR VOLCANICS PROJECT**

### **Airborne Surveys**

Data from 14 aeromagnetic surveys have been recovered including two 50m spaced surveys and four 100m spaced surveys (Figure 1). The data comprise located magnetic data only and in the case where radiometric data were also collected (four surveys), this has not been found. Of the 14 surveys, eight are documented as open-file surveys, seven of which are included the state database however the digital data is registered as not available. Two surveys are confidential detailed (50m) surveys flown by RGC over the Thalanga and Highway Reward-Waterloo areas in 1997 and 1996 respectively. The remaining four surveys are previously known open-file surveys with obtainable data.



**Figure 1.** Outlines of the 14 airborne datasets recovered. Liontown tenements shown in white.

In ca. 1995, RGC commissioned Geomage in Brisbane to carry out a regional merge of the magnetic data (S. Mudge, pers. comm., September 2007). The resulting grids have been recovered in this compilation and indicate that the merge excluded the detailed 50m data. Geomage has since been contacted and has confirmed that they have the details of this job in their database and the data can be restored upon request. They also appear to have the radiometric data from the four surveys mentioned above that has not been recovered.

The outlines of these surveys have been digitised and attributed with their survey specifications into a GIS table. This is summarised in Table 2.

The recovery of these surveys is a significant result as they provide much higher resolution data coverage than previously known to Liontown Resources.

### **Ground Surveys**

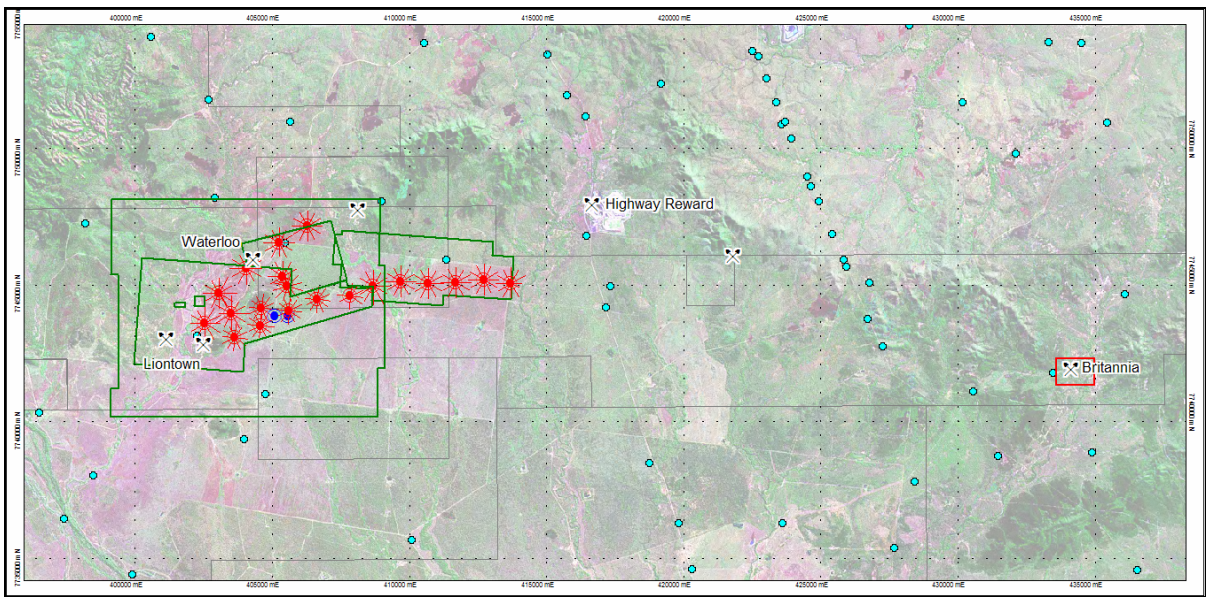
Limited ground geophysical data at Liontown has been recovered. Figure 2 [REDACTED]

[REDACTED] e:  
[REDACTED]  
[REDACTED]  
[REDACTED]



3. [REDACTED]

6. Gravity – A subset of located data from the open-file National Gravity Database. No new surveys have been identified.



**Figure 2.** [REDACTED]

**IP Data**

A primary aim of this compilation exercise was to locate the historical IP data over the Liontown area. These surveys were carried out mostly by Esso from 1974-1984 and Pan Con in 1992 [REDACTED]. The surveys were documented in a Terra Search metadata compilation for Bullion Minerals in 2005 (Beams, 2005) and it was believed that RGC had commissioned Zonge in the mid 1990s to digitise the original data from hardcopy and model it (S. Mudge, pers. comm., October 2007).

This data has not been found on the discs provided for this compilation. I subsequently contacted Zonge and had them perform an archive search. They located records of this job however it was only for the Highway Reward project; they had no record of completing this exercise at Liontown. A copy of this restored archive data was received from Zonge and was found to be a duplicate of DDIP data already recovered from the original discs.

I was then given the names of the RGC geologist (Craig Miller) and geophysicist (Chris Dauth) working the project at the time from Stephen Mudge (former RGC chief geophysicist). I contacted both of them for their recollection of the work completed and both confirmed that the digitising of the

historical IP and modelling was only ever completed at Highway Reward, never at Liontown (C. Dauth, writ. com., 11 February 2008; C. Miller, pers. com., 5 February 2008). All three, however, recalled the great success they had in drilling the resulting IP targets.

[REDACTED]

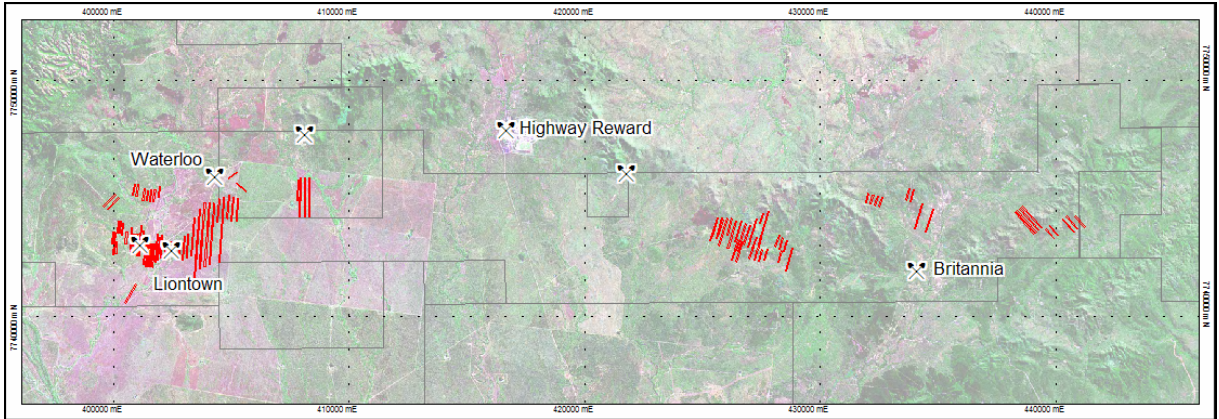


Figure 3. [REDACTED]

## **RECOMMENDATIONS**

Based on the results of this data compilation, the following recommendations are made for further geophysical work at the Mt Windsor Volcanics project.

1. Seek permission from the owners (Barrick) to acquire the detailed aeromagnetic and airborne radiometric data held at Geospatial. These surveys should be included in future merges. They should also be consulted when planning new surveys in the area so as not to re-fly areas unnecessarily.
2. Digitise and model, with current techniques, the historical IP data across the Liontown area and other prospects if of interest. This will require acquiring the relevant historical reports. These can be sourced via QDEX, the Queensland Department of Mines and Energy online exploration reporting database, or possibly Simon Beams of Terra Search who was a project geologist for Esso at the time.
3. Model the radial downhole IP with current techniques.
4. Consider the use of the gravity method for detecting dense sulfide mineralisation.

## **REFERENCES**

Beams, S. D., 2005. Report on Metadata to Accompany Polygons of Historical Surveys for Mt Windsor Volcanic Belt, Bullion Minerals Ltd EPM14161. Document #16776.1005, TS Shelf Ref #2005/7. Prepared by Terra Search Pty Ltd, Townsville, QLD, Australia. 87 p.

Peters, W. S., 2008. Core Physical Property Tests, Liontown Project. SGC Report #1800. Prepared by Southern Geoscience Consultants Pty Ltd, Perth, WA, Australia. 22 p.

**Table 1.** Directory structure of re-compiled data with data summaries.

\ AMAG		
\ Braceborough	\ Data	: Binary database of full located magnetic data (*.ANX). Data extracted to ASCII by SGC.
	\ Geotiffs	: Created by SGC from original ERMMapper grids. Registration files included.
	\ Grids	: Original ERMMapper grid of magnetics.
\ GIS		: ERMMapper vector and DXF files of aeromagnetic survey boundaries. DXF converted to MapInfo TAB by SGC.
\ Regional Grids		: ERMMapper grid of regional TMI magnetics.
\ Regional Mt Windsor Merge	\ ERMMapper	: ERMMapper vector and algorithm files.
	\ Grids	: Original ERMMapper grids of merged magnetics.
	\ Images	: JPG and BMP images of merged magnetics with MapInfo TAB files.
\ Rocky Creek	\ Data	: Binary database of full located magnetic data (*.ANX). Data extracted to ASCII by SGC.
	\ Geotiffs	: Created by SGC from original ERMMapper grid. Registration files included.
	\ Grids	: Original ERMMapper grid of magnetics.





Table 2. Survey specification summary of discovered airborne magnetic-radiometric data.

Survey Name	Owner / Company / Source	Contractor	Flown For	Date Flown	Data Format	Data Type	Line Bearing	Line Spacing	Flying Height	MAG Data	RAD Data	DTM Data	Gravity Data	EM Data	Confidential	Comments
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
Braceborough	Open file	Geotrex Pty Ltd	CRA Exploration Ltd	30/11/1983	LDT & GDT	MAG,RAD	0	200	0	T	T	F	F	F	F	Included in 2005 Bullion regional merge.
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
Rocky Creek	Open file	Aerodata Holdings Ltd	Pan Australian Exploration Pty Ltd	1/01/1988	LDT & GDT	MAG RAD	0	200	60	T	T	F	F	F	F	Included in 2005 regional merge.
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	0	200	0	T	T	F	F	F	F	[REDACTED]

## **APPENDIX 2**

### **Aeromagnetic/Radiometric Survey Logistics Report**



**Logistics Report**

for a

**DETAILED AIRBORNE  
MAGNETIC, RADIOMETRIC AND  
DIGITAL TERRAIN SURVEY**

for the

**CHARTERS TOWERS PROJECTS**

carried out on behalf of

**LIONTOWN RESOURCES LTD**

(UTS Job #B040)

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**UTS GEOPHYSICS**  
High Resolution Airborne Surveys



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## 1 GENERAL SURVEY INFORMATION

UTS Geophysics conducted a low level airborne geophysical survey for the following company:

Liontown Resources Ltd  
Level 2, 1292 Hay Street  
West Perth WA 6005

Acquisition for this survey commenced on the 27<sup>th</sup> July 2008 and was completed on the 4<sup>th</sup> August 2008. The base location used for operating the aircraft and performing in-field quality control was Charters Towers, Queensland.

## 2 SURVEY SPECIFICATIONS

The area surveyed was approximately 50km southwest of Charters Towers in Queensland. The survey was flown using the MGA94 coordinate system (a Universal Transverse Mercator projection) derived from the Geocentric Datum of Australia and was contained within zone 55 with a central meridian of 147 degrees. Details of the datum and projection system are provided in Appendix B of this report. Survey boundary coordinates are listed in Appendix C.

The survey data acquisition specifications for each area flown are specified in the following table:

PROJECT NAME	LINE SPACING	LINE DIRECTION	TIE LINE SPACING	TIE LINE DIRECTION	SENSOR HEIGHT	TOTAL LINE KM
Charters Towers	100m	000-180	1000m	090-270	30m	7,622
<b>TOTAL</b>						<b>7,622</b>

The specified sensor height for the magnetic samples is as stated in the above table. This sensor height may be varied where topographic relief or laws pertaining to built up areas do not allow this altitude to be maintained, or where the safety of the aircraft and equipment is endangered.

### 3 AIRCRAFT AND SURVEY EQUIPMENT

The UTS navigation flight control computer, data acquisition system and geophysical sensors were installed into a specialised geophysical survey aircraft.

The list of geophysical and navigation equipment used for the survey is as follows:

#### **General Survey Equipment**

- FU24 – 954 fixed wing survey aircraft.
- UTS proprietary flight planning and survey navigation system.
- UTS proprietary high speed digital data acquisition system.
- Novatel 3951R, 12 channel precision navigation GPS.
- OMNILITE 132 real time differential GPS system.
- UTS LCD pilot navigation display and external track guidance display.
- UTS post mission data verification and processing system.
- Bendix King KRA-405 radar altimeter.

#### **Magnetic Data Acquisition Equipment**

- UTS tail stinger magnetometer installation.
- Scintrex Cesium Vapour CS-2 total field magnetometer.
- Fluxgate three component vector magnetometer.
- RMS Aeromagnetic Automatic Digital Compensator (AADC II).
- Diurnal monitoring magnetometer (Scintrex Envimag).

#### **Radiometric Data Acquisition Equipment**

- Exploranium GR-820 gamma ray spectrometer.
- Exploranium gamma ray detectors.
- Barometric altimeter (height and pressure measurements).
- Temperature and humidity sensor.

### 3.1 Survey Aircraft

The aircraft used for this survey was a FU24 – 950 series fixed wing survey aircraft, owned and operated by UTS Geophysics, registration VH-UTR. The specifications are as follows:

#### Power Plant

- Engine Type                      Single engine, Lycoming, IO-720
- Brake Horse Power      400 bhp
- Fuel Type                              AV-GAS

#### Performance

- Cruise speed                      105 Kn
- Survey speed                      100 Kn
- Stall speed                              45 Kn
- Range                                      970 Km
- Endurance (no reserves)      5.6 hours
- Fuel tank capacity                      490 litres



### 3.2 Data Positioning and Flight Navigation

Survey data positioning and flight line navigation was derived using real-time differential GPS (Global Positioning System).

Navigation was performed using a UTS designed and built electronic pilot navigation system providing computer controlled digital navigation instrumentation mounted in the cockpit as well as an externally mounted track guidance system.

GPS derived positions were used to provide both aircraft navigation and survey data location information.

The GPS systems used for the survey were:

- Aircraft GPS Model                      Novatel 3951R
- Sample rate                              0.5 Seconds (2 Hz)
- GPS satellite tracking channels      12 parallel
- Typical differentially corrected accuracy      1-2 metres (horizontal)  
3-5 metres (vertical)

### 3.3 *UTS Data Acquisition System and Digital Recording*

All geophysical sensor data and positional information measured during the survey was recorded using a UTS developed, high speed, precision data acquisition system. Survey data was downloaded onto magnetic tape on completion of each survey flight.

Instrument synchronisation times were measured and removed in real-time by the UTS data acquisition system.

### 3.4 *Altitude Readings*

Accurate survey heights above the terrain were measured using a King radar altimeter installed in the aircraft. The height of each survey data point was measured by the radar altimeter and stored by the UTS data acquisition system.

- Radar altimeter models            Bendix/King KRA-405
- Accuracy                                0.3 metres
- Resolution                              0.1 metres
- Range                                    0 - 500 metres
- Sample rate                            0.1 Seconds (10Hz)

The digital terrain model is calculated by subtracting the terrain clearance (radar altimeter) from the GPS height (interpolated to 0.1 Hz), and as such the accuracy is constrained by the differentially corrected GPS position.

### 3.5 *UTS Stinger Mounted Magnetometer System*

The installation platform used for the acquisition of magnetic data was a tail mounted stinger. This proprietary stinger system was constructed of carbon fibre and designed for maximum rigidity and stability.

Both the total field magnetometer and three component vector magnetometer were located within the tail stinger.





### 3.6 *Total Field Magnetometer*

Total field magnetic data readings for the survey were made using a Scintrex Cesium Vapour CS-2 Magnetometer. This precision sensor has the following specifications:



- Model Scintrex Cesium Vapour CS-2 Magnetometer
- Sample Rate 0.1 seconds (10Hz)
- Resolution 0.001nT
- Operating Range 15,000nT to 100,000nT

### 3.7 *Three Component Vector Magnetometer*

Three component vector magnetic data readings for the survey were made using a Develco Fluxgate Magnetometer. This precision sensor has the following specifications:

- Model Develco Fluxgate Magnetometer
- Sample Rate 0.1 seconds (10Hz)
- Resolution 0.1nT
- Operating Range -100,000nT to 100,000nT

### 3.8 *Aircraft Magnetic Compensation*

At the start of the survey, the system was calibrated for reduction of magnetic heading error. The heading and manoeuvre effects of the aircraft on the magnetic data was removed using an RMS Automatic Airborne Digital Compensator (AADC II).

Calibration of the aircraft heading effects were measured by flying a series of pitch, roll and yaw manoeuvres at high altitude while monitoring changes in the three axis magnetometer and the effect on total field readings. A 26 term model of the aircraft magnetic noise covering permanent, induced and eddy current fields was determined. These coefficients were then applied to the data collected during the survey in real-time.

UTS static compensation techniques were also employed to reduce the initial magnetic effects of the aircraft upon the survey data.

### 3.9 *Diurnal Monitoring Magnetometer*

A base station magnetometer was located in a low gradient area beyond the region of influence of any man made interference to monitor diurnal variations during the survey.

The specifications for the magnetometer used are as follows:

- Model Scintrex Envimag
- Resolution 0.1 nT
- Sample interval 5 seconds (0.2 Hz)
- Operating range 20,000nT to 90,000nT
- Temperature -20°C to +50°C



### 3.10 *Barometric Altitude*

An Air DB barometric altimeter was installed in the aircraft so as to record and monitor barometric height and pressure. The data was recorded at 0.10 second intervals and is used for the reduction of the radiometric data.

- Model Air DB barometric altimeter
- Accuracy 2 metres
- Height resolution 0.1 metres
- Height range 0 - 3500 metres
- Maximum operating pressure: 1,300 mb
- Pressure resolution: 0.01 mb
- Sample rate 10 Hz

### 3.11 Temperature and Humidity

Temperature and humidity measurements were made during the survey at a sample rate of 10Hz. Ambient temperature was measured with a resolution of 0.1 degree Celsius and ambient humidity to a resolution of 0.1 percent.

### 3.12 Radiometric Data Acquisition

The gamma ray spectrometer used for the survey was capable of recording 256 channels and was self stabilising in order to minimise spectral drift. The detectors used contain thallium activated sodium iodide crystals.

Thorium source measurements were made each survey day to monitor system resolution and sensitivity. A calibration line was also flown at the start and end of each survey day to monitor ground moisture levels and system performance.

Spectrometer model	Exploranium GR820
• Detector volume	32 litres
• Sample rate	1 Hz



## 4 PROJECT MANAGEMENT

Liontown Resources Ltd

Mike Sexton  
Paul Dale

UTS Geophysics Perth Office

Nino Tuffili  
David Abbott  
Cameron Johnston  
Rebecca Steadman

## 5 DATA PROCESSING PROCEDURES

### 5.1 *Data Pre-processing*

The raw survey data was loaded from the field tapes and the recorded data trimmed to the correct survey boundary extents. Any survey lines subsequently re flown were removed from the dataset.

At the commencement of each acquisition flight, all the instrumentation clocks were synchronized to local time, and the error and latency of each instrument in providing its data measurement calculated. The results of these latency measurements were recorded into a synchronisation file, and the results used to assign GPS positions to the magnetic, radiometric and elevation data. Any residual parallax was removed via correlation software.

The synchronized, parallax corrected data was then exported as located ASCII data.

## **5.2 Magnetic Data Processing**

The diurnal base station data was checked for spikes and steps, and suitably filtered prior to the removal of diurnal variations from the aircraft magnetic data.

The filtered diurnal measurements were subtracted from the diurnal base field and the residual corrections applied to the survey data by synchronising the diurnal data time and the aircraft survey time. The average diurnal base station value was added to the survey data.

The X and Y positioning of the data was then checked for spikes before applying the IGRF correction. Any spikes in the positions were manually edited. The updated IGRF 2005 correction was calculated at each data point (taking into account the height above sea level).

This regional magnetic gradient was subtracted from the survey data points.

Tie line levelling was applied to the data by least squares minimisation, using a polynomial fit of order 0, of the differences in magnetic values at the crossover points of the survey traverse and tie line data.

In order to remove any residual long wavelength variations in the tie line levelled data along the traverse lines, polynomial levelling was then applied.

Final micro-levelling techniques were then selectively applied to the tie line levelled data to remove minor residual variations in profile intensity

Located and gridded data were generated from the final processed magnetic data.

### 5.3 Radiometric Data Processing

Statistical noise reduction of the 256 channel data was performed using the Noise Adjusted Singular Variable Decomposition (NASVD) method described by Hovgaard and Grasty (1997).

Noise-adjusted singular value decomposition is performed, and the number of components to be used is determined by inspection of plots of the spectral components and by a statistical analysis of the contributions of the components. If the spectral shapes show any unusual characteristics, further analysis of the concentrations of the spectral components in the line data is performed in order to identify and eliminate any corrupt spectra. If such spectra were eliminated, the NASVD process is re-performed, in order to obtain spectral components free of any bias from corrupt spectra.

Only the dominant spectral shapes (identified as described above) were used in the spectral reconstruction process. The first 8 NASVD components were used for this process.

Channels 30-250 only are spectrally smoothed, as these contain the regions of interest and are not dominated by the lower end of the Compton continuum. The energy spectrum between the potassium and thorium peaks was recalibrated from the spectrally smoothed 256 channel measurements.

The aircraft background spectrum and the scaled unit cosmic spectrum were then subtracted from the 256 channel data. This 256 channel data was then windowed to the 5 primary channels of total count, potassium, uranium, thorium and low-energy uranium. Dead time corrections were then applied to the data. Radon background removal was performed using the Minty Spectral Ratio method (1992).

The radar altimeter data was corrected to standard temperature and pressure, and height corrected spectral stripping was then applied to the windowed data. Height attenuation corrections based on the STP radar altimeter were then performed to remove any altitude variation effects from the data.

The Uranium and Total Count channels were tie-levelled to remove the effects of residual radon background. The tie-levelling process employed was a least-squares/median filter procedure, which generated a single correction for each line of data. Mis-matches were calculated at each tie-traverse intersection and the median mismatch for each flight line was calculated as the residual levelling error for that line.

Final micro-levelling techniques were then selectively applied to the tie line levelled data to remove minor residual variations in profile intensities, as per the method outlined for magnetic data micro-levelling in 7.2 above.

#### **5.4 Digital Terrain Model Data Processing**

The radar altimeter data was subtracted from the GPS altimeter data leaving digital terrain data.

The digital terrain data thus derived was tie line levelled and gridded. Tie line levelled data was then examined and selectively microlevelled to produce a grid without line dependent artifacts.

**For further information concerning the survey flown, please contact the following office:**

**Head Office Address:**

UTS Geophysics  
Fauntleroy Avenue, Perth Airport  
REDCLIFFE WA 6104

Tel: +61 8 9479 4232  
Fax: +61 8 9479 7361

**Postal Address:**

UTS Geophysics  
P.O. Box 126  
BELMONT WA 6984

**Quoting reference number: B040**



## 6 APPENDIX A - LOCATED DATA FORMATS

### MAGNETIC LOCATED DATA

-----			
FIELD FORMAT DESCRIPTION			UNITS
-----			
1	I8	LINE NUMBER	
2	I4	FLIGHT/AREA NUMBER	AAFF (Area/Flight)
3	I9	DATE	YYMMDD
4	F10.1	TIME	sec
5	I8	FIDUCIAL NUMBER	
6	I4	UTM ZONE	
7	F12.6	LATITUDE (WGS84)	degrees
8	F12.6	LONGITUDE (WGS84)	degrees
9	F12.2	EASTING (MGA94)	metres
10	F12.2	NORTHING (MGA94)	metres
11	F8.1	RADAR ALTIMETER HEIGHT	metres
12	F8.1	GPS HEIGHT (WGS84)	metres
13	F8.1	TERRAIN HEIGHT (WGS84)	metres
14	F10.2	RAW MAGNETIC INTENSITY	nT
15	F10.2	DIURNAL CORRECTED TMI	nT
16	F10.2	DIURNAL AND IGRF CORRECTED TMI	nT
17	F10.2	TIE LINE LEVELLED TMI	nT
18	F10.2	FINAL TOTAL MAGNETIC INTENSITY	nT
-----			

**RADIOMETRIC LOCATED DATA**

FIELD FORMAT DESCRIPTION			UNITS
1	I8	LINE NUMBER	
2	4	FLIGHT/AREA NUMBER	AAFF (Area/Flight)
3	I9	DATE	YYMMDD
4	F10.1	TIME	sec
5	I8	FIDUCIAL NUMBER	
6	I4	UTM ZONE	
7	F12.6	LATITUDE (WGS84)	degrees
8	F12.6	LONGITUDE (WGS84)	degrees
9	F12.2	EASTING (MGA94)	metres
10	F12.2	NORTHING (MGA94)	metres
11	F8.1	RADAR ALTIMETER HEIGHT	metres
12	F8.1	GPS HEIGHT (WGS84)	metres
13	I5	LIVE TIME	milli sec
14	F8.1	PRESSURE	hPa
15	F6.1	TEMPERATURE	Degrees Celcius
16	F6.1	HUMIDITY	percent
17	I6	TOTAL COUNT (RAW)	Counts/sec
18	I6	POTASSIUM (RAW)	Counts/sec
19	I6	URANIUM (RAW)	Counts/sec
20	I6	THORIUM (RAW)	Counts/sec
21	I6	COSMIC (RAW)	Counts/sec
22	F8.1	TOTAL COUNT (CORRECTED)	Counts/sec
23	F8.1	POTASSIUM (CORRECTED)	Counts/sec
24	F8.1	URANIUM (CORRECTED)	Counts/sec
25	F8.1	THORIUM (CORRECTED)	Counts/sec
26	F9.4	DOSE RATE	nGy/hr
27	F9.4	POTASSIUM GRND CONCENTRATION	%
28	F9.4	URANIUM GRND CONCENTRATION	ppm
29	F9.4	THORIUM GRND CONCENTRATION	ppm

## GRIDDED DATASET FORMATS

Gridding was performed using a bicubic spline algorithm.

The following grid formats have been provided:

- ER-Mapper format

## LINE NUMBER FORMATS

Line numbers are identified with a six digit composite line number and have the following format - AALLLLB, where:

A or AA	Survey area number
LLLL	Survey line number 0001-8999 reserved for traverse lines 9001-9999 reserved for tie lines
B	Line attempt number, 0 is attempt 1, 1 is attempt 2 etc..

## UTS FILE NAMING FORMATS

Located and gridded data provided by UTS Geophysics uses the following 8 character file naming convention to be compatible with PC DOS based systems.

File names have the following general format - JJJJAABB.EEE, where:

JJJJ	UTS Job number
AA	Area number if the survey is broken into blocks
BB	M     Magnetic data R     Radiometric data TC    Total count data K     Potassium counts U     Uranium counts Th    Thorium counts DT    Digital terrain data
EEE	File name extension DAT   Located digital data file DFN   Located data definition file ERS   Ermapper gridded data header file Ermapper data portion has no extension GRD   Geosoft gridded data file

## 7 APPENDIX B - COORDINATE SYSTEM DETAILS

Locations for the survey data are provided in both geographical latitude and longitude and Universal Transverse Mercator metric projection coordinate systems.

**WGS84**  
Coordinate Type  
Semi Major Axis  
Flattening

World Geodetic System 1984  
Geographical  
6378137m  
1/298.257223563

**MGA94**  
Coordinate type  
Geodetic datum  
Semi major axis  
Flattening

Map Grid of Australia 1994  
Universal Transverse Mercator Projection Grid  
Geocentric Datum of Australia  
6378137m  
1/298.257222101

## 8 APPENDIX C - SURVEY BOUNDARY DETAILS

### COORDINATES REPORT

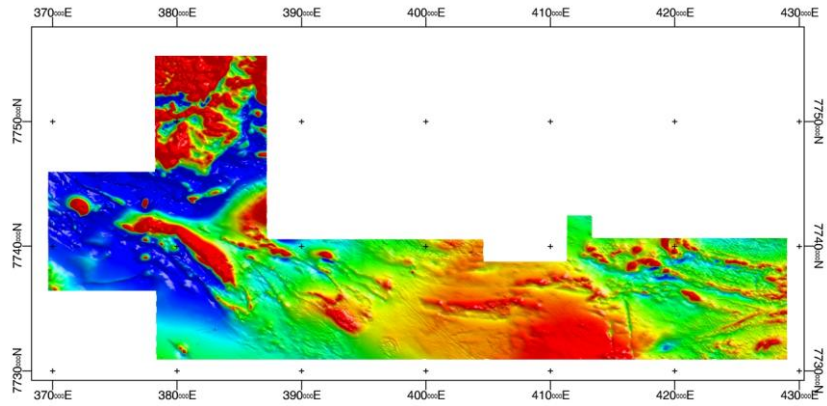
Job ID code: B040  
Client: Liantown Resources  
Job: Charters Towers  
Grid Zone: 55  
Include Point: 0.0 0.00

Surround

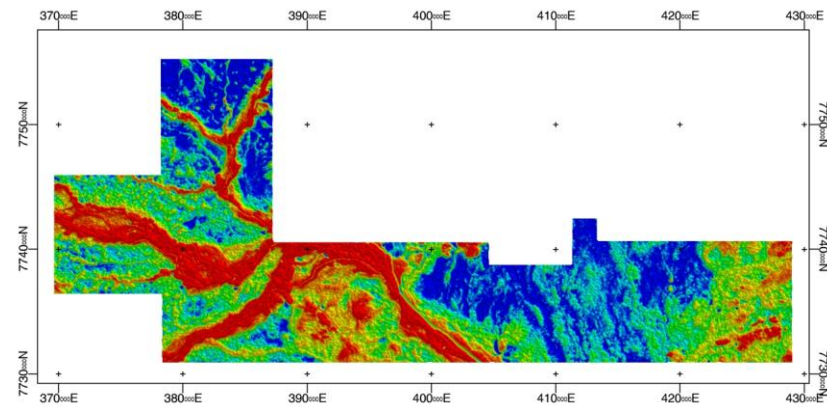
369600.000	7745900.000
378200.000	7745900.000
378200.000	7755200.000
387200.000	7755200.000
387200.000	7740500.000
404600.000	7740500.000
404600.000	7738700.000
411300.000	7738700.000
411300.000	7742400.000
413300.000	7742400.000
413300.000	7740600.000
429000.000	7740600.000
429000.000	7731000.000
378300.000	7731000.000
378300.000	7736500.000
369600.000	7736500.000
369600.000	7745900.000

# 9 APPENDIX D - PROJECT DATA OVERVIEW

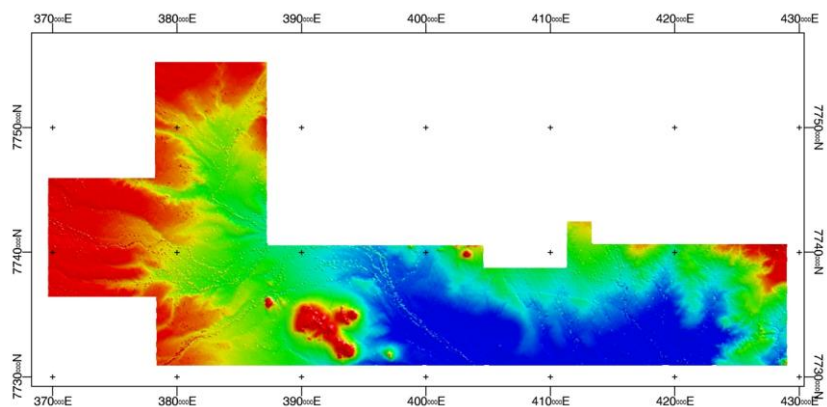
## Charters Towers Project



Total Magnetic Intensity



Radiometric Total Count



Digital Terrain Model

## APPENDIX E – PROCESSING PARAMETERS

### Magnetic Processing Parameters

IGRF Date: IGRF 2008.58  
 Average Declination: 7.82 degrees  
 Average Inclination: -49.98 degrees  
 Average Field strength: 50.083 nT  
 Average diurnal: 50.000 nT

### Radiometric Processing Parameters

#### *Height Attenuation Coefficients*

Total Count: -0.0074  
 Potassium: -0.0094  
 Uranium: -0.0084  
 Thorium: -0.0074

#### *Cosmic Correction Coefficients*

Total Count: 0.7407  
 Potassium: 0.0386  
 Uranium: 0.0340  
 Thorium: 0.0405

#### *Aircraft Background Coefficients*

Total Count: 56.791  
 Potassium: 9.533  
 Uranium: 0.9167  
 Thorium: 0.6254

#### *Sensitivity Coefficients*

Total Count: 45.4 cps/dose rate  
 Potassium: 193 cps/%k  
 Uranium: 17.2 cps/ppm  
 Thorium: 9 cps/ppm

***Final Reduction*** - All data reduced to STP height datum 30m

## **APPENDIX 3**

### List of MapInfo Files



# LIONTOWN RESOURCES LTD

## MOUNT WINDSOR VOLCANICS

### MapInfo Files

#### Contours @ 1:25,000

- MtW\_TMI\_25kConts - TMI Contours (Interval @ 10, 50, 250, 1000 nT)
- MtW\_RTP\_25kConts - TMI RTP Contours (Interval @ 10, 50, 250, 1000 nT)
- MtW\_RTP1VD\_25kConts - RTP FVD Contours (Interval @ 0.25, 1, 5 nT/m)
- MtW\_DTM\_25kConts - Digital Elevation Contours (Interval @ 1, 5, 25 m)
- MtW\_TC\_25kConts - Total Count Contours (Interval @ 100, 500, 2500 cps)

#### Geotiffs

- MtWindsor\_AnSig\_N\_shadeNL - Analytic Signal Image (NL) Shaded with 50% N Gradient
- MtWindsor\_AnSig\_N\_shadeL - Analytic Signal Image (Lin) Shaded with 50% N Gradient
- MtWindsor\_RTP\_1\_greyNL - RTP Image (NL) Greyscale with N, NE, E, or SE Gradient
- MtWindsor\_RTP\_AGCgreyNL - RTP Image (NL) AGC Greyscale
- MtWindsor\_RTP\_GradCombNL - RTP Image (NL) Gradient Combination (Blue = NE, Green = E, Red = SE)
- MtWindsor\_RTP\_N\_shadeNL - RTP Image (NL) Shaded with 50% N Gradient
- MtWindsor\_RTP\_1\_AGCshadeL - RTP Image (Lin) Shaded with 50% N, NE, E, or SE AGC Gradient
- MtWindsor\_RTP\_1\_AGCshadeNL - RTP Image (NL) Shaded with 50% N, NE, E, or SE Gradient
- MtWindsor\_RTP\_1VD\_AGCshade75L - RTP Image (Lin) Shaded with 75% 1VD AGC
- MtWindsor\_RTP\_2VD\_AGCshade75L - RTP Image (Lin) Shaded with 75% 2VD AGC
- MtWindsor\_RTP2VD\_greyNL - RTP 2VD Image (NL) Greyscale
- MtWindsor\_RTP2VD\_AGCgreyNL - RTP 2VD Image (NL) AGC Greyscale
- MtWindsor\_RTP1VD\_greyNL - RTP 1VD Image (NL) Greyscale
- MtWindsor\_RTP1VD\_N\_shadeNL - RTP 1VD Image (NL) Shaded with 50% N Gradient
- MtWindsor\_RTP1VD\_1\_AGCshadeL - RTP 1VD Image (Lin) Shaded with 50% N, NE, E, or SE AGC Gradient
- MtWindsor\_RTP1VD\_1\_AGCshadeNL - RTP 1VD Image (NL) Shaded with 50% N, NE, E, or SE AGC Gradient
- MtWindsor\_RTPTilt\_1\_AGCshadeL - RTP Tilt Angle Image (Lin) Shaded with 50% N, NE, E, or SE AGC Gradient
- MtWindsor\_TMI\_N\_greyNL - TMI Image (NL) Greyscale with N Gradient
- MtWindsor\_TMI\_N\_shadeNL - TMI Image (NL) Shaded with 50% N Gradient
- MtWindsor\_TMI\_N\_AGCshadeL - TMI Image (Lin) Shaded with 50% N AGC Gradient
- MtWindsor\_TMI\_N\_AGCshadeNL - TMI Image (NL) Shaded with 50% N AGC Gradient
- MtWindsor\_TMI1VD\_N\_shadeNL - TMI 1VD Image (NL) Shaded with 50% N Gradient
- MtWindsor\_TMI1VD\_N\_AGCshadeL - TMI 1VD Image (Lin) Shaded with 50% N AGC Gradient
- MtWindsor\_TMI1VD\_N\_AGCshadeNL - TMI 1VD Image (NL) Shaded with 50% N AGC Gradient
- MtWindsor\_TC\_N\_shadeL - Total Count Image (Lin) Shaded with 50% N Gradient
- MtWindsor\_K\_N\_shadeL - Potassium Image (Lin) Shaded with 50% N Gradient
- MtWindsor\_Th\_N\_shadeL - Thorium Count Image (Lin) Shaded with 50% N Gradient
- MtWindsor\_U100\_N\_shadeL - Uranium Count Image (Lin) No Clip Shaded with 50% N Gradient
- MtWindsor\_UClip\_N\_shadeL - Uranium Count Image (Lin) 1%-99% Clip Shaded with 50% N Gradient
- MtWindsor\_UTh\_N\_shadeL - Uranium / Thorium Ratio Image (Lin) Shaded with 50% N Gradient
- MtWindsor\_KTh\_N\_shadeL - Potassium / Thorium Ratio Image (Lin) Shaded with 50% N Gradient
- MtWindsor\_Ternary\_L - Ternary Radiometric Image (Lin) – Blue = U, green = TH, red = K

<sup>1</sup> Multiple images with the indicated shading: N, NE, SE or E

- MtWindsor\_Ternary\_NL - Ternary Radiometric Image (NL) – Blue = U, green = TH, red = K
- MtWindsor\_Ternary\_N\_TCshadeNL - Ternary Radiometric Image (NL) – Blue = U, green = TH, red = K shaded with 50% N Total Count Gradient
- MtWindsor\_Ternary\_N\_TCshadeL - Ternary Radiometric Image (Lin) – Blue = U, green = TH, red = K shaded with 50% N Total Count Gradient
- MtWindsor\_DTM\_N\_shadeL - Digital Terrain Image (Lin) Shaded with 50% N Gradient

## Image Details

### Magnetic Images

#### Top Left Coordinate:

369575 mE, 7755300 mN

Cell Size = 25 m

Lines = 980

Pixels = 2382

### Radiometric Images

#### Top Left Coordinate:

369575 mE, 7755300 mN

Cell Size = 25 m

Lines = 980

Pixels = 2382

### DTM Image

#### Top Left Coordinate

369575 mE, 7755300 mN

Cell Size = 25 m

Lines = 980

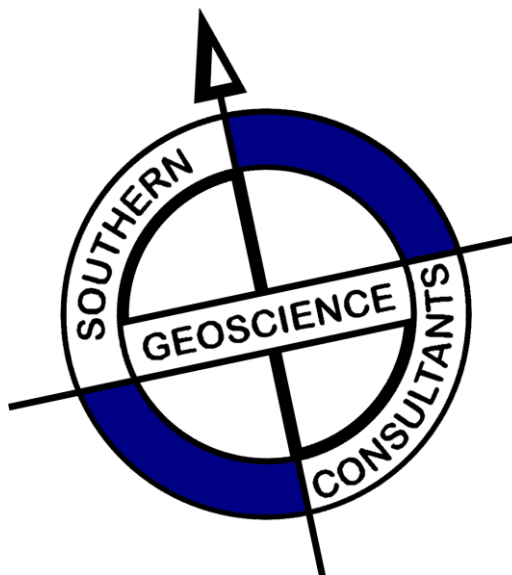
Pixels = 2382

## CO-ORDINATE SYSTEM

- *GDA94 Datum*
- *MGA Zone 55*
- *Southern Hemisphere*

## PROCESSING DETAILS

- *347 Mb*
- *17 September 2008*
- *SGC*



## **APPENDIX 4**

IKONOS metadata files list



**LIONTOWN RESOURCES**

**LIONTOWN SATELLITE IMAGE 11.07.08**

**VOLUME 888C0152\_Liontown NOB**

**Summary**

**Project**

Colour IKONOS satellite imagery was captured over the Liontown area on 11 July 2008 and delivered to the client on the 18 November 2008.

**Data**

The imagery is supplied in 3 Band GeoTiff and ECW with corresponding georeference files.

The processed imagery is georeferenced to GDA94 MGA55.

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## 1. DATA INSTALLATION

Data format : GeoTiff, ECW  
Number & type of media : One 4.7GB DVD-ROM  
Number of files on media : 119x data, 2 x metadata/license,  
1 x Readme\_888c0152\_Liontown NOB.PDF  
Data formatted on : 18.11.2008  
Disk volume : Readme\_888c0152\_Liontown NOB  
AAMHatch Job Manager : Catherine Chee

### **README FILE**

This document (Readme\_888c0152\_Liontown NOB.PDF) is provided as an Acrobat file in this volume.

To open the file, double click on the PDF file to activate Acrobat Reader Software.

Adobe Acrobat Reader may be downloaded from:

<http://www.adobe.com/products/acrobat/readstep2.html>

### **LOADING NOTES**

Data may be copied using a file copy utility such as Windows Explorer or similar.

### **FILE SIZES AND NAMES**

Name ▲	Size
ECW	9920 KB
TIFF	12.6 GB
Client_Acceptance Single_Multi User License Agreement.pdf	137 KB
Liontown_metadata.txt	26 KB
Readme_Liontown 888c0152 .pdf	979 KB

## 2. METADATA

### DATA CHARACTERISTICS

Characteristic	Description
Format Imagery	GeoTiff, ECW 0.8m cell size, 8 bit colour

### REFERENCE SYSTEMS

	Horizontal	Vertical
Datum	GDA94	N/A
Projection	MGA55	N/A



**GDA** *This data is GDA-compatible*

### SOURCE DATA

	Source	Description	Ref No	Capture Date
Satellite Imagery	GeoEye	IKONOS	888c0152	11.07.08

### EXPECTED ACCURACY

Project specifications and technical processes were designed to achieve accuracies as follows:

	Measured Point	Derived Point	Basis of Estimation
Imagery	~1-3m	N/A	Deductive estimate (excluding terrain)

#### **Notes On Expected Accuracy**

- Values shown represent standard error (68% confidence level or 1 sigma), in meters to supplied ground control
- This data has not been field tested for accuracy. Full proof of accuracy achieved requires comparison to independent test points.

### USE OF DATA

- Intended use : Planning and mapping
- Intended use : Viewing

### 3. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **LIONTOWN RESOURCES**.

The data in this volume is provided by AAMHatch Pty Limited (AAMHatch) to **LIONTOWN RESOURCES** under AAMHatch standard Terms of Engagement and the GeoEye License Agreement for IKONOS products, which provide a license for **LIONTOWN RESOURCES** to access and use the data only for the project and explicit purpose for which it is provided. AAMHatch and GeoEye retain ownership of all Intellectual Property Rights in relation to this data or modifications, enhancements or subsets of this data. The data must not be sold, lent or distributed to any other party; and used subject to the following conditions:

1. This file (Readme\_888c0152\_Liontown NOB.PDF) is always stored with the unaltered data contained in this volume.
2. The data is not altered in any way without the approval of AAMHatch. The data may be copied from this file to another.
3. The data is not used for purposes beyond that explicitly agreed in the description of the Services provided by AAMHatch.

Any breach of these conditions will result in the immediate termination of the license issued by AAMHatch, and **LIONTOWN RESOURCES** will indemnify AAMHatch from all resulting liabilities.

Any problems associated with the information in the data files contained in this volume should be reported to:

AAMHatch Pty Limited

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SPRING HILL QLD 4000  
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Facsimile (07) 3620 3133  
Email [info@aamhatch.com](mailto:info@aamhatch.com)  
Web [www.aamhatch.com](http://www.aamhatch.com)

#### 4. VALIDATION PLOT

