EXPLORATION PERMIT COAL (EPC) 1555 – "MOUNT EMLYN"

FINAL REPORT FOR THE PERIOD
17th AUGUST 2009 TO 16th AUGUST 2014

Tenure Holder:

MATILDA COAL PTY. LTD.

(ABN: 103 651 538)

A wholly-owned subsidiary of

Cockatoo Coal Limited,

(ACN: 112 682 158)

Submitted by: Cockatoo Coal Limited

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1. Summary

This report is a summary of all work undertaken within EPC 1555 “Mount Emlyn” as part of Cockatoo Coal’s Surat exploration program for the whole period of the tenure. This covers the period 17th August 2009 to 16th August 2014. The work program for the whole tenure period was desktop studies and combining a comprehensive dataset from Cockatoo Coal and Blackwood Corporation. This report comprises a geological overview of the tenement area and summary of exploratory data obtained during the tenure period.

Cockatoo Coal’s recent friendly takeover of Blackwood Corporation has grouped a number of tenements in the Surat region and therefore a comprehensive dataset. This is now being combined into one database for a comprehensive Surat geological model. Part of this dataset includes a study of remote sensing and geophysical signatures of the Walloon Coal Measures and Tertiary basalts; to define the distribution of Tertiary basalt and igneous intrusions and determine the distribution of water-bearing units. Blackwood also commissioned the acquisition of 50cm GSD (Ground Sample Distance) colour RGB digital imagery and a DEM/DSM (Digital Elevation Model/Digital Surface Model) from the acquired imagery. During year 5, activities included desktop studies and the merging two comprehensive datasets from Cockatoo Coal and Blackwood Corporation. The information merged includes the remote sensing study conducted on the Blackwood tenements before they were part of Cockatoo Coal, but the information obtained is equally relevant to the Cockatoo Coal tenements. This report comprises a geological overview of the tenement area and a summary of exploratory data obtained during the tenure period.

The recent friendly take-over of Blackwood Corporation has involved a complex refinancing arrangement which benefits both companies. The equity raising provides Cockatoo with major shareholders going forward that support the successful development of the existing functioning coal mine (Baralaba) and strong support of developing the exploration portfolio. The portfolio in what the company is now calling “South Surat” is being relinquished over the next year. Even though there is mineable coal in the area, the proximity to major towns and Priority Agriculture Areas means that any coal found would be unlikely to get approval to proceed to a coal mine. The South Surat project (EPC’s 1509, 1530, 1533, 1597, 1706, 1711, 1760, 2045, 2067, 1555, 1702, 1703, 1474, 1475 & 1761) occur in the Jurassic Walloon Coal Measures at the western arm of the Clarence Moreton Basin in south-east Queensland. Cockatoo Coal is targeting coal deposits in the Middle to Upper Jurassic Walloon Coal Measures.

The South Surat Project lies towards the eastern end of the Surat Basin in South East Queensland. EPC 1555 covers subcrop of the Jurassic-age Walloon Sub-group, which includes the Juandah and Taroom Coal Measures. EPC 1555 is 12kms west of Commodore Mine, which supplies Millmerran Power station.

2. Introduction

2.1 TENURE

EPC1555 containing 25 sub blocks was granted to Matilda Coal Pty Ltd on 17th August 2009 for a term of 5 years. The first relinquishment of 5 sub blocks was completed in August 2011. Another 4 sub blocks were relinquished in 2012 followed by another 3 in 2013 bringing the current number of sub blocks to 13 (see Figure 1 & Table 1).

Table 1: Current Sub-Blocks in EPC 1555

BIM	BLOCK	SUB BLOCK	TOTAL BLOCKS=13
BRIS	3398	- - - - - - - - - - - - - O P - - - T U - - - Y Z	6
ARMI	14	- - - D E - - - J - - - - - O - - - - T - - - - Y -	6
ARMI	87	- - - - - - - - - - - - - - - Q - - - - - - - - -	1

2.2 LOCATION AND ACCESS

EPC1555 is located within the Toowoomba Regional Council government area and the tenement lies centred 17kms Sout West of Millmerran. EPC 1555 is located on the mapsheets indicated in Table 2. Several secondary roads run through the tenement and there are other minor tracks within the tenement. Most of the EPC is covered by cattle breeding/fattening and cropping land.

Table 2: Published Maps

Scale	Map Series	Sheet	Sheet Number
1 : 100 000	Land Map Series	Inglewood	9141
1 : 100 000	Land Map Series	Millmerran	9141
1 : 250 000	Land Map Series	Goondiwindi	SH56-1
1 : 250 000	Land Map Series	Dalby	SG56-13

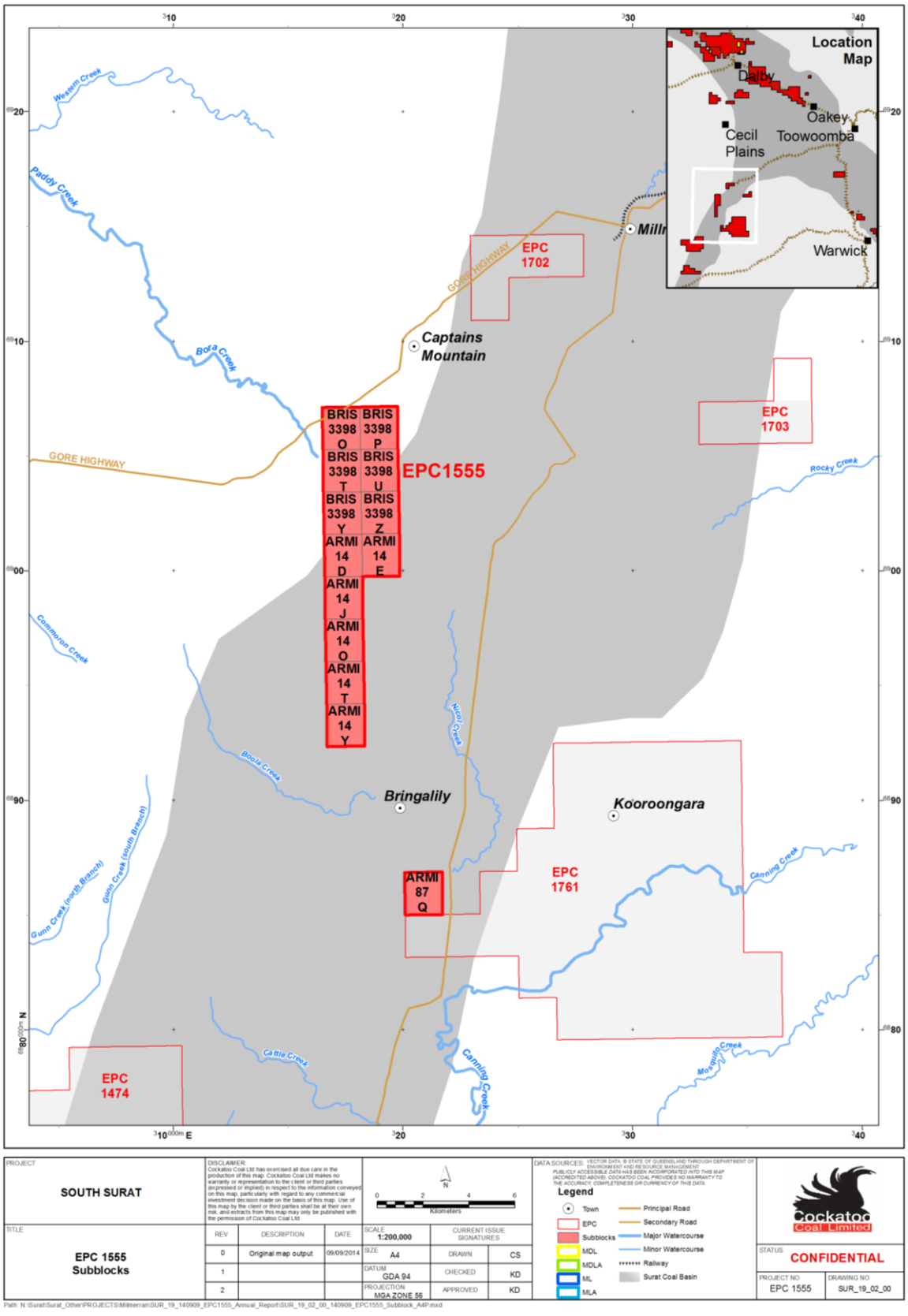

Figure 1: EPC 1555 Location and Sub Blocks

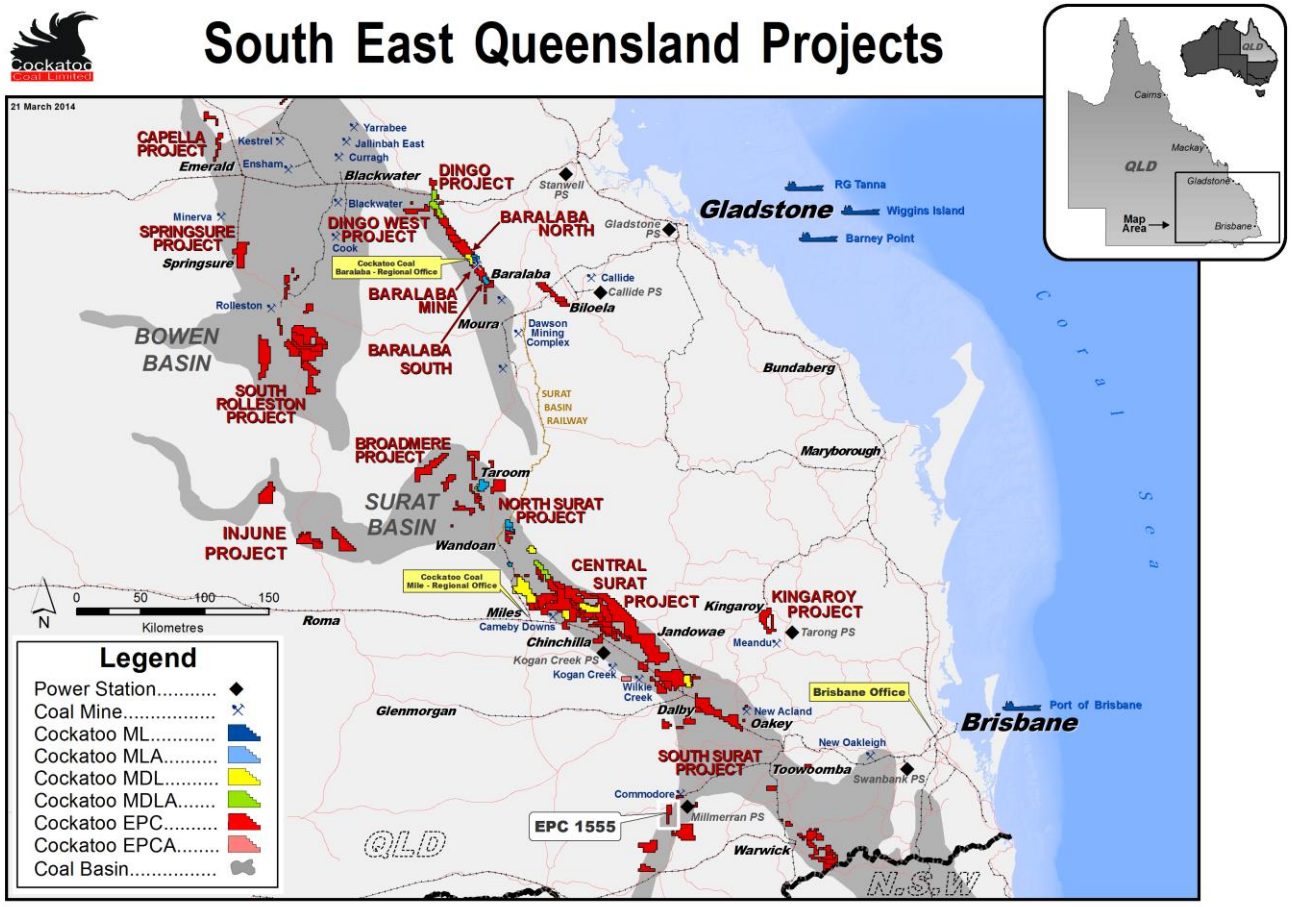

Figure 2: Cockatoo Coal Limited Project Tenements – South Surat Project Location Plan

2.2.1 Future Rail Access

The South Western rail system runs from Toowoomba to Millmerran. The rail line terminates 13kms from EPC 1555.

2.2.2 Native Title

There are no active native title claims over the area covered by EPC 1555.

2.2.3 Cultural Heritage

Before any ground-breaking activity occurs, cultural heritage assessments are carried out. Over and above that, all company field employees are trained to understand and accept their cultural heritage duty of care responsibilities. Contractors are instructed about their responsibilities, both at site inductions and at regularly-held toolbox meetings.

2.2.4 Restricted Areas

EPC 1555 is impacted by the Darling Downs Priority Agriculture Area. The boundary of the Milmerran Priority Living Area is just 11km north east of the tenement.

2.2.5 Environmentally Sensitive Areas

A web search of Environmentally Sensitive Areas on the Department of Environment and Heritage Protection web site has found there are several scattered sections of Endangered Regional Ecosystems in the northern sub blocks. All the sub blocks are also in a 'River Improvement Area'.

2.2.6 Overlapping Tenure

A web search of MinesOnlineMaps indicated that there are two overlapping tenements. The overlapping tenures are shown in Table 3. Major Reforms to Overlapping tenure in Queensland were announced in a 'White Paper' in October 2013. The "Transitional Arrangements" particularly impact coal mining opportunities in the Surat Basin. If there is an existing Petroleum Lease (PL), the leaseholder requires 15 years notice if a mining lease application is lodged in currently undefined area in the Surat Basin.

Table 3: Overlapping Tenure for EPC 1555

Tenure	Status	Grant Date	Expiry Date	Holder
ATP 683	Granted	03/02/2000	29/02/2020	ARROW ENERGY PTY LTD
PCA 114	Application	N/A	N/A	ARROW ENERGY PTY LTD

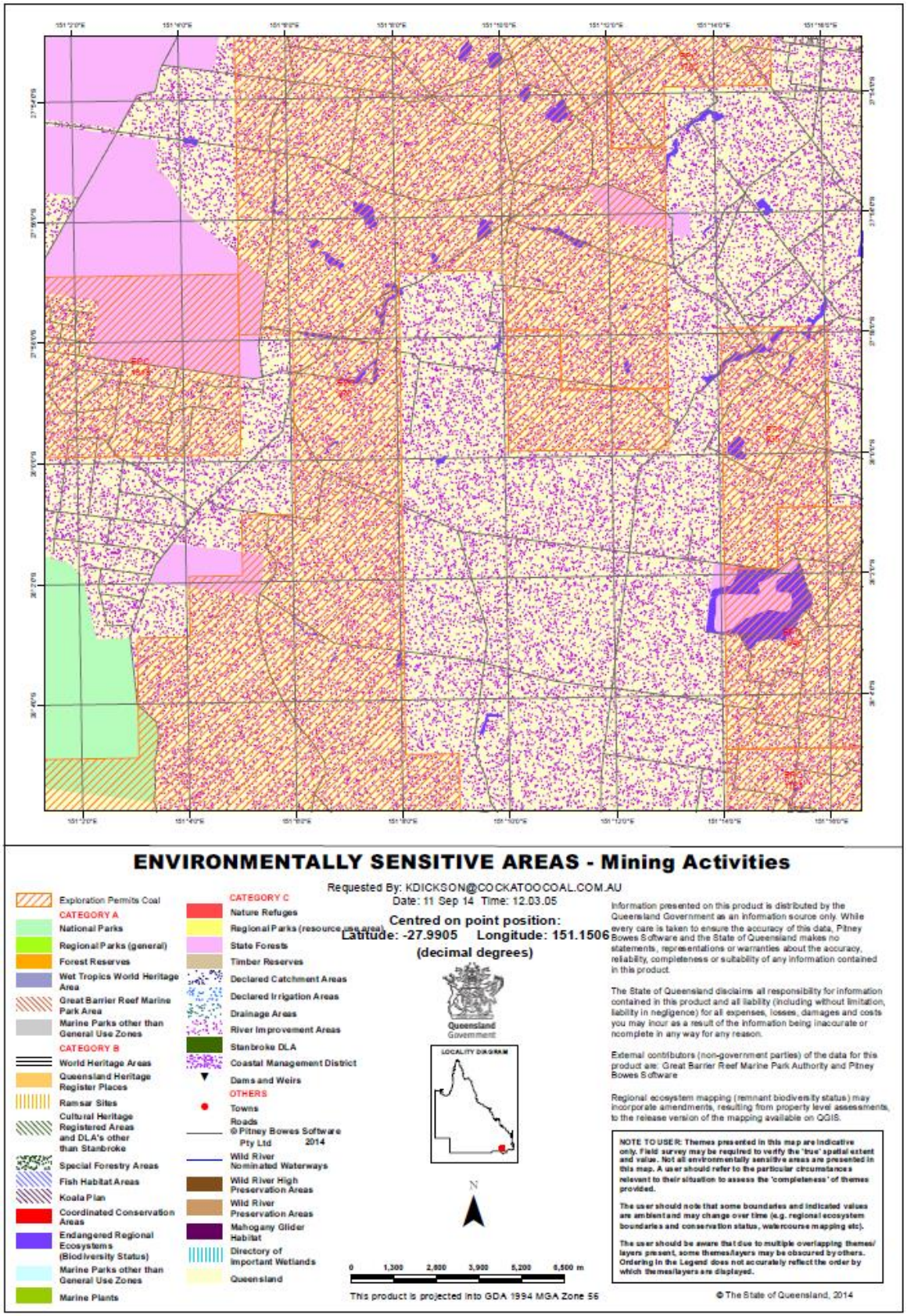

Figure 3: Area around EPC 1555 Environmentally Sensitive Area Map

3. Geology and Historical Exploration

3.1 Regional Geology

EPC 1555, which is located 17km south-west of the town of Millmerran, was part of the Blackwood Corporation/Matilda Coal Millmerran Project prior to amalgamation with Cockatoo Coal. The project lies in the western Clarence-Moreton Basin approximately 35km north of the Texas Block which is made up of Carboniferous siliciclastic Texas Beds mapped as thin to thick-bedded, volcaniclastic arenite, siltstone, mudstone and slate; local phyllite; sporadic lenses of jasper, chert, limestone and mafic volcanics; rare conglomerate. Blackwood Corporation is targeting open-cut coal deposits in the Middle to Upper Jurassic aged Walloon Coal Measures in the Surat Basin.

Jurassic sedimentation in the Surat Basin commenced with deposition of sandstones: the Precipice Sandstone, Evergreen Formation, the Hutton Sandstone and Eurombah Formation (Exon 1976). Early fluvial sedimentation was followed by the deposition of the Walloon Sub-group, which is divided into three units, the Taroom Coal Measures, the Tangalooma Sandstone, and the Juandah Coal Measures (Jones and Patrick 1981, Scott et al 2006). Deposition of the Walloon Sub-group was followed by the fluvial deposition of the Springbok Sandstone, the Westbourne Formation and the Gubberamunda Sandstone (Exon, 1976).

The Middle Jurassic Walloon Sub-group contains two episodes of coal deposition, the Juandah Coal Measures and the Taroom Coal Measures. They are positioned about 180 metres stratigraphically below the Juandah Coal Measures. The Taroom Coal Measures subcrop to the north east of the Juandah Coal Measures.

The coal “seams” occurring within the two coal-bearing Formations are commonly described as “coal packages”, because distinct extensive tabular coal seams are unusual. Seam splitting and variation in thickness are a common feature (Figure 5). Usually a coal package contains a number of coal seams. In some cases the packages can be recognized on a basin wide scale. Martin et al (2013) recognizes seven packages within the Juandah Coal Measures and three packages within the Taroom Coal Measures which can be correlated over much of the explored portions of the Surat Basin.

The Juandah Coal Measures contain a widely correlated, thick, coal-bearing package near the top, the “Macalister Seam”, which has been drilled basin-wide near its sub-crop. Coal packages lower in the Juandah Coal Measures are characterized by more common seam splitting. Commercially interesting deposits have yet to be discovered within packages low in the Juandah Coal Measures. The Taroom Coal Measures are best developed near Taroom. There, the unit contains one package with potentially economic characteristics.

Coal packages in the Walloon Sub-group formed in a high winter rainfall environment, but only where sandy river channels held in natural levees were relatively stable. Winter floods enabled peat deposition in swamps distal to the channels. Proximal overbank deposits are siltstones and mudstones.

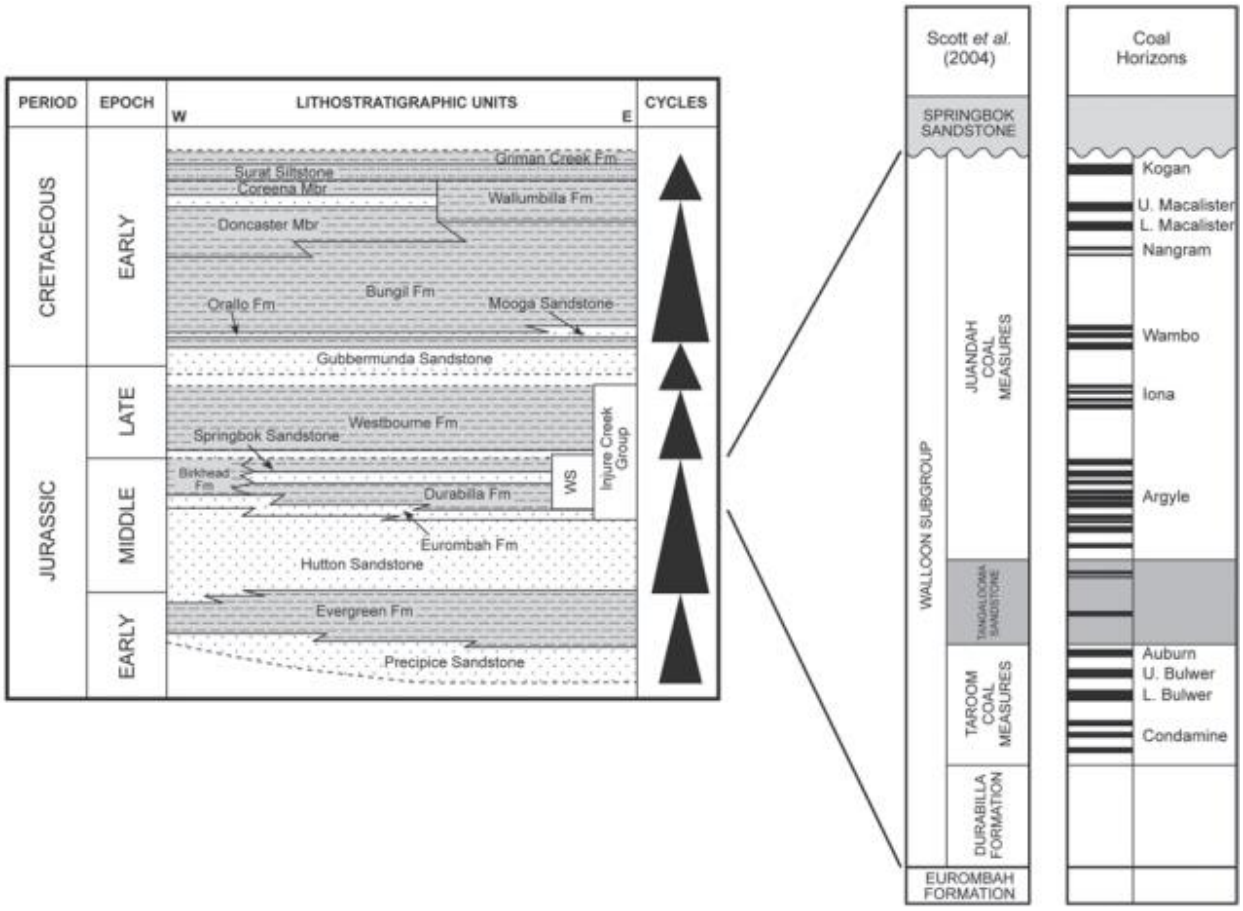

Figure 4: Stratigraphic Column (Modified after McKellar 1998; Scott et al. 2007). The Walloon Supergroup is Callovian (Middle Jurassic) in Age and is typically 300 to 500 m Thick and Comprised of approximately 10% coal. (Martin et al. 2013)

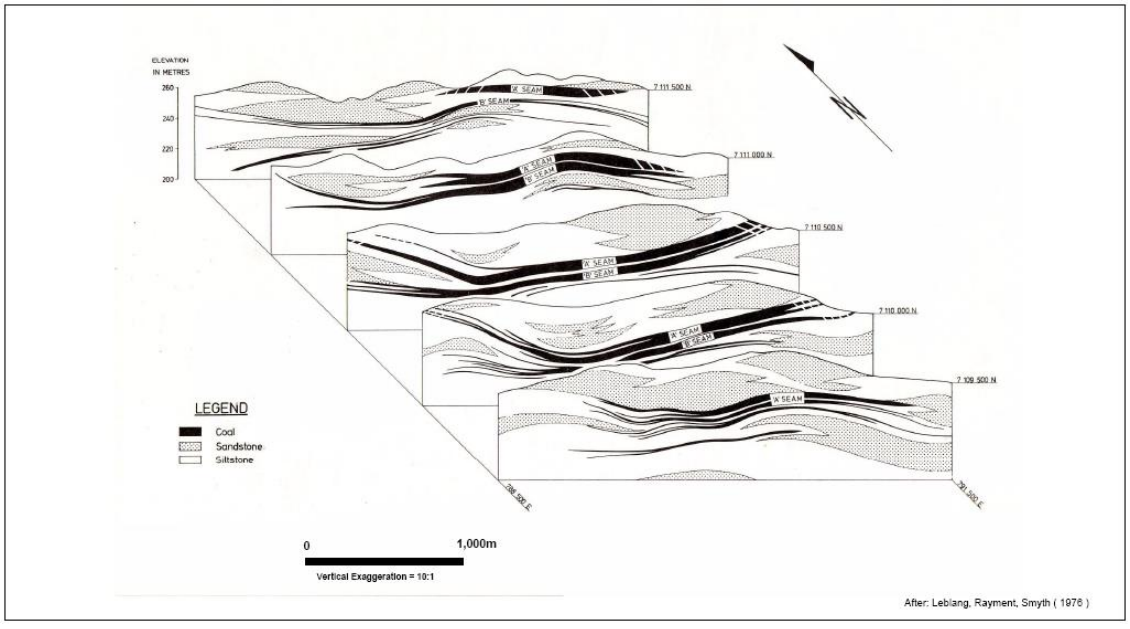

Figure 5: Typical Surat Basin Coal Seams

Swamps formed pod-shaped and possibly even sinuous deposits between channels. Channel migration and annual sediment-overbank flooding restricted potential for regionally extensive swamp development. Catastrophic levee-collapse sandstones herald major channel relocation and often top a coal package. Requirements for lengthy periods of uninterrupted peat deposition included considerable distance from sandy rivers (rarer disruption by overbank sediment load) and rare pyroclastic deposition.

The natural consequence of these pre-conditions is that thick coal deposits are commonly less than a few kilometres across, which is in contrast to the region-wide seams of the Bowen and Sydney Basins.

The Taroom Coal Measures formed in a similar environment to the Juandah Coal Measures, but likely with lower energy floods. Three seam packages are consistently recognized near the top of the Formation, the Auburn, the Bulwer and the Condamine coal packages.

3.2 LOCAL GEOLOGY

The Clarence-Moreton/ Surat Basin has a fairly simple structure of horizontally bedded Triassic and Jurassic sediments. The Walloon Coal Measures are within these sediments in the Middle to Late Jurassic.

The local geology of EPC 1555 is shown in Figure 6. The target Walloon Coal Measures lie at shallow depth beneath Cainozoic cover, and the late Jurassic Kumbarilla beds in the north of the EPC. In borehole 'Bora Creek 1'; 1.5km to the north of the tenement, the Walloon Coal Measures were intersected at a depth of 11m and were 230m thick. There was 6.3m net coal intersected within the Walloon Coal Measures in Bora Creek-1. The coal deposits Brigalily North and South, which are located between the two separated areas making up EPC 1555 have strata that dip gently west. Here three coal seams are present: T seam – 0.5m-1m average thickness; MU seam – 1.49m; and ML seam – 0.5-2m. Commodore mine, located just north of EPC 1555 mines three banded seams: Kooroongarra – up to 3m thick; Commodore – 5.2m average thickness; and bottom Rider – 0.5-0.9m thick. These deposits are amenable to large scale open-cut mining.

In the southern-most sub-blocks the Walloon Coal Measures are sub-cropping, covered by only shallow alluvium. Trapyard-1 was drilled approximately 7km to the south-west of EPC 1555, intersecting 9.5m of net coal within the Walloon Coal Measures (though mostly at depths >140m). Based on wire line logs the seams range in thickness from 1.35m to 0.12m. It appears that the upper Jundah Measures have been eroded in this well, suggesting that in nearby areas of Walloon Coal Measures sub-crop; the upper seams may also be eroded.Arrow Energy drilled CSG Well 'Glenhaven 1' some 20km northwest of Inglewood and observed that much of the Juandah Coal Measures had been eroded by the Springbok Sandstone with only the Argyle and Taroom coals being intersected. Based on the wireline logs the coals were thin with a maximum thickness of 0.6m within the Argyle package.

Thick Taroom coals which Arrow had intersected further to the north appear to be non-existent or very thin. Oberhardt, 2005 postulated that this might be due to the fact that the southern parts of the Millmerran Project Area may be closer to the sediment source or the deposition palaochannel environment of the meandering-

braided fluviatile system. 'Bora Creek-1', a CSG Well also drilled by Arrow Energy, 10km south of Millmerran/45km northeast of 'Glenhaven 1' encountered an eroded section of the Walloon Coal Measures with only the Wambo, Iona and Argyle of the Juandah Coal Measures present above the lower Taroom Coal Measures. Both Well Completion Reports comment on lateral changes in the coal measures and thinning/deterioration to the south; a comment reiterated by Agip Australia Pty Ltd.

Blackwood's Millmerran tenements include EPC 1702 and EPC 1703 which surround the 3Mtpa Commodore open-cut mine, located just south of the town of Millmerran. The mine commenced production in 2001 to supply coal to the 840MW Millmerran power station. Further significant coal resources, Bringalily South, Bringalily North and Lochbar have been delineated to the south of Commodore and are amenable to open-cut extraction. Blackwood's Millmerran tenements EPC 1555 and EPC 1761 are situated within one kilometre of the Bringalilly North and Bringalily South resources.

The target Walloon Coal Measures lie at shallow depth beneath Cainozoic cover, and the late Jurassic Kumbarilla Beds within the EPC. In borehole "Bora Creek 1"; approximately 5km to the south-west of the tenement, the Walloon Coal Measures were intersected at a depth of 11m and were 230m thick. There was 6.3m net coal intersected within the Walloon Coal Measures in Bora Creek-1. Commodore open-cut mine, located 6km south-east of EPC 1702, mines three banded seams: Kooroongarra – up to 3m thick; Commodore – 5.2m average thickness; and bottom Rider – 0.5-0.9m thick.

According to Millmerran Coal's maps of previous drilling there is "major coal development" in boreholes; 115, 117, and 118, with "minor coal development" in boreholes 120 to 123. English logs of borehole logs were not provided with the company report therefore depth of cover, seam thickness and total borehole depths are not available. The regional strike is north-south and the strata dip 1-2 degrees to the west. Cross sections of the area indicate this westerly dip which implies the lower Walloon Coal Measures should near the surface in the eastern portion of EPC 1702. Drilling in this section of the tenement will verify the extent of coal development within the lower Walloon Coal Measures, and allow for interpretation of any local structures.

The local geology of EPC 1555 is shown in Figure 6. The tenement is mostly covered by Jurassic Kumbarilla Beds sandstone and conglomerate, which most likely overlies the Marburg Subgroup given Millmerran Coal Pty Ltd's drilling results from boreholes 14, 109, 111, and 113. These boreholes were drilled to the east of the "Main Seam" sub-crop in the lower Walloon Coal Measures to depths of between 45-55m, returning no coal. Quaternary overburden is reported to probably be at least 45m thick in this area with any underlying Walloon Coal measures being stratigraphically lower than the target seams given the regional strike is north-south and the strata dip gently to the west south-west. Further drilling to more significant depths is needed to verify this conclusion.

Commodore open-cut mine, located 12km East of EPC 1555, mines three banded seams: Kooroongarra – up to 3m thick; Commodore – 5.2m average thickness; and bottom Rider – 0.5-0.9m thick. It appears that these seams do extend further north into EPC 1702, however, this needs to be verified by drilling.

3.2.1 Local Coal Resources

In the Clarence–Moreton Basin, coal deposits of economic importance lie within the Walloon Coal Measures of Middle Jurassic age. The seams occur in thick, banded intervals, in which lenticular beds of carbonaceous shale, mudstone, siltstone and sandstone of varying thickness separate the individual coal bands. Mining operations have generally been based on extracting the better quality seams within such banded sections.

3.2.2 Coal Quality

The Walloon Coal Measure coals in the Surat Basin are classified as high volatile thermal coals with excellent combustion and burnout characteristics, well suited for power generation. The coal is perhydrous and is a good feedstock for the production of synthetic liquid fuels, and for gasification (Mutton, 2003).

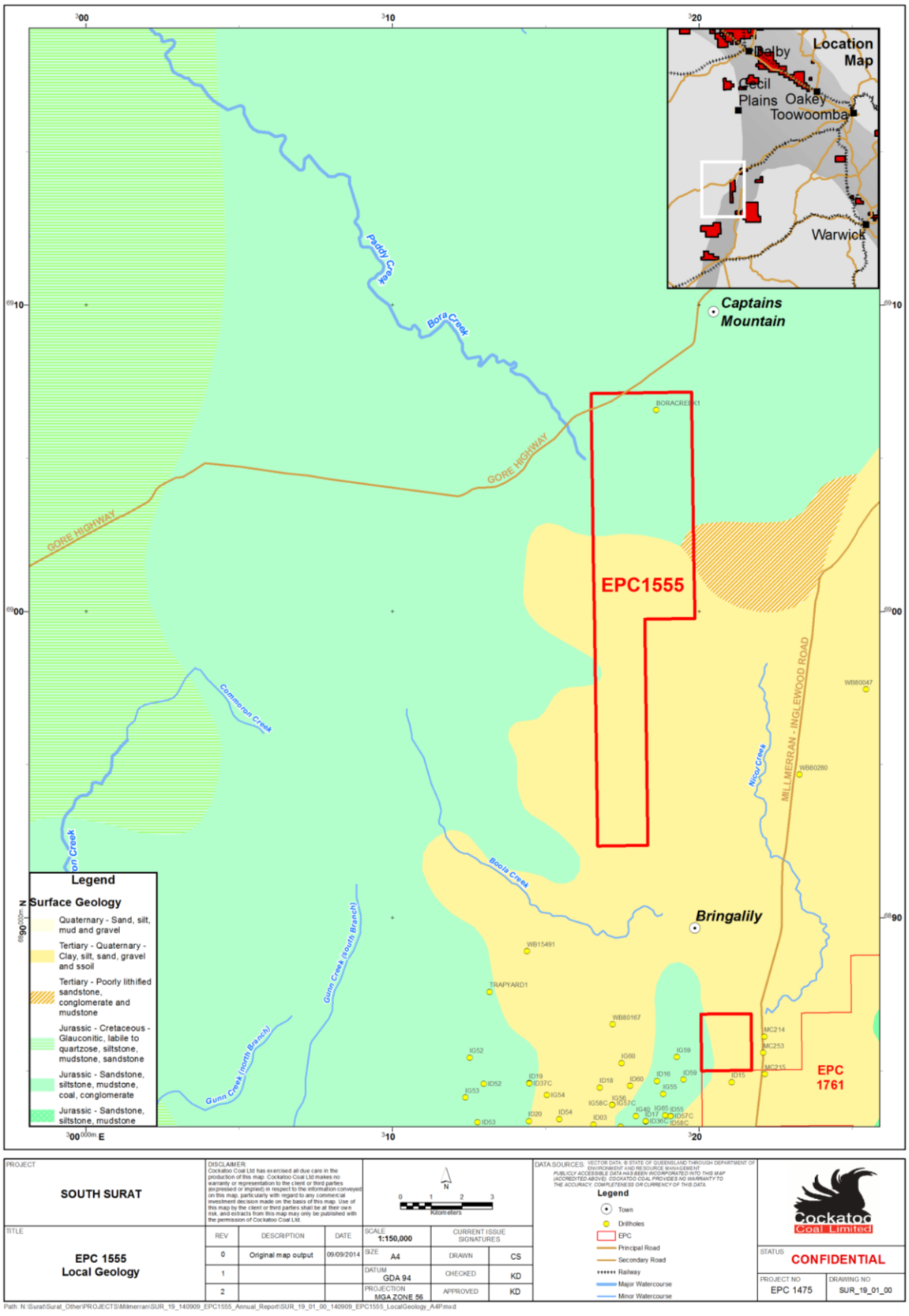

Figure 6: Historic Drill Holes and Local Geology of EPC 1555

3.3 Regional Review

Cockatoo has carried out a regional review of the geology and historic exploration in the Millmerran Project area to put EPC 1555 in perspective in terms of its potential to host an economic coal deposit. This review and highlights the number of MDL's in the area and the proximity of ML50151 held by Queensland Power Company. This Mining Lease supplies coal to the 850 mega-watt Millmerran coal fired power station.

3.4 Historic Exploration

There has been extensive exploration drilling around Millmerran, especially since the 1970s. Typically historical drilling for coal has been relatively shallow, averaging 50-80m. Much of the Millmerran area contains Walloon Coal Measures at shallow depths, with gently dipping strata. The largest discovery near Millmerran has been the deposit at Commodore Mine 7km to the south of the town.

In 2001 construction of the 500Mt Commodore Coal Mine began. It currently produces 3.6Mtpa, which has supplied Intergen's Millmerran power station since 2002.

Previous exploration indicates the likelihood of intersecting significant coal seams within EPC 1555. They are expected to be within 50-200m of the surface. Boreholes to the north and south of EPC 1702 have intersected coal at shallow depths. The coalfields in neighboring MDL299 indicate the high prospectivity of this tenement, which contains the same coal bearing strata. EPCs 1474 and 1475 cover the southern strike of the Walloon coal measures from the Millmerran deposits.

3.5 Work completed in year ended 16 August 2014 (Year 5)

During Year 5 activities included desktop studies and the merge of two comprehensive datasets from Cockatoo Coal and Blackwood Corporation. Cockatoo Coal's recent friendly takeover of Blackwood Corporation has grouped a number of tenements in the Surat region and therefore a comprehensive dataset. This is now being combined into one database for a comprehensive South Surat geological model. Part of this dataset includes a study of remote sensing and geophysical signatures of the Walloon Coal Measures and Tertiary basalts; to define the distribution of Tertiary basalt and igneous intrusions and determine the distribution of water-bearing units. Blackwood also commissioned the acquisition of 50cm GSD (Ground Sample Distance) colour RGB digital imagery and a DEM/DSM (Digital Elevation Model/Digital Surface Model) from the acquired imagery.

The information merged includes the remote sensing study conducted on the Blackwood tenements before they were part of Cockatoo Coal, but the information obtained is equally relevant to the Cockatoo Coal tenements. This work is detailed in the following sections titled "4. Exploration Rationale" as it explains why the South Surat Project area is prospective.

4. Exploration Rationale

The target within Cockatoo's South Surat exploration program is thermal coal in the Jurassic Walloon Coal Measures. Historical drilling and proximal deposits indicate this unit to be at shallow depths just south of EPC 1555. Commodore mine and Lochbar coal deposit are directly east of EPC 1555. Further drilling, along with seismic where required, will test the continuity and structure of any seams within EPC 1555.

Coal seams hosted by the Walloon Coal Measures in the Clarence Moreton Basin are currently being mined for thermal coal at Commodore, Jeedropilli, New Ackland, and Felton. ROM coal has predominantly been used as feedstock for domestic mine mouth power plants but can be washed down to a 12.0-17.0% ash thermal coal product suitable for the export market.

A review of historical data including boreholes within the region, geological maps, and other historical data from surrounding tenements confirms the potential presence of an economic coal resource in EPC 1555. Further exploration, will provide a much greater understanding of EPC 1555's coal resources. The points below briefly summarise why Blackwood Corporation continuing pursue the Millmerran Project:

- Prioritisation of historic data compilation within EPC 1555 and EPC 1702. Both these tenements are interpreted to be largely unencumbered by Tertiary Basalts and analysis of the waterbore data suggests the higher priority areas within EPC 1555 and EPC 1702 are relatively less affected by groundwater. There are 25 boreholes to be compiled and these are often spaced at less than 2km, providing sufficient data for prospectivity analysis. Exploration planning would benefit from additional attribution of the database and a review of a new drilling compilation to be release by GSQ during March, 2013 is warranted.
- The spectral classification study has highlighted areas of interest warranting field follow-up and cross-reference to the Blackwood borehole database within EPC 1474 and EPC 1475. These patches (approximately 2km x 2km in extent) show clay-rich spectral characteristics similar to that of the known coal resources against an iron-rich background.
- Comparison by Blackwood of higher coal to burden ratios at Millmerran with equivalent data at Chinchilla, Dalby and Warwick. Analysis on the current Blackwood borehole database indicates the best coal to burden ratio within a Blackwood Millmerran tenement occurs in the eastern parts of EPC 1474 and EPC 1475 (1.3m in 10m).
- Literature reviews on the Bringalily North and South and Lochbar coal resources that border Blackwood tenements EPC 1555 and EPC 1761 to understand the potential for continuation of the resource into these tenements.

4.1 WORK INTEGRATED WITH COCKATOO DATABASE

The historic reports available were reviewed are shown in Table 4.

Table 4: Historic Reports Reviewed

Report CR	Tenement
10353	ATP 291C
9771	ATP 291C
57149	ATP 935C
22440	ATP 203C
11816	ATP 349C
11304	ATP 203C
10778	ATP 349C
10666	ATP 287C
10353	ATP 291C
9974	ATP 203C
9771	ATP 291C
9770	ATP 291C
9676	ATP 349C
9229	ATP 291C
9176	ATP 287C
9175	ATP 287C
8884	ATP 203C
8884	ATP 203C
8675	ATP 330C
8257	ATP 291C
8256	ATP 291C
8216	ATP 287C
8215	ATP 287C
7718	ATP 203C
7255	ATP 240C
7189	ATP 230C
7136	ATP 203C
7133	ATP 203C

6825	**ATP 203C**
6662	**ATP 225C**
6334	**ATP 203C**
6258	**ATP 72?C**
4962	**ATP 142C**
4473	**ATP 112C**
4264	**ATP 112C**

An integrated remote sensing study has been conducted and an extensive framework has been built by Global Ore Discovery for the sole use of Blackwood Corporation Ltd (wholly owned subsidiary of Cockatoo Coal).

In particular, the integrated remote sensing study report addresses data compilation, processing and the interpretation of:

- Major regional structures;
- Base and Top of Walloon Coal Measures;
- Tertiary basalt: flows, dykes and sills.

4.1.1 Geophysics

Airborne geophysical and ground geophysical datasets were compiled and were used in the study. The data includes regional open-file gravity, magnetic and radiometric surveys and seismic reports. Compiled airborne and magnetic surveys:

- Grafton-Tenterfield, NSW 2011, 250m, P1252 (just released)
- Bowen-Surat South, QLD 2006, 400m, P1108
- Bowen-Surat North, QLD 2006, 400m, P1107
- Texas, QLD 1996, 400m, P792
- Kingaroy-Mackay, QLD1995-6, 400m, P791
- Maryborough, QLD 2005, 400m, P1094
- Northern Moree, NSW 2001, 400m, P1037

Seismic line data that has been relevant to structural and stratigraphic interpretation within the project areas, has been hotlinked within the company GIS to open-file images of the seismic stack data (Figure 7). However, following compilation many of the lines within the Blackwood Project Areas were found to be pre-1970s and the final stack data is insufficient for stratigraphic and structural interpretation. There has been no recovery of raw data nor seismic reprocessing to highlight structural features within shallow stratigraphy.

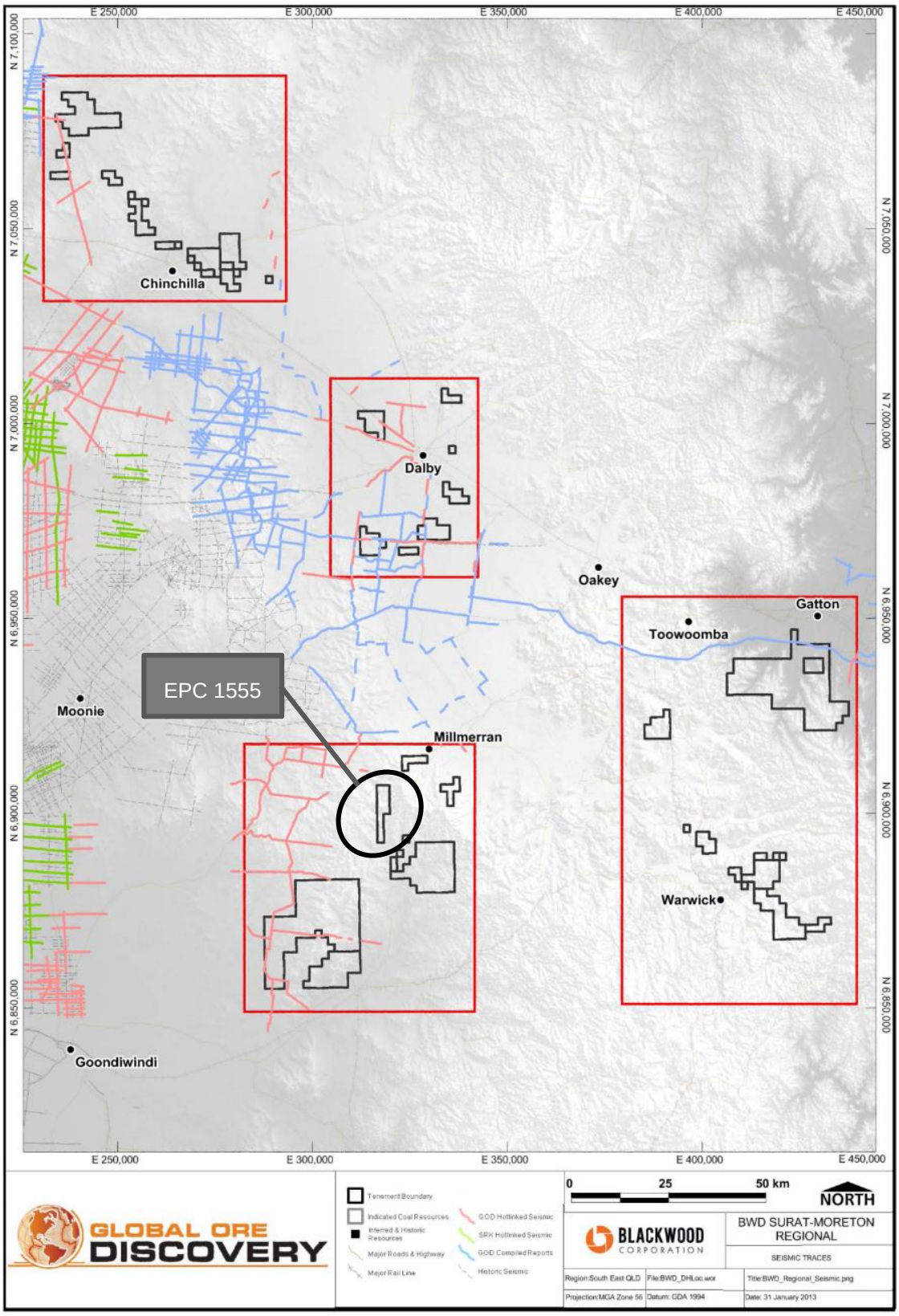

Figure 7 Seismic data compilation and hot linking status, Blackwood Corporation Surat Projects (now known as Cockatoo Coal South Surat Project and South Surat Project)

4.1.2 Remote Sensing

Satellite acquired remote sensing datasets have been compiled and used in the study:

- ASTER scenes selected and processed

Granule ID	Global ORE Scene ID	Data Center	Acquisition Date	Center Point	Cloud Coverage
SC:AST_L1A.003:2017871732	AST535	LPDAAC_ECS	09 Oct 2003, 00:05:35.0990	-27.2600 Lat, 151.8071 Lon	0
SC:AST_L1A.003:2017871729	AST543	LPDAAC_ECS	09 Oct 2003, 00:05:43.0960	-27.7925 Lat, 151.6726 Lon	0
SC:AST_L1A.003:2028644454	AST1130	LPDAAC_ECS	12 Apr 2005, 00:11:30.0380	-27.4066 Lat, 151.3025 Lon	0
SC:AST_L1A.003:2028644549	AST1139	LPDAAC_ECS	12 Apr 2005, 00:11:39.0250	-27.9398 Lat, 151.1736 Lon	0
SC:AST_L1A.003:2038622503	AST458	LPDAAC_ECS	18 Nov 2006, 00:04:58.0510	-26.6764 Lat, 151.5898 Lon	0
SC:AST_L1A.003:2038622558	AST507	LPDAAC_ECS	18 Nov 2006, 00:05:07.0370	-27.2086 Lat, 151.4547 Lon	0
SC:AST_L1A.003:2038622555	AST516	LPDAAC_ECS	18 Nov 2006, 00:05:16.0240	-27.7407 Lat, 151.3184 Lon	0
SC:AST_L1A.003:2038622561	AST525	LPDAAC_ECS	18 Nov 2006, 00:05:25.0100	-28.2726 Lat, 151.1813 Lon	0
SC:AST_L1A.003:2041778223	AST1204	LPDAAC_ECS	17 Mar 2007, 00:12:04.0850	-26.8205 Lat, 151.0477 Lon	0

- Landsat scenes selected and processed

Granule ID	Global Ore Scene ID	Acquisition Date	Time	Centre Point	Cloud Coverage
LE70900792003137ASN00	LS0079	17/05/2003	23:36:59	-27.4239 Lat, 151.7066 Lon	0
LE70900802003105ASN00	LS0080	15/04/2003	23:37:27	-28.9133 Lat, 151.3251 Lon	0
LE70910782003144ASA00	LS1078	24/05/2003	23:42:46	-25.9888 Lat, 150.5249 Lon	0

- 1 second SRTM v1.0 digital elevation model (DEM-H)
- Astrium geo-information services SPOT base map imagery
- CSIRO ASTER data acquired is referenced as Australian ASTER Geoscience Product Notes, Version 1, 7th August, 2012 – CSIRO ePublish No. EP-30-07-12-44. The 1 second SRTM v1.0 DEM is referenced as Geocat 72759 Australian Government Geoscience Australia, 2011.

Multispectral ASTER and Landsat 7ETM+ data, as well as SPOTMaps and digital elevation imagery has been compiled, processed and incorporated into the GIS database for use in the integrated interpretation and as a basis for the coal exploration program. These imagery types exploit lithological and mineral composition variations and are useful for reviewing spectral properties over large areas of stratigraphy. In this study, high vegetation areas have been mapped to create a masking layer which excludes regions where spectral properties may be inaccurate due to vegetation mixing or poor surface reflectance.

Key products and applications of the ASTER and Landsat TM processing included:

- Iron oxide mapping aimed at basalt outcrop and subcrop interpretation;
- Clay occurrence and composition for fined grained stratigraphy mapping;
- Silica occurrence mapping, to assist quartzose stratigraphy interpretation.

4.1.2.1 Magnetics

Seven 400 m or better line-spaced airborne magnetic surveys from Queensland and New South Wales were identified within a greater Area of Interest (AOI) selected for Gravity and Magnetics processing.

Re-levelling was not found to be necessary except in a small part of one of the survey areas. This new grid was then remerged with the national 80 m Geoscience Australia grid, containing mainly 1600 m historical data to fill the remaining AOI and create a new 80 m-grid of Total Magnetic Intensity (TMI). Standard interpretative transforms of the magnetics data were then computed using Fast Fourier transforms in Intrepid software. These included Reduction to Pole (RTP), 1st and 2nd Vertical Derivative (1vd and 2vd), Analytical Signal Amplitude (ASA) and Tilt Angle (TA). These grids were used solely or in combination to create a variety of images suitable for magnetics interpretation.

Four separate areas including Blackwood's Chinchilla Project Area were picked out within the greater AOI. For each of these areas, the larger merged TMI grid was sub-sectioned into a smaller grid to cover the area, and wavelength matched filtering (similar to depth slicing) was performed to generate regional and residual magnetics grids representing shallow and deeper sources. Standard interpretative transforms were re-created for all of the shallow residual magnetics grids, and identical ranges of images created for each of the four areas.

Two open-file company magnetics surveys containing 100 m line data were identified as being viable for interpretation at higher resolution within the greater AOI. An area surrounding the two surveys was subsectioned from the greater AOI and resampled to 25 m grid cell spacing. This grid was then merged using Intrepid software with the two higher resolution 25 m cell company grids. After performing wavelength matched filtering on this new grid, standard interpretative transforms were re-created and identical ranges of images created for this higher resolution area.

The imagery products selected for basalt, stratigraphic and structural interpretation were predominately the total magnetic intensity reverted to pole (tmi-vrtp), the analytical signal amplitude (asa), first vertical derivative (1vd) (**Error! Reference source not found.**Figure 9) and tilt angle (ta).

Where surveys of different resolution were merged, excellent amplitude matching across the survey boundary showed the processing conducted in this study was effective.

4.1.2.2 Gravity

The national gravity database was sampled to the AOI and 11648 stations downloaded. A variable density gridding algorithm in Intrepid software was used to grid the Bouguer Gravity data at 1 km grid spacing. Again, matched wavelength filtering was used to identify the regional and residual components of the Bouguer Gravity grid signal. Regional and Residual gravity grids were then created using the filtering software.

Identical potential field transforms (except for 2vd) of the gravity data were then computed and used to create a number of gravity images for interpretation.

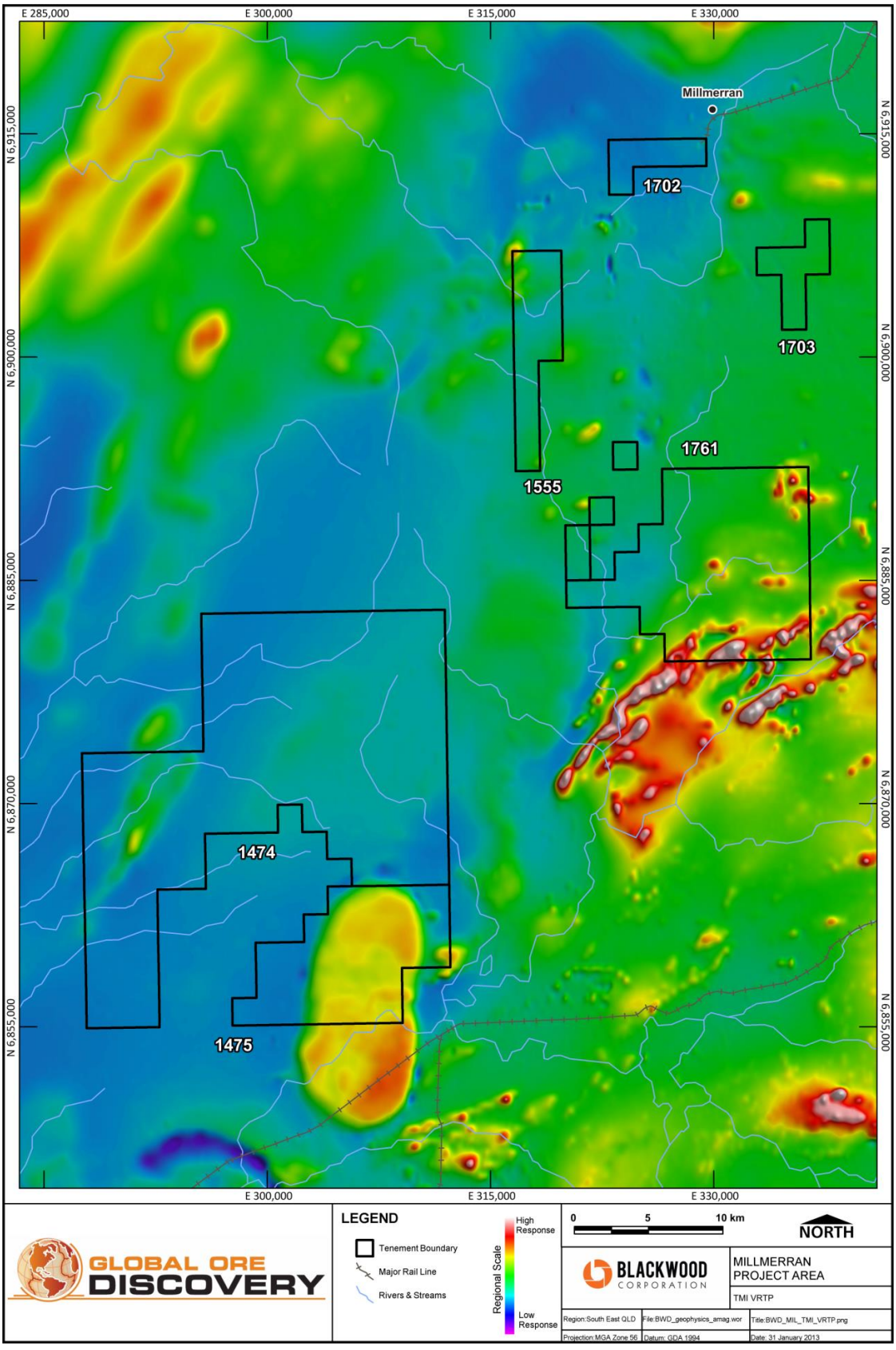

Figure 8 VRTP processed Total Magnetic Intensity (TMI), Millmerran Project Area

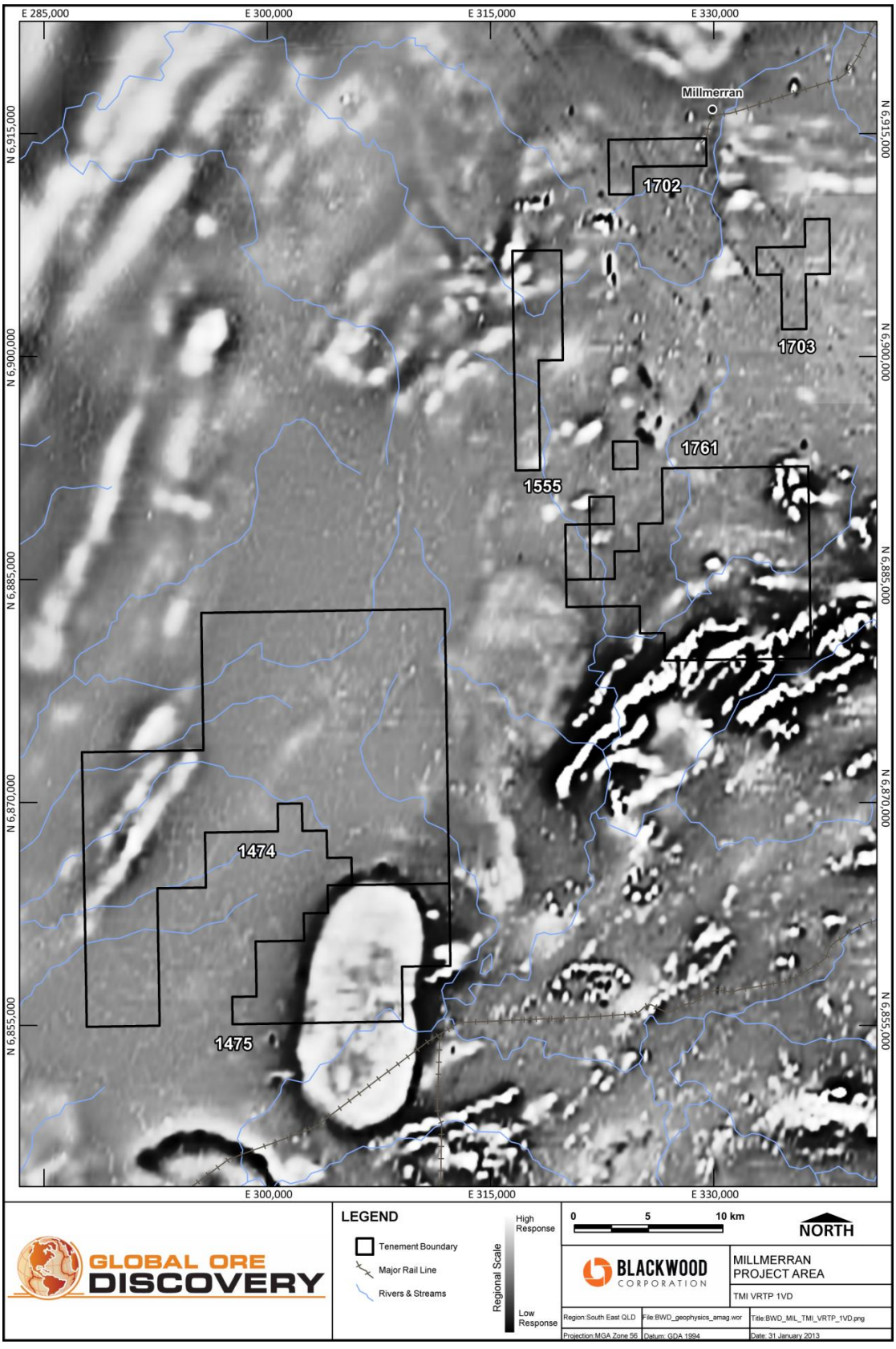

Figure 9 VRTP First Vertical Derivative (1VD) of TMI, Millmerran Project

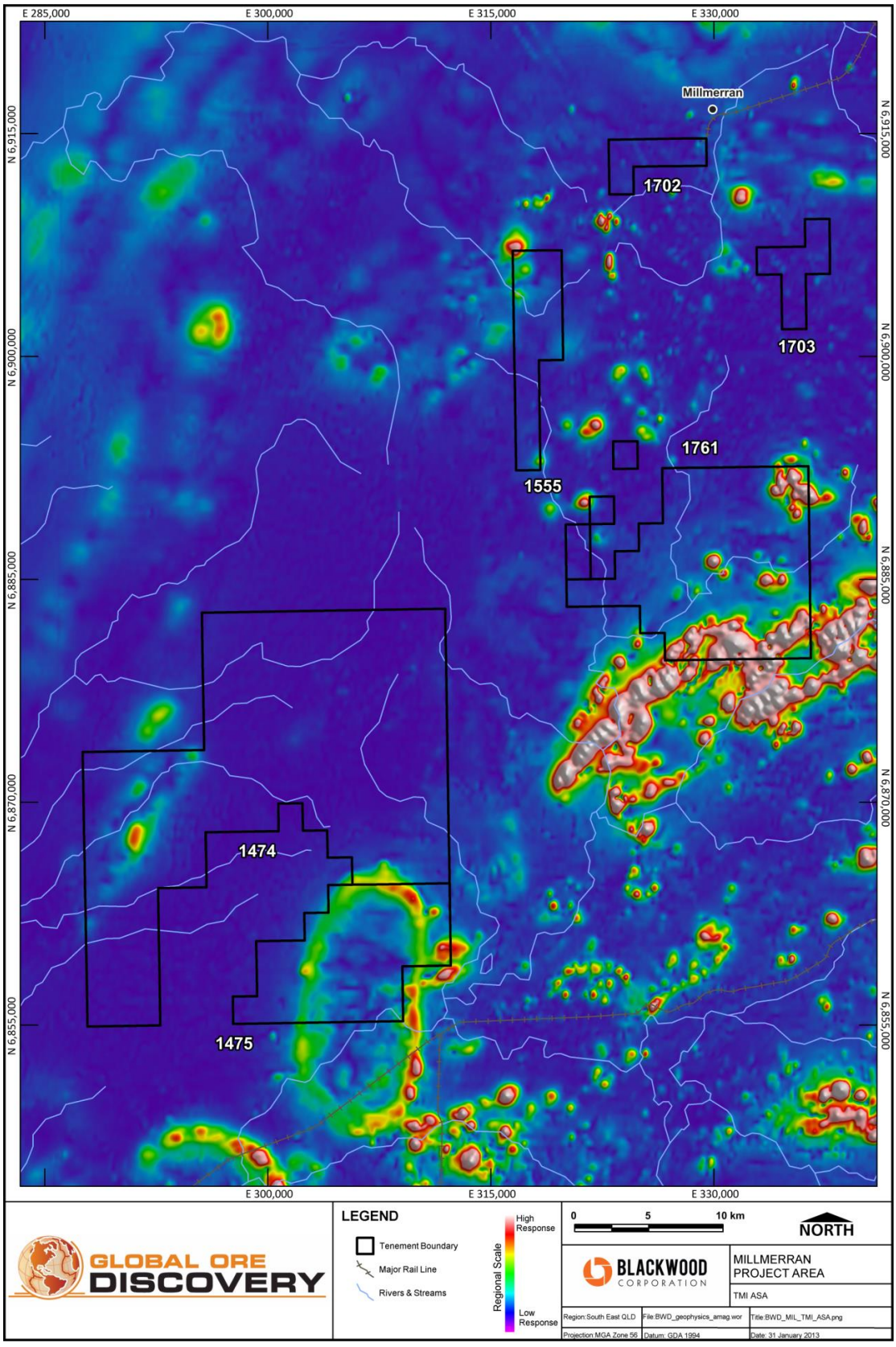

Figure 10 Analytical Signal Amplitude (ASA) OF TMI, Millmerran Project

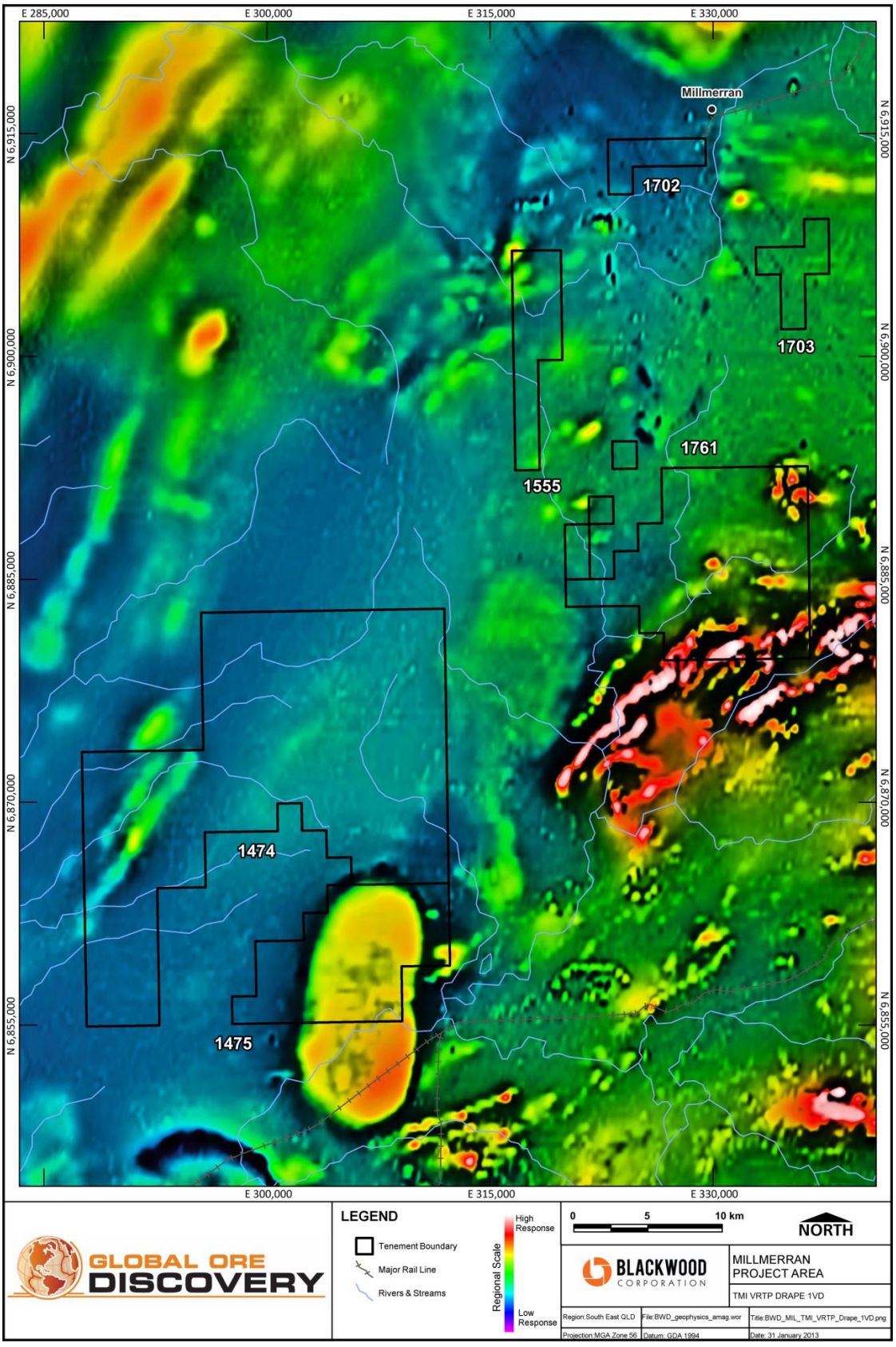

Figure 11 Drape of 1VD over TMI VRP, Millmerran Project

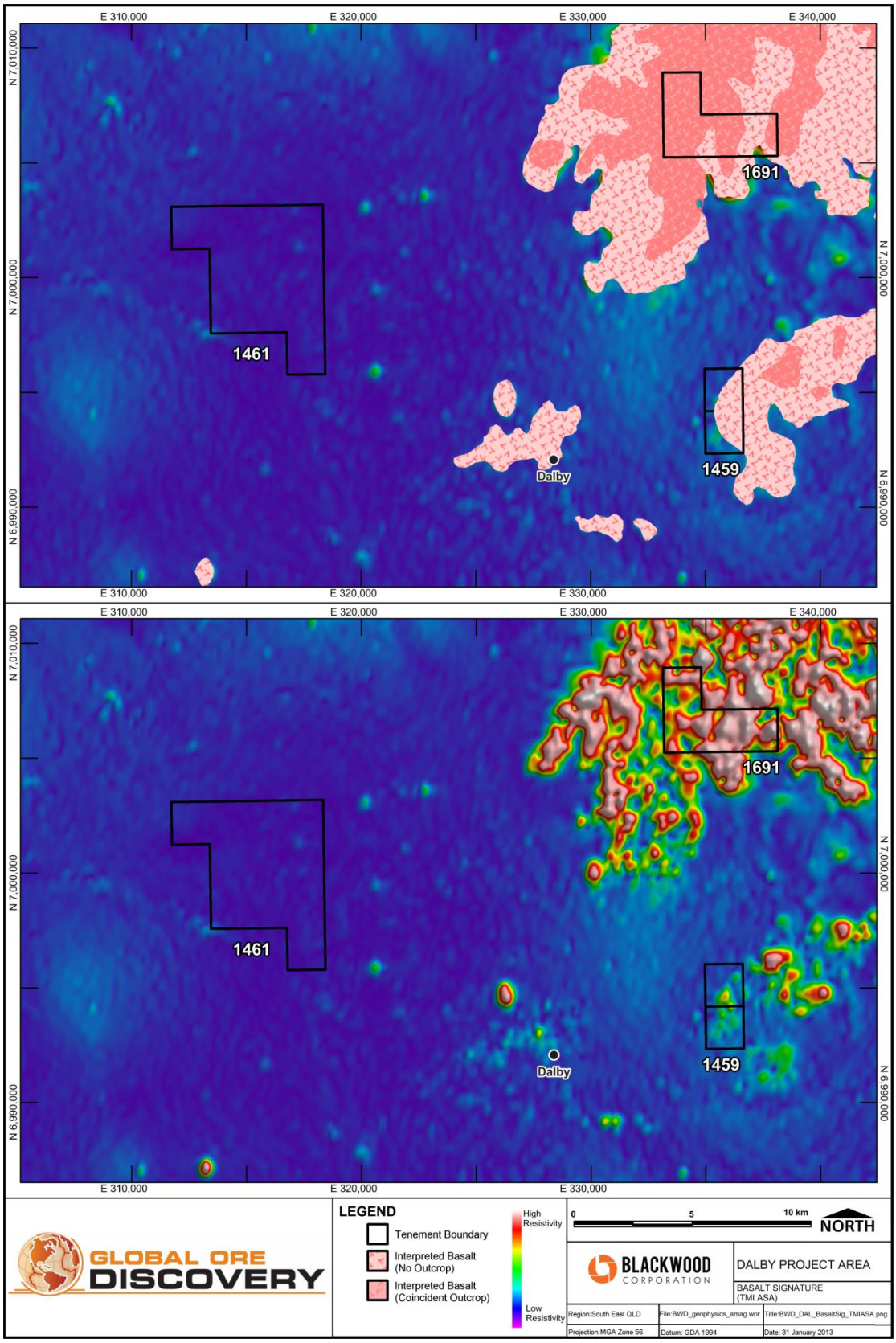

Figure 12 Magnetic Character of basalts in the magnetic first vertical derivative, example from Dalby shown

4.1.2.3 Radiometrics

The contact between the Marburg Sandstone and the Walloon Coal Measures is important for exploration planning and borehole targeting in the Surat Basin.

In this study, Global Ore has drawn upon Geoscience Australia's compilation of regional radiometric surveys (RADMAP 2010) in which merges and equivalent concentration processing has already been conducted. Using Geoscience Australia's Radmap 2010 radiometric point data, Global Ore has generated:

- an RGB product (K-U-Th) Figure 13,
- an RGB drape product (RGB draped over the total count);
- a total count product and;
- a series of radioelement and ratio products, all supplied as GIS layers,.

Global Ore mapped features in the radiometric character of the RGB (K, U, Th), total count and ratio layers as preliminary products to the integrated interpretation. Within the Chinchilla Project Area, data quality is good with line spacing of 250 to 400 m, and radiometric character is interpretable.

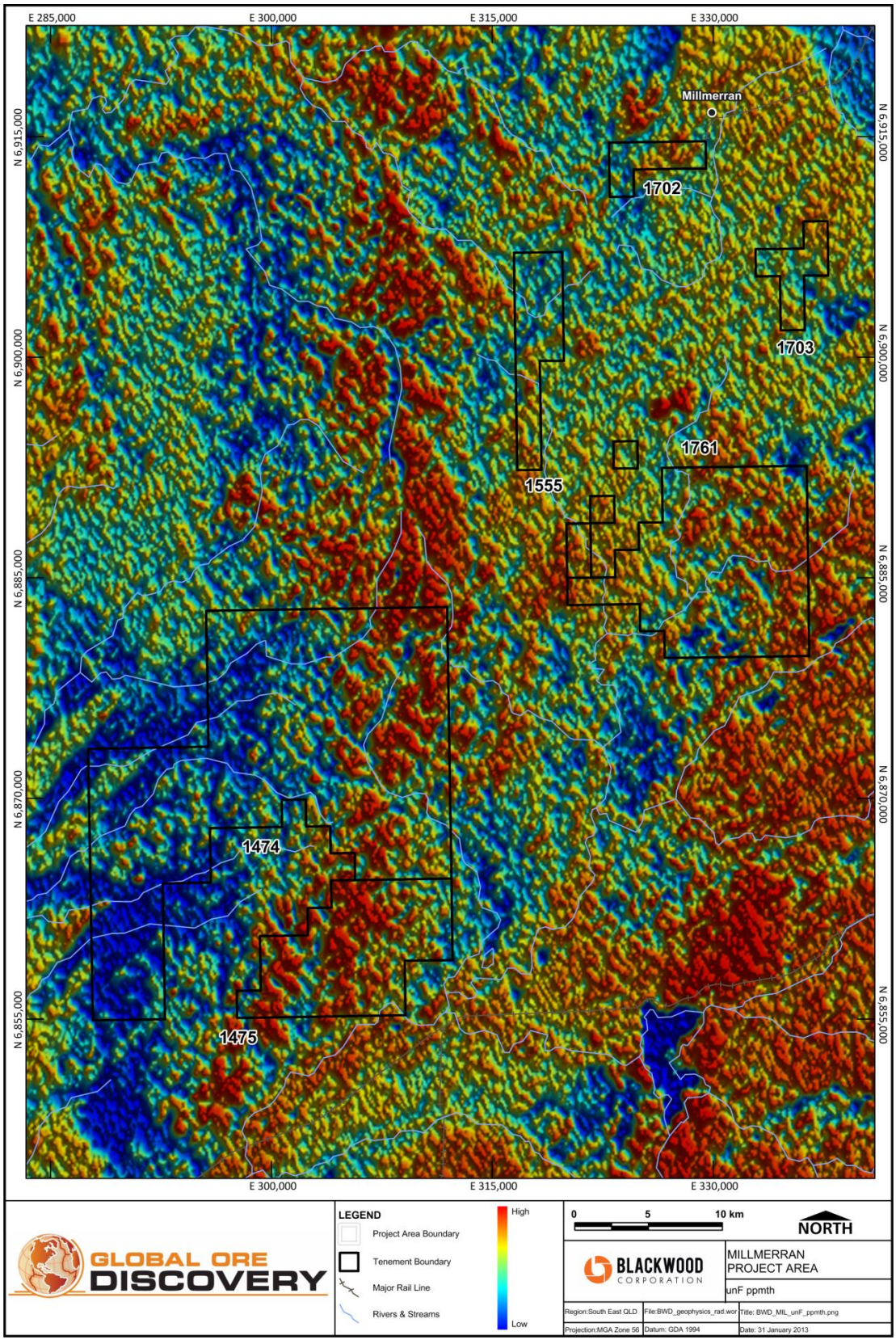

Figure 13 Sun shaded RADMAP 2010 Filtered (F) Thorium (TH)

4.1.3 Geology

The 1: 250 000 GSQ and 1: 1 000 000 scale Geoscience Australia data was merged to create a base geology map. The base geology map created covers the entire extent of the Blackwood southeast Queensland tenements and was modified by integrated interpretation in the project areas. Colour look-up tables have been used to group the stratigraphy into 'exploration units', highlighting the distribution of Walloon Coal Measures, basalts, basement, pre-Walloon sedimentary rocks, post-Walloon sedimentary rocks, hard cover and Quaternary sediments. Also, Regional fault data and stratigraphic surfaces for the main units of the Surat Basin have been compiled from both Healy et al. 2008 and GSQ (Dixon, 2011). Additional local dip data has been digitised from 1:100 k GSQ geology maps. Fault architecture was interpreted from mapped geology and mapped structure both in the basin and within the immediate Surat Basin basement and combined with structural interpretations of the reprocessed magnetic and gravity data for the region.

4.1.4 Drill Data Processing and Manipulation

A GIS database has been created and include (but is not restricted to) the following features:

- Thematic map of aggregate coal thickness
- Thematic map of coal to burden (non-coal material) ratios to 100m and total hole depth
- Grids of depth to first coal (Figure 15)
- Gridded ratio of coal to burden
- Percentage pies that pictorially show both the hole depth and the proportion of each hole assigned to a particular stratigraphic unit
- A validated MapInfo drillhole project to facilitate the construction of downhole geology logs and cross-sections from the supplied Blackwood database

All visualisation of the drilling data queries has been undertaken within the MapInfo GIS system. This includes locations plots, thematics and gridded products. A relatively new yet powerful thematic is the utilisation of percentage pies, Figure 14. For percentage pies the overall diameter of the pie represents the total hole depth and the pie portion reflects the % of a given formation's abundance. For instance a very shallow hole will be a very small pie, and pie representations of the formation might show the % of Upper Walloons, Tangalooma and Lower Walloons as portions.

A coal to burden ratio (CTBR) analysis was undertaken within the Millmerran Project Area after applying a 100m depth limit. Comparisons between CTBR for coal less than 100m and the CTBR total borehole depth show no differences, reflecting the observed absence of significantly thicker coal accumulations at depth.

There are ten holes within the Millmerran Project with CTBRs exceeding 1 in 10 within the Lower Walloon Coal Measures. Only one occurrence has a ratio exceeding 1.8 in 10, which does not have a sequence allocated in the database and occurs above the Auburn at 1-2 m depth within the weathered zone. This occurrence is between EPC 1555 and EPC 1474 where there are several high CTBRs but reasonably extensive drilling ~ 1.5 km spacing. Within EPC 1474 there is poor drilling coverage with conceptual potential for both Upper and Lower Walloon coal packages. Previous explorers have noted coal seams thin and deteriorate in this part of the Millmerran Project Area relative to the seams that occur at the Commodore Mine and examination of historic borehole data not currently in the Blackwood database could be used to validate that observation and determine the priority for exploration.

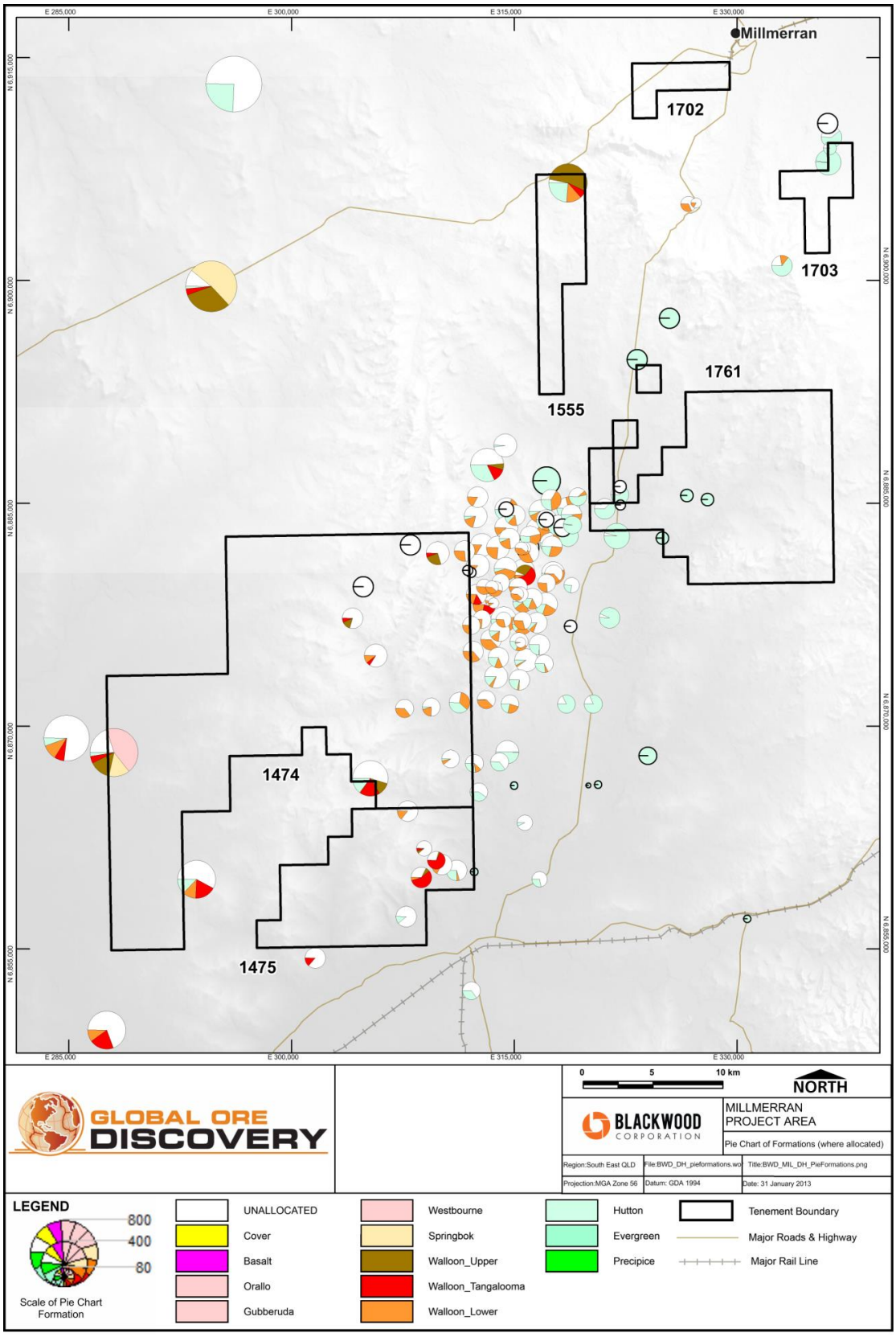

Figure 14 Formation Summary Pie Charts, Millmerran Project

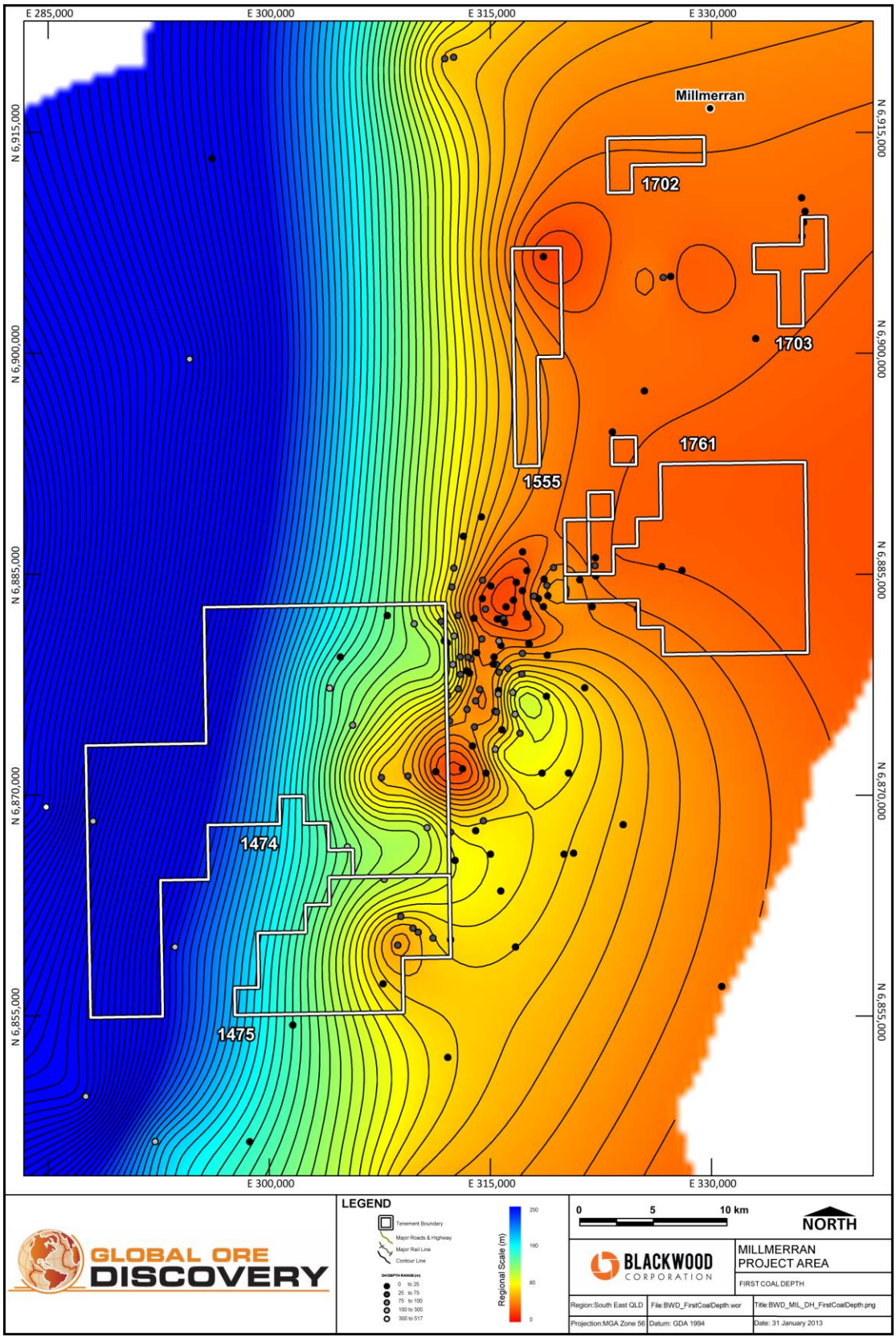

Figure 15 Depth to First Coal Mention, Blackwood Borehole Database, Millmerran Project

4.1.5 Waterbore data for preliminary groundwater analysis

To understand the distribution of drilled water-bearing horizons, both laterally and in the sub-surface, publically available waterbore data was compiled (DNRM 2010 and 2012). Downhole descriptions of intersected stratigraphy and lithological metadata, clipped to the Blackwood southeast Queensland Project Areas, were subjected to database queries in MapInfo to identify holes that reported water intersections.

Interpretations drawn on this data need to take into account that this information is not complete for every drillhole, and that in many cases descriptions were made by non-technical field staff. Waterbore data has not been used in its entirety for the main coal related interpretations in this study due to concerns about waterbore logging reliability. However the huge quantity of data available in the dataset provides a powerful overview of the groundwater system. In this study, a series of queries were built to

- Classify bores as having intersected dry, 'general' water-bearing and major water-bearing horizons
- Obtain an indicative aggregate aquifer thickness above the coal-bearing horizon

In order to determine whether a waterbore intersected major water, 'general' water or was dry the lithological descriptions were reviewed for suitable search terms. These search terms were grouped into three categories to distinguish 'general' and major water in each waterbore.

The categories and search terms of that category were:

- Major Water: including terms such as 'swl' (standing water level), 'l/s' (litres per second), 'water at XXm', 'water sample taken';
- General Water: including terms such as 'water-bearing", 'some water', 'water bed', 'water soak'
- Dry: all other holes that did not return any of the search queries above.
- Note that spelling and grammatical variations of the search terms above were also searched.

The aquifers of the Surat and Moreton Basin exist as confined intervals and comprise a complex multi-layered sedimentary sequence of fluvially-deposited sandstone units (confined aquifers) interspersed with marginal-marine mudstone and siltstone units (confining beds). In all the aquifers the groundwater is largely stored in inter-granular pore spaces with fracture porosity being generally unimportant (Exon, 1973 in Worley Parsons, 2010). Groundwater recharge dominantly occurs across the northern and eastern margins of the Basin where the sandstone units are exposed (outcrop) or subcrop below belts of overlying alluvium and sandy soil.

A report by Worley Parsons, 2010, identifies alluvial sediments, Kumbarilla Beds, Walloon Coal Measures and Marburg Formation as the important aquifers within the Dalby Project Area.

Regional groundwater flow is dominantly from the topographically elevated recharge zones around the Basin margins towards the lower part of the landscape. Within the Great Artesian Basin, groundwater flow is

predominantly sub-horizontal, with limited flow occurring perpendicular to the bedding plane of the aquifers (i.e. in the vertical direction). Significant inter-aquifer flow may, however, occur locally in areas of direct aquifer connectivity, for instance, in locations where intervening aquitards are narrow, particularly, around the margins of the basin. The potential for inter-aquifer connectivity and groundwater transfer may also be enhanced where aquifers are connected by faults. However, fault gouge or secondary mineral precipitation within the spaces generated by the rock movement can effectively create a seal and limit significant movement of groundwater between aquifers (Worley Parsons, 2010).

Figure 16 shows waterbore with the classified data showing clustering of 'water' and 'major water' intersections, suggesting geological controls. The majority of major water intersections aligned east-west around EPC 1555.

The Well Completion Report for CSG well 'Bora-Creek 1' mentioned that no significant water was encountered until Hutton Sandstone was penetrated (Oberhardt & Scott, 2001), however the Walloon Coal Measures at the Commodore Mine are known to be water bearing.

In order to further understand how water is controlled by the geology, this dataset should be combined with the main borehole database and reviewed in the context of major Geoscience Australia reports and studies underway at publically funded Universities. Global Ore have approached both these institutions as part of this study and found neither party to be immediately forthcoming, however Geoscience Australia do anticipate the release of some data related to their studies in later 2013.

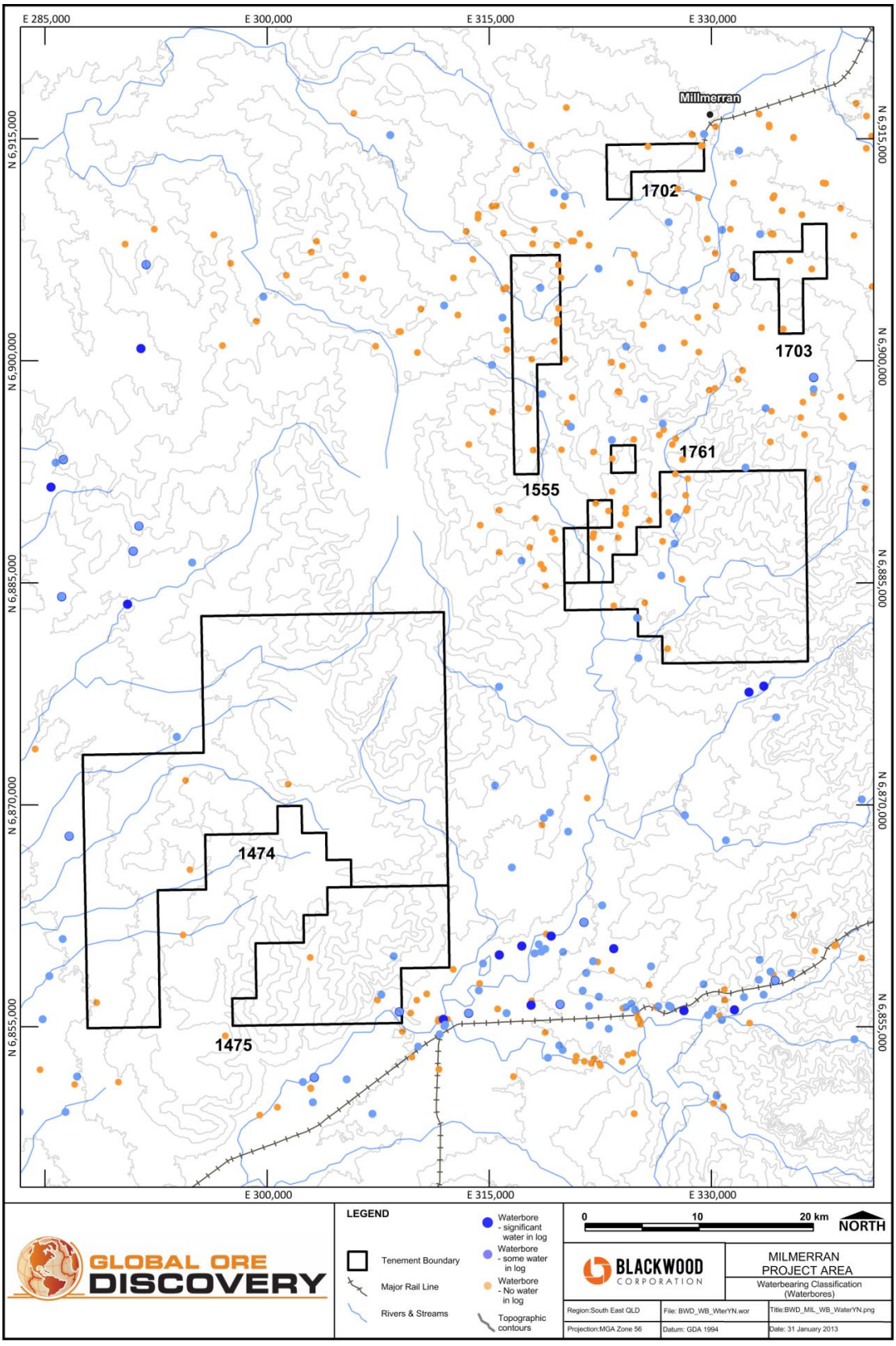

Figure 16 Distribution of water bearing and 'dry' waterbores, Millmerran Project area

4.1.6 Interpreted Walloon Coal Measures

The Walloon Coal Measures comprise shale, siltstone, sandstone and coal and host economic coal deposits in the Surat and Moreton Basins. To the east of the Texas Beds Block, (Blackwood's Warwick Project Area) the Walloons have very similar spectral response to the Hutton equivalent in the RGB KUTH and also have similar response the Th/K ratio imagery.

The key to identifying and mapping the Walloons in this area appears to be the presence of higher AlOH Content and Ferric Oxide being spatially coincident with high Th/K ratios. This suggests that unlike the Hutton equivalent the Walloons are clay rich, however the low K content indicates that the Walloons are dominated by K poor clays such as montmorillonite. The observation is consistent with reports in historic relinquishments of montmorillonitic clays within the Walloon Coal Measures.

In the Millmerran Project Area, west of the Texas Beds block, the lower coal packages in the Walloons have a similar signature to that described above, however upper units appear light redish in the radiometrics, indicating elevated K (K rich clays). This signature is repeated to the northwest of Chinchilla where it is mapped in 1:1M scale geology as the Injune Creek Group. It is interpreted that this radiometric character may represent a clay compositional variation of the upper Walloon's (higher proportions of K rich clay than the lower Walloons). It should be noted that the radiometric character is not evident along the total length of the western Walloons which may be due to limited outcrop rather than a true change in character.

It is important to note that the known coal resources are generally spatially associated with a low Th/K ratio in the Walloons with Hutton like signatures which indicates less sand (monazite) and/or higher K clay content at those locations. Figure 17 shows the outcome of a spectral classification study of outcrop overlying known resources and mapped Walloon Coal Measures. The Bringally and Commodore resource is profiled and shows patterned clay-silica and iron-silica components.

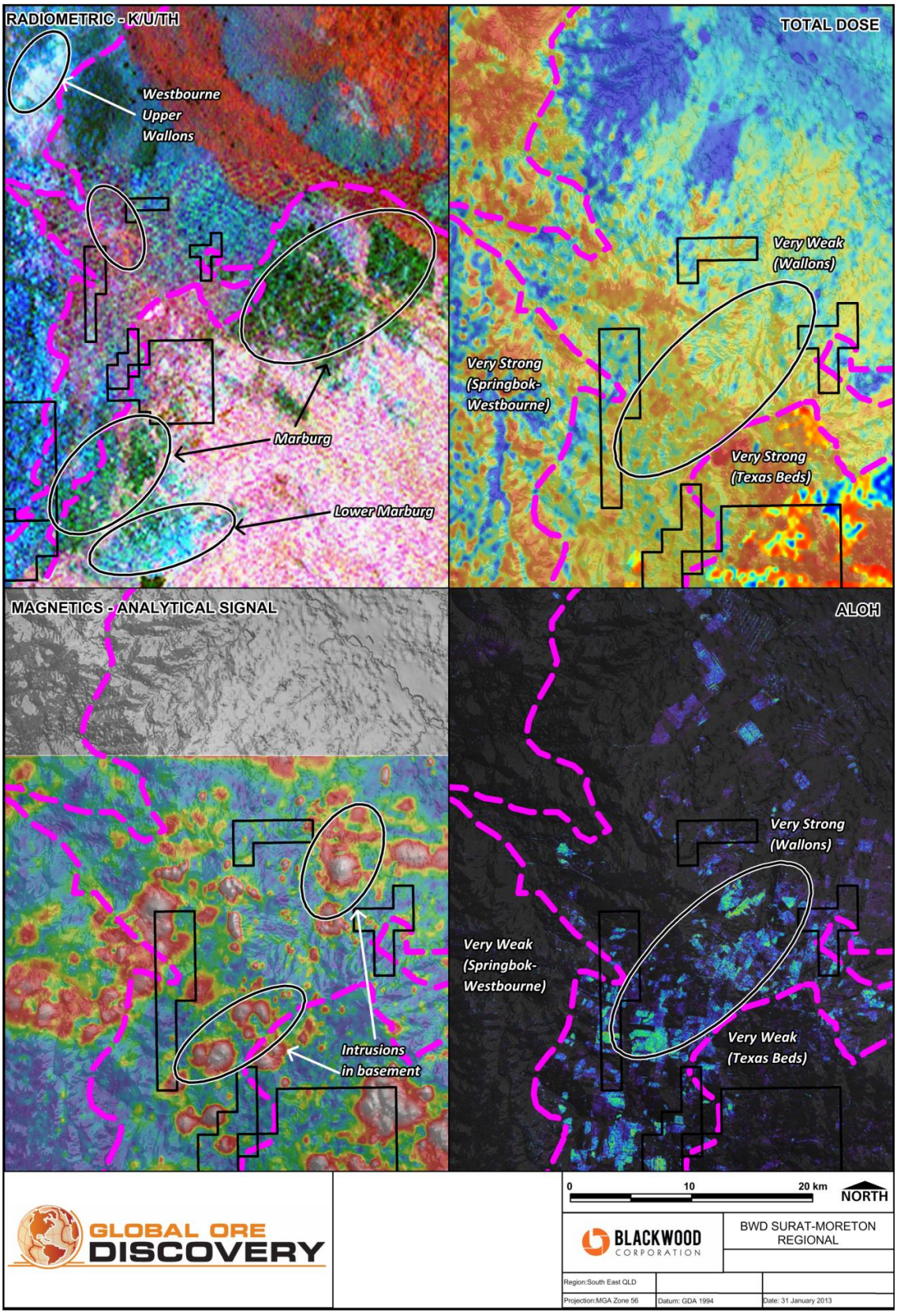

Figure 17 Walloon Coal Measures stratigraphic signatures in radiometric and spectral data

Integrating the remote sensing data has interpreted the shallow-covered base and top contact of the Walloon Coal Measures in the Millmerran Project Area. It should be noted that an optimistic approach to mapping the extent of Walloon Coal Measures and Basalt with the aim identifying unrecognised exploration potential. The contact interpretation considered

- Changes in radioactivity and AlOH content compared to the surrounding lithology.
- 1 second SRTM DEM
- Published outcrop geology maps
- Global Ore generated working sections derived from the borehole database

Figure 18 shows the surficial geology map updated with interpreted lesser-covered Walloon Coal Measures. This has been overlain with regionally interpreted structures. Key advantages of the interpretation is the incorporation of processed ASTER imagery and 1 second SRTM DEM. The interpretation was conducted in parallel with other parts of this study and requires cross-reference with the drilling data.

Quaternary cover dominantly occurs as red/red orange hues in the radiometric indicating high K rich clay content. AlOH and Kaolinite indices confirm this however as discussed a number of other units in the sequence have elevated AlOH signature.

By far the best method of mapping the quaternary cover is to utilise the radiometrics in conjunction with the high resolution SRTM. The high resolution SRTM is particularly useful in identifying slight topographic rises in the quaternary that may signify subcrop to outcrop. Additionally the kaolinite index is particularly useful in mapping areas of crystalline kaolinite (red in the Kaolinite Index ASTER image) that are likely to be due to outcrop rather than weathering products which produce poorly crystalline kaolinites.

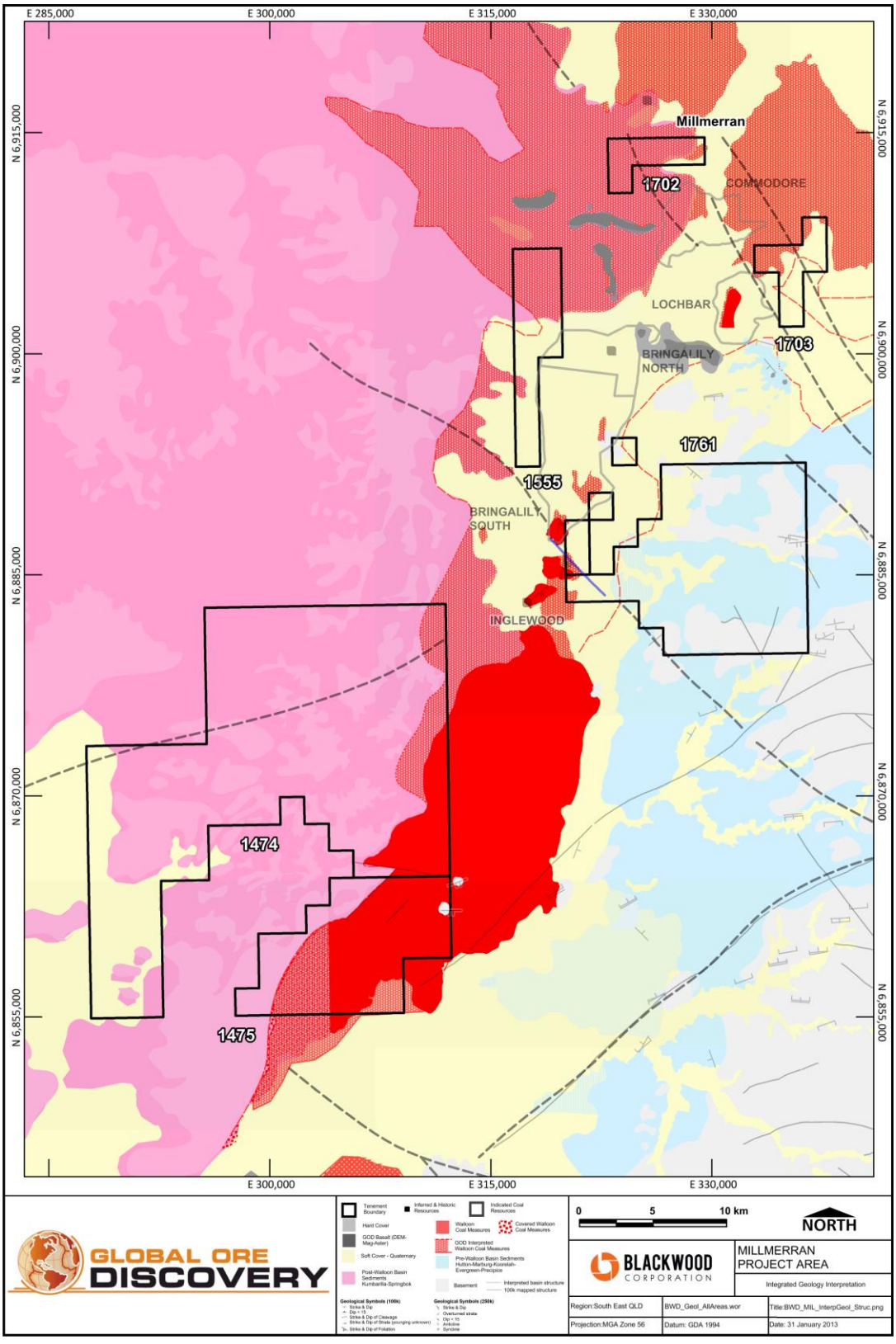

Figure 18 Integrated interpretation showing interpreted contact Walloon Coal Measures (top and base), Tertiary Basalts, and interpreted regional structures.

4.1.7 DEM/DSM

Polygons were supplied and imported into the Flight Management System , “TrackAir”, and with the required resolution parameters set, produced flight lines and required photo centre positions based on an 80 % forward and 50 % overlap geometry. The system is coupled with a medium format digital camera comprised of a 40 mb Leaf Aptus II sensor back, attached to a Contax 645 camera body capturing RGB imagery. The planned resolution required flying with clear sky conditions at 11000 ‘ AGL, but due to operational requirements most was done at an average of 9000 ‘ AGL which gave average resolutions of around 47 cm per pixel.

The ‘raw’ image files were imported to “Capture 6” software and processed to JPEG digital files. These were checked for colour and exposure and aligned with the recorded photo centre positions. The images were then ortho-rectified in blocks to match the target polygons, using software from PIX4D. A DEM was produced in the same programme from these images, with grid points calculated at no more than 100 cm apart. In most cases image coverage resulted in 3D points matching over 2,000,000 times in 2 to 3 images, over 200,000 in 4 to 5 images, and over 15,000 in 10 to 11 images. An example ‘screen scrape’ of the output can be seen in Figure 19, with the undulating cropping fields looking north. Schwartetns Rd can be seen in the middle distance, with the outskirts of the town which is visible in the hills in the top right of the picture. This DEM will significantly improve the geological models that have been run previously as we now have extremely accurate detail of the surface topography, which will also help to define the base of weathering which trends off the surface topography.

The results/output from this study are:

- An ortho mosaic composed from 141 out of 141 original images;
- An ortho mosaic covering an area of 130.68 sq. km / 13068ha / 50.48 sq. mi;
- A mean GSD (size of a pixel on the ground) of the original images computed at 47.8296 cm.

Figure 19 An example of the Digital Surface Model of EPC 1702 in Millmerran area with 10 X vertical exaggeration

4.2 EXPLORATION PLANNING

Cockatoo Coal Limited has no plans to explore this tenement any further. Although there is coal at mineable depths in the area, there are 29 parcels of land covered by the EPC and it overlaps the Darling Downs Priority agriculture area. The tenement is also completely covered by grazing and cropping land. With DSDIP giving more autonomy to local councils, it is unlikely that any coal development would be approved.

5. Conclusion

A review of historical data relevant to EPC 1555 including boreholes within the region, regional geological maps, and other historical data was integrated with a remote sensing study to deliver 4 key objectives. These being to build a digital framework for Blackwood's ongoing exploration program; to identify remote sensing and geophysical signatures of the Walloon Coal Measures and Tertiary basalts; to define the distribution of Tertiary basalt and igneous intrusions and determine the distribution of water-bearing units. Blackwood also commissioned the acquisition of 50cm GSD (Ground Sample Distance) colour RGB digital imagery and a DEM/DSM (Digital Elevation Model/Digital Surface Model) from the acquired imagery.

This years work program has

- Provided a regional geological context for comparing Blackwood's coal tenure.
- Developed new exploration concepts that ground-truthing studies can evaluate such as interpretation of stratigraphic horizons from radiometric data.
- Provided a set of new products, supplied in a GIS framework that allows the products to be readily accessed, overlaid, compared, interrogated and updated dynamically during project scale field mapping, drilling and geophysical program iterations.
- Identified at least 25 boreholes relevant to the exploration of Blackwood's Millmerran Project Area that require incorporation into the borehole database.
- Identified areas mapped as Kumbarilla Beds that are potentially Walloon Coal Measures within EPC 1702 and EPC 1555 for ground-truthing.
- Defined clay-rich parts of the Walloon Coal Measures within EPC 1474 and EPC 1475 with similar spectral characteristics to the known coal resources at Bringalily and Lochbar.
- Provided a first-pass indication of relative groundwater encumbrance.

This study showed remote sensing and geophysical datasets have potential application to tenure scale exploration in the Surat-Moreton Basin. Features in remote sensing and geophysical data correlate with lithological variations within the basin sediments and basement volcanics and the characteristics identified have the potential to aid geological mapping at the tenement scale.

It is clear from this years' work that there is a high potential for the presence of coal resources within the Middle to Upper Jurassic Walloon Coal Measures. The proximity of EPC 1555 to an existing coal mine is a good indication of the presence of coal in the EPC. However, the proximity to towns and coverage of Priority Agriculture Area means it is unlikely to gain approval for a coal mine. For this reason Cockatoo Coal has fully relinquished EPC 1555.

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