



Investigation report

Leakage testing of coal seam gas wells in the Tara
'rural residential estates' vicinity

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Executive Summary

The Petroleum and Gas Inspectorate was advised of complaints made by a number of Tara rural residential estate residents. The Commissioner for Mine Safety and Health Mr Stewart Bell authorised an investigation into the allegations of excessive noise and concerns regarding possible toxins and gas leaks from Queensland Gas Company (QGC) coal seam gas well heads.

In response to these concerns, the Safety and Health Division of the Department of Employment, Economic Development and Innovation (DEEDI) in conjunction with Simtars (Safety in Mines Test and Research Station) undertook a gas analysis, noise monitoring and well head leakage investigation. The Simtars report from work undertaken on the 30-31 March 2010 has been posted on the DEEDI web page.

The following report deals with leakage testing of QGC well heads in the Tara area, included testing carried out by the Petroleum and Gas Inspectorate on the 27-29 April 2010 and 11-12 May 2010 and testing by Simtars on 30-31 May 2010.

A total of fifty-eight (58) individual gas wells have been inspected and tested to date at the QGC Kenya gas fields of Lauren, Codie and Kate. Of the fifty-eight gas wells tested:

- One (2%) of the gas wells tested was found to be leaking above the LEL (lower explosive limit) of methane.
- Four (7%) of the gas wells were leaking at a rate at or above ten percent of the lower explosive limit (LEL) of methane.
- Twenty one (36%) of the gas wells tested were found to have very minor to minor ppm gas leaks.

The leakage testing conducted by the Petroleum and Gas Inspectorate on the 27-29 April 2010 identified a small number of coal seam gas well heads with leaks in the low parts per million (ppm) range and several with readings at percentages of the lower explosive limit (LEL). The lower explosive limit is the lowest level of methane in air at which a methane/air mixture can be ignited.

The risk of an incident from these well heads is extremely low, given the nature and size of the leaks and the isolation of the well heads from public access. Nevertheless, a Compliance Direction (CD 1741) was issued to QGC instructing QGC to undertake repairs to the well heads and provide weekly progress reports to the Petroleum and Gas Inspectorate.

The leakage testing conducted on 11 - 12 May 2010 identified a number of well heads with leaks in the low parts per million (ppm) range. Three wells had readings above 10% of, but below the lower explosive limit (LEL). One gas well head (Lauren #42) registered a reading in the percentage methane gas range of 6%. QGC were immediately issued a verbal compliance direction instructing them to take immediate steps to repair this gas well head. A work-over rig was immediately diverted to the site to affect the necessary repairs.

On 14 - 15 May 2010, similar compliance directions to that issued to QGC on 30 April 2010 were issued to all other coal seam gas production operators to ensure all companies undertake appropriate well head inspections and any required remediation, to ensure the level of risk associated with these well heads is as low as reasonably practicable.

Industry is developing a common approach to the inspection, repair and isolation of wells to ensure all wells are safe.

The Petroleum and Gas Inspectorate will continue to monitor coal seam gas companies' response to the compliance directions and testing programs. The Inspectorate will continue to conduct random site inspections along with its own testing program.

1 Introduction

1.1 Background

Over the past six months officers from the Department of Employment, Economic Development and Innovation (DEEDI) have been liaising with Tara land owners in relation to a range of environmental and access related issues associated with coal seam gas activities in the area.

In March 2010, Ms Wanda McCarthy (acting Deputy Mining Registrar based in Roma) contacted the Safety and Health Division (DEEDI) requesting assistance in relation to a complaint from Mr Michael Bretherick from Tara.

Mr Bretherick expressed concerns relating to the toxicity of gas leaking from coal seam wells. The Commissioner for Mine Safety and Health, Mr Stewart Bell authorised an investigation into these allegations. As a result, scientists from Simtars (Safety in Mines Testing and Research Station) travelled to QGC Kenya, coal seam gas fields to check wells for leaks and to take gas samples for analysis. Inspectors from the Petroleum and Gas Inspectorate also inspected wells for gas leaks.

Mr Michael Quinn, a Tara block estate resident prepared a DVD showing himself and another person conducting leak tests on QGC well sites at the Lauren, Codie and Kate gas fields using a handheld gas detector. Mr Quinn provided a list of wells he considered to be leaking to the Australian Broadcasting Commission (ABC). This list of leaking wells was subsequently provided to the Department.

1.2 Site Details

Queensland Gas Company (a subsidiary of British Gas) operates the Kenya coal seam gas fields in question (Lauren, Codie, and Kate). These fields are located between the towns of Chinchilla and Tara in south western Queensland.

Maps of the Codie and Lauren fields are attached in Appendix 2.

2. Testing Process

2.1 Simtars Testing

The results of Simtars testing undertaken on the 30-31 March 2010 have been posted on the Departmental web page: [http://www.dme.qld.gov.au/zone_files/Petroleum_and_Gas_PDFs/gas_monitoring_at_tara_gas_field_\(final\).pdf](http://www.dme.qld.gov.au/zone_files/Petroleum_and_Gas_PDFs/gas_monitoring_at_tara_gas_field_(final).pdf)).

Seven (7) wells were tested for leaks using a GEM 2000 gas analyser.

2.2 Petroleum and Gas Inspectorate leak tests




The Petroleum and Gas Inspectorate subsequently undertook two additional inspections of the QGC Kenya gas fields. The purpose of each inspection was as follows:

On 27-29 April 2010 Petroleum and Gas Inspectors met with Mr Quinn who had been independently testing QGC wells to explain gas detection methods being used by the Petroleum and Gas Inspectorate and to gauge the accuracy of Mr Quinn's detector when it was compared against a properly calibrated gas detector. The Inspectorate tested eighteen (18) wells using a GMI Gasurveyor 500 a parts per million (ppm) flammable gas detector. This round of tests did record several low ppm and percentage of the lower explosive limit (LEL) gas readings (see section 3.3 for an explanation of LEL).

On 11-12 May 2010 additional leak testing was undertaken by the Inspectorate. A total of forty-six (46) wells were tested using a GMI Gasurveyor 500 a parts per million (ppm) flammable gas detector, these included the thirty-nine (39) wells previously identified by Mr Quinn as leaking. The testing procedure involved checks of the immediate surrounding atmosphere around each well head from a distance of approximately two metres away, and up to the well head itself using the ppm leak detector.

2.3 Gas detection equipment

During the March 2010 inspections, a GEM 2000 Gas Analyser was utilised. During the April and May 2010 inspections, a highly sensitive GMI parts per million (ppm) gas detector was used. This unit was not available for the prior inspection on the 30-31 March 2010. A Bacharach Leakator detector was also used where appropriate.

Analyser	Detection range	calibration date	comments
GMI (Gasurveyor 500) Detector 	0 to 1000 ppm 0% to 100% LEL 0% to 100% gas	April 2010 This unit was calibrated by its owners the APA Group on the 5 April 2010.	Gasurveyor 500 (0-1000 ppm / Volume gas 0–100%) detector. This unit was calibrated by its owners the APA Group on the 5 April 2010.
Bacharach Leakator Ionizing detector 	0 to 1000 ppm	No calibration These units are presence of gas indicator only. They do not record the level of gas present	Bacharach (Leakator) Ionizing detector has no means of calibration. These types of units are a presence of gas indicator only. They do not record the level of gas present.
GEM 2000 Gas Analyser 	0% to 100% LEL	April 2010 calibrated by Health Pipeline Services.	Registers LEL

3. Investigation Findings

A summary of the results of all leakage testing conducted or provided on a well by well basis is provided in Appendix 1.

This testing was conducted over three periods. Some wells were inspected and tested more than once.

3.1 Simtars testing

On 30-31 March 2010 Simtars conducted gas and air sampling and infield leak testing. A copy of the Simtars report has been posted on the Departmental web pages.

([http://www.dme.qld.gov.au/zone_files/Petroleum_and_Gas_PDFs/gas_monitoring_at_tara_gas_field_\(final\).pdf](http://www.dme.qld.gov.au/zone_files/Petroleum_and_Gas_PDFs/gas_monitoring_at_tara_gas_field_(final).pdf)).

Seven (7) wells were also tested for leaks using a GEM 2000 gas analyser. No wells were identified as leaking. A methane concentration was detected near an over pressure vent on an associated pipeline to the separator which is consistent with the operation of the vent.

3.2 Petroleum and Gas Inspectorate inspection of gas well heads for leaks

3.2.1 Inspection conducted on 27-29 April 2010

As a result of the Department's testing, it was established that Mr Quinn's 'gas detector' was shown to indicate inaccurate levels of gas when compared with the GMI Gasurveyor 500 detector. In general Mr Quinn's 'gas detector' gave higher gas indications than those determined by the calibrated GMI Gasurveyor 500 detector.

Eighteen (18) well heads were inspected and leak tested using the GMI Gasurveyor 500 detector:

- One (1) well head had methane levels recorded above 10% LEL.
- Five (5) well heads were found to have very minor to minor ppm readings, only when the detector was held hard against the well head equipment.

All leaks represent extremely low level concentrations of methane. These minor leaks were detectable on the well heads only when the detector was held immediately hard up against the well head equipment. There were no methane gas readings detected at a distance of approximately half a metre away from any of the well heads checked.

3.2.2 Inspection conducted on 11-12 May 2010

Forty-six (46) well heads were inspected:

- One (1) well head Lauren #42 was found to have a reading of 6% methane gas. This was reported to QGC and a verbal compliance direction was issued by the Inspectorate to QGC to immediately take action to repair the leak.
- Three (3) well heads had methane levels recorded above 10% of LEL.
- Sixteen (16) well heads were found to have very minor to minor ppm readings, only when the detector was held hard against the well head equipment. These represent very low level concentrations of methane. No methane was detected in the atmosphere immediately adjacent (half a metre) from the well heads.

3.3 Analysis of findings

A total of fifty-eight (58) individual gas wells have been inspected and tested to date at the QGC Kenya gas fields of Lauren, Codie and Kate. Of the fifty-eight gas wells tested:

- One (2%) of the gas wells tested was found to be leaking above the LEL of methane.
- Four (7%) of the gas wells were leaking at a rate at or above ten percent of the lower explosive limit (LEL) of methane.
- Twenty-one (36%) of the gas wells tested were found to have very minor to minor ppm gas leaks.

At all the well sites where leaks were found, no methane was detected at a distance of half a metre from the well head.

The composition of the gas samples taken from the wells were of the order of approximately 99% methane (see Simtars report). Methane is a non-toxic gas that is lighter than air (i.e. it will rise upwards into the air/sky when released into the atmosphere).

Methane is flammable only when it is in concentrations of between 5 and 15% in air. If the methane concentration is less than 5% or more than 15%, ignition of the air/methane mixture is not possible. The lowest concentration of methane in air at which flammability can occur (if ignition was introduced) is called the lower explosive limit or (LEL).

A reading of 10,000 ppm is equal to 1% of methane and 50,000 ppm equals 5% methane or the LEL. Typical personal gas detectors are set to provide audible alarm at limits of 10% (5,000 ppm) or 20% (10,000 ppm) of the LEL (as a preliminary warning device).



Photo of a typical well head – majority of the detected gas readings were recorded at the threaded connection between the steel casing pipe and the well head base at ground level (see red arrow).

4 Actions Taken / Proposed

At the time of writing this report a total of fifty-eight (58) QGC wells had been inspected. One well had a gas reading of 6% methane gas. QGC were instructed to take immediate action to repair the well head (Lauren #42) and this was completed on 15 May 2010.

The majority of the leaking wells had recorded levels of methane in the very minor to minor ppm range, with four in the low percentage of LEL range. With all but one of the wells having gas readings below the LEL, the risk of ignition from these leaks is extremely remote given that the well heads are exposed to the open air and the area is well ventilated. QGC policy requires that there are no ignition sources within a 15 metre radius of the well heads.

After the initial inspection on the 30-31 March 2010, the Chief Inspector Petroleum and Gas issued a Compliance Direction to QGC under the *Petroleum and Gas (Production and Safety) Act 2004* (P&G Act). The compliance direction (CD1641) required the operator of the wells (QGC) to undertake inspections of the wells and to conduct a risk assessment in regard to the risks associated with the wells. They were also required to put in place controls to ensure an acceptable level of risk as low as reasonably practicable, as required under the P&G Act. The compliance direction also required gas sampling to be undertaken to identify if any toxic gases were present.

QGC undertook inspections with an LEL detector and identified no leaks. Lauren #51, which had previously been identified as having a leak and awaiting the availability of a work over rig, was repaired on 28 March 2010.

Following the second inspection of the wells on 27-29 April 2010 with a sensitive ppm detector, QGC were issued a second compliance direction (CD 1741) to reinspect their wells with a ppm detector and take 'necessary remedial action'. It was confirmed that this action should be inline with the identified risks taking into consideration of the size of the leak, the security and isolation of the well head. The required action will vary in accordance with the leak and the other controls in place around the wells (e.g, fencing).

Further representative sampling of the gas stream and ambient air at the well head and gas plant was also requested from the company along with analysis of the exhaust emissions from gas fired engines used at well heads. These actions are required to be undertaken by 28 May 2010.

A third compliance direction (CD1778) was issued to QGC specifically in regard to Lauren #42 which was found to have a leak above the LEL limit and this well was repaired on 15 May 2010.

On 14 and 15 May 2010 compliance directions similar to the QGC CD 1741 were issued to all (ten) coal seam gas companies operating production wells in Queensland. These companies were directed to inspect their production wells for leaks and to undertake similar risk assessments in relation to the well heads. The well head integrity of all production wells was required to be verified to meet the relevant standards under the Petroleum and Gas (Production and Safety) Regulation 2004. Companies were given until 11 June 2010 to undertake the required work.

Further Work:

Further ambient air testing has been conducted by Simtars during the week of the 18 May 2010. The issue of air quality from exhaust emissions from gas powered engines driving the well head pumps has been raised by residents and further sampling is proposed for the coming weeks. Companies will continue to report the results of their findings and remediation work they undertake to the Petroleum and Gas Inspectorate on a weekly basis. The Petroleum and Gas Inspectorate will also undertake random field inspections and testing to ensure the gas companies meet their legislative obligations.

Appendix 1 Results of gas well leak testing

Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
Lauren #4	12 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	418	Nil
	12 May	Well head fitted Shut in	Bacharach & GMI 500	320 ppm	524	Under casing connection to well head
	12 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	550	Nil
Lauren #32	12 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	480	Nil
	12 May	Well head fitted Shut in	Bacharach & GMI 500	320 ppm	524	Under well head to casing connection
	12 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	540	Nil
Lauren #40	11 May	Well head fitted Shut in	Bacharach & GMI 500	320 ppm	586	Below 2" ball valve on well head
Lauren #41	11 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	72	Nil
Lauren #42	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	11 May	Well head fitted Shut-in	Bacharach & GMI 500	6% Methane gas	529	Under the Eco-meter side of well head
Lauren #43	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	11 May	Well head fitted Shut-in	Bacharach & GMI 500	2000 ppm	240	Around casing connection

Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
Lauren #44	12 May	Well head fitted Shut-in	Bacharach & GMI 500	30 ppm	Not recorded	On casing connection under wheel handle. Note: 2" plug missing thread of ball valve stripped
Lauren #45	12 May	Well head fitted Shut in	Bacharach & GMI 500	200 ppm	580	On casing connection under main valve
Lauren #46	11 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	585	Nil
Lauren #47	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	11 May	Well head fitted Shut in	Bacharach & GMI 500	60% of LEL	469	Around casing connection to well head
Lauren # 48	12 May	Well head fitted Shut in	Bacharach & GMI 500	40% of LEL	586	Under main ball valve and casing connection
Lauren #49	11 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	2.9	Nil
Lauren #50	11 May	Well head fitted Shut in	Bacharach & GMI 500	2000 ppm	522	Around casing connection to well head
Lauren #51	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	27 April	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	521	Nil

Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
Lauren #52	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	27 April	Well head fitted Shut in	Bacharach detector ppm detector	No readings recorded	Not recorded	Nil
	11 May	Well head fitted Shut in	Bacharach & GMI 500	No readings recorded	521	Nil
Lauren #53	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	540	Note: ½" plug missing from needle valve
Lauren #54	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	580	Nil
Lauren #55	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	603	Nil
Lauren #56	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	512	Nil
Lauren #57	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	2.7	Note: ½" plug missing from needle valve
Lauren #58	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	7.8	Nil
Lauren #64	11 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	.6	Nil
Lauren #65	11 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	548	Nil
Lauren #66	11 May	Well capped no well head fitted	Bacharach and GMI 500	No readings recorded	Not recorded	Nil

Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
Lauren #67	29 April	Well head fitted Shut in	GEM detector	1000 ppm	Not recorded	At screwed connection on "B" section
	12 May	Well head fitted Shut in	Bacharach and GMI 500	3500 ppm	65	At casing connection to well head
Lauren #68	12 May	Well head fitted Shut in	Bacharach and GMI 500	350 ppm	596	Under main valve at well head
Lauren #69	12 May	Well head fitted Shut in	Bacharach and GMI 500	315 ppm	589	Under casing connection
Lauren #70	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	5.5	Nil
Lauren #71	29 April	Well head fitted- Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	11 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	13	Nil
Lauren #72	29 April	Well head fitted Shut in	Simtars Gem LEL Analyser	1500 ppm	Not recorded	Directly under well head outlet
	12 May	Well head fitted Shut in	Bacharach and GMI 500	3000 ppm	566	Under casing connection
Lauren #73	29 April	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings	633	Nil
Lauren #74	29 April	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	613	Nil
Lauren #75	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	20	Nil

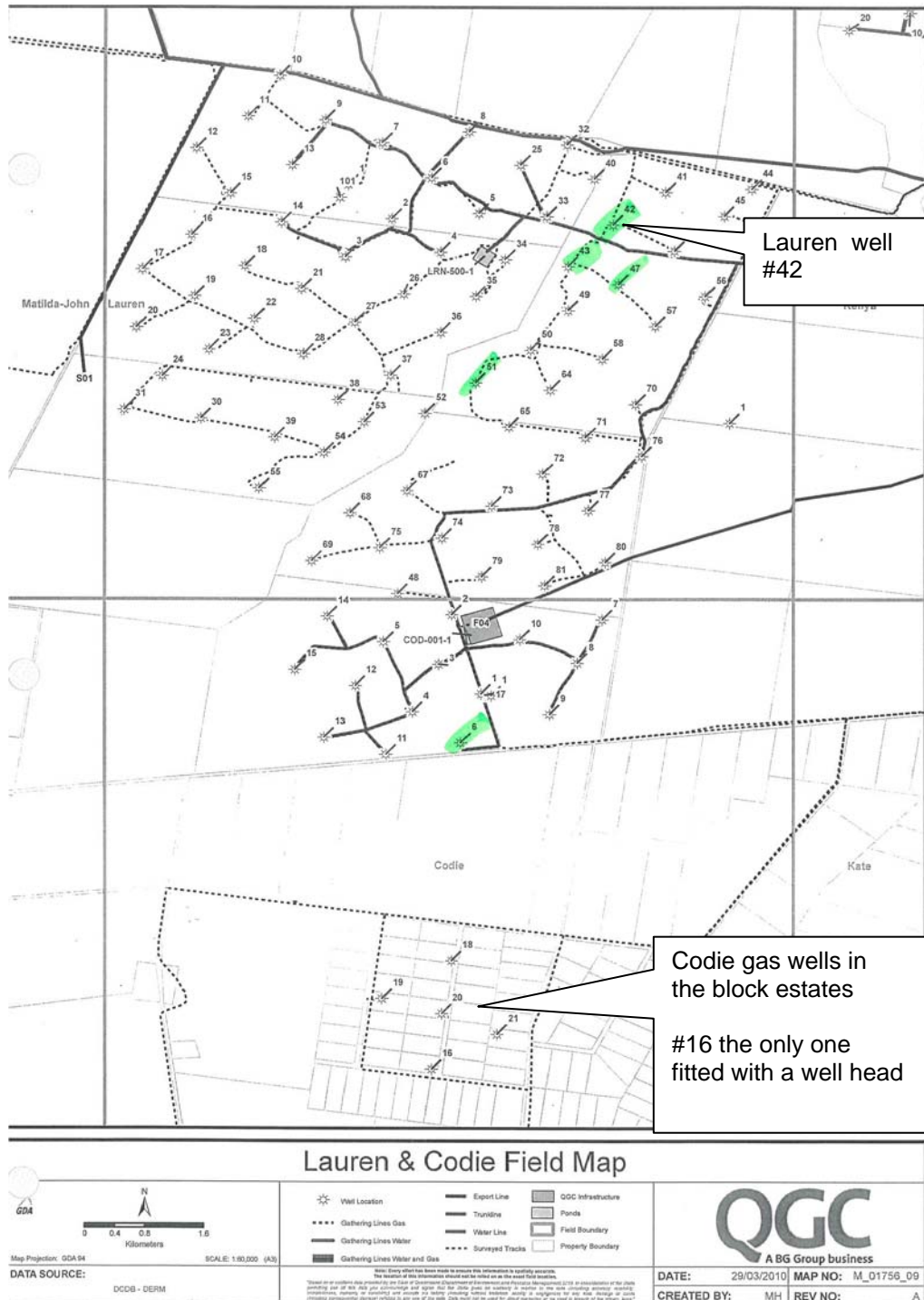
Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
Lauren #76	29 April 12 May	Well head fitted Shut in Well head fitted Shut in	Simtars Gem LEL Analyser Bacharach and GMI 500	No readings recorded No readings recorded	82	Nil Nil
Lauren #77	12 May	Well head fitted Shut in	Bacharach and GMI 500	20 ppm	35	Under casing connection
Lauren #78	12 May	Well head fitted Shut in	Bacharach and GMI 500	1000 ppm	622	To side of main ball valve on casing connection
Lauren #79	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	625	Nil
Lauren #80	12 May	Well head fitted Shut in	Bacharach and GMI 500	35% of LEL	380	Under main valve on casing connection
Lauren #81	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	626	Nil
KATE FIELD						
Kate #2	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	0	Nil
Kate #3	29 April	Well head fitted Shut in	Simtars Gem LEL Analyser	55 ppm	Not recorded	Around screwed flange connection
Kate #4	29 April	Well head fitted Shut in	Simtars Gem LEL Analyser	40 ppm	Not recorded	reading around flange bolts
Kate #6	27 April	Well head fitted Shut in	Simtars Gem LEL Analyser	120 ppm	Not recorded	Around screwed connection on the "B" section. Visually identified using soapy water solution

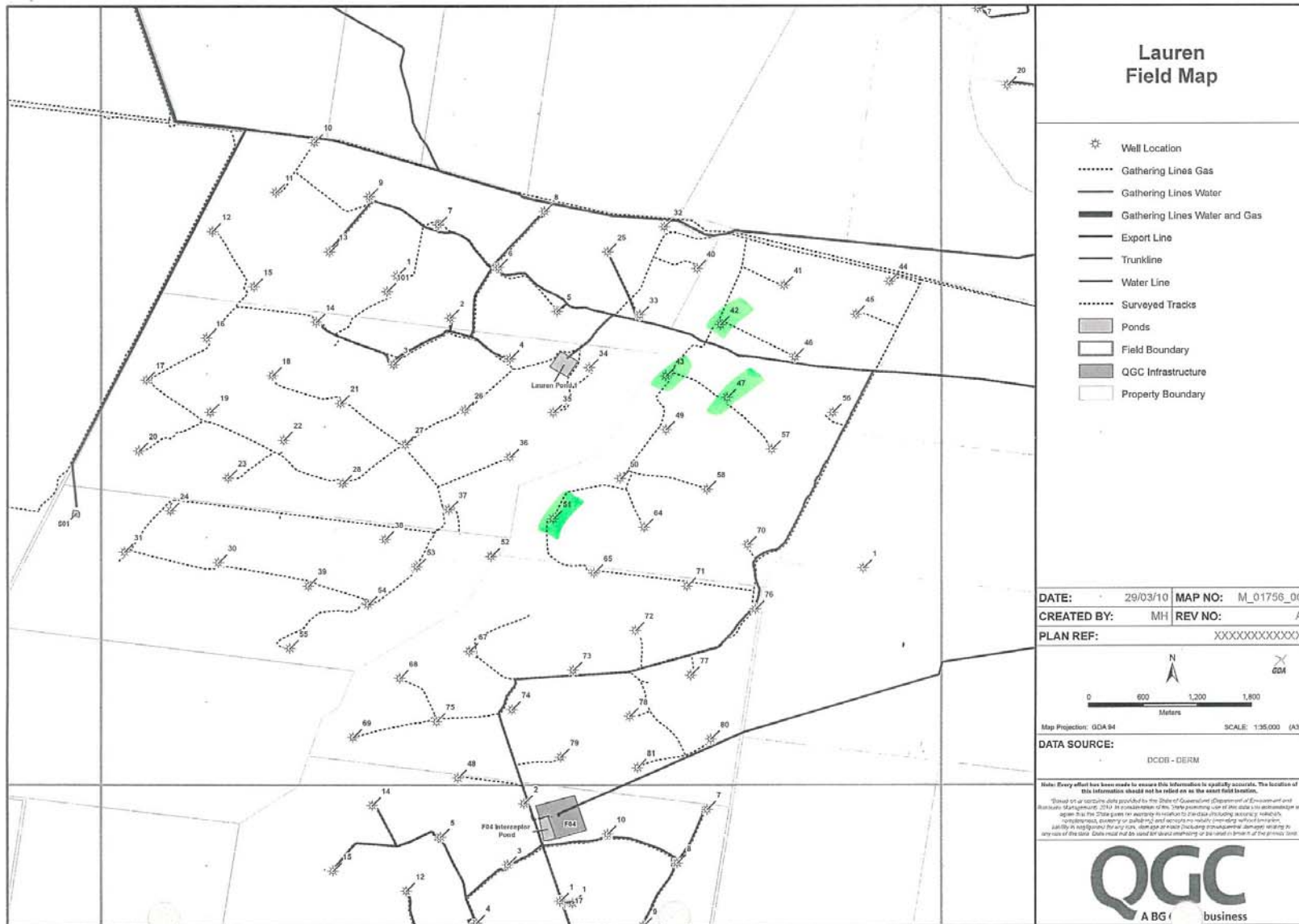
Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
CODIE FIELD						
Codie #4	12 May	Well head fitted Shut in	Bacharach and GMI 500	2000 ppm	556	Under outlet ball valve Note: Plug missing from batt valve
Codie #5	12 May	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	8	Nil
Codie #6	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	29 April	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	3	Nil
Codie #14	12 May	Well head fitted Shut in	Bacharach and GMI 500	40 ppm	577	Under casing connection Note: 2 x plugs missing
Codie #15	12 May	Well head fitted; Shut in	Bacharach and GMI 500	40 ppm	556	Under casing connection Note:1 plug missing
Codie #16	30 March	Well head fitted Shut in	Simtars Gem LEL Analyser	No readings recorded	Not recorded	Nil
	28 April	Well head fitted Shut in	Bacharach and GMI 500	No readings recorded	Not recorded	Nil
Codie #18	28 April	Well capped no well head fitted	Bacharach and GMI 500	No readings recorded	Not recorded	Nil
Codie #19	28 April	Well capped no well head fitted	Bacharach and GMI 500	No readings recorded	Not recorded	Nil
Codie #20	28 April	Well capped no well head fitted	Bacharach and GMI 500	No readings recorded	Not recorded	Nil
Codie #21	28 April	Well capped no well head fitted	Bacharach and GMI 500	No readings recorded	Not recorded	Nil

Well	Date Sampled	Well status at time of inspection	Detector	Recordings	Well pressure In PSI	Leak location
Codie #48	29 April	Well capped no well head fitted	Bacharach and GMI 500	11% of LEL	Not recorded	Note: Plugs missing from open quarter turn valves on well head 2 x 3"; 1 x 1/2" (photo taken)

Appendix 2 QGC Documentation

QGC Lauren and Codie coal seam field maps

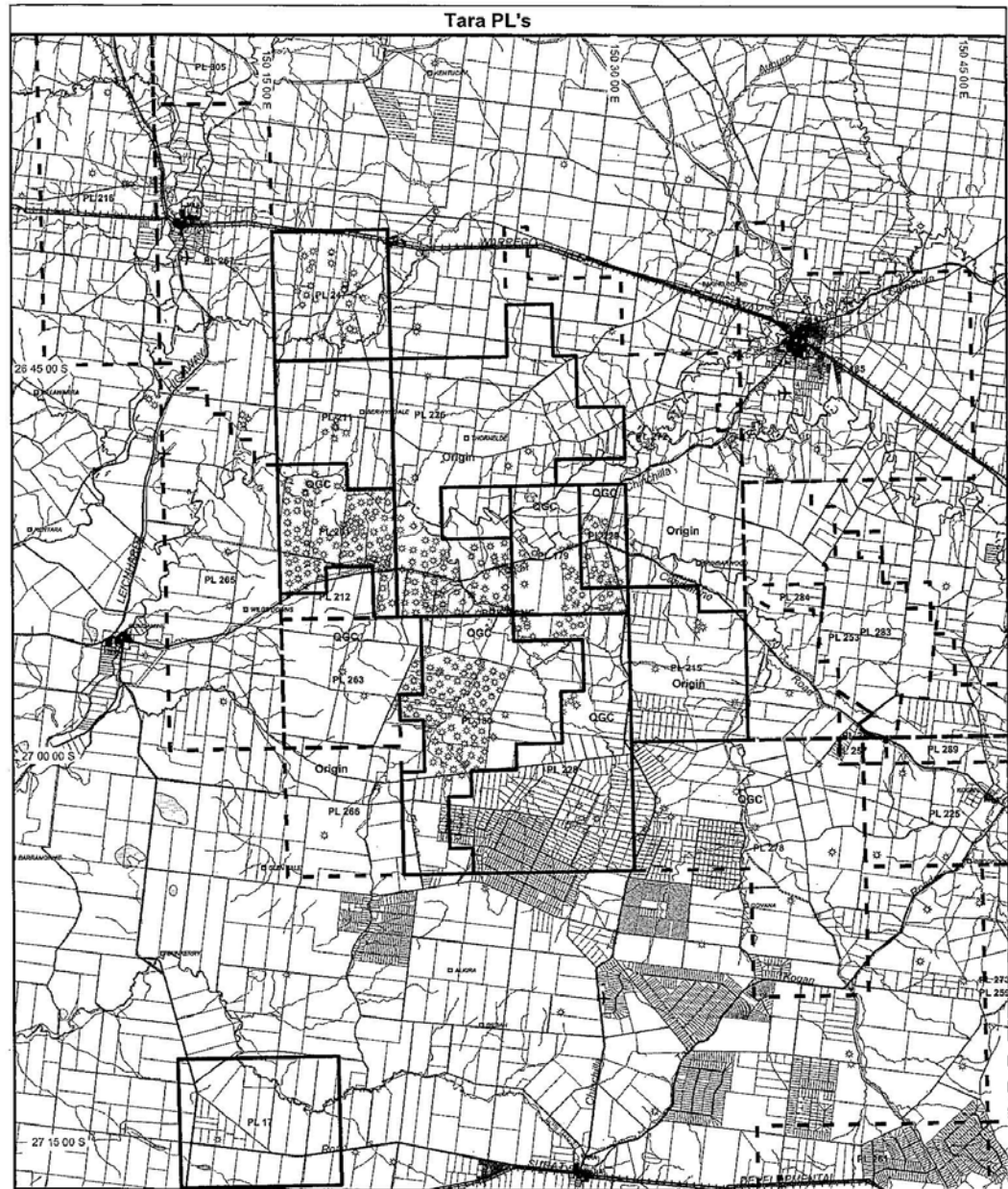




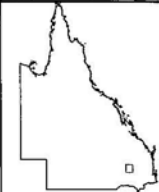
Tara PL's

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- Mining District
- PL Application
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- Topo - Towns



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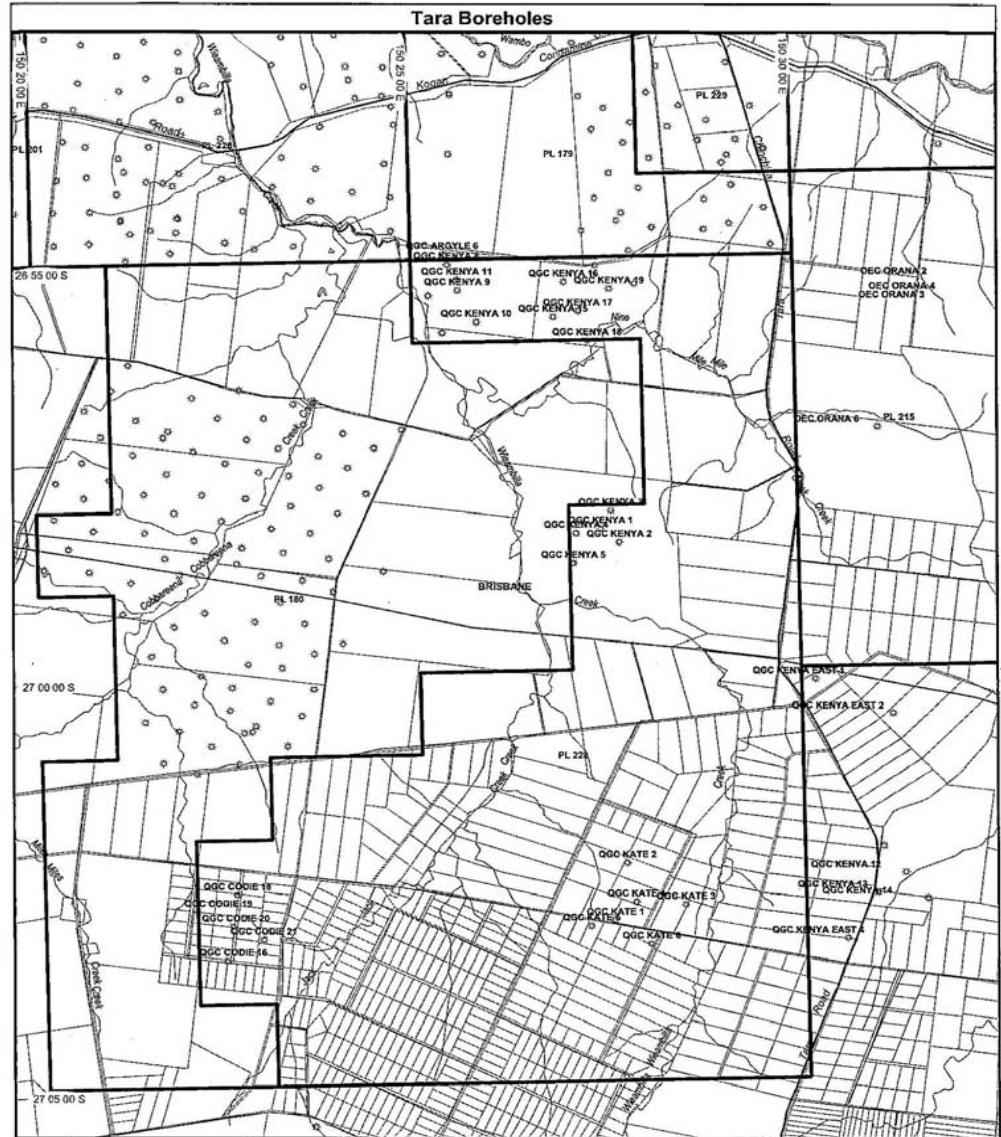
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- reservoir [NII]
- salt_cst_R [NII]
- salt_w_bund [NII]
- swamp marsh [NII]
- swamp [NII]
- Topo - Localities (100K) [NII]
- Bay / inlet / Cove [NII]
- Beach [NII]
- Cape / Headland / Point [NII]
- Cemetery [NII]
- Gorge [NII]
- Homesite [NII]
- Mountn / Peak / Hill [NII]
- Pass [NII]
- Populated Place [NII]
- Road Junction [NII]
- Waterbody Island [NII]
- Topo - Offshore [NII]
- Topo - Railway Stations [NII]
- rail_station [NII]
- Topo - Railways [NII]
- Topo - Rivers [NII]
- Topo - Road
- Highways
- Major Roads
- Roads
- Topo - Streams [NII]
- right_a [NII]
- watercourse_a [NII]
- watersite
- Topo - Towns [NII]



Please turn over for legend

Scale 1:75,000
 0 1 2 km
 Projection: UTM (QGA94)
 Zone: 56



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