SURAT BASIN
ATP 790P
Stratheden-2
Walloon CSG
Well Proposal
January 2007

On Approval Copies must be sent to:

Arrow well site representative
Triassic Geological Services
Arrow GM Exploration & Land
Arrow CEO
Arrow Principal Drilling & Completions Engineer
Johnson Drilling
Arrow Energy well file

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CEO

Exploration Manager

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APPENDIX 1

JSEA (RISK ASSESSMENT)

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1. SUMMARY / SPEC CARD

Well Name:	**Stratheden-2**
Tenure:	ATP 790P
Map Sheet:	Kogan 1:100,000 Dalby 1:250,000
Latitude/Longitude:	*27°13' 21"S* *151°01' 15"E* (GDA 94)
Easting/Northing:	**303 990** *E* ***6 987 370*** *N* (GDA 94, Zone 56)
Elevation:	330m
Block:	Lot 1 on RP 203843
Landholder:	Edward Wanka
Nearest Town:	Dalby (20km East)
Nearest Road:	Ducklo School Rd

Directions to proposed drill sites (see Figure 1):

- From Dalby, head west along the Dalby-Kogan Road
- After ~21km turn left (south) into the Daandine-Nandi Rd (intersection is marked by a disused petrol station)
- Continue ~6.5km and turn right (west) into the Duleen-Daandine Rd
- After ~3.5km the road bends hard left (south), continue following this road.
- ~500m from the bend, turn right (west) down Ducklo School Road
- After ~2.5km follow the road around to the left (south)
- Drill site is ~2.7km on the left (east) just off the road

Nearest Wells:	Daandine-17 (12km NNW) Broadwater-1 (10km S) DB035a (2.2km west)
Surface Casing Depth:	115m (10% TD + margin or 20m below top competent formation and into top Walloons) depth is to be increased if significant alluvium thickness is intersected.
Main Target:	Walloon Coal Measures
Estimated Total depth:	460m (increase to 555m if the Hutton is to be tagged for stratigraphic control)

Net Coal thickness expected: 30m

Drilling Contractor and Rig: Johnson Drilling Rig 5

Well Abbreviation: **SE2**

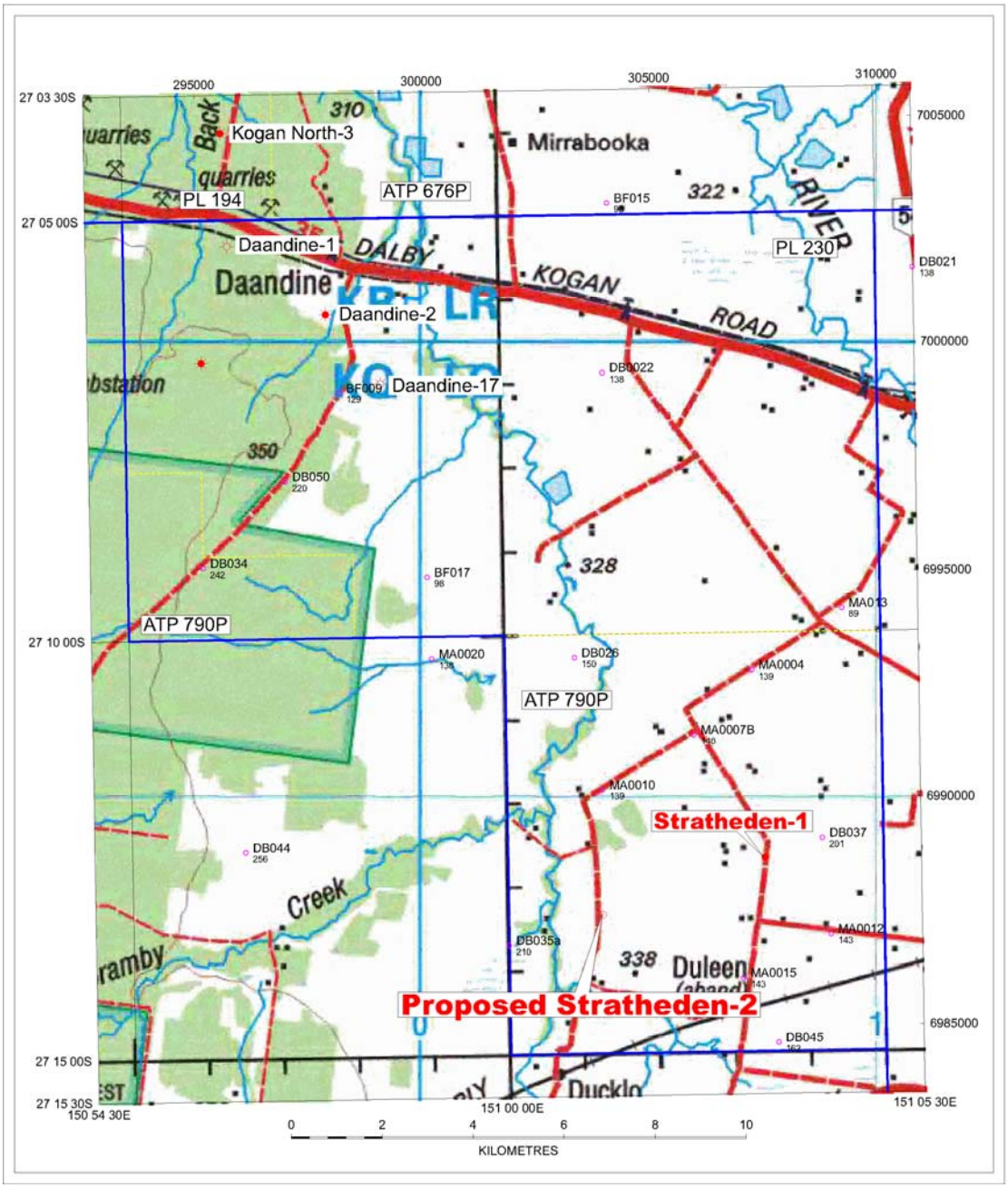

Figure 1: Regional location of Stratheden-2 in ATP 790P

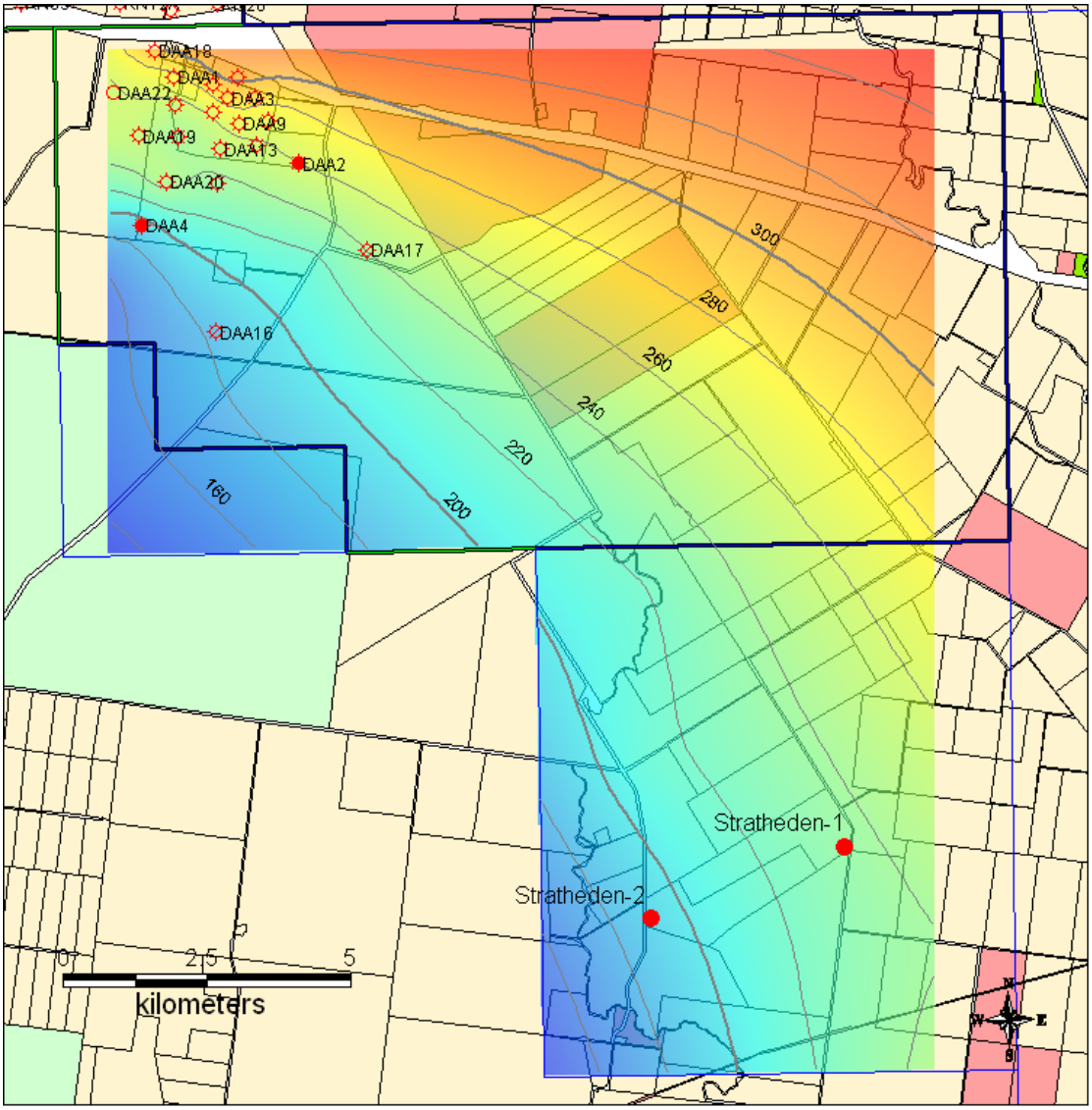

Figure 2: Stratheden-2 Location on Regional Structure

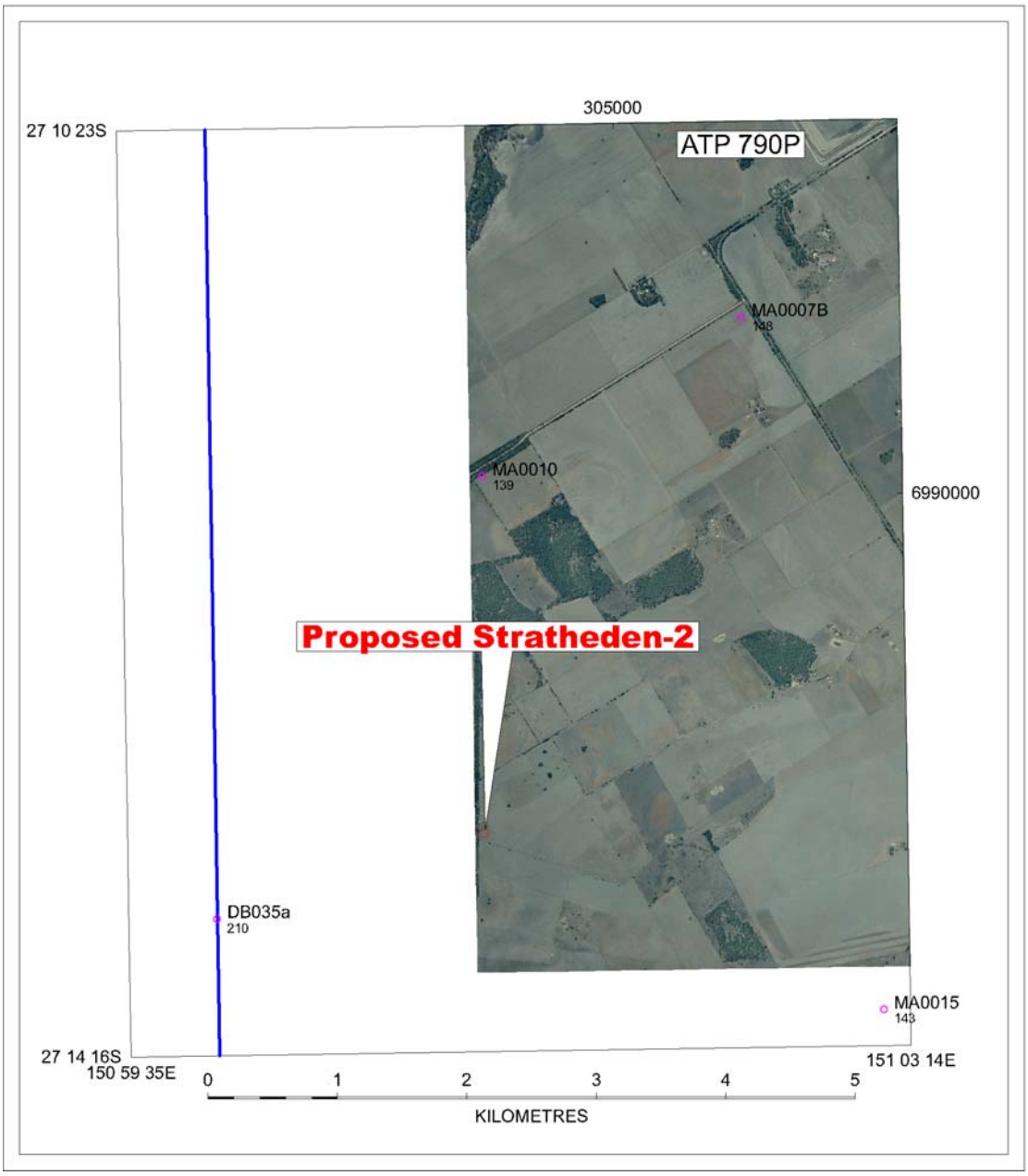

Figure 3: Location of Stratheden-2 on local Airphoto

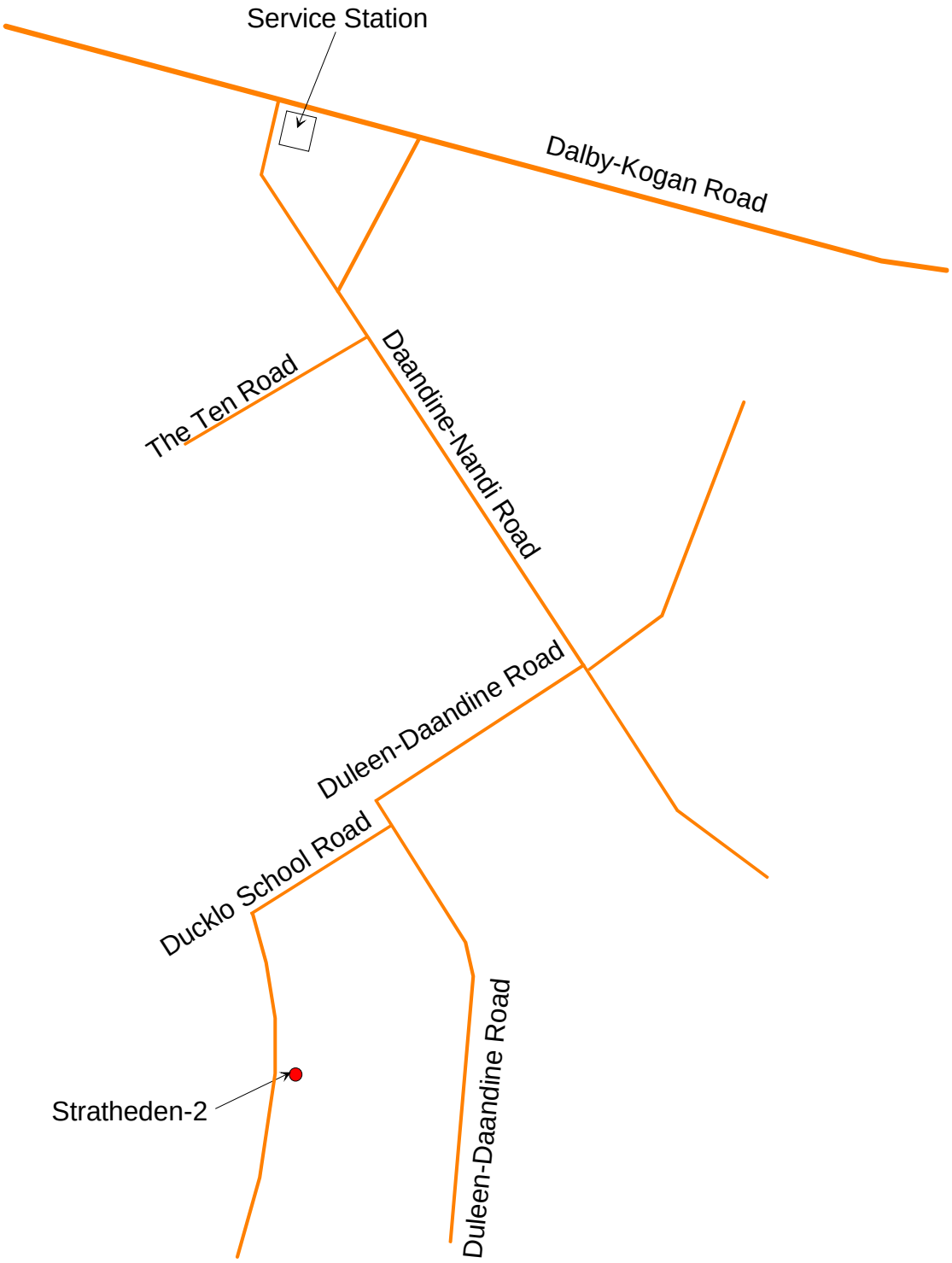

Figure 4: Mud map to Stratheden-2

2. GEOLOGY

2.a. Geological Summary

The Surat Basin is a large intracratonic basin of Mesozoic age covering approximately 300,000km^2 of southeastern Queensland and northern New South Wales (Figure 5). The basin forms part of the larger Great Australian Basin (Green at al, 1997), interfingering westward across the Nebine Ridge with the Eromanga Basin, and eastward across the Kumbarilla Ridge with the Clarence-Moreton Basin (Exon, 1976). Basin Blocks consisting of the Central West Fold Belt and the New England Fold Belt limit the basin to the south, while in the north the basin unconformably overlies Triassic and Permian sediments of the Bowen Basin.

The Surat Basin contains up to 2,500m of sedimentary rocks deposited during the later Triassic to Early Cretaceous periods (Figure 6). The succession in the basin consists of five fining-upwards sedimentary cycles dominated by fluvio-lacustrine deposits (Exon, 1976; Exon and Burger, 1981; Day et al, 1983). The lower part of each cycle typically comprises coarse-grained mature sandstone, grading up into more labile sandstone and siltstone, with mostly siltstone, mudstone and coal in the upper part. In the Cretaceous, inundation of the land through an increase in sea level led to deposition of predominantly coastal plain and shallow sediments in two cycles.

Structurally, the Surat Basin is relatively simple, with the area of maximum deposition in the Mimosa Syncline, which overlies the thickest Permian-Triassic rocks in the Taroom Trough of the underlying Bowen Basin (Day et al., 1983). Major faulting within the basin predominantly mirrors basinal boundary faults of the underlying Bowen Basin. There is substantial folding across the basin, which is due to compaction and draping, as well as some rejuvenation of older pre-Jurassic structures and faults. Formations outcrop along the northern erosional boundary and dip gently to the south and southwest at less than 5°.

A simplified stratigraphic section of the Surat Basin is shown in Figure 6. Basin fill started with the Precipice Sandstone, which was overlain by the more silty Evergreen Formation. A renewal of sedimentation laid down the Hutton Sandstone. Above these the Walloon Coal Measures were conformably deposited. Overlying the Walloon Coal Measures with a slight unconformity is the Springbok Sandstone (or Kumbarilla Beds further east). The springbok sandstone is overlain by the Westbourne Formation and Gubbermunda Sandstone. In the study area, the Surat Basin sequence is overlain by tertiary sediments and alluvial deposits.

The Walloon Coal Measures are usually shales, siltstones, and claystones, with fine to medium calcareous sandstones and greywackes. There is also a number of discontinuous coal seams of varying thicknesses present (Gould, 1968). Individual lithologies usually form lenses that are only of limited lateral

extent (Yago et al., 1994), although sand bodies may be quite extensive and thick (up to 30m; Fielding, 1993). Coal bodies are generally sheet-like when viewed locally, but lenticular over wider areas (Yago & Fielding, 1996).

Where unweathered, the Walloon Coal Measures are usually light grey sandstones, siltstones and mudstones. Sandstones are generally fine to medium-grained, poorly-sorted and angular to subrounded. Finer-grained layers usually have a silky to soapy texture, and are poorly laminated. The mudrock units frequently contain nodular masses of siderite (Fielding, 1993).

The base of the Walloon Coal Measures is defined by the first significant coarse quartz sand of the Hutton Sandstone. This is usually indicated on wireline logs by a sharp SP break, and a lesser gamma break.

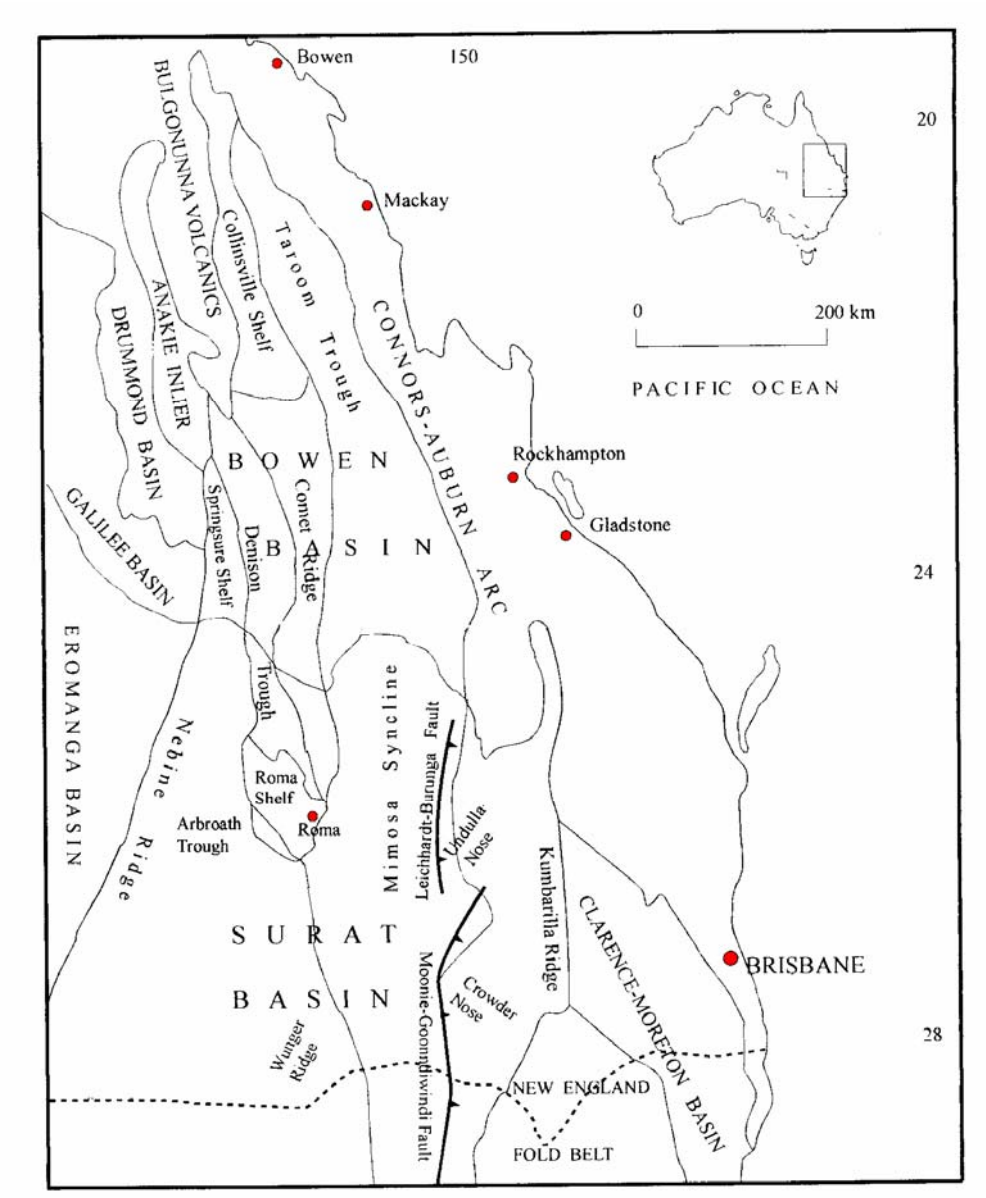

Figure 5: Structural Elements of the Surat Basin (after Nguyen and Dewhirst, 2002)

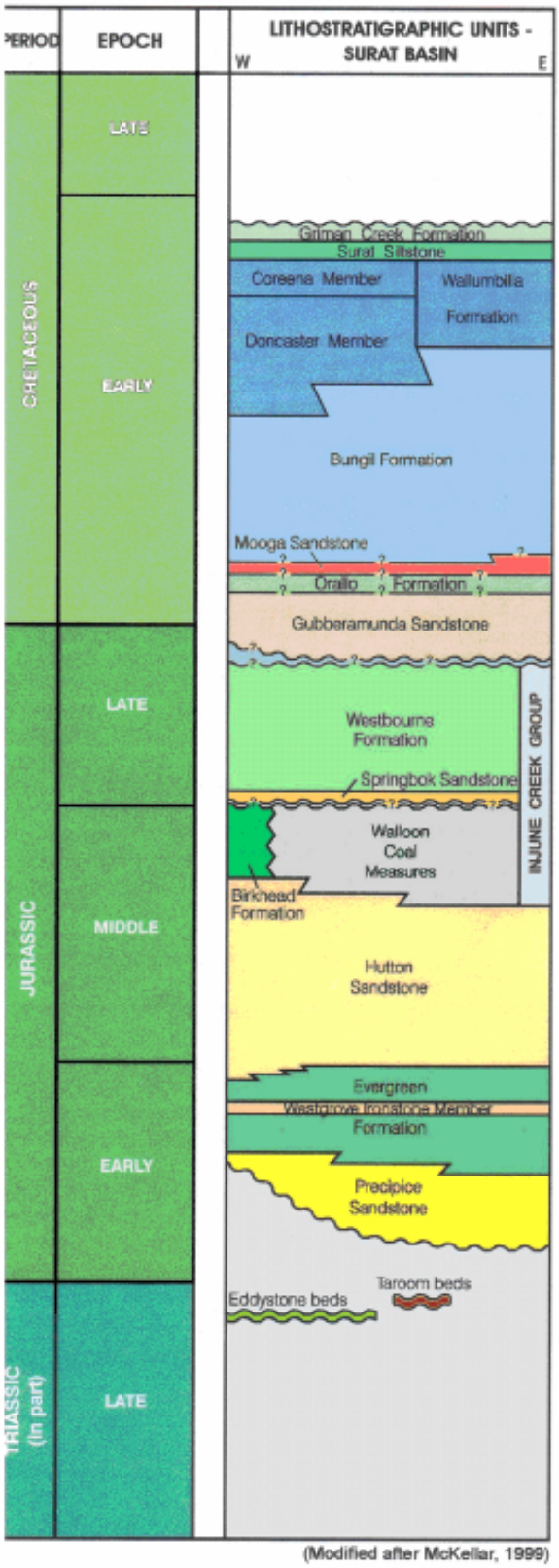

Figure 6: Surat Basin Stratigraphic Section (After McKellar, 1999)

2.b. Previous Exploration

Exploration for CSG in the area of ATP 790P began with the Daandine-1 stratigraphic well. This was drilled as a followup to drilling in the adjacent Kogan North Field. Subsequent coring has shown good gas contents and coal development, while production drilling has demonstrated gas producability in the north west of the permit.

2.c. Reasons for Drilling

Stratheden-2 is being drilled test coal development and structure in the portion of ATP 790P not covered by PL 230. The well is part of a program to prove reserves and justify further development planning.

The wellsite has been situated on an area of open paddock to minimize landholder and environmental disturbance (see airphoto in Figure 3).

2.d. Predicted Section

Stratheden-2 will spud into an unknown thickness (20-30m based on nearby wells) of Tertiary alluvium deposited by the paleo-Condamine River. This will consist of unconsolidated to semi consolidated clays, silts, sands, and gravels. Water production or loss of circulation is possible. Some well cemented white sandstones of tertiary age may be intersected immediately below the base of alluvium, however depths are not known.

Quartzose sands of the Springbok Sandstone would be expected from the base of the Tertiary to the top of the Walloon Coal Measures. Water bearing sands will probably be intersected within the Springbok Sandstone.

The top of the Walloon Coal Measures are expected at 100m. A complete Kogan through Taroom section is expected, with predicted seam depths shown in table 1 and graphically in

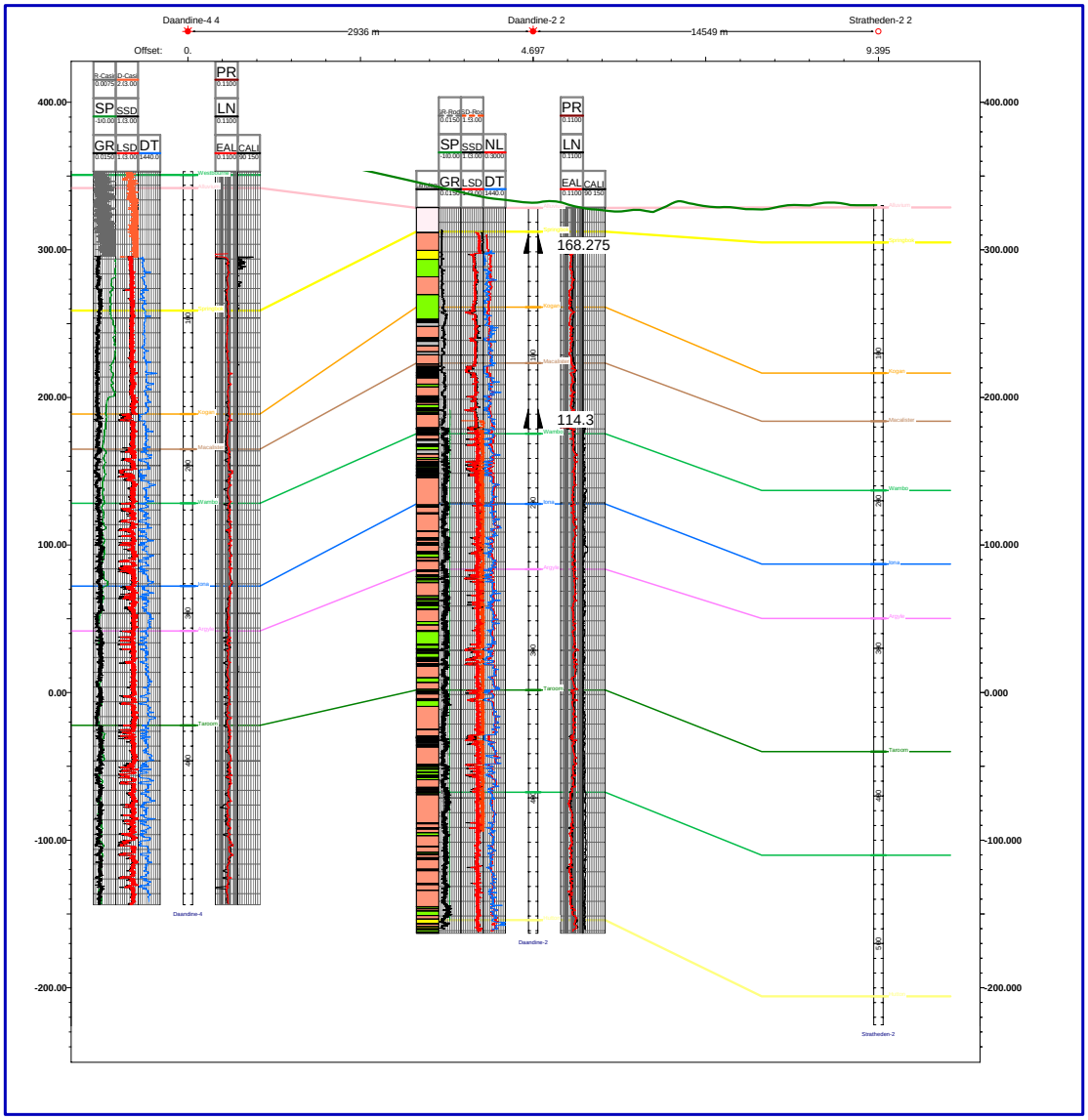

Figure 7. The top Walloon will be identified while chip drilling by: a change in lithology from moderately clean yellow to grey quartz sandstones to interbedded silts, clays, coals, and dark grey clay choked sandstones; a decrease in drilling rate, an increase in mud pressure due to clays on the bit; and increase in background gas in the mud from zero to a few lel of methane.

If formations cannot be picked clearly in the field, the Hutton Sandstone at the base of the Walloons acts as a marker. It can be identified by coarse white quartz sandstone and a distinct drilling break. There may also be loss of mud into the porous sand, or water production.

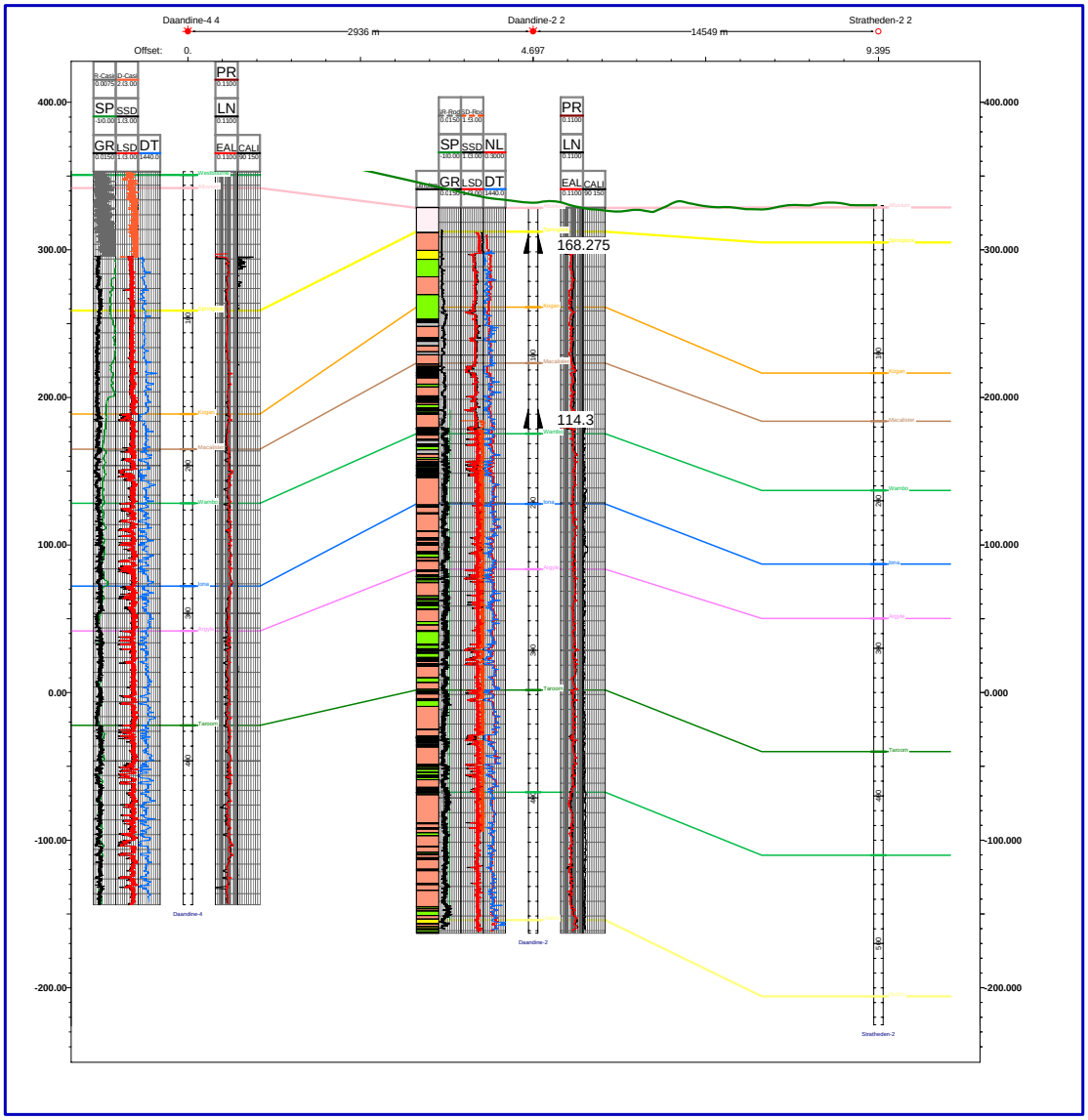

Figure 7: Predicted section of Stratheden-2 based on Daandine-2 & -4

Formation	Top (mMD)	Top (mAMSL)	Thickness	Notes
Alluvium	0	330	25	Unknown thickness
Tertiary sand	???	???	???	Unknown
Springbok Sandstone	25	305	87	
Kogan	112	218	35	
Macalister	147	183	45	
Wambo	192	138	50	
Iona	242	88	38	
Argyle	280	50	90	
Taroom	360	-40	70	
Eurombah	440	-110	95	Only drill through if well cannot be correlated
Hutton	535	-205	+20	Not to be fully penetrated

Table 1: Predicted Formation Tops and Thicknesses

3. WELL PROPOSAL

3.a. Drilling Procedure / Hole Design

The following is a guide for drilling Stratheden-2 (Figure 8). The actual work carried out may be contingent on the results during drilling and any subsequent special instructions. In the absence of any special instructions, use the guide below.

Drilling program is as follows:

- The proposed drilling procedures are as follows:
- Read and understand risk assessment presented in Appendix 1
- Mobilisation of drilling rig, necessary equipment and personnel to the well site
- Establishment of all equipment
- Site preparations, including mud overflow pits, a flare pit and cellar, as required by drilling rig. Ensure that the flare pit is a minimum distance of 30m from the well. Site offices and parking areas should also be 30m from the well.
- Drilling Operations will be conducted on a 12hr per day, 7 day per week basis
- Set surface conductor as required (i.e. ± one 6m length)
- Drill 216mm (8 1/2") hole to 115m or just into the top Kogan Package
- Run 168.3mm (OD) X 6.4mm Wt threaded surface casing (if threaded casing is unavailable, welded may be used provided a qualified boiler-maker is used)
- Cement with minimum 30% excess cement and a 10m cement plug (excess to be increased to 50% if hole conditions are poor). Cement slurry is to be mixed at the ratio of one 40kg bag of GP / portland cement and/or builders cement with 25% pozzolan (fly ash) to 25L of water and have a measured S.G. of no less than 1.64kg/L, once cement is mixed and density checked, add 1.5% (based on dry cement weight) Daraceel-AF or Mira-55 accelerator. Mix for ~2mins and pump in hole immediately.
- Install well head/flange for the BOP stack
- After 4 hours top up cement job if necessary
- After top-up job has set for a minimum of 2 hours, equip well with blow-out prevention devices and a flare line on the 168mm casing string.
- If the density of cement slurry is between 1.64-1.71 kg/L (SG), allow cement to set for minimum 8 hours before testing the BOP. If the density is between 1.71-1.75 kg/L (SG), allow cement to set for minimum 6 hours before testing BOP.
- First conduct low-pressure test of the BOP system to 200PSI and hold for 5 mins, then conduct high pressure test at 700PSI and hold for 10 mins (casing burst pressure is 1034PSI, therefore do not exceed 900 PSI under any circumstances). Maximum acceptable pressure loss is 20%. The operator of the BOP must be ticketed, and must be

witnessed by the Arrow site representative. Arrow BOP test record to be completed and filed. Results of test must be recorded in daily report.
- At all times while drilling below surface casing the driller operating the rig must hold a current BOP ticket
- Setup gas detection system on the blooie line
- Drill out cement from surface casing, and ~1m into formation.
- Pressure test surface casing integrity and formation leak-off. Record leakoff pressures in daily report.
- Drill with 146mm (5 7/8") PCD bit to TD utilizing air as a fluid (expected at 460m, see Section 2.d)
- Any water intersected should be sampled and rates estimated
- The well should be flow tested after each coal seam intersection
- Should the well start to produce too much water to be handled by air drilling, KCl mud may be used after consultation with Arrow Energy head office.
- At TD, flush hole making sure all cuttings are out and hole is clean. A wiper trip may be necessary if hole conditions are poor
- Run wireline logs.
- Flow test the hole as required – instructions to be given by the wellsite geologist with consultation with head office
- Take gas samples (min 3) from any gas flows encountered
- Fill the well with formation water and cap with a 2" ball valve.
- Rig down and cleanup site as directed by arrow energy N.L.

3.b. Evaluation and Sampling Program

- Continuous gas monitoring and recording is to be undertaken utilising a V-RAE gas detector on the blooie line.

- Cuttings samples are to be taken every 6m prior to setting the 119mm casing, then every 3m until TD. Chips will be washed and dried prior to sampling in calico bags and plastic cuttings trays.

- Water and gas samples will be taken from any water and/or gas flows intersected.

- Wireline logs consisting of Density, Gamma, Caliper, Neutron, SP, and Resistivity will be run from casing shoe to TD with Density, Gamma, and Neutron also being run through the 168mm casing string.

- Open hole flow tests will be conducted on all coal seams during drilling unless significantly high water rates have been intersected previously in the well.

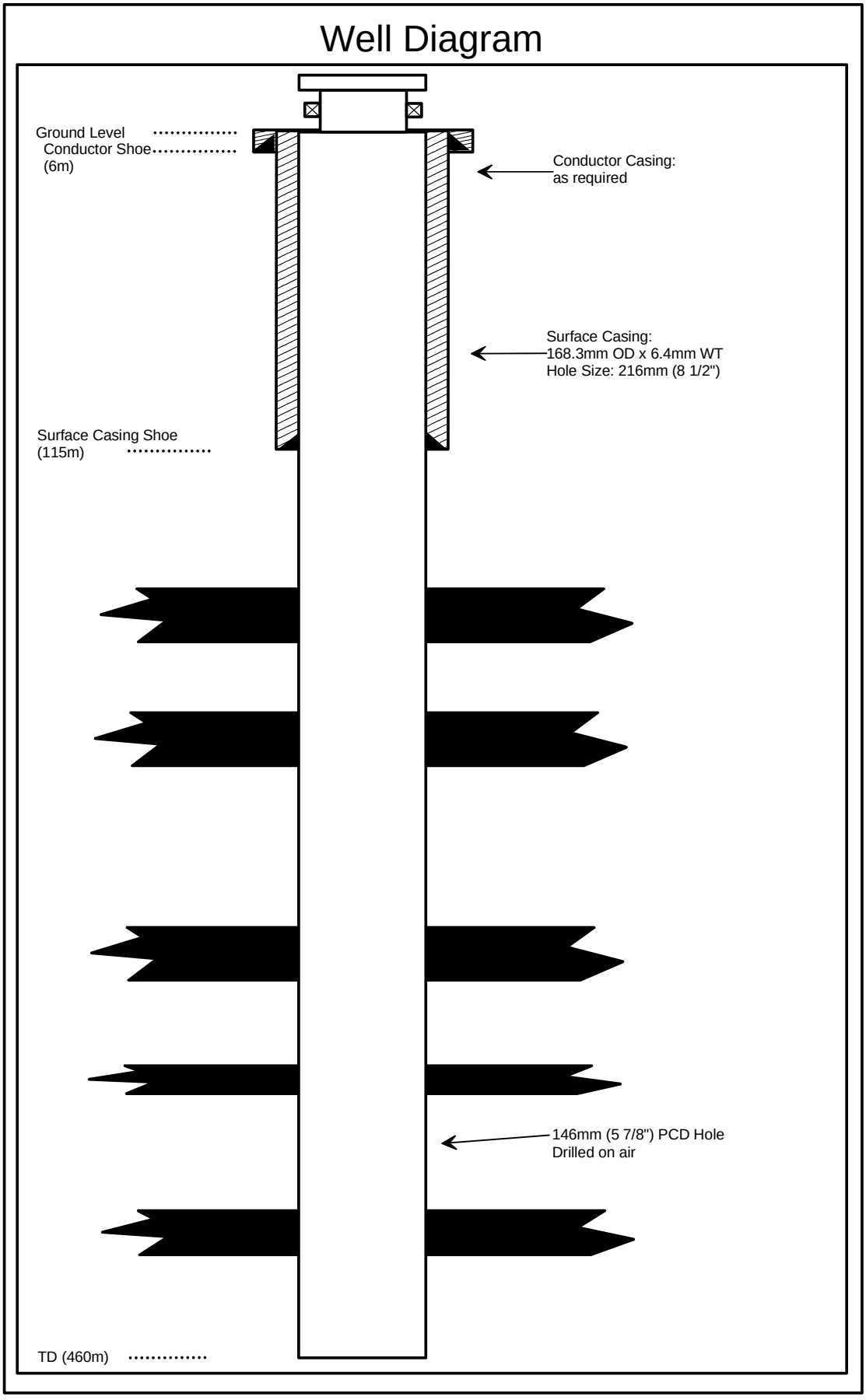

Figure 8: Diagrammatic well design

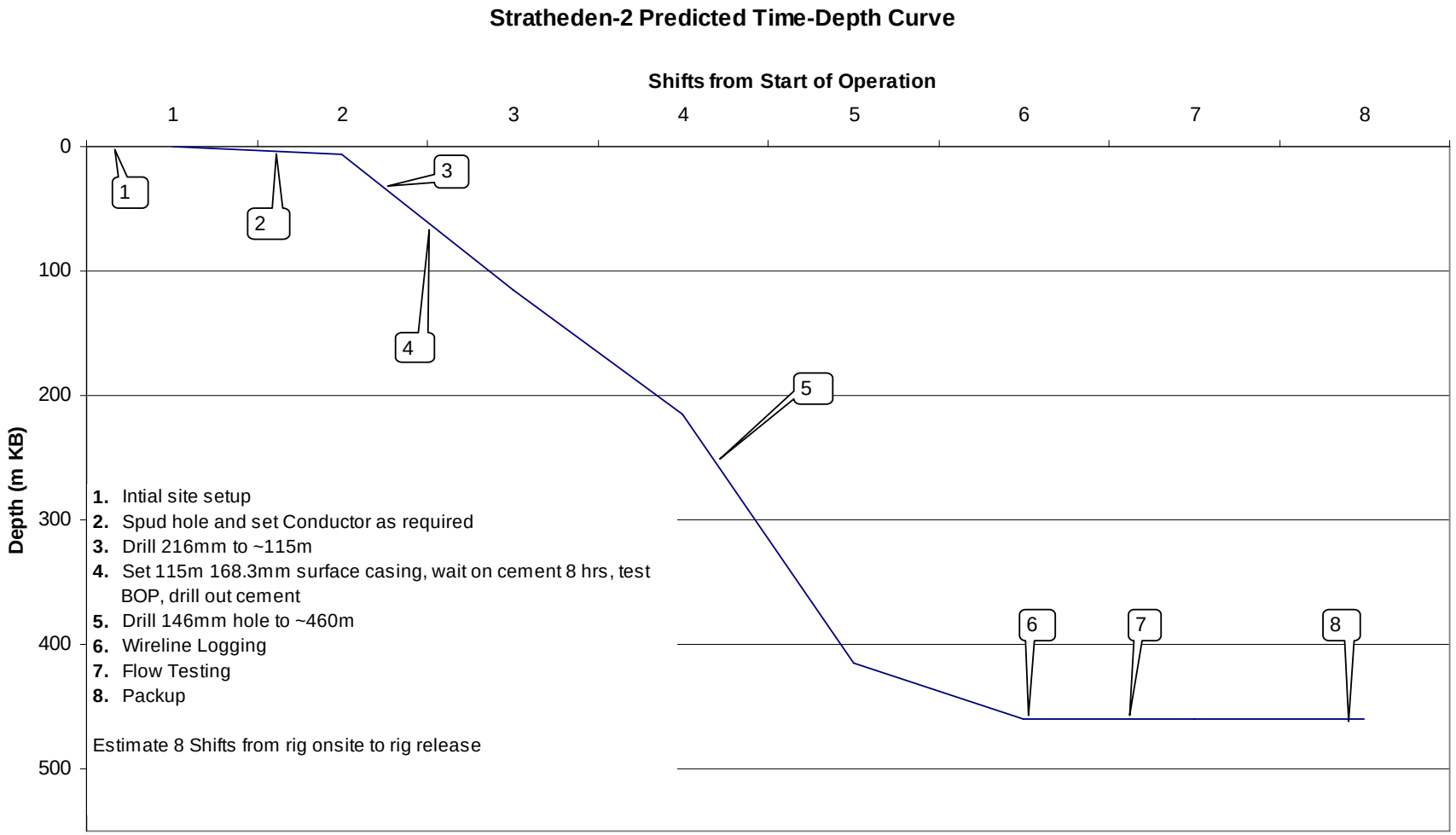

Figure 9: Predicted time depth curve.

3.c. Reporting

Daily drilling reports will be e-mailed to the supervising geologist in the Arrow Brisbane office each evening. The reports will then be forwarded to the relevant people. Suitable phone communications will be established from the well site for additional ad-hoc reporting. The daily report will be in the approved Arrow format and contain:

- Well name
- Date
- Current depth and meters drilled today
- Current operations summary
- Next 24hrs operations summary
- Detailed description of the days operations
- OHS summary
- Geological descriptions and interpretations
- Engineering summary
- Gas readings
- Drilling rate
- Foreseeable problems
- Wellsite geologist name and contact number
- Drillers name and contact number

The report will be sent to directors and operational staff at Arrow Energy, and the following people outside Arrow:

Andy Kozak QLD DNRM andy.kozak@nrm.qld.gov.au

4. WORKPLACE HEALTH AND SAFTEY

Occupational HEALTH AND SAFETY for exploration and production drilling and workover operations
Revised Monday 27th February 2006

AE = Arrow Energy NL

Safety Management Plan and Training:

Prior to commencement of the drilling program, the drilling contractor is to provide a CD ROM to the AE NL OHS Manager with the following:

- Project Safety Management Plan (the contents of which must comply with procedure E9.1.1 Contractor OHSMP Compliance Requirements of the AE OHS Management Plan),
- Drilling Procedures Manual (SOPs, SWIs etc)
- Risk Management Manual
- MSDS Register with contents consistent with all chemical substances used on site
- List of all employees, sub-contractors and staff anticipated to work on the drilling operation together with legible copies (or scanned onto CD) of evidence that all have been trained in the contractor company's OH&S Safety Management System and Risk Management System (signed certificates etc.), vehicle licenses, industrial inductions, plant and vehicle use training (drilling qualifications/experience, Hiab, crane etc).

Drillers are required to have a current Senior First Aid Certificate (at least one qualified Senior First Aider must be on site each shift).

Drillers are required to have a current BOP introductory training certificate so that at least one BOP qualified driller shall be on the rig for each shift.

Contractor Drilling Supervisors shall be fully BOP trained and certified (Full 5-day BOP course).

The drilling contractor and crew should be aware of the geological risk assessment carried out for this drill hole by AE prior to commencing drilling operations. The risk assessment is found on the last page of this document in Appendix 1.

AE Generic Operational Induction

Also, prior to accessing any AE operational area to carry out work, all Contractors, service providers etc are to complete the AE Generic Operational Induction. If the operational activity is in the Dalby area (Tipton West Project, Daandine Project and Kogan North Project), the AE Generic Operational Induction is to be completed at the Dalby Depot, corner of Bennie and Russell Sts, Dalby. This can be organised by contacting Paul Boland or Nathan Williams on 07 4662 3999.

For exploration or other project areas, please contact Brisbane office on 07 31053 400, and you will be directed to the project supervisor who will organise a time and location for the induction.

Drillsite Inductions

All AE staff and contractors working on a new drill-workover site shall complete the site specific AE **Drill - Workover Site Workers Induction Course,** sign the **Drill – Workover Site Induction Register** and must be familiar with AE's Occupational Health and Safety Policies and Procedures Manual and compliance forms located within the site hut.

All visitors to site must complete the AE **Drill - Workover Site Visitors Induction Course,** sign the **Drill – Workover Site Induction Register and be supervised at all times when on site.**

Other Site Safety Issues

The **Personnel Movement Register** is to be completed on arrival and departure by all site workers and visitors.

All contractors are to attend a daily **Prestart Safety Meeting** (minuted) to discuss and record daily safety/risk issues and compile required JSEA's or review a relevant SOP, the titles of which are to be documented on the Prestart Meeting form. A copy of minutes and a dated and signed attendance record must be provided to the AE Site Supervisor *after each daily site safety meeting*.

Prior to the rig moving on site, the drilling contractor representative and the AE Site Supervisor are to agree on a site layout plan in accordance with both the Contractor's and AE's site requirements. This is to determine the appropriate location for the site office, site entrance, vehicle parking, emergency evacuation muster location and designated smoking area, all to be located outside the 30m ignition exclusion zone.

The **Pre-drilling and Safety Checklist** is to be completed by the AE Site Supervisor prior to commencement of drilling to ensure that site layout is appropriate with safety issues addressed.

The following is a list of key instructions that must be followed:

- **AE have a total smoking ban within 30m of the rig and in the AE site office on all drill - workover sites while the rig is on site**. That means no smoking or ignition sources are allowed within 30m of the rig. **All potential ignition sources including cigarettes, matches and cigarette lighters, flash cameras and mobile phones are to be left at the site hut and are not allowed within the 30m ignition exclusion zone**.
- Any person caught smoking within the 30m ignition exclusion zone will be dismissed from site. If the removal of a worker from site (for a smoking breach) results in a perceived unacceptable work safety risk, **the AE Site Supervisor is authorised to shut down the rig at the Contractors expense** until such time as a replacement worker is supplied at site. Smoking is allowed adjacent to the site hut in the designated smoking area only.
- **PPE to be worn at all times** – including hard hats, steel capped boots, eye protection (safety glasses) and long sleeve shirts and pants. Ear protection is to be worn when working in the vicinity of operating drill rigs and compressors.
- **All drill-workover site injuries-incidents are to be immediately reported to the OHS Manager (0428 193959)**. Incidents involving Contractor staff are to be documented immediately by the Contractor on Contractor incident report forms with a copy provided to the AE Site Supervisor who will send a copy to the OHS Manager immediately. The Contractor will be required to report Prescribed Incidents in accordance with Schedule 2 or the Pet and Gas (Prod & Safety) Regs 2004.
- Emergency Evacuation procedures are to be discussed at the first Prestart Safety Meeting to ensure that Contractor staff and AE staff are aware of joint responsibilities in an emergency.
- Emergency response details including emergency contact number lists for all contractors on site must be posted **in all site offices or accommodation units.**
- No hot work is to be commenced without a **Hotwork Permit**.

5. CONTRACTOR CONTACT LIST

Drilling Contractor:	Johnson Drilling PO Box 575 Warrego Highway Roma, 4455 Rick Johnson: 07 4622 2543
Gas Analysis	ACS Laboratories Pty Ltd 8 Cox St Windsor QLD 4030 Nick Cox: 07 3357 1133
Geophysical Logging:	Pilbara Wireline Services Unit 2/7 Pitino Crt Osborne Park, WA 6017 Office: 08 9244 4882 Stuart Power: 0429 955 344 Craig Dixon: 0427 000 766

6. REFERENCES

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Task	Description of Task	Tools, equipment PPE	Hazards within the task	Raw Risk	Controls	Residual Risk
1	Drilling through surfical sediments to ~25m	Drill Rig	Hole Collapse	8	Drill hole rapidly and do not leave open for significant lengths of time prior to running casing	5
2.	Drilling through Walloon Coal measures to 460m	Drill rig	Hole collapse	8	Drill with mud if hole stability is in question, don't leave rods in hole if there are any indications of instability, give hole a thorough circulation prior to pulling rods to build up a thick mud cake Use KCl mud to control clays	5
			Gas blowout from coal	14	Use BOP rated and tested to at least 700 PSI Monitoring of mud pit levels to detect any influx into well Drill on mud prior to setting surface casing	10
			Gas leaking from mud into air around rig causing fire hazard	9	Continuous gas monitoring, eliminate ignition sources	6