HYDROGEOLOGY
Great Artesian Basin /Galilee Basin

Presented by

John Hillier

Acknowledgement

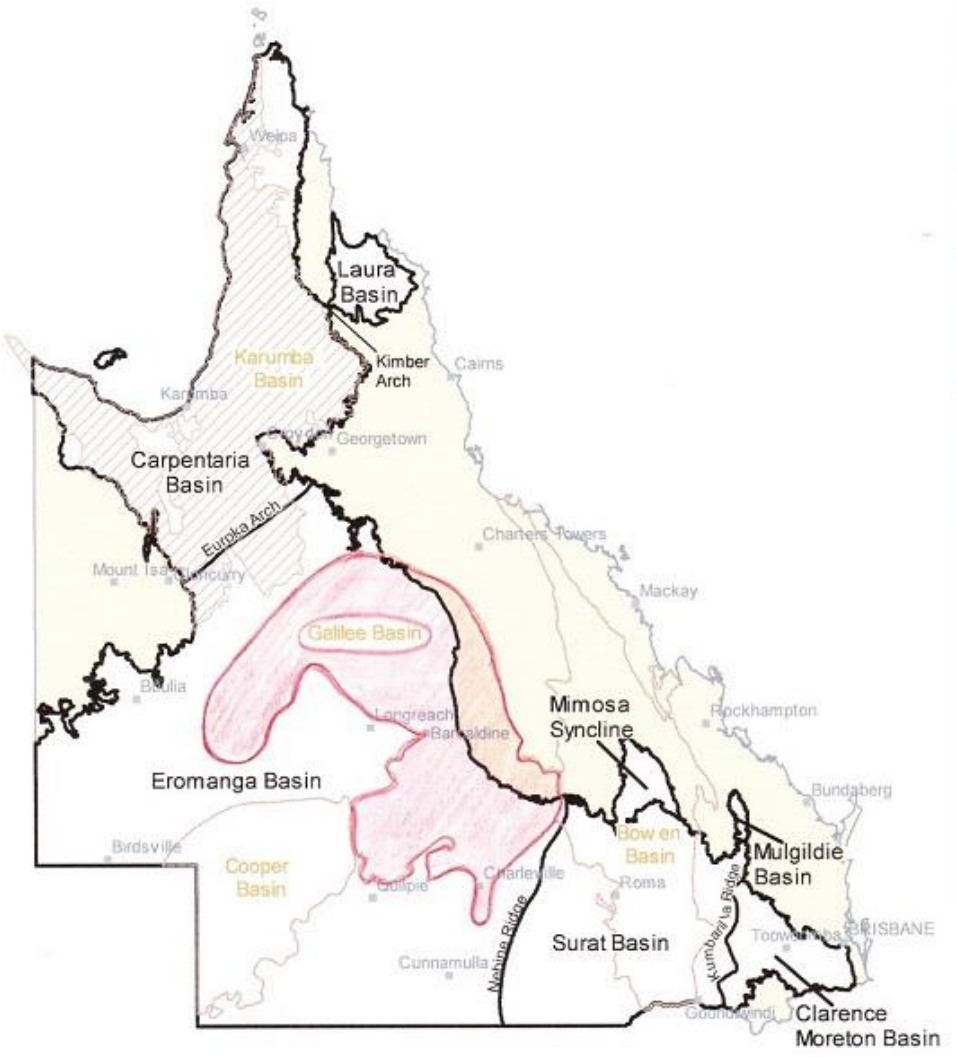
- Part of this presentation includes some of the findings of a report commissioned by members of the Galilee Basin Operators Forum (GBOF).

- The report was compiled by RPS Australia East Pty Ltd.

- Some Maps and Figures form their report have been used in this presentation.

Location of GAB & Galilee Basins

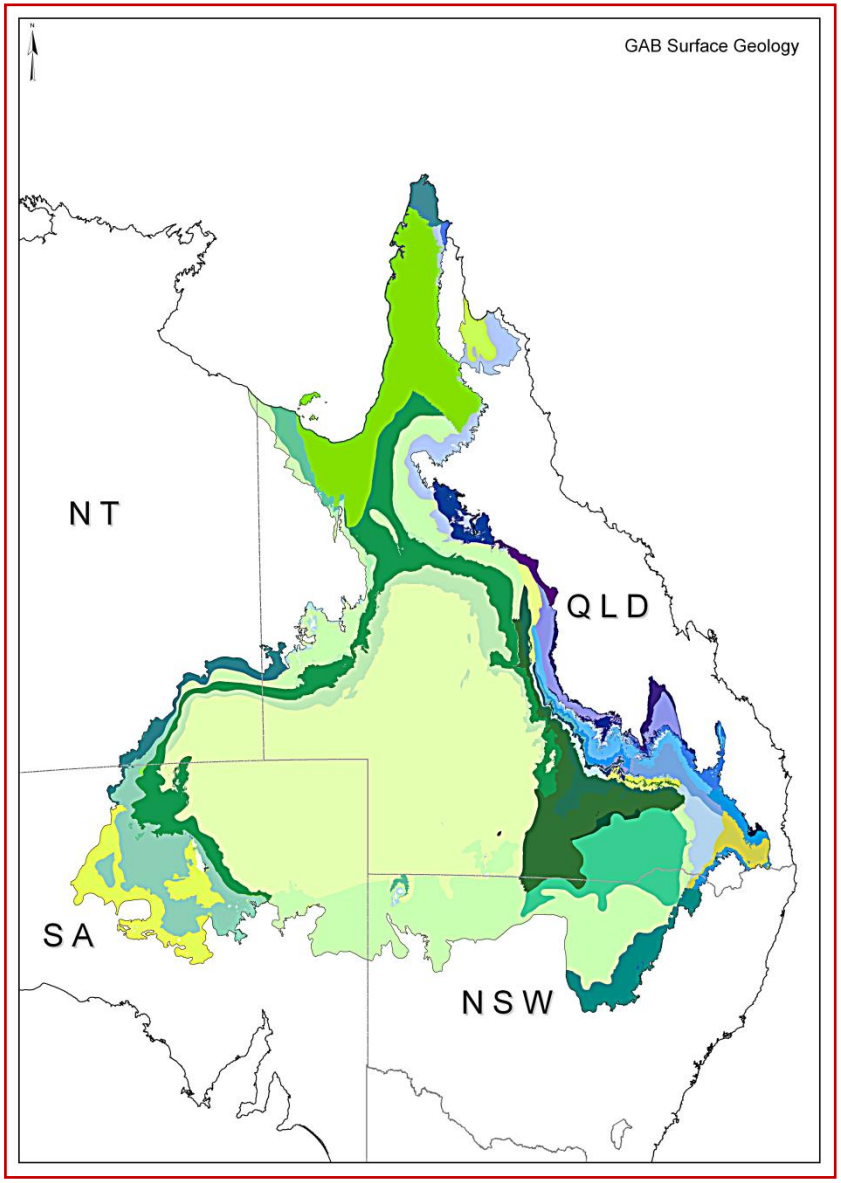
- The Galilee Basin partly underlies the Great Artesian Basin
- Both were deposited on a very uneven surface



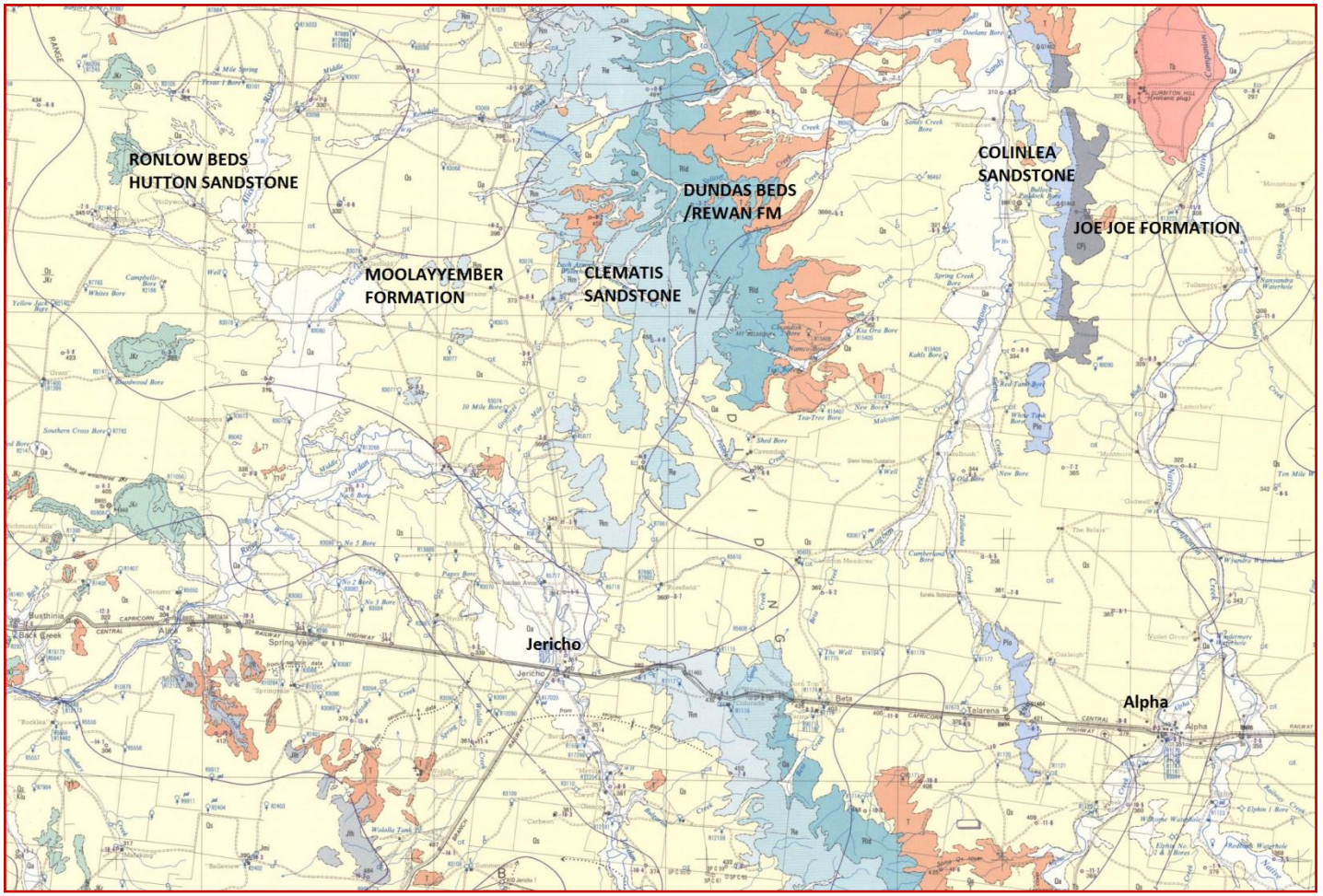
STRATIGRAPHY

AGE	BASIN	FORMATION
CRETACEOUS (66 – 145 Myr)	EROMANGA (GREAT ARTESIAN BASIN)	ROLLING DOWNS GROUP (e.g. Winton Formation, Wallumbilla Formation, etc)
		CADNA-OWIE FORMATION
		HOORAY SANDSTONE
		WESTBOURNE FORMATION
JURASSIC (145 – 200 Myr)		ADORI SANDSTONE
		BIRKHEAD FORMATION
		HUTTON SANDSTONE
TRIASSIC (200 – 253 Myr)	GALILEE (GREAT ARTESIAN BASIN)	MOOLAYEMBER FORMATION
		CLEMATIS SANDSTONE
		REWAN FORMATION (includes Dundas Beds)
PERMIAN (253 – 299 Myr)	GALILEE	BETTS CREEK BEDS (Includes Bandanna Formation and Colinlea Sandstone)
		JOE JOE FORMATION (Includes Aramac Coal Measures)

GAB - Surface Geology



Eastern Area Outcrop

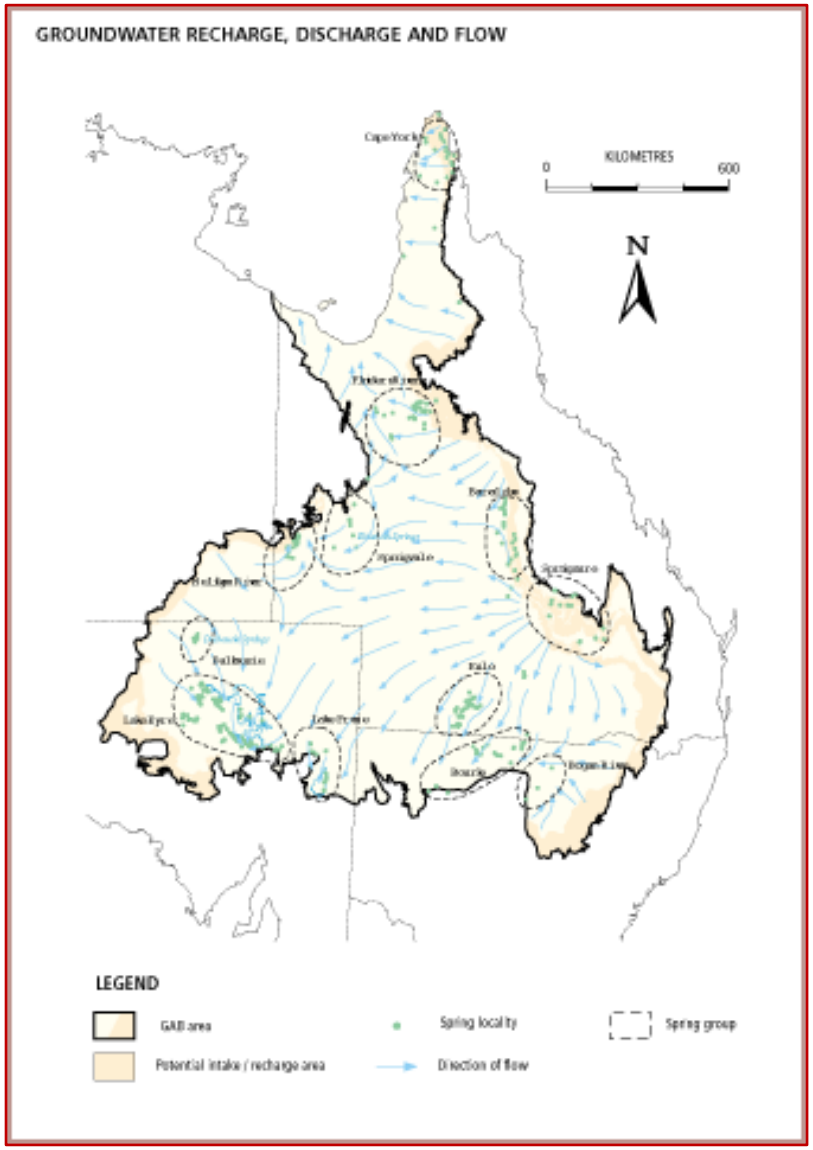


Galilee Basin Coal

- Coal is mainly in the Colinlea Sandstone and the overlying Bandana Formation
- Near outcrop, where it is to be mined for coal, the coal seams range up to 8m in thickness
- Seam thicknesses vary considerable throughout the Basin

How does the GAB operate

- Water is stored in sandstone aquifers
- Recharge is from rainfall that enters the aquifers where they outcrop at the surface
- Groundwater movement in the GAB is slow – 1 to 5 metres per year under natural gradients

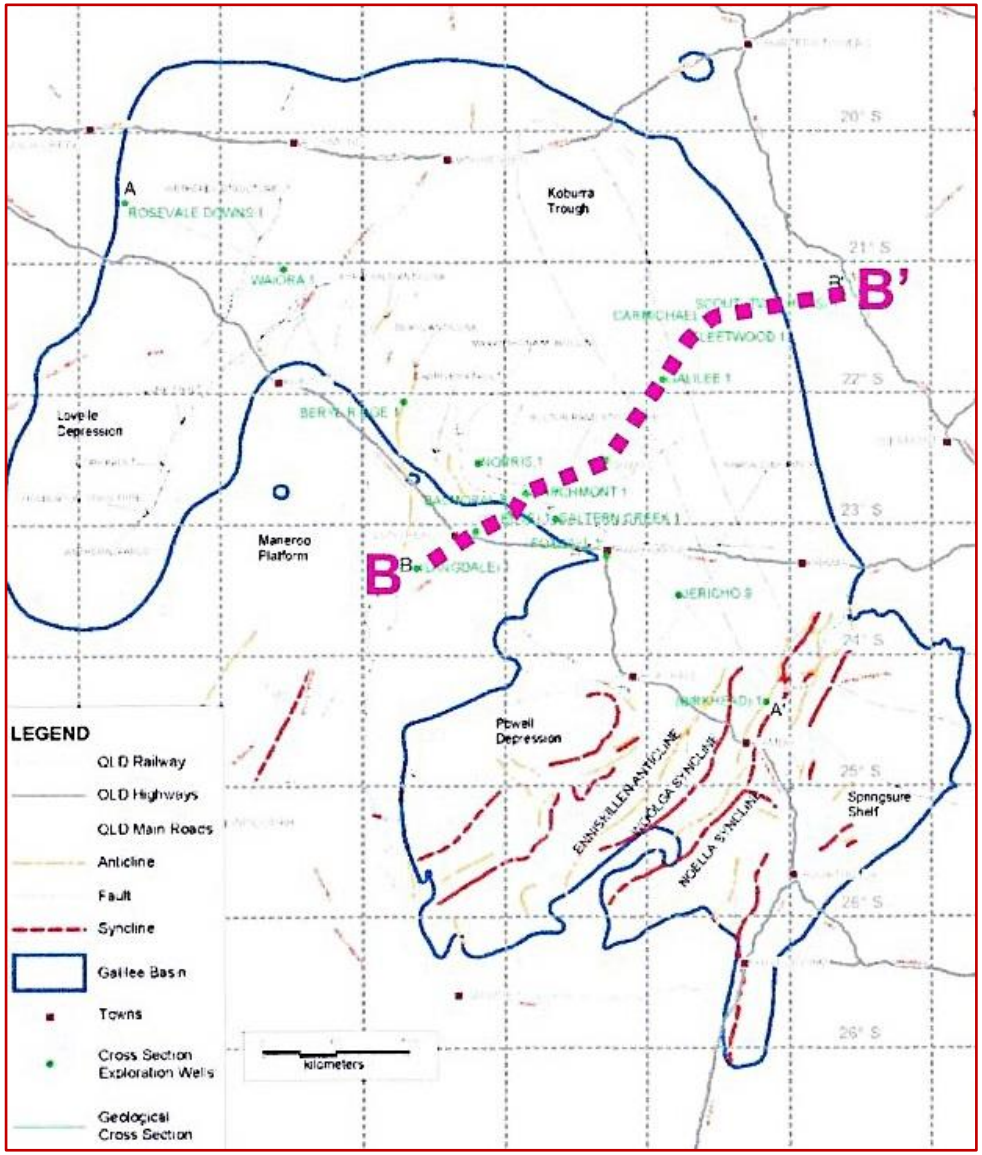


Great Artesian Basin Facts

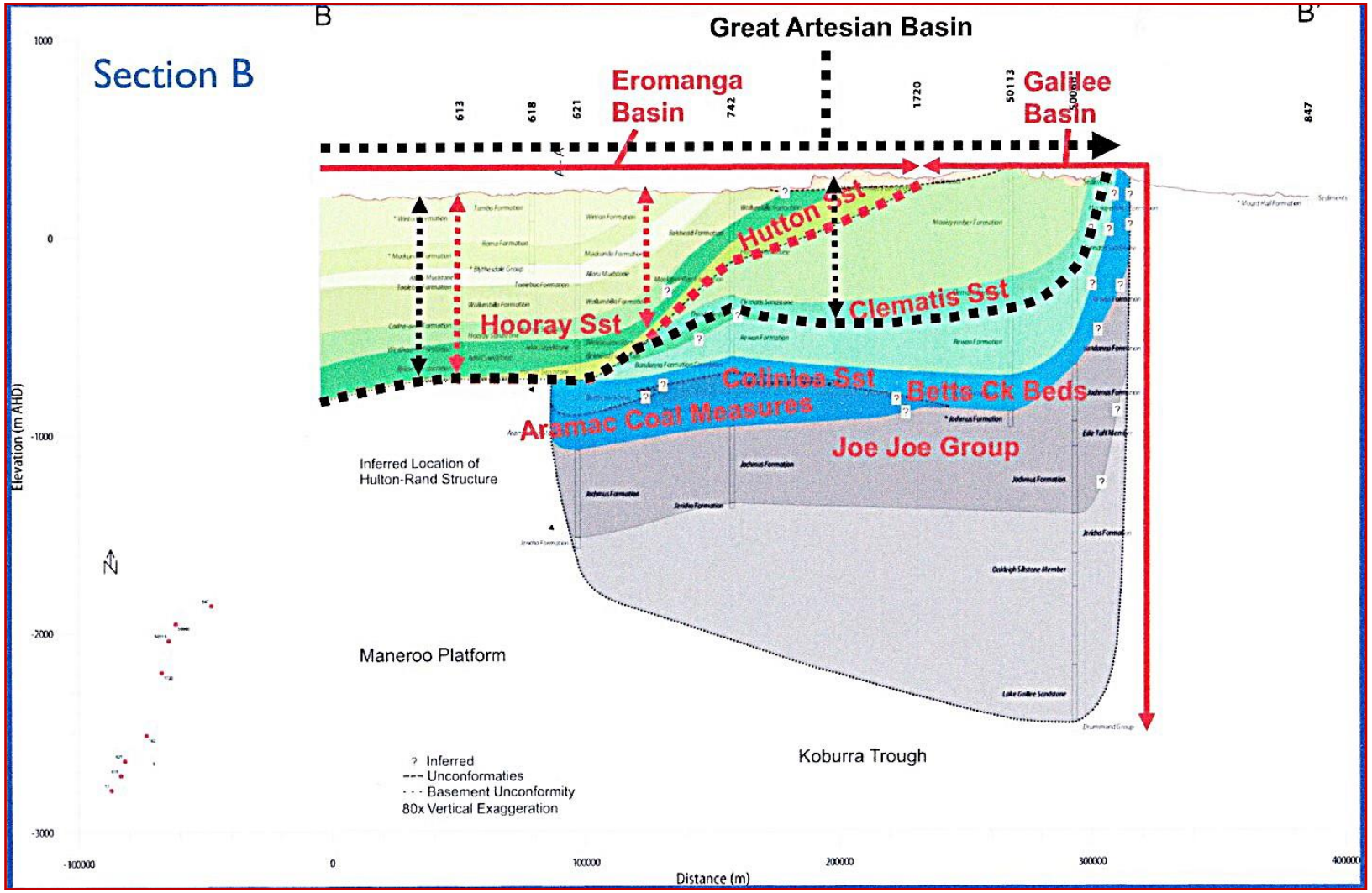
- Covers 22% of the Australian continent
- The GAB contains an incredibly large water volume, calculated to be about 64,900 million megalitres
- Total outflow from bores (including wastage) since 1880 is about 60 million megalitres – less than 0.1% of the volume in storage
- Artesian heads have fallen up to 120m since the resource was discovered – largest in the Charleville area
- Wastage has been the biggest user of water

Charleville Bore 1897

Location of East – West Section B - B



Section B - B


Section B
B
B'
Great Artesian Basin
Eromanga Basin
Galilee Basin
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Hutton Sst
Clematis Sst
Hooray Sst
Colinlea Sst
Betts Ck Beds
Aramac Coal Measures
Joe Joe Group
Inferred Location of Hulton-Rand Structure
Maneroo Platform
Koburra Trough
? Inferred
--- Unconformaties
· · · Basement Unconformity
80x Vertical Exaggeration
Elevation (m AHD)
1000
0
-1000
-2000
-3000
-100000
0
100000
200000
300000
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Distance (m)

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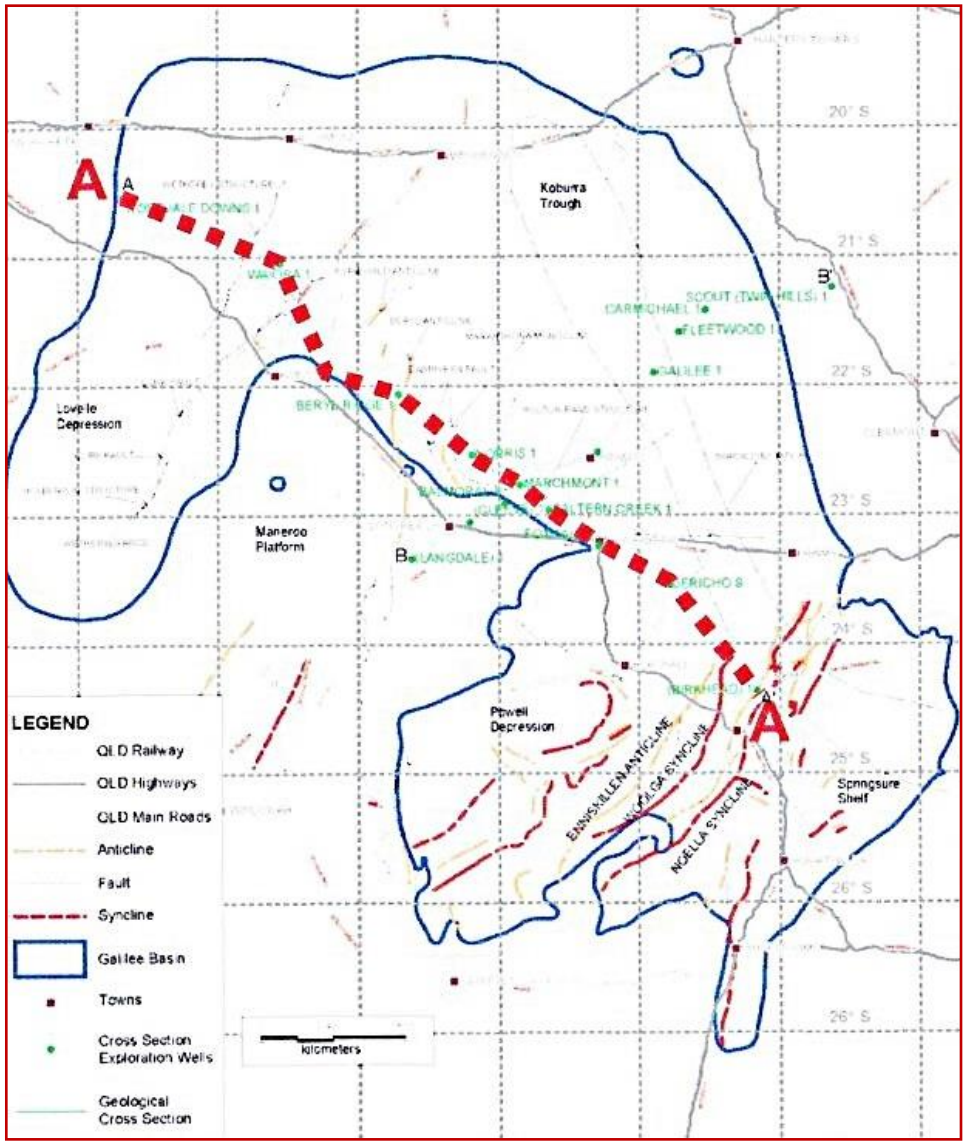
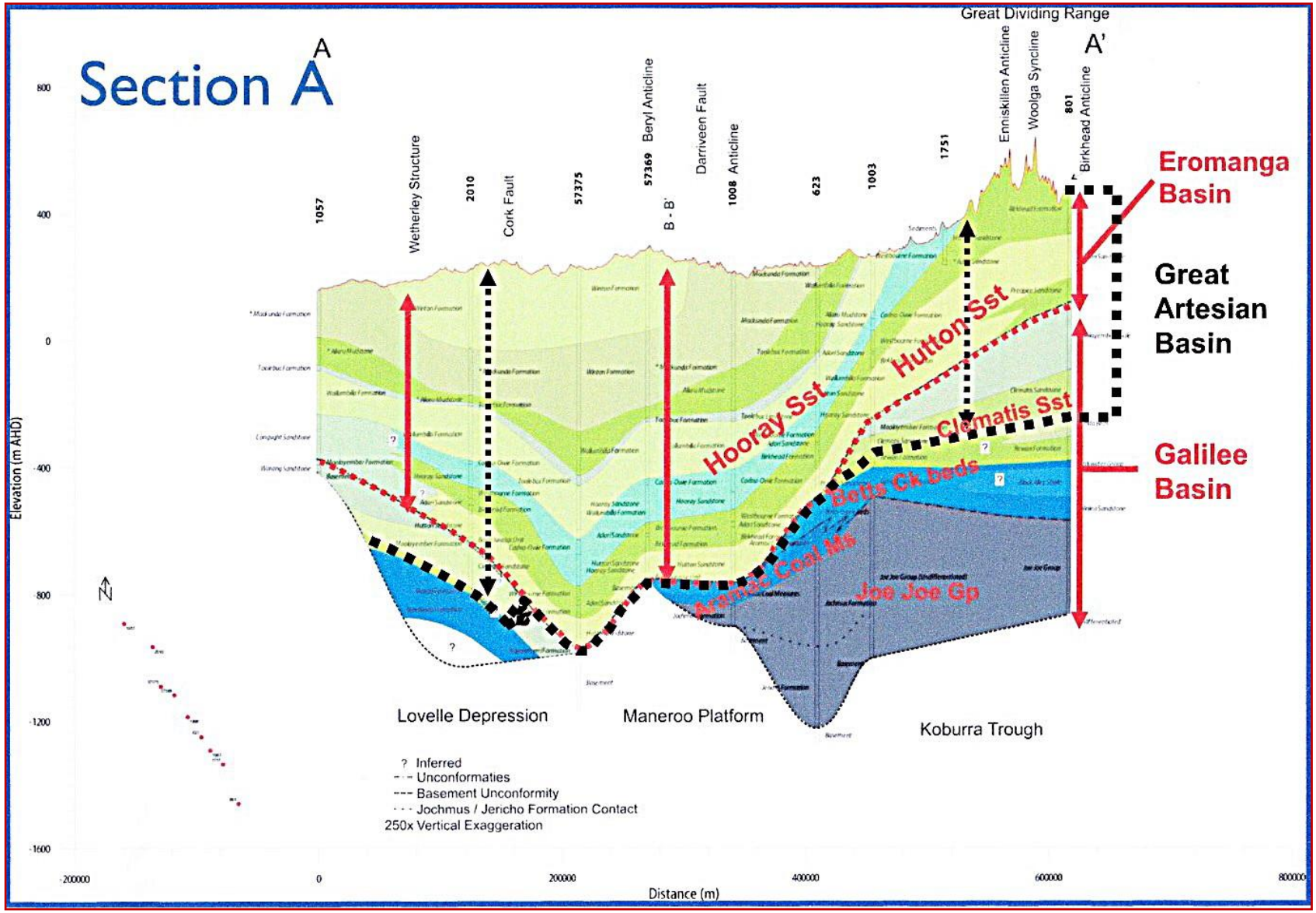
Location of North – South Section A - A



Section A - A


Section A
A
A'
Great Dividing Range
Wetherley Structure
Cork Fault
Beryl Anticline
Darriveen Fault
Anticline
Enniskillen Anticline
Woolga Syncline
Birkhead Anticline
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B - B'
Eromanga Basin
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Galilee Basin
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Hooray Sst
Clematis Sst
Betts Ck beds
Joe Joe Gp
Lovelle Depression
Maneroo Platform
Koburra Trough
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Unconformaties
Basement Unconformity
Jochmus / Jericho Formation Contact
250x Vertical Exaggeration
Elevation (m AHD)
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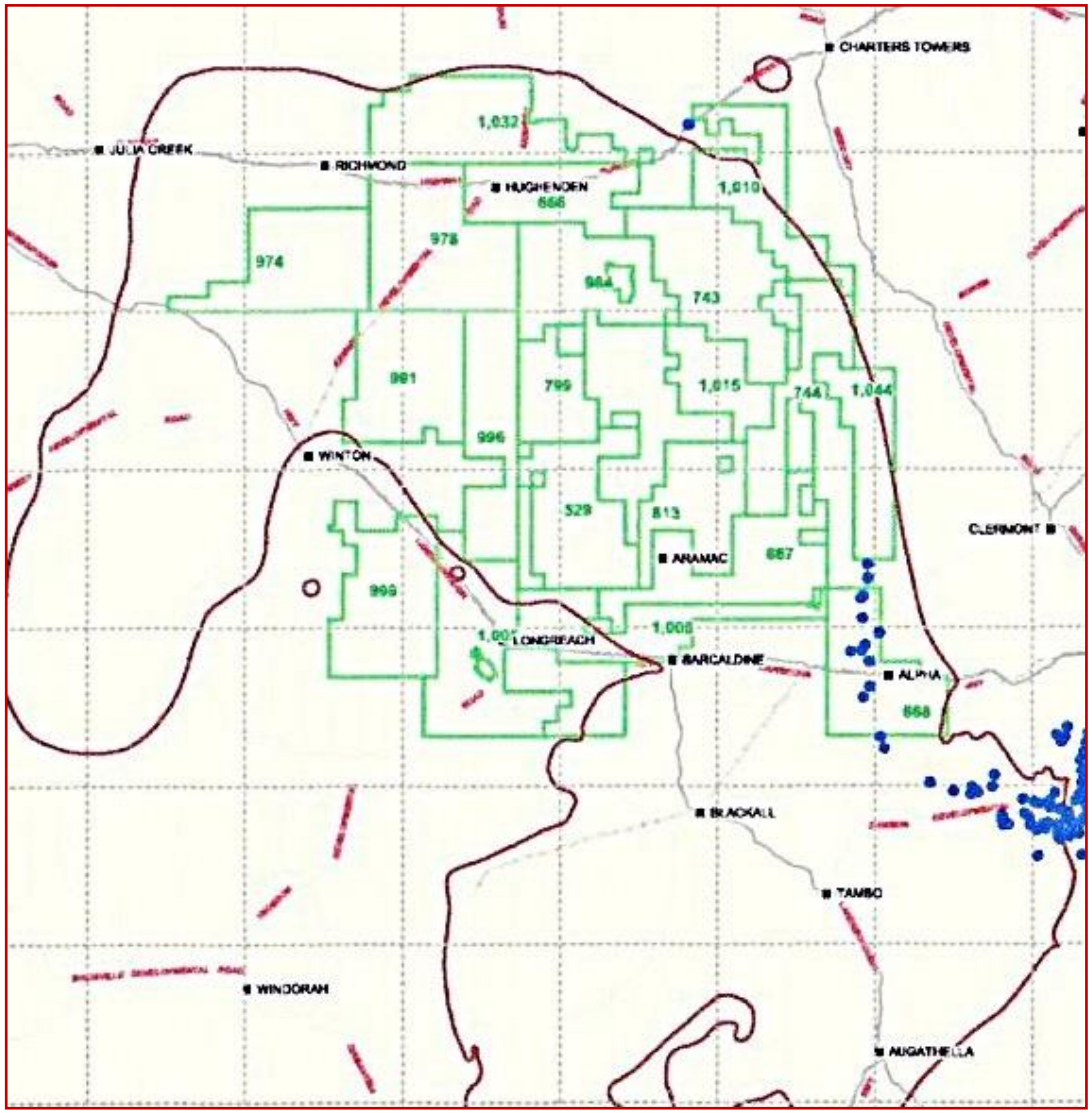
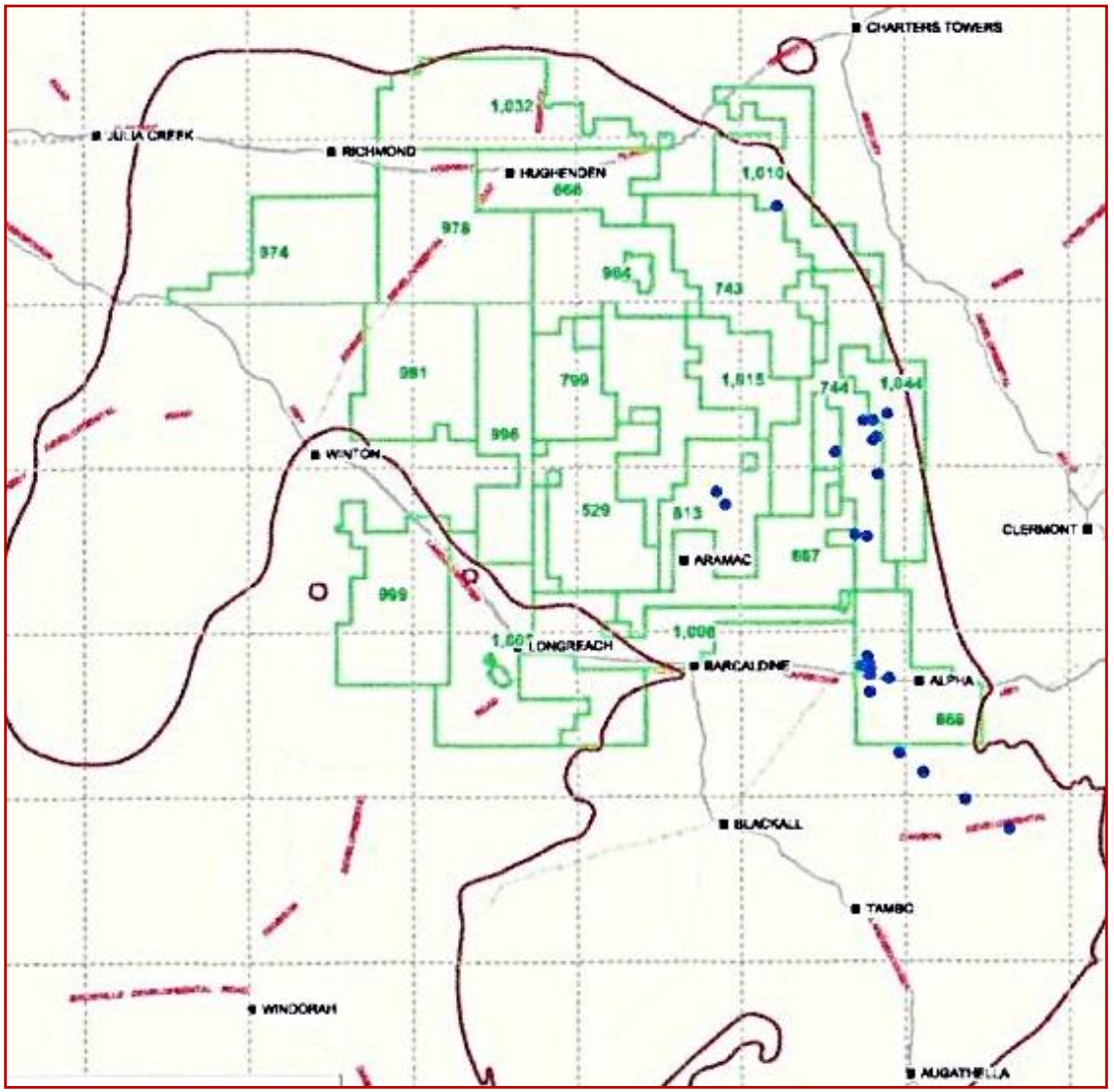
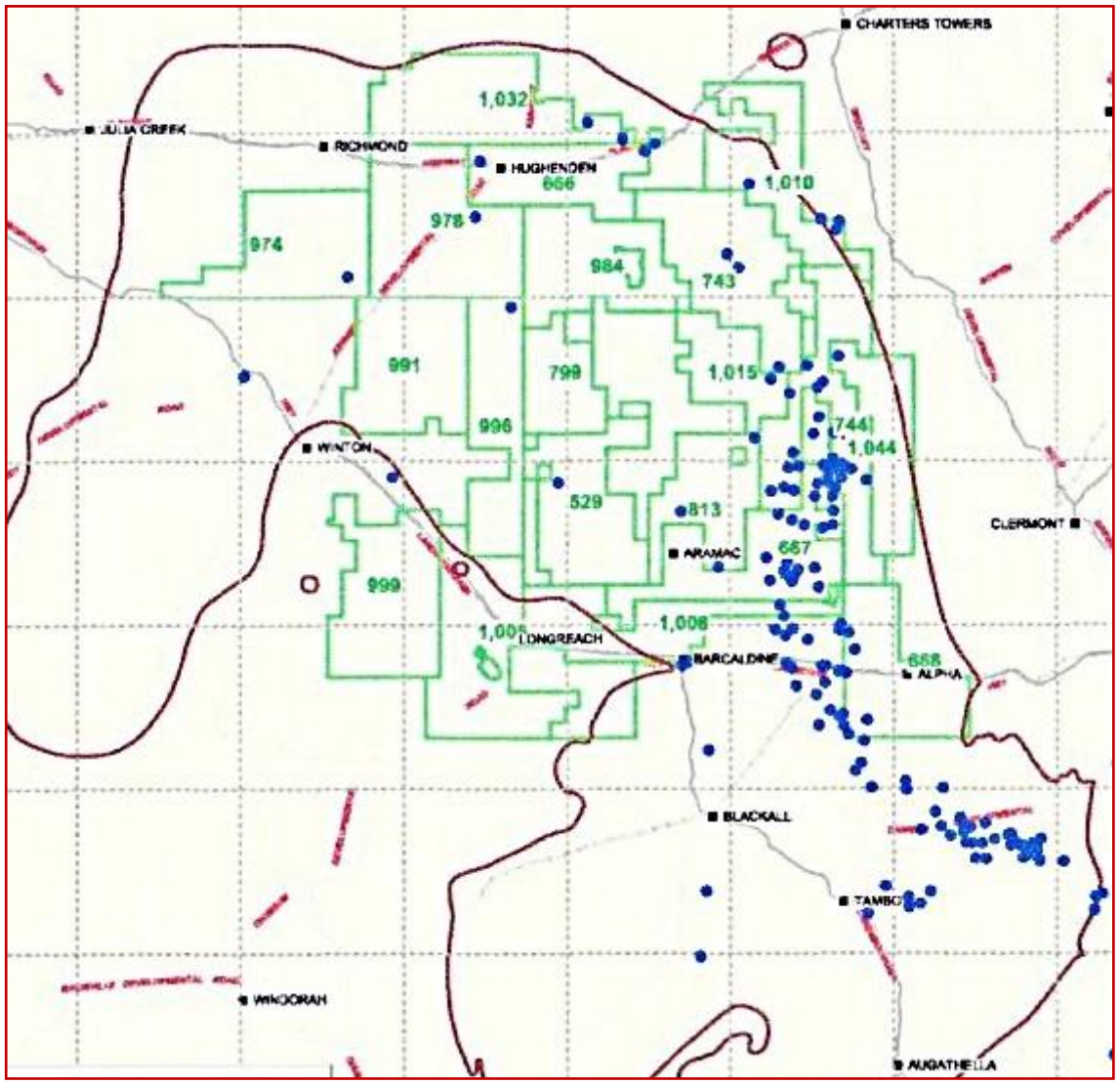
Bores tapping the Colinlea Sandstone



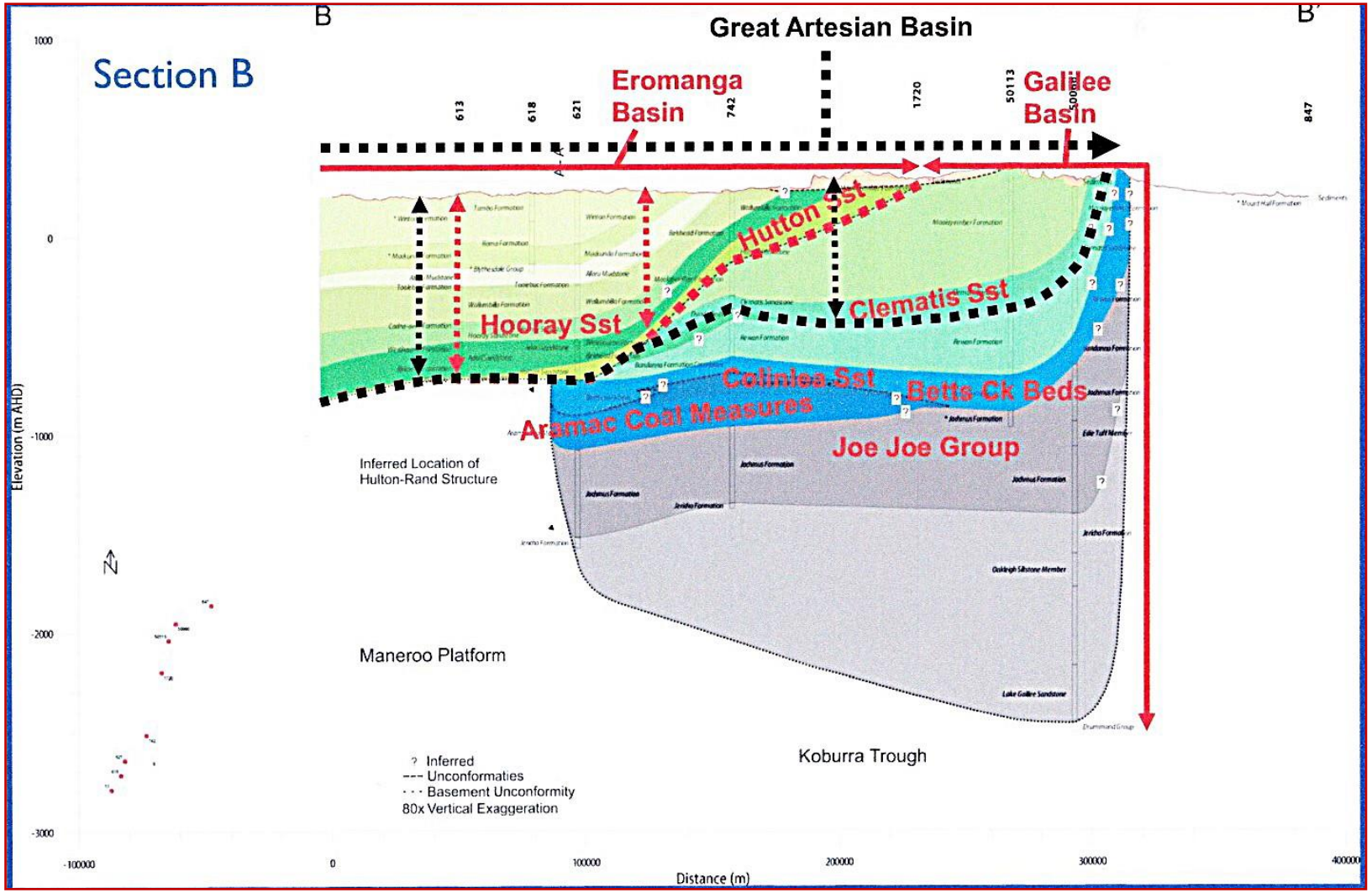
Bores tapping the Rewan Formation



Bores tapping the Clematis Sandstone



Section B - B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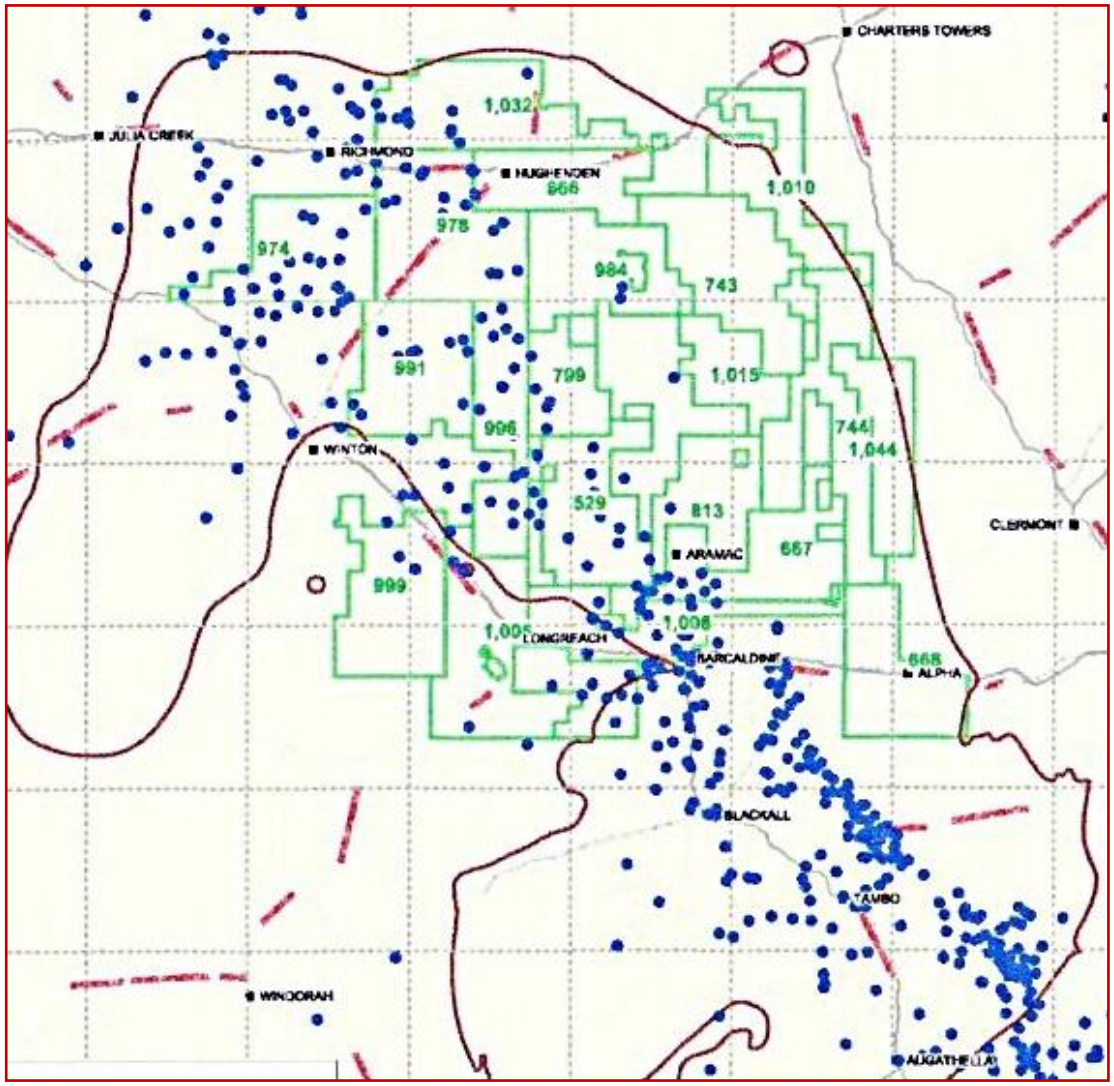
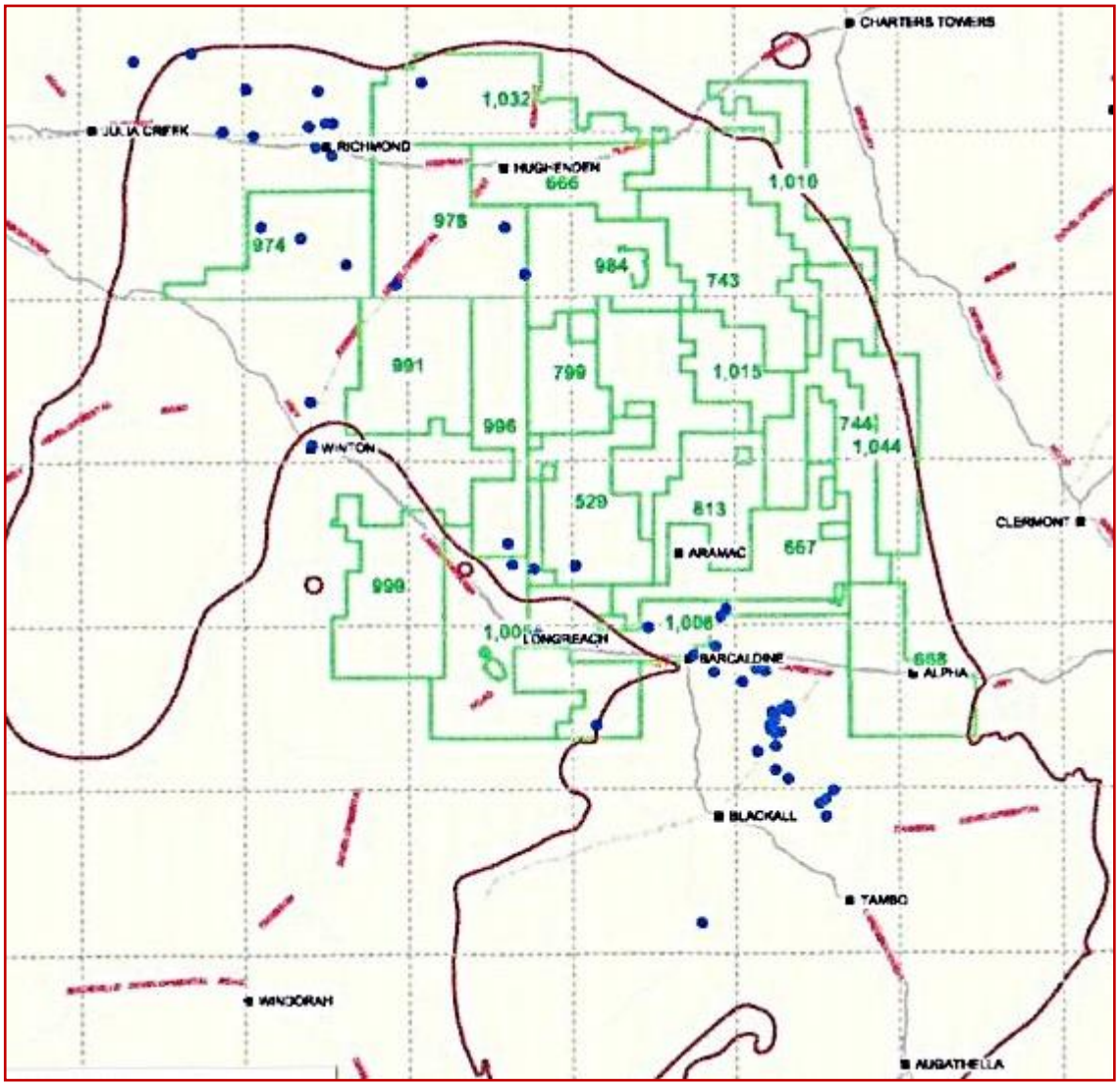
Bores tapping the Hutton Sandstone



Bores tapping the Adori Sandstone



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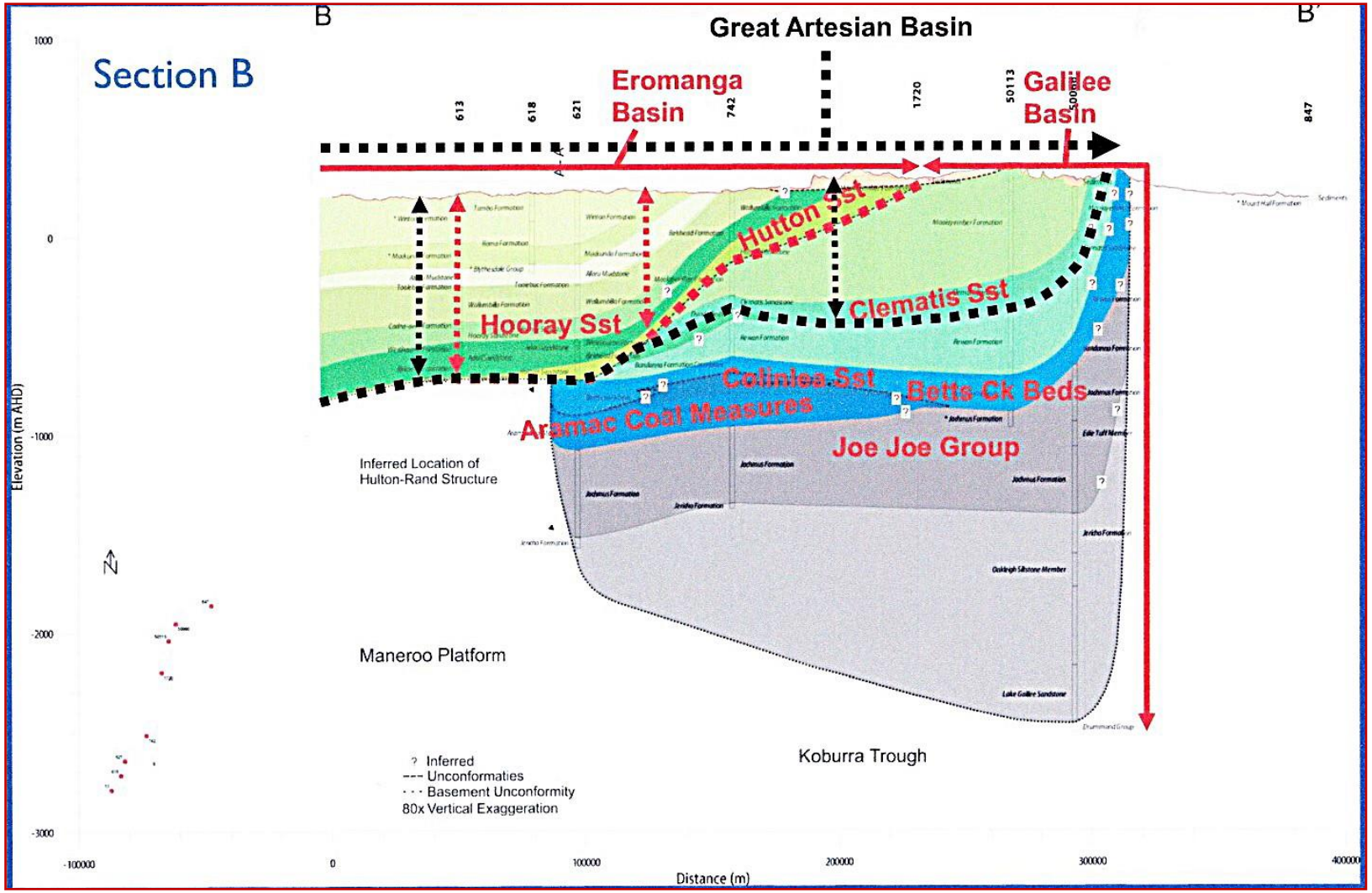
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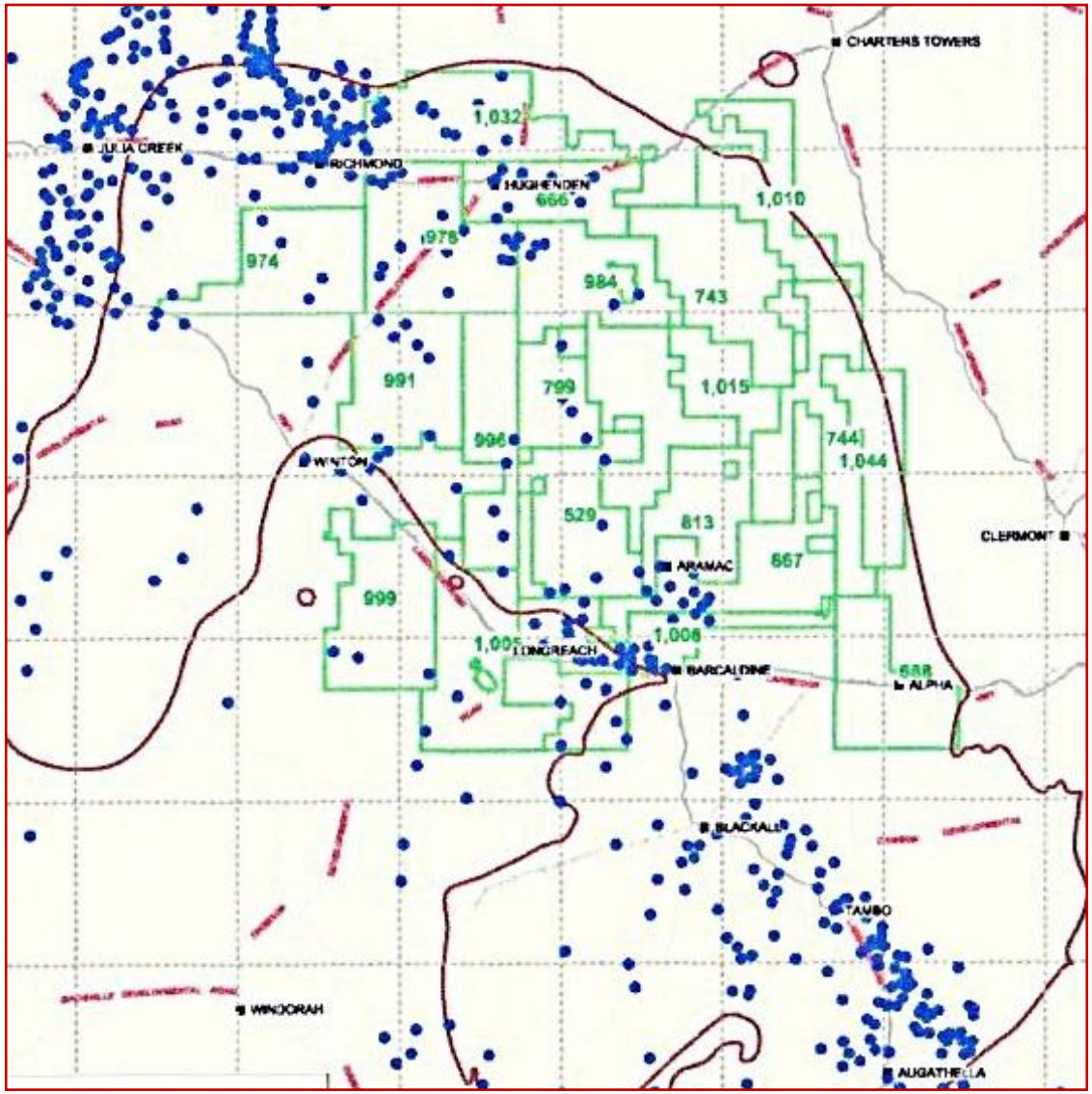
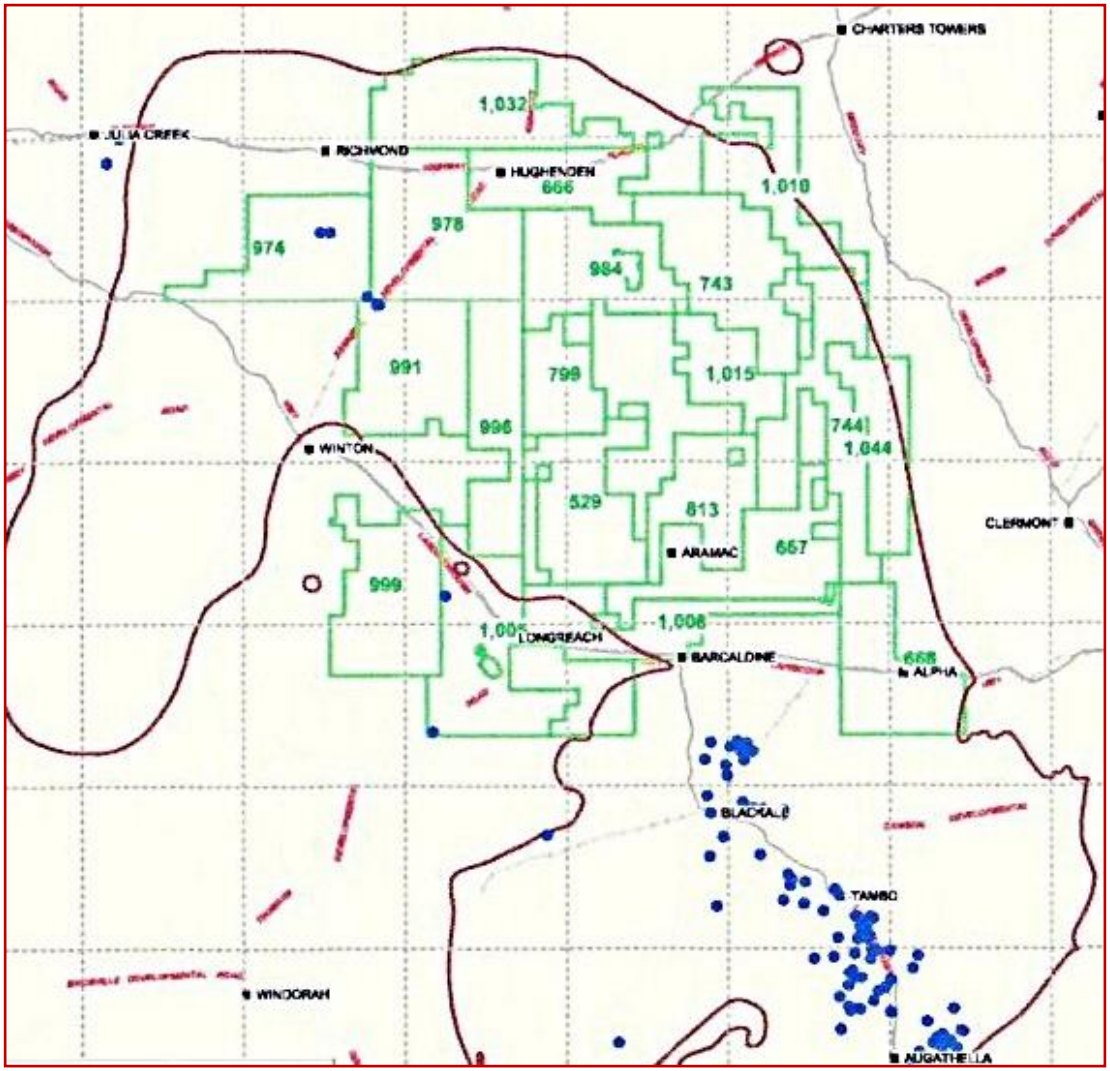
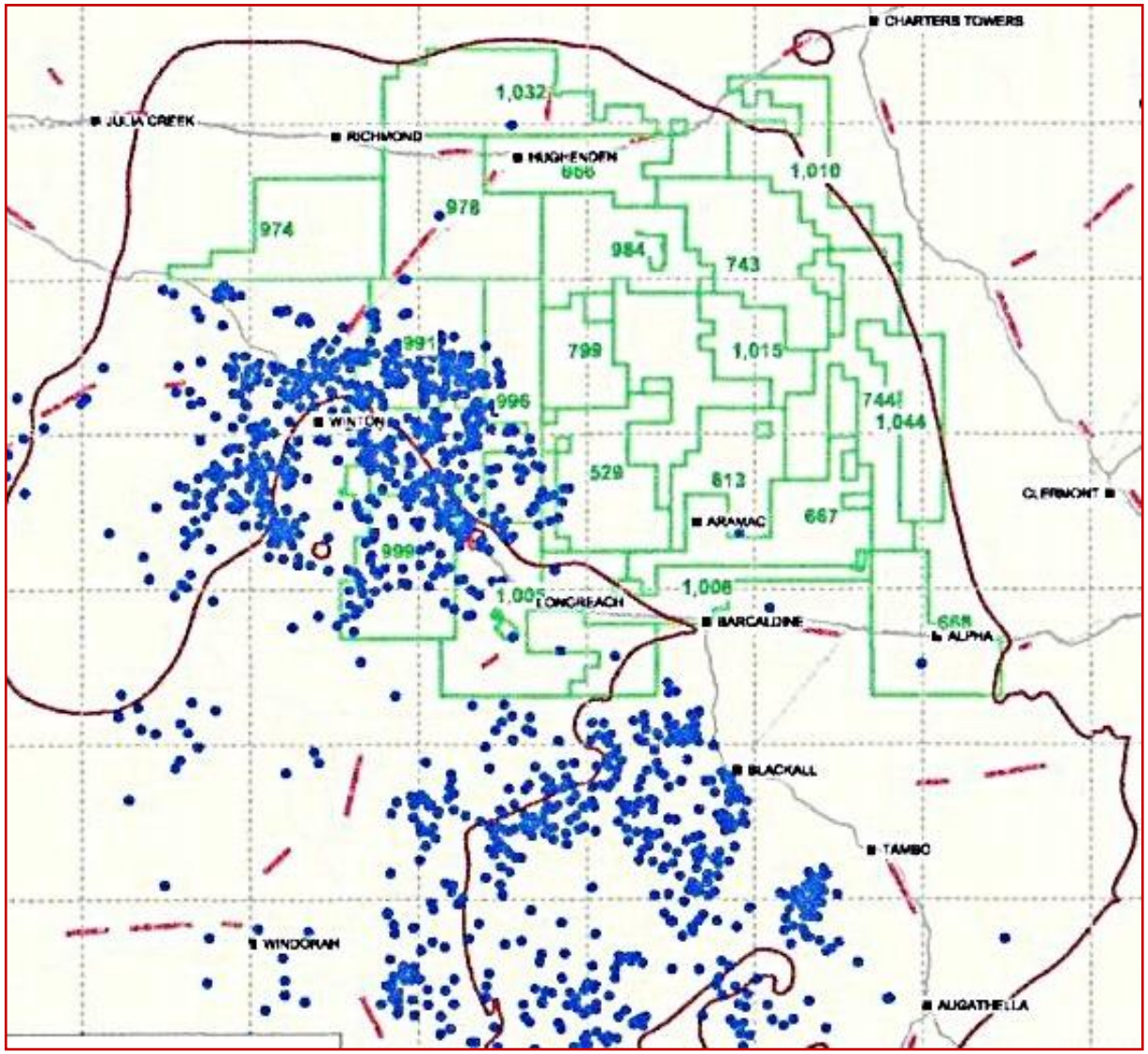
Bores tapping the Hooray Sandstone



Bores tapping the Cadna-owie Form.



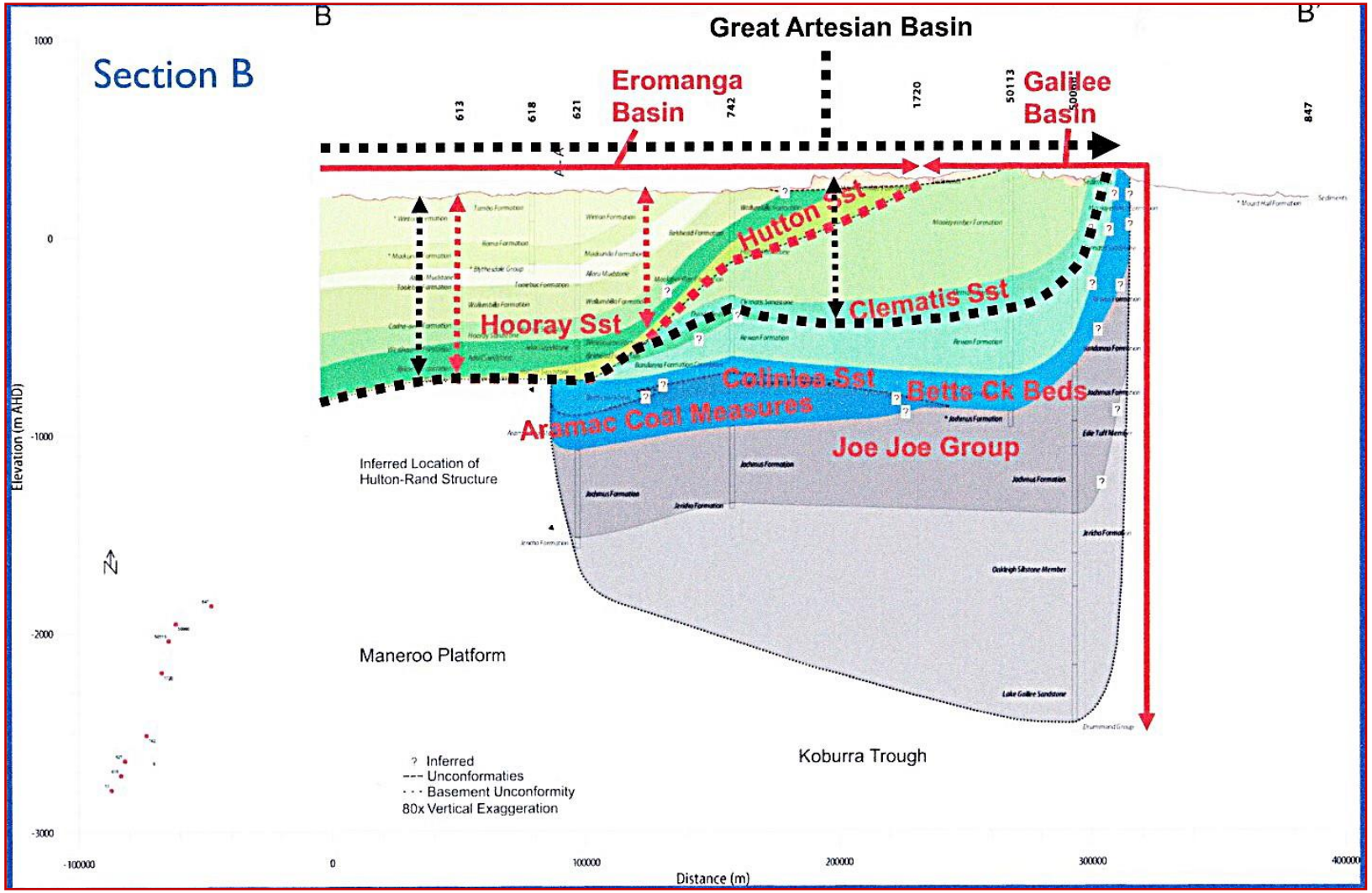
Bores tapping the Winton Formation



Likely Impacts of CSG Production

- Quite different from the CSG in the Surat Basin
- Each area has to be assessed individually
- Coal seams are in the Galilee Basin sediments, located below the GAB sediments
- In some areas, there is a large thickness of very low permeability sediments between coal and the main aquifers
- In some areas, the coal bearing Formations are in close contact with the GAB sediments

Section B - B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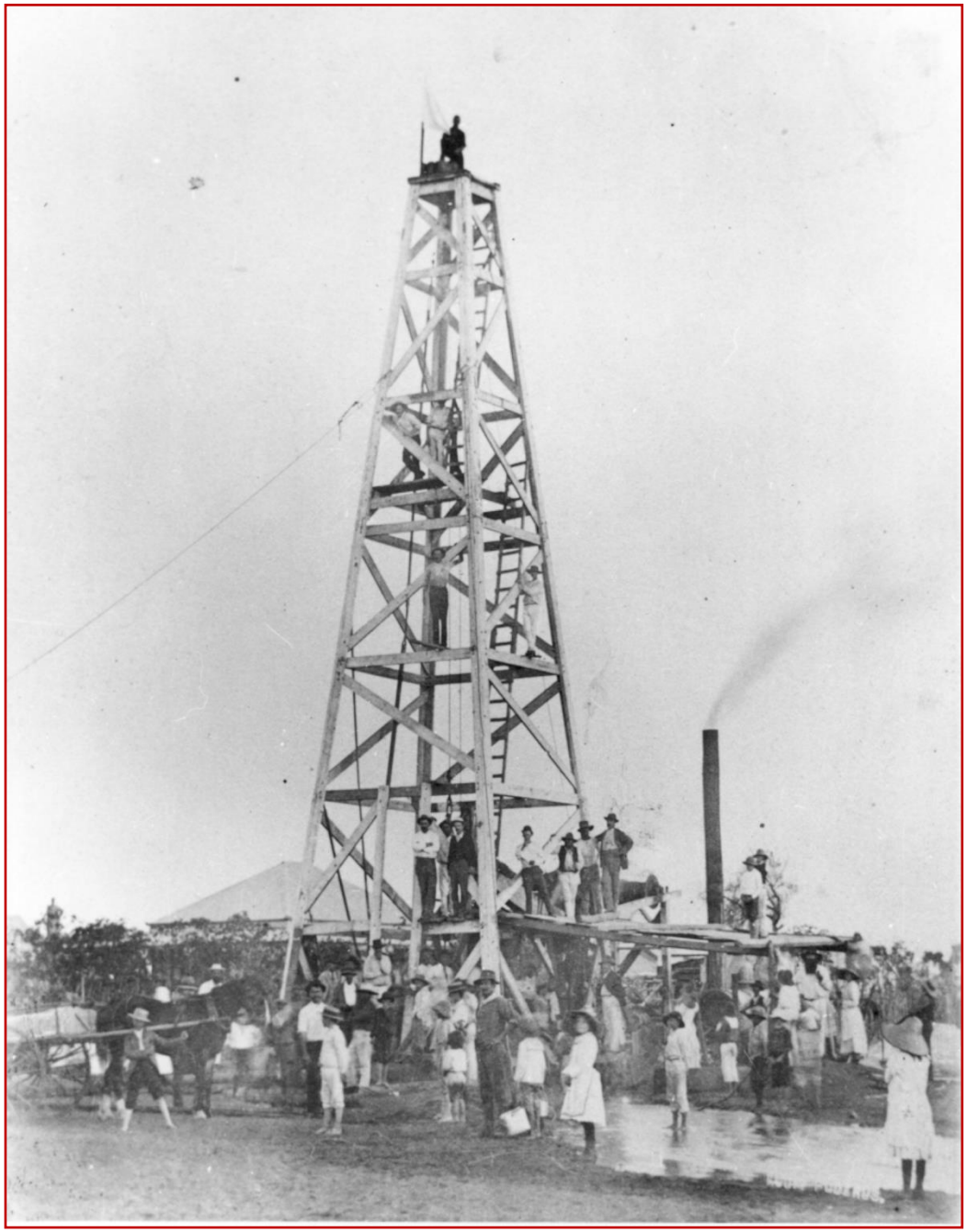
Barcaldine Area

- Original water supply from bores drilled in the GAB in 1890s
- Ash Street Bore (1893) was drilled to 685.8m and latter deepened to 817m, obtained water from the Hutton Sandstone
- Bore was drilled through the Hooray Sandstone, probably to obtain a larger flow.
- There is very little separation between the base of this bore and the Galilee Basin Formations that contain coal

Ash Street Bore

Barcaldine 1893



Barcaldine Baths Bore

- **Drilled in 1887 (first in Barcaldine), depth 211m.**

- **Costs per bath – single: 2d. (two pence);**
  weekly family cost: 2s. 6p. (two shillings and sixpence)

- **Bathing times – gentlemen: 6am to 1pm:**
  ladies: 1pm to 4pm
  children: 4pm to 5 pm.

Hydraulic Engineers Report 1891

(Mr J B Henderson)

- ***"The question of waste of water from artesian bores is one the Department has not lost sight of,.....Whether such waste will have any prejudicial effect upon the permanency of the flow is a question..... it is impossible to answer with any degree of certainty; but it has been reported to me that there are signs of a diminution.."***

Hydraulic Engineers Report 1893

(Mr J B Henderson)

- ***"..I would repeat that as there does not appear to me to be any sound reason why this waste should continue, I would again suggest that the subject receive due consideration at an early date....I submit that now is the time to take action."***

Final Conclusion

- Groundwater movement in the GAB is very slow – a few metres per year at most
- Vertical movement of groundwater is maybe 10 to 100 times slower
- If there is a direct connection between an aquifer and the coal seam, there would be too much water for CSG development
- Any effects will be in the future – maybe many tens of years – as the pressure differential slowly induces flow through the lower permeable sediments
- Only a few GAB aquifers in certain areas will be at any risk of water level falls caused by CSG activity