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An initial CSG pilot site with multiple wells was established in the early 2000s at Rodney Creek, about 5 km north-east of Glenaras, by Galilee Energy. The pilot site at Rodney Creek was based upon the earlier work of EEA, and targeted coal seams in both the Betts Creek beds and the underlying Aramac Coal Measures. However, despite drilling several wells and intersecting prospective coal seams, the pilot wells at Rodney Creek were largely unsuccessful and failed to produce commercial quantities of CSG. This was interpreted as due to fracture stimulation of the coals unintentionally penetrating into overlying aquifers, resulting in insufficient drawdown of the CSG reservoirs to reach desorption pressures ([AGL, 2009](#)). At the end of the test period these wells were plugged and abandoned.



easternwell 

Glenaras 10L Well Completion Report

ATP 2019P – Galilee Basin, QLD

Date: December, 2018

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1. Executive Summary

Glenaras 10 and Glenaras 10L were drilled in the southern portion of ATP 2019 as part of the Glenaras Multilateral Pilot (Fig 1). The pilot is located 65km northeast of Longreach and 12km south-southwest of the junction of Aramac Creek and Rodney Creek. The Glenaras Multilateral Pilot is the third pilot in the area and is positioned 1.8km southwest of the Rodney Creek Pilot and 2.5km northeast of the Glenaras Pilot (Fig 2). The three wells in the Glenaras Multilateral Pilot have all been drilled on the seismic control line L81-3.

The Glenaras Multilateral Pilot was designed and executed to assess the coal seam gas potential of the Early Permian Betts Creek Beds using three wells (GA10L, GA11L and GA12L; Fig 3) targeting the R3 Seam. Glenaras 10 was spudded 23rd March 2018 with Easternwell 101 (Table 1) as an 8-1/2" diameter, vertical pilot borehole to provide stratigraphic depth control for all formations from surface through to total depth of 1,083mKB in the upper Aramac Coal Measures. Upon reaching total depth and running wireline logs, the borehole was plugged back to 440mKB in the Wallumbilla Formation, where Glenaras 10L was sidetracked as an 8-1/2" borehole to the southwest, building in angle to horizontally enter the R3 Seam in the Betts Creek Beds at 1,187mKB (994mTVD) and ~400m distant at an azimuth of 237 degrees.

7" casing was then run in hole to the intermediate depth and the 6-1/8" horizontal production borehole drilled directionally in the R3 Seam. Drilling of the production borehole was logged while drilling using Halliburton's Geosteering Solutions technology and achieved 100% in-seam penetration along the entire 413m length. Two sidetracks were required during the course of the production borehole, but no deviation out of seam occurred.

Upon reaching total depth of the production borehole at 1,622mKB (989.7mTVD), the 6-1/8" production borehole was left open hole with an ESP installed downhole at the entry point into the R3 Seam to maximise drawdown on the reservoir. The rig was released on the 7th April 2018.

The well has since been placed on production as part of the Glenaras Multilateral Pilot as the central well with Glenaras 11L 250m to the northwest and Glenaras 12L 250m to the southeast. Since commissioning, Glenaras 10L has recorded sustained water and gas rates.

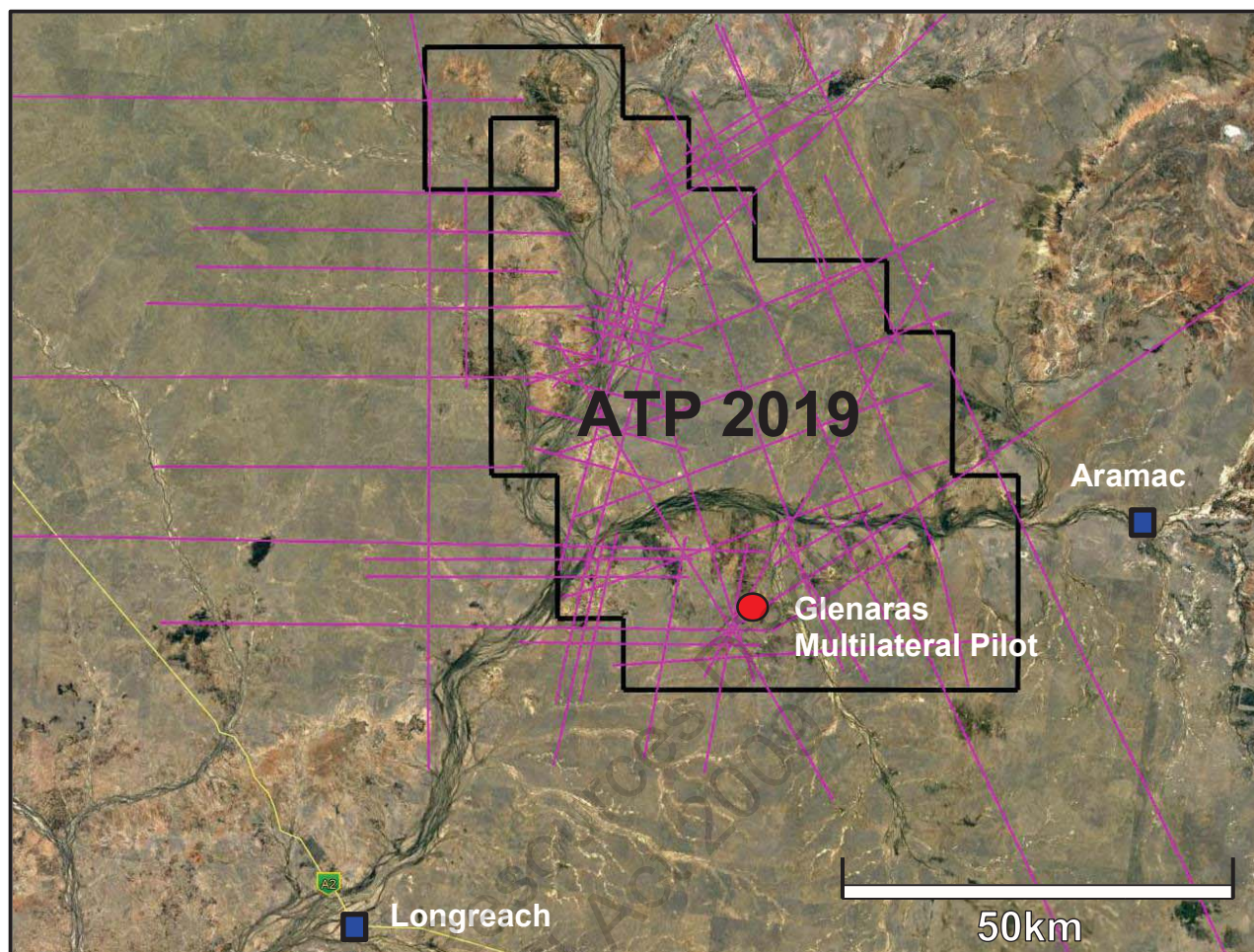


Figure 1. Glenaras Multilateral Pilot location.

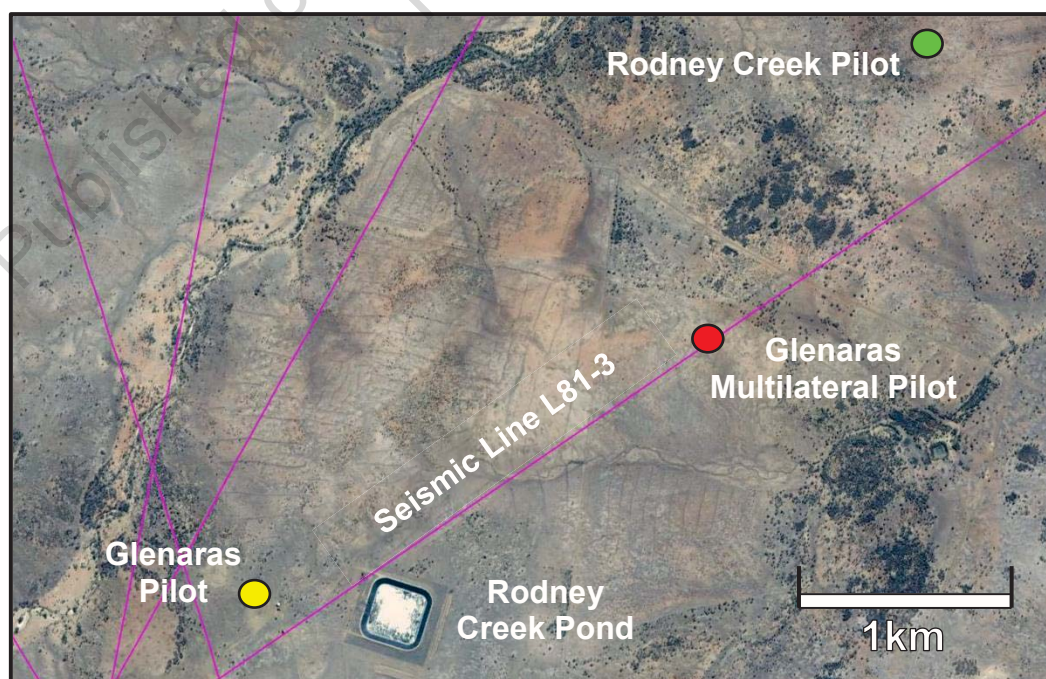


Figure 2. Glenaras 10 / Glenaras 10L location.

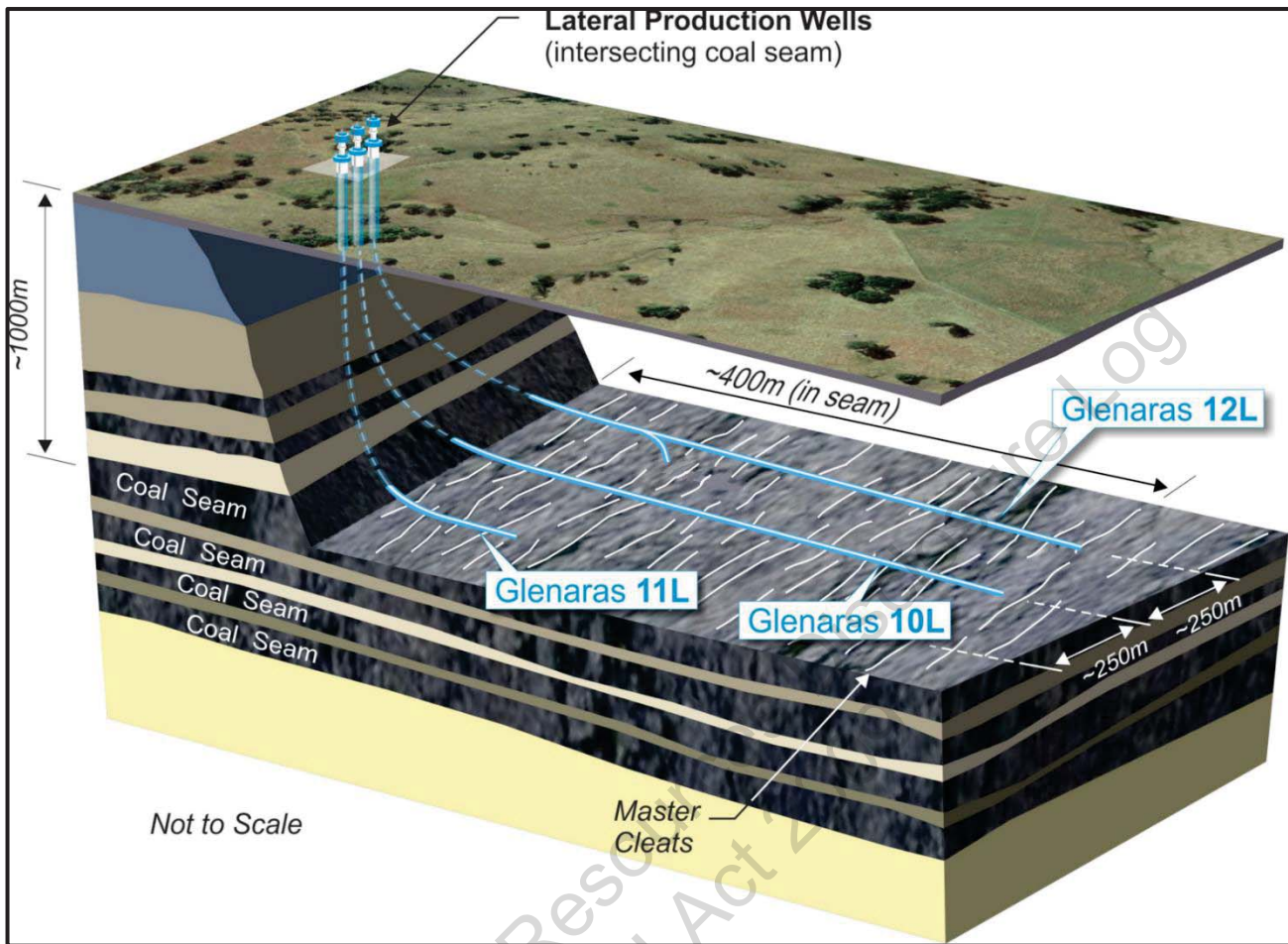


Figure 3. Glenaras multilateral pilot configuration.

2. Well Card

2.1. Drilling Data

2.1.1. General Data

Well Name	Glenaras 10		Glenaras 10L	
Permit	ATP 2019P			
State	Queensland			
Basin	Galilee			
Operator	Galilee Energy Limited (100%), GPO Box 1944, Brisbane, Queensland. 4006			
Joint Venture Partners	-			
Primary Objective	Betts Creek Beds		Betts Creek Beds, R3 Seam	
Secondary Objective	Aramac Coal Measures		-	
Well Class & Type	Coal seam gas appraisal			
Well Category	Multi-wellbore			
Well Design	Vertical stratigraphic pilot		Horizontal production pilot	
Wellbore Identifier	GA10		GA10L	
Well Status	Plugged back		Cased and completed and currently producing.	
Drilling Rig	Easternwell, Rig 101			
Surface Coordinates	144° 45' 0.792" E, 23° 04' 33.091" S			
Surface UTM	269526.85mE, 7446308.51mN			
Total Depth Coordinates	-		144° 45' 0.792" E, 23° 04' 33.091" S	
Total Depth UTM	-		269526.85mE, 7446308.51mN	
Projection	UTM Zone 55			
Datum	GDA94			
Spud / Start Date	23 rd March 2018		30 th March 2018	
Rig Finish / Release	26 th March 2018		7 th April 2018	
Ground Level Elevation (GL)	218.767m above Mean Sea Level			
Kelly Bushing Elevation (KB)	222.967m above Mean Sea Level			
Total Depth	1,083mKB	1,083mTVD	1,622.25mKB	989.61mTVD
Production casing	-		6-1/4" open-hole	

Table 1. Glenaras 10 & Glenaras 10L well data card.

2.1.2. Formations Penetrated

Formation/Member	Depths (m)			
	Measured Depth (mKB)	True Vertical Depth (mTVD)	True Vertical Depth subsea (mTVDSS)	Thickness (m)
Allaru Mudstone	4.10	4.10	218.77	366.40
Toolebuc Formation	370.50	370.50	-147.63	9.00
Wallumbilla Formation	379.50	379.50	-156.63	167.75
Cadna-Owie Formation	547.25	547.25	-324.38	34.90
Hooray Sandstone	582.15	582.15	-359.28	59.15
Westbourne Formation	641.30	641.3	-418.43	26.10
Adori Sandstone	667.40	667.400	-444.53	19.20
Birkhead Formation	686.60	686.60	-463.73	72.40
Hutton Sandstone	759.00	759.00	-536.13	110.50
Rewan Formation	869.50	869.50	-646.63	33.03
Betts Creek Beds	902.53	902.53	-679.66	38.82
R1 Seam Top	941.35	941.35	-718.48	29.47
Colinlea Sandstone	970.82	970.82	-747.95	21.57
R2 Seam Top	992.39	992.39	-769.52	10.39
R3 Seam Top	1,002.78	1,002.78	-779.91	6.38
R4 Seam Top	1,009.16	1,009.16	-786.29	14.14
R5 Seam Top	1,023.30	1,023.30	-800.43	6.21
R6 Seam Top	1,029.51	1,029.51	-806.64	4.49
R7 Seam Top	1,034.00	1,034.00	-811.13	8.41
Aramac Coal Measures	1,042.41	1,042.41	-819.54	-
Total Depth	1,083.00	1,083.00	-859.13	-

Table 2. Glenaras 10 formation tops. (see Table 3 for Glenaras 10L formation tops).

Formation/Member	Depths (m)			
	Measured Depth (mKB)	True Vertical Depth (mTVD)	True Vertical Depth subsea (mTVDSS)	Thickness (m)
Cadna-Owie Formation	543.40	542.83	-319.86	35.58
Hooray Sandstone	579.44	578.41	-355.44	59.75
Westbourne Formation	641.04	638.16	-415.19	27.81
Adori Sandstone	669.92	665.97	-443.01	14.02
Birkhead Formation	684.44	679.99	-457.02	84.69
Hutton Sandstone	772.26	764.68	-541.71	99.18
Rewan Formation	878.16	863.86	-640.90	30.22
Betts Creek Beds	914.75	894.08	-671.11	42.57
R1 Seam	977.74	936.65	-713.68	26.11
Colinlea Sandstone	1,031.43	962.76	-739.80	22.60
R2 Seam	1,100.58	985.36	-762.39	8.80
R3 Seam	1,187.04	994.16	-771.19	-
Total Depth	1,622.25	989.61	-766.65	-

Table 3. Glenaras 10L formation tops. (see Table 2 for Glenaras 10 formation tops).

2.1.3. Drilling Summary

Note: all depths are measured depth relative to Kelly Bushing (mKB) unless otherwise indicated.

Glenaras 10 was spudded at 13:30hrs on the 23rd March 2018 by Easternwell 101 with the surface hole drilled vertically to an intermediate depth of 196mKB using a 12-1/4" PDC bit and KCI mud system. The surface hole was then cased with 9-5/8", 36lb/ft K55 casing to 193.73mKB.

The pilot borehole was then drilled vertically through the intermediate cement shoe with an 8-1/2" PDC bit and KCI brine to a total depth of 1,083mKB. Two wireline logging runs were then performed by Schlumberger. Run 1 was executed with no problems and comprised the Quad Combo PEX-AIT-BHC tools. Run 2, MDT tool, was run-in hole, but the run was aborted after encountering under-gauge hole. Following a wiper trip, the MDT was rerun and four pressure points recorded throughout the Betts Creek coal seams. After retrieving the wireline tools, the vertical 8-1/2" was plugged back to 440mKB in preparation for drilling the Glenaras 10L sidetrack.

The Glenaras 10L borehole was then commenced via sidetracking out of the open-hole, 8-1/2", Glenaras 10 borehole. The sidetrack was drilled using an 8-1/2" diameter PDC bit and KCI brine. The borehole was drilled directionally to the southwest to enter the Betts Creek R3 coal seam at 90 degrees at 1,187mKB (994mTVD). This intermediate sidetrack was then cased to surface with 7", 23lb/ft K55 casing to 1,204.15mKB.

The production borehole was then drilled through the intermediate sidetrack shoe with a 6-1/8" PDC and KCI brine mud system. The borehole was monitored while drilling with Halliburton's azimuthal resistivity and gamma ray tools to ensure the drill bit tracked exclusively through the R3 coal seam to maximise the production interval and reduce the risk of water influx from adjacent clastic intervals. To maintain full borehole isolation in the R3, two sidetracks were executed in the 6-1/8" section. Glenaras 10L was drilled through to 1,266mKB and then terminated due to approaching the roof of the R3. After pulling back, Glenaras 10L-ST1 was commenced at 1,230mKB and drilled to 1,485mKB where it was terminated due to approaching the floor of the R3. After pulling back again, Glenaras 10L-ST2 was commenced at 1,408mKB and drilled to the total depth of 1,622.25mKB (989.61mTVD).

The horizontal, production borehole was then left open-hole and following conditioning of the well and installing the wellhead B-section, Easternwell 101 was rigged down and released at 17:30hrs on the 7th April 2018.

TDC arrived onsite on the 17th May 2018 to complete the well. An electrical submersible pump was run-in hole via 2-3/8" tubing to 1,176mKB. The tubing was then landed and the electrical connection to the pump successfully tested. TDC was then rigged down and released on the 21st May 2018.

2.1.4. Bit Record

Borehole	Bit Run	Diameter (inches)	Type	Serial Number	Depth In (mKB)	Depth Out (mKB)	Depth Drilled
GA10	1	12-1/4"	Ultrerra U419S	23662	12.6m	196.0m	183.4m
GA10	2	8-1/2"	Ultrerra CF419	37797	196.0m	1,083m	887.0m
GA10L	3	8-1/2"	Ultrerra U516S	38347	440.0m	1,209m	747.0m
GA10L	4	6-1/8"	Ultrerra U613S	36248	1,209.0m	1,622.25m	413.25m

Table 4. Glenaras 10 / Glenaras 10L bit record.

2.1.5. Deviation Data

See Appendix 1.

2.1.6. Drilling Fluids Summary

Borehole		Depth Interval	Casing	Specification	Data
Glenaras 10	12-1/4" surface hole	Surface to 196mKB	9-5/8" casing	Mud weight (ppg)	8.7 – 9.0
				Total hardness (mg/Lt)	200
				Ph	8.0 – 10.0
				Funnel Viscosity (sec./qt.)	28 – 32
				KCl (by weight %)	5.0 – 5.1
	8-1/2" vertical pilot	196mKB to 1,083mKB	Plugged back	Mud weight (ppg)	8.65 – 9.2
				API Filtrate (ml/30 min)	NC
				Hardness (Ca++ & Mg++) (mg/l)	200 – 400
				Chlorides (mg/l)	24,000 – 32,000
				pH	8.5 – 9.5
Glenaras 10L	8-1/2" intermediate build	440mKB to 1,209mKB / 994mTVD	7" casing	Mud weight (ppg)	8.6 – 8.7
				Hardness (Ca++ & Mg++) (mg/l)	220 – 350
				Chlorides (mg/l)	24,000 – 30,000
				pH	8.0 – 9.5
				Funnel Viscosity (sec./qt)	29 - 32
	6-1/8" production	440mkb to 1,622mkb / 989mTVD	Open-hole	Mud weight (ppg)	8.5 – 8.8
				Hardness (Ca++ & Mg++) (mg/l)	220 – 300
				Chlorides (mg/l)	18,000 – 26,000
				pH	8.0 – 9.5
				Funnel Viscosity (sec./qt)	28 - 29

Table 5. Glenaras 10L / Glenaras 10L drilling fluids summary.

2.1.7. Bottom Hole Assembly Summary

See Appendix 2.

2.1.8. Casing and Cement Report

See Appendix 3.

2.1.10. Perforations

No perforations were shot in the well. The horizontal 6-1/8" production borehole is completed open hole.

2.1.11. Well Completion

See Appendix 4.

2.2. Well Testing

2.2.1. Wireline Logging

Borehole	Suite	Run	Hole Size	Tool	Depth Top	Depth Base
Glenaras 10	1	1	8-1/2"	PEX-AIT-BHC	9.98m	1,085.14m
	1	2	8-1/2"	MDT	<i>Aborted</i>	
	1	3	8-1/2"	MDT (4 stations)	953.3m	1,026.5m
Glenaras 10L	<i>No wireline logging</i>					

Table 6. Glenaras 10L / Glenaras 10L wireline logging summary.

2.2.2. MWD/LWD Logging

Borehole	Run	Hole Size	Tool	Depth Top (mKB)	Depth Base (mKB)
Glenaras 10	<i>No LWD/MWD</i>				
Glenaras 10L	1	8-1/2"	PGRC	415.00m	1,204.00m
Glenaras 10L	2	6-1/8"	PCRC/GBCGC/HGBTQC/HGBR QC/HGBBQC/HGBLQC/GBXT/A RM48P-T/ARH16P-T	1,204.00m	1,231.00m
Glenaras 10L-	3	6-1/8"		1,231.00m	1,408.50m
Glenaras 10L-	4	6-1/8"		1,408.5m	1,622.30m

Table 7. Glenaras 10L / Glenaras 10L MWD/LWD summary.

2.2.3. Conventional Coring

No conventional cores were cut.

2.2.4. Sidewall Coring

No Sidewall cores were cut.

2.2.5. Formation Testing

Test #	Formation	Gauge Depth (mKB)	Mud Pressure Before (psi)	Mud Pressure After (psi)	Last Build-Up Pressure (psi)	Temperature After (deg C)	Kh (mD.m)	Skin
1	R5 Seam	1,026.08	1,568.78	1,576.42	1,481.84	68.49	7-10	8-11
2	R4.2 Sst	1,022.32	1,656.16	1,569.03	1,472.25	68.75	Unstabilised	
3	R3 Seam	1,005.30	1,539.12	1,539.70	1,461.51	68.87	32	5
4	R1 Seam	952.91	1,460.00	1,461.30	1,389.67	65.65	2.6	8

Table 8. MDT formation test data

3. Geology

3.1. Regional Geology

The Galilee Basin is located in western Queensland and is estimated to be 247,000km² in area (Fig 4). Regionally, the basin is separated from the Cooper Basin to the west by the Canaway Ridge, while the Nebine Ridge and Springsure Shelf separate it from the northern Bowen Basin to the east. The Galilee Basin's internal architecture comprises three primary depocentres (Fig 5); the Lovelle Depression in the northwest, the Koburra Trough in the northeast and east and the Powell Depression in the south. Key internal structures that have controlled the formation of these depocentres include the central Manaroo Platform and the Barcaldine Ridge, both of which represented palaeohighs at the time of initial deposition.

Formed during the Late Carboniferous and containing up to 3,000m of siliciclastic units with interbedded coals and volcanics, the base of the Galilee Basin is marked by an unconformable boundary with both the Late Devonian to Early Carboniferous Drummond and Adavale basins (Fig 6), while the upper limit is defined by an unconformable boundary with the overlying sediments of the Jurassic-Cretaceous Eromanga Basin. Despite local depositional differences in each of these discrete depocentres and subsequent erosion on local scales, the gross stratigraphy is ubiquitous across the basin.

Two major depositional periods define the Galilee Basin sequence. The earliest sequence, the Late Carboniferous to Early Permian Joe Joe Group,

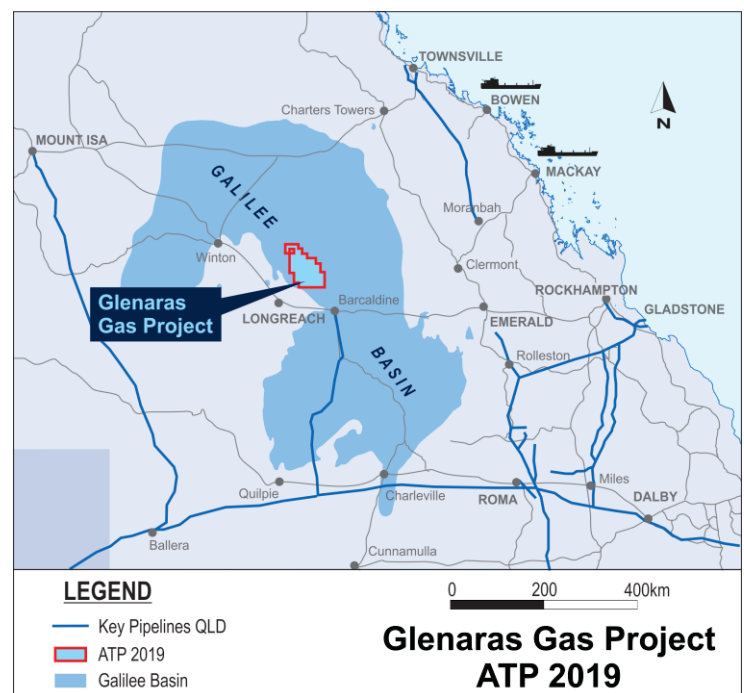


Figure 4. Galilee Basin and ATP 2019P location.

comprises basal fluvial and glacially derived sands interbedded with tuffs, which are overlain by the paludal and marshland formed Aramac Coal Measures (time equivalent to the Reids Dome Beds in the adjacent northern Bowen Basin and Denison Trough).

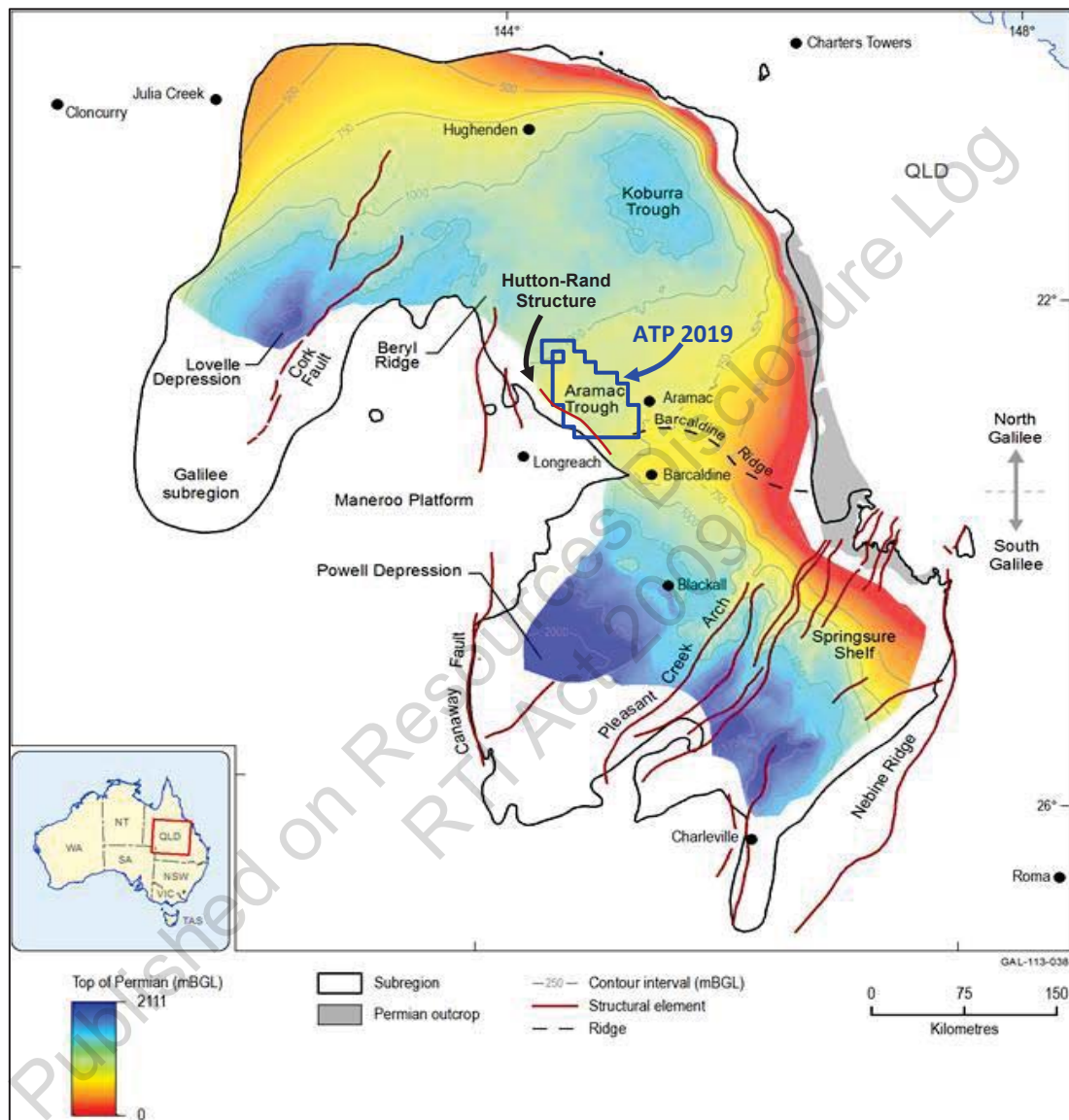


Figure 5. Galilee Basin structural architecture (Moya, *et al* 2014).

Following a major unconformity and period of non-deposition, the second period occurred during the Late Permian to Mid Triassic. The base of this sequence is represented by the coastal plain derived Betts Creek Beds (time equivalent to the Bandanna Coal Measures in the Bowen Basin) and is made up of interbedded sands, coals and mudstones. The upper limit of the Betts Creek Beds is signified by another regionally extensive unconformity that comprised significant tectonic uplift and erosion. Deposition was reinstated during the Early Triassic with the fluvially derived Rewan Group. This was in turn followed by the regionally pervasive Clematis Sandstone and Moolayember Formation. The upper limit

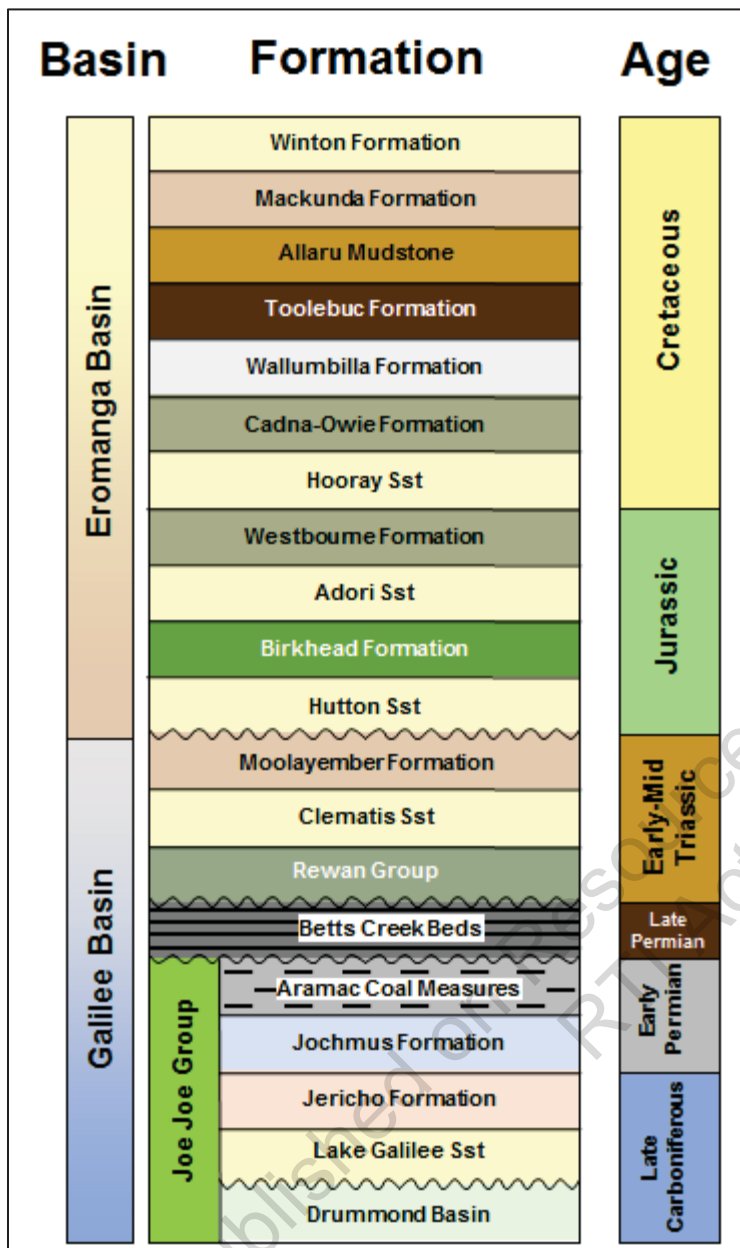


Figure 6. Aramac Trough stratigraphic column.

of the Galilee Basin section is then capped by the Mid Triassic unconformity, which marks the base of the overlying Jurassic-Cretaceous Eromanga Basin.

3.2. Local Structure

ATP 2019 is in the central area of the Galilee Basin, in the Aramac Trough, which is a smaller depocentre associated with the larger Koorarra Trough system. The Aramac Trough is a northeast-southwest trending, localised graben that offshoots from the Koorarra Trough and dips into the Hutton-Rand Structure (Fig 5), which is a major contributing element to the basin-controlling Maneroo Platform. The Hutton-Rand Structure was a significant feature created during basin formation with continued growth along it, particularly through the Late Carboniferous to Late Permian depositional cycles, which provided sufficient accommodation space to emplace the full Galilee Basin stratigraphic section across the ATP 2019 area.

The northwest flank of the Aramac Trough is marked by the Maranthona Monocline, while the southeast flank is a more subtle flexure that dips upwards towards the southern margins of the Koorarra Trough.

3.3. Local Stratigraphy

The full Galilee Basin stratigraphic section has been confirmed across most of the ATP 2019 area. The gross section is thickest in the Glenaras area in the southwest of the permit, where deposition abutted the Hutton-Rand Structure, while the thinnest gross section is in the very northwest of the permit on the uppermost flanks of the Aramac Trough. In this area the basal units of the Joe Joe Group are less developed due to the higher palaeorelief during the Late Carboniferous and Early Permian.

Glenaras 10 intersected the full geologic sequence from surface to the Aramac Coal Measures at 1,083mKB (Section 2.1.2). Glenaras 10L was sidetracked from the vertical pilot hole at 440mKB in the Wallumbilla Formation and then drilled directionally through the identical geologic sequence through to the Betts Creek Beds, where the horizontal production hole was drilled through the Betts Creek Beds R3 Seam.

3.3.1. Galilee Basin Sequence

The Early Permian Aramac Coal Measures were the deepest sediments intersected in Glenaras 10 at 1,042mKB (>41m thick). This commercially prospective coal seam gas section comprises interbedded coals, sandstones, siltstones and shales, deposited under marsh conditions within a larger coastal plain environment. The overlying, Early Permian Betts Creek Beds, which represent the primary coal seam gas target in ATP 2019, were intersected at 903mKB (139m thick). Across ATP 2019, the Betts Creek Beds comprise seven, laterally continuous coal seams interbedded with carbonaceous shales, siltstones and sandstones of varying permeability. The R1 Seam is the shallowest and thickest at >10m, with the deeper R2 to R7 seams varying from 1m to 3m in thickness. The R3 Seam was the target reservoir in Glenaras 10 for the sidetracked production borehole and was ~2.5m in thickness. The Betts Creek Beds coals are typically sub-bituminous in rank, generally dull with some brighter banding and localised fracturing.

The Early Triassic Rewan Formation was intersected at 870mKB (33m thick) and comprise dryland alluvial sands with lesser siltstones and shales. The Rewan Formation marks the top of the Galilee Basin sequence with the remaining Triassic section, the Clematis Sandstone and the Moolayember Formation, both eroded from this location.

3.3.2. Eromanga Basin Sequence

The Middle Jurassic aged Hutton Sandstone and Birkhead Formation were the lowermost Eromanga Basin units intersected in Glenaras 10 at 759mKB (111m thick) and 687mKB (72m thick) respectively. The Hutton Sandstone predominantly comprises massive sandstones with minor shales and carbonaceous shales, deposited within a regionally pervasive, braided fluvial environment upon the Late Triassic unconformity. The Birkhead Formation represents a reduction in depositional energy and a transition to fluviodeltaic and lacustrine environments, which laid down a more heterogeneous section of typically finer grained sandstones and extensive siltstones and shales with some carbonaceous shales.

The Late Jurassic Adori Sandstone and Westbourne Formation were encountered at 667mKB (19m thick) and 641mKB (26m thick) respectively. These two formations combined effectively form a larger fining upward parasequence of higher energy fluvial sandstones and minor shales of the Adori Sandstone at the base that grade upwards into interbedded siltstones, sandstones and mudstones of the Westbourne Formation.

The shallowest Eromanga Basin sediments drilled in Glenaras 10 are Early Cretaceous in age and are made up of a series of diverse depositional environments that are both terrestrial and marine in origin. The Hooray Sandstone was intersected at 582mKB (59m thick) and is predominantly sandstone with minor siltstones and claystones, laid down under fluvial conditions. A subsequent marine transgression laid down the finer-grained sandstones and siltstones of the overlying Cadna-Owie Formation, which was intersected at 547m (35m thick). A persistent, shallow marine

environment followed, which deposited the claystones and minor sandstones of the Wallumbilla Formation at 380mKB (168m thick), which were followed by the fossil-rich, marine shales of the Toolebuc Formation at 371mKB (9m thick). Finally, the shallowest formation and surface outcropping formation at Glenaras 10 was the Allaru Mudstone (366m thick), which comprises interbedded claystones and siltstones, also laid down under shallow marine conditions.

3.4. Well Objectives

Glenaras 10 was designed to be a vertical pilot well to provide accurate stratigraphic control for drilling all three horizontal production boreholes in the Betts Creek Beds R3 Seam via Glenaras 10L, 11L and 12L. Upon logging the complete vertical section of Glenaras 10 from the Aramac Coal Measures to surface, the sidetrack, Glenaras 10L, was planned to be kicked-off in the Wallumbilla Formation and drilled directionally to horizontally enter the top of the R3 Seam. Then a continuous 450m production borehole would be directionally drilled through the R3 Seam.

Glenaras 10L would ultimately be completed openhole with an ESP installed downhole and commissioned for production as the central borehole between and parallel to Glenaras 11L and 12L as part of the Glenaras Multilateral Pilot.

3.5. Prognosis v Actual

Formation	Prognosed		Actual*		Difference (+high/-low)
	Measured Depth (mKB)	True Vertical Depth (mTVDSS)	Measured Depth (mKB)	True Vertical Depth (mTVDSS)	
Allaru Mudstone	4.00	218.77	4.10	218.77	-0.10
Toolebuc Formation	370.10	-145.00	363.60	-140.63	6.50
Wallumbilla Formation	379.10	-154.00	370.26	-147.29	8.84
Cadna-Owie Formation	545.10	-320.00	547.23	-324.27	-2.13
Hooray Sandstone	577.10	-352.00	582.16	-359.19	-5.06
Westbourne Formation	640.10	-415.00	641.14	-418.17	-1.04
Adori Sandstone	668.10	-443.00	667.37	-444.40	0.73
Birkhead Formation	685.10	-460.00	687.91	-464.94	-2.81
Hutton Sandstone	763.10	-538.00	770.87	-547.91	-7.77
Rewan Formation	869.10	-644.00	864.07	-641.10	5.03
Betts Creek Bed	915.60	-690.50	902.45	-679.48	13.15

R1 Seam	956.10	-731.00	941.21	-718.24	14.89
R2 Seam	1007.10	-782.00	992.43	-769.46	14.67
R3 Seam	1011.60	-786.50	1,002.60	-779.64	9.00
R4 Seam	1021.60	-796.50	1,009.14	-786.17	12.46
R5 Seam	1030.10	-805.00	1,023.51	-800.54	6.59
R6 Seam	1037.60	-812.50	1,029.60	-806.64	8.00
R7 Seam	1042.60	-817.50	1,033.95	-810.98	8.65
Aramac Coal Measures	1050.60	-825.50	1,042.91	-819.95	7.69

* Glenaras 10 vertical pilot depths.

Table 9. Glenaras 10 depth prognosis v actual.

3.6. Hydrocarbon Shows

No significant hydrocarbon shows were recorded during the drilling of both Glenaras 10 and Glenaras 10L.

4. Summary

4.1. Hydrocarbon Potential

Glenaras 10 and Glenaras 10L have both confirmed the laterally continuous nature of the Betts Creek Beds coal seams through the Glenaras area and their collective prospectivity for economically recoverable coal seam gas. Sufficient seam thickness and total net coal were intersected through the entire section, particularly in the targeted R3 Seam, in which the Glenaras 10L horizontal production borehole was successfully drilled. Since drilling, Glenaras 10L has been completed and placed on extended production with sustained water and gas rates.

4.2. Completion

Glenaras 10 was plugged back with cement to 440mKB to facilitate the Glenaras 10L sidetrack. Upon reaching its target intermediate depth at the top of the R3 Seam, the build-up section of the sidetrack was cased with 7" back to surface. The 6-1/8" horizontal production borehole drilled through the R3 Seam was completed open-hole along its 413m length with an electric submersible pump installed downhole to maximise drawdown of the reservoir.

Appendix 1

Deviation Data

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APPENDIX 2

Bottom-Hole Assembly

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APPENDIX 3

Casing and Cement Report

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APPENDIX 9

Drilling Fluids Report

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Glenaras 11L Well Completion Report

ATP 2019P – Galilee Basin, QLD

Date: December, 2018

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1. Executive Summary

Glenaras 11L was drilled in the southern portion of ATP 2019 as part of the Glenaras Multilateral Pilot (Fig 1). The pilot is located 65km northeast of Longreach and 12km south-southwest of the junction of Aramac Creek and Rodney Creek. The Glenaras Multilateral Pilot is the third pilot in the area and is positioned 1.8km southwest of the Rodney Creek Pilot and 2.5km northeast of the Glenaras Pilot (Fig 2). The three wells in the Glenaras Multilateral Pilot have all been drilled on the seismic control line L81-3.

The Glenaras Multilateral Pilot was designed and executed to assess the coal seam gas potential of the Early Permian Betts Creek Beds using three wells (GA10L, GA11L and GA12L; Fig 3) targeting the R3 Seam. Glenaras 11L was spudded 8th April 2018 with Easternwell 101 (Table 1) as the northern flank well in the pilot, 250m northwest of Glenaras 10L. After setting 9-5/8" surface casing at 196mKB, the 8-1/2" intermediate borehole was drilled vertically to the base of the Allaru Mudstone, where directional drilling commenced towards an azimuth of ~236° to intersect the primary target, the Betts Creek Beds R3 Seam at a hole angle of 90°. The 8-1/2" section was terminated in the R3 Seam at 1,311mKB (996.51mTVD) with an azimuth of ~234.7° and a hole angle of 90.9°.

7" casing was then run in hole to the top of the R3 Seam and the 6-1/8" horizontal production borehole drilled directionally through the R3 Seam using Halliburton's Geosteering Solutions technology. Unfortunately, the bottom hole assembly became stuck at 1,369.38mKB (995.78mTVD) with an azimuth of ~235.3° and a hole angle of 90.62°. Following extensive retrieval operations, the drill pipe was cut at 1,078.1mKB, leaving an ~297m fish downhole in the toe of the well, which comprised ~297m of drill pipe and bottom hole assembly.

Following installation of the wellhead, Easternwell 101 was rigged down and released on the 21st April 2018. The well is currently being used as a monitoring well in the Glenaras Multilateral Pilot with Glenaras 10L positioned 250m to the southeast.

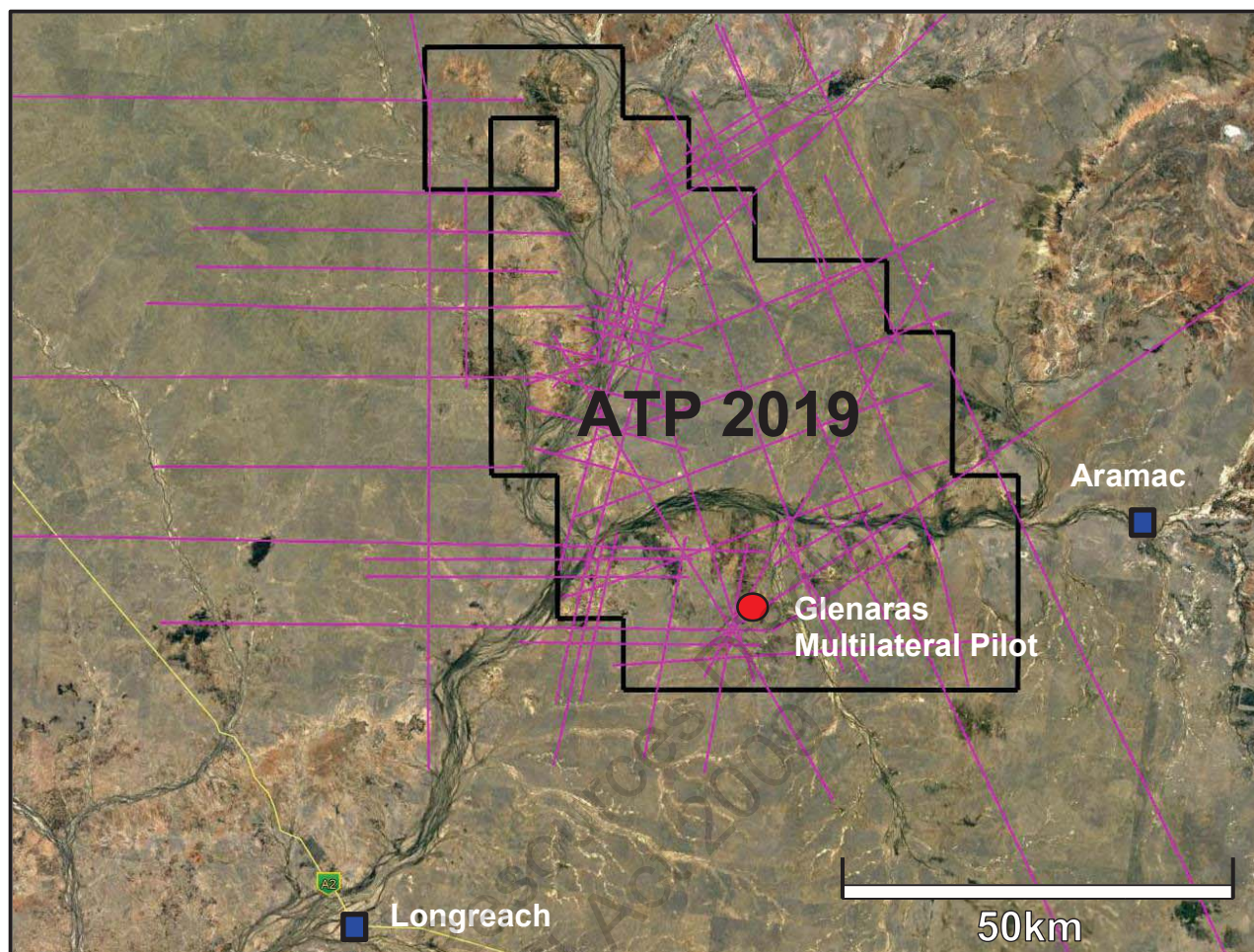


Figure 1. Glenaras Multilateral Pilot location.

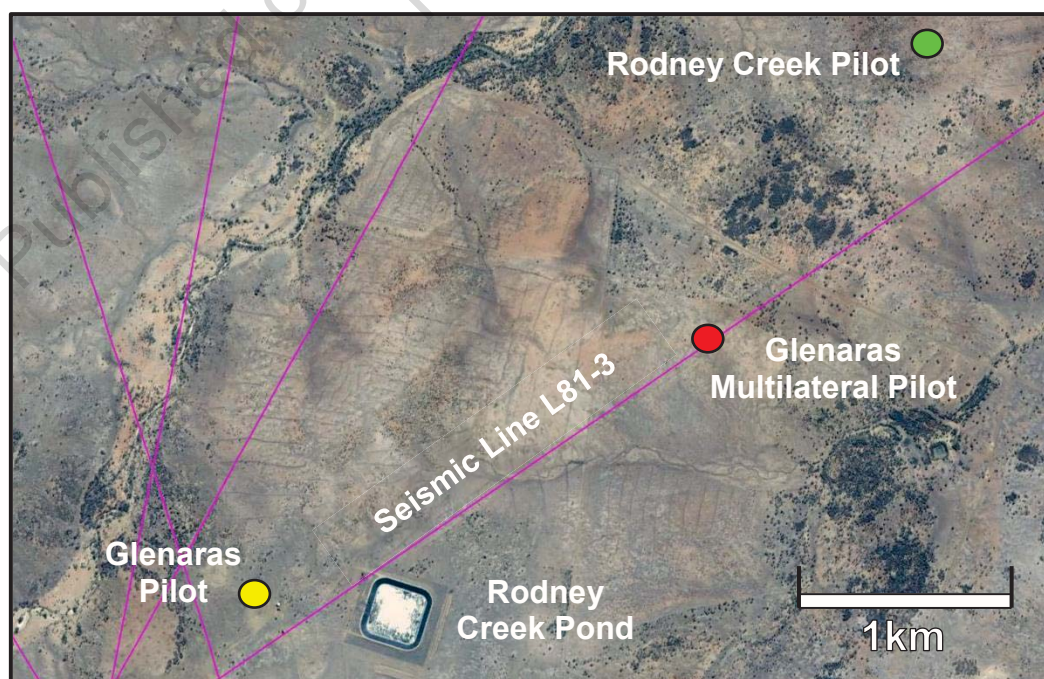


Figure 2. Glenaras 11L location.

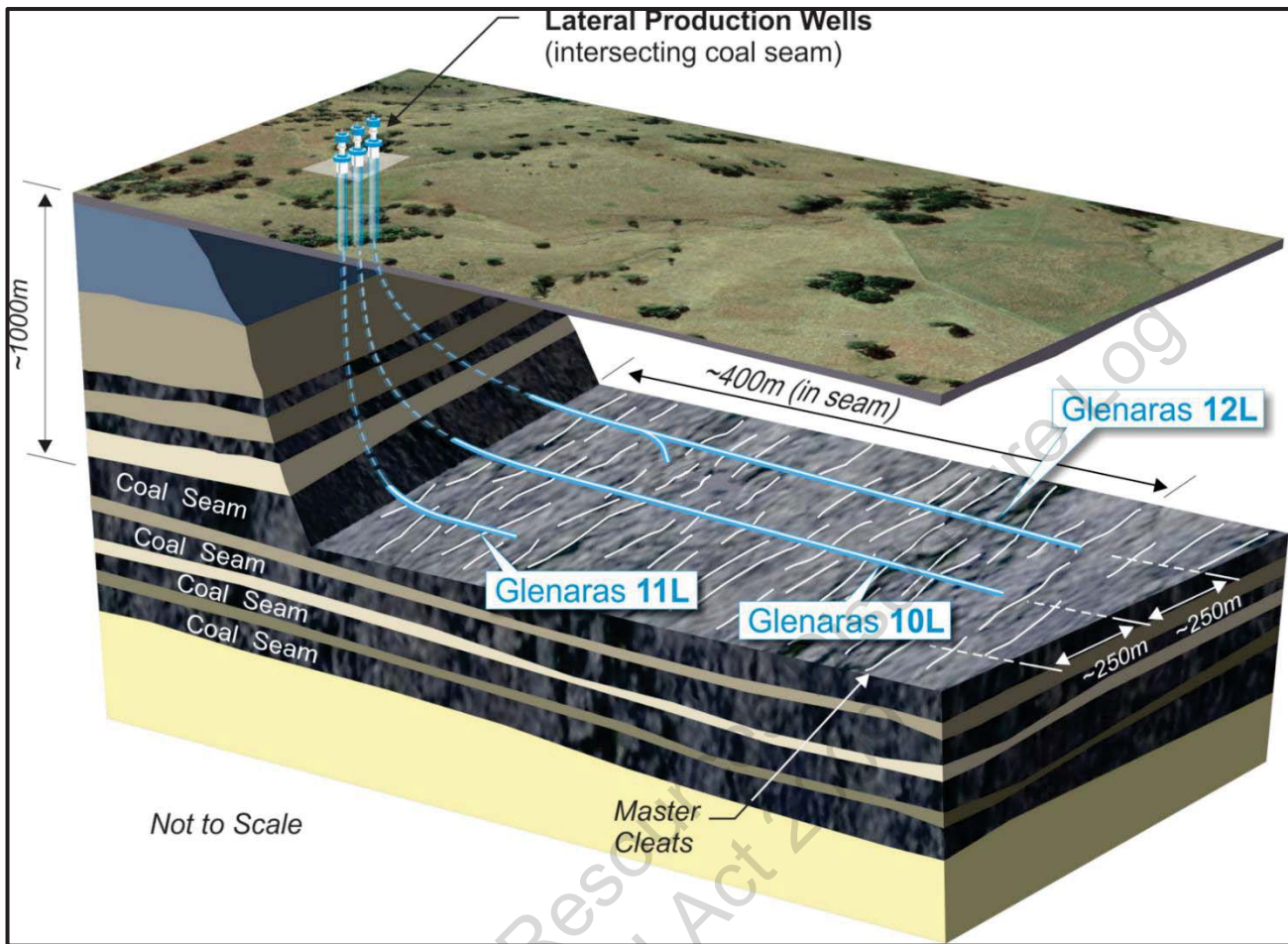


Figure 3. Glenaras multilateral pilot configuration.

2. Well Card

2.1. Drilling Data

2.1.1. General Data

Well Name	Glenaras 11L	
Permit	ATP 2019P	
State	Queensland	
Basin	Galilee	
Operator	Galilee Energy Limited (100%), GPO Box 1944, Brisbane, Queensland. 4006	
Joint Venture Partners	-	
Primary Objective	Betts Creek Beds, R3 Seam	
Secondary Objective	-	
Well Class & Type	Coal seam gas horizontal production pilot	
Well Category & Design	Single wellbore, deviated	
Wellbore Identifier	GA11L	
Well Status	Cased and completed. Currently commissioned as a monitoring borehole with downhole fish.	
Drilling Rig	Easternwell, Rig 101	
Surface Coordinates	144° 45' 01.231" E, 23° 04' 32.813" S	
Surface UTM	269539.21mE, 7446317.27mN	
Total Depth Coordinates	144° 44' 41.68" E, 23° 04' 35.12" S	
Total Depth UTM	268983.78mE, 7446237.658mN	
Projection	UTM Zone 55	
Datum	GDA94	
Spud / Start Date	8 th April 2018	
Rig Finish / Release	21 st April 2018	
Ground Level Elevation (GL)	218.77m above Mean Sea Level	
Kelly Bushing Elevation (KB)	222.97m above Mean Sea Level	
Total Depth	1,369.38mKB (995.78mTVD)	
Production casing	Intermediate: 7" csg to top R3 Seam	Production: 6-1/4" open-hole

Table 1. Glenaras 11L well data card.

2.1.2. Formations Penetrated

Formation/Member	Depths (m)			
	Measured Depth (mKB)	True Vertical Depth (mTVD)	True Vertical Depth subsea (mTVDSS)	Thickness (m)
Allaru Mudstone	4.20	4.20	218.73	355.41
Toolebuc Formation	360.87	359.61	-136.68	6.05
Wallumbilla Formation	367.07	365.66	-142.73	181.09
Cadna-Owie Formation	560.57	546.75	-323.82	33.58
Hooray Sandstone	596.73	580.33	-357.40	58.97
Westbourne Formation	660.80	639.30	-416.37	24.83
Adori Sandstone	687.35	664.13	-441.20	19.55
Birkhead Formation	708.35	683.68	-460.75	72.49
Hutton Sandstone	786.91	756.17	-533.24	104.64
Rewan Formation	906.76	860.81	-637.88	37.69
Betts Creek Beds	955.45	898.50	-675.57	36.69
R1 Seam Top	1,011.58	935.19	-712.26	28.10
Colinlea Sandstone	1,068.98	963.29	-740.36	24.42
R2 Seam Top	1,175.68	987.71	-764.78	7.84
R3 Seam Top	1,283.60	995.55	-772.62	-
Total Depth	1,369.38	995.78	-772.85	-

Table 2. Glenaras 11L formation tops.

2.1.3. Drilling Summary

Note: all depths are measured depth relative to Kelly Bushing (mKB) unless otherwise indicated.

Glenaras 11L was spudded at 16:00hrs on the 8th April 2018 by Easternwell 101 with the surface hole drilled vertically to 195.5mKB using a 12-1/4" PDC bit and KCI mud system. The surface hole was then cased with 9-5/8", 36lb/ft K55 casing to 195.5mKB.

The 9-5/8" cement shoe was then drilled out and the intermediate borehole commenced with an 8-1/2" PDC bit and KCI brine. The top length of the hole was drilled vertically to 415.6mKB into the Wallumbilla Formation where the build-up section kicked-off. The remainder of the intermediate borehole was then drilled directionally towards the southeast with Halliburton's PGRC LWD tool to monitor the stratigraphy. The primary target, the Betts Creek R3 Seam was

encountered at 1,283.60mKB (995.55mTVD) at an angle of 90.9° and an azimuth of 234.7°. Total depth for the intermediate borehole was reached at 1,306mKB with 7", 23lb/ft K55 casing run back to surface.

The production borehole was then drilled through the 9-5/8" intermediate shoe with a 6-1/8" PDC and KCl brine mud system. The borehole was monitored while drilling with Halliburton's azimuthal resistivity and gamma ray tools to ensure the drill bit tracked exclusively through the R3 coal seam to maximise the production interval and reduce the risk of water influx from adjacent clastic intervals. Unfortunately, drilling was halted at 1,369.38mKB (995.78mTVD) at an angle of 90.62° and an azimuth of 235.3° due to hole stability problems.

Overpull and backside pressure operations failed to release the stuck pipe. A Kinetic Stringshot was then run to back off the stuck pipe and after a tool failure on the first run, a second run was achieved to 1,078.1mKB and successfully fired. The free drill pipe was then retrieved, leaving ~297m of drill pipe and bottom hole assembly, stuck in the toe of the horizontal production borehole. Further jarring operations failed to loosen the remaining drilling assembly and the fish was left in the hole and Easternwell 101 was rigged down and released at 09:00hrs on the 21st April 2018.

2.1.4. Bit Record

Bit Run	Diameter (inches)	Type	Serial Number	Depth In (mKB)	Depth Out (mKB)	Depth Drilled
1	12-1/4"	Ultrerra U419S (PDC)	23662	12.6m	195.5m	182.9m
2	8-1/2"	Ultrerra U516S (PDC)	38347	195.5m	1,210.0m	1,115.5m
3	8-1/2"	Ultrerra U516S (PDC)	38348	1,311.0m	1,311.0m	0.0m
4	6-1/8"	Ultrerra U613S (PDC)	36248	1,311.0m	1,369.38m	58.38m

Table 3. Glenaras 11L bit record.

2.1.5. Deviation Data

See Appendix 1.

2.1.6. Drilling Fluids Summary

Borehole	Depth Interval	Casing	Specification	Data
12-1/4" surface hole	0mKB to 195.5mKB	9-5/8" casing	Mud weight (ppg)	8.6 – 8.7
			Total hardness (mg/Lt)	200
			Ph	8.0 – 9.0
			Funnel Viscosity (sec./qt.)	27 – 29

			KCl (by weight %)	5.0%
8-1/2" intermediate build-up	0mKB to 1,306mKB	7" casing	Mud weight (ppg)	8.6 – 8.7
			Hardness (Ca++ & Mg++) (mg/l)	200 – 260
			Chlorides (mg/l)	22,000 – 24,000
			pH	8.0 – 9.5
			Funnel Viscosity (sec./qt)	29 - 32
6-1/8" production	1,306mKB to 1,369.38mKB / 995.78mTVD	Open-hole	Mud weight (ppg)	8.45 – 8.8
			Hardness (Ca++ & Mg++) (mg/l)	20 – 180
			Chlorides (mg/l)	15,000 – 49,500
			pH	8.0 – 9.0
			Funnel Viscosity (sec./qt)	28 - 29

Table 4. Glenaras 11L drilling fluids summary.

2.1.7. Bottom Hole Assembly Summary

See Appendix 2.

2.1.8. Casing and Cement Report

See Appendix 3.

2.1.10. Perforations

No perforations were shot in the well. The horizontal 6-1/8" production borehole is completed open hole with the ~297m fish remaining down hole at the toe of the well.

2.1.11. Well Completion

See Appendix 4.

2.2. Well Testing

2.2.1. Wireline Logging

No wireline logs were run.

2.2.2. MWD/LWD Logging

Borehole	Hole Size	Tool	Depth Top (mKB)	Depth Base (mKB)
Glenaras 11L intermediate build-up	8-1/2"	PGRC	174.00m	1,300.00m
Glenaras 11L horizontal production borehole	6-1/8"	PCRC/GBCGC/HGBTQC/HGBRQC/HGBBQC/HGBLQC/GBXT/ARM48P-T/ARH16P-T	1,300.00m	1,326.00m

Table 5. Glenaras 11L MWD/LWD summary.

2.2.3. Conventional Coring

No conventional cores were cut.

2.2.4. Sidewall Coring

No Sidewall cores were cut.

2.2.5. Formation Testing

No formation testing was performed.

3. Geology

3.1. Regional Geology

The Galilee Basin is located in western Queensland and is estimated to be 247,000km² in area (Fig 4). Regionally, the basin is separated from the Cooper Basin to the west by the Canaway Ridge, while the Nebine Ridge and Springsure Shelf separate it from the northern Bowen Basin to the east. The Galilee Basin's internal architecture comprises three primary depocentres (Fig 5); the Lovelle Depression in the northwest, the Koburra Trough in the northeast and east and the Powell Depression in the south. Key internal structures that have controlled the formation of these depocentres include the central Manaroo Platform and the Barcaldine Ridge, both of which represented palaeohighs at the time of initial deposition.

Formed during the Late Carboniferous and containing up to 3,000m of siliciclastic units with interbedded coals and volcanics, the base of the Galilee Basin is marked by an unconformable boundary with both the Late Devonian to Early Carboniferous Drummond and Adavale basins (Fig 6), while the upper limit is defined by an unconformable boundary with the overlying sediments of the Jurassic-Cretaceous Eromanga Basin. Despite local depositional differences in each of these discrete depocentres and subsequent erosion on local scales, the gross stratigraphy is ubiquitous across the basin.

Two major depositional periods define the Galilee Basin sequence. The earliest sequence, the Late Carboniferous to Early Permian Joe Joe Group, comprises basal fluvial and glacially derived sands interbedded with tuffs, which are overlain by the

paludal and marshland formed Aramac Coal Measures (time equivalent to the Reids Dome Beds in the adjacent northern Bowen Basin and Denison Trough).

Following a major unconformity and period of non-deposition, the second period occurred during the Late Permian to Mid Triassic. The base of this sequence is represented by the coastal plain derived Betts Creek Beds (time equivalent to the Bandanna Coal Measures in the Bowen Basin) and is made up of interbedded sands, coals and mudstones. The upper limit of the Betts Creek Beds is signified by another regionally extensive unconformity that comprised significant tectonic uplift and erosion. Deposition was reinstated during the Early Triassic with the fluvially derived Rewan Group. This was in turn followed by the regionally pervasive Clematis Sandstone and Moolayember Formation. The upper limit of the Galilee Basin section is then capped by the Mid Triassic unconformity, which marks the base of the overlying Jurassic-Cretaceous Eromanga Basin.

3.2. Local Structure

ATP 2019 is in the central area of the Galilee Basin, in the Aramac Trough, which is a smaller depocentre associated with the larger Koburra Trough system. The Aramac Trough is a northeast-southwest trending, localised graben that offshoots from the Koburra Trough and dips into the Hutton-Rand Structure (Fig 5), which is a major contributing element to the basin-controlling Maneroo Platform. The Hutton-Rand Structure was a significant feature created during basin formation with continued growth along it, particularly through the Late Carboniferous to Late Permian depositional cycles,

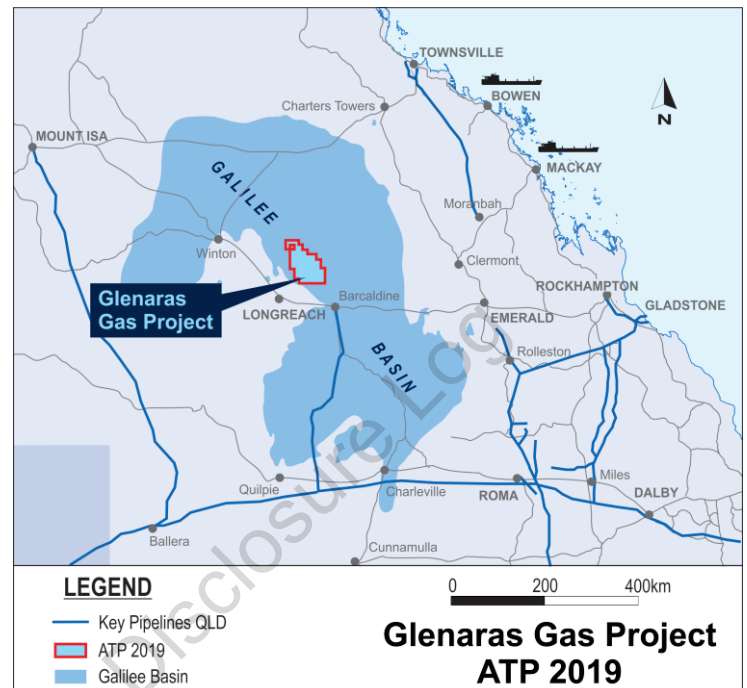


Figure 4. Galilee Basin and ATP 2019P location.

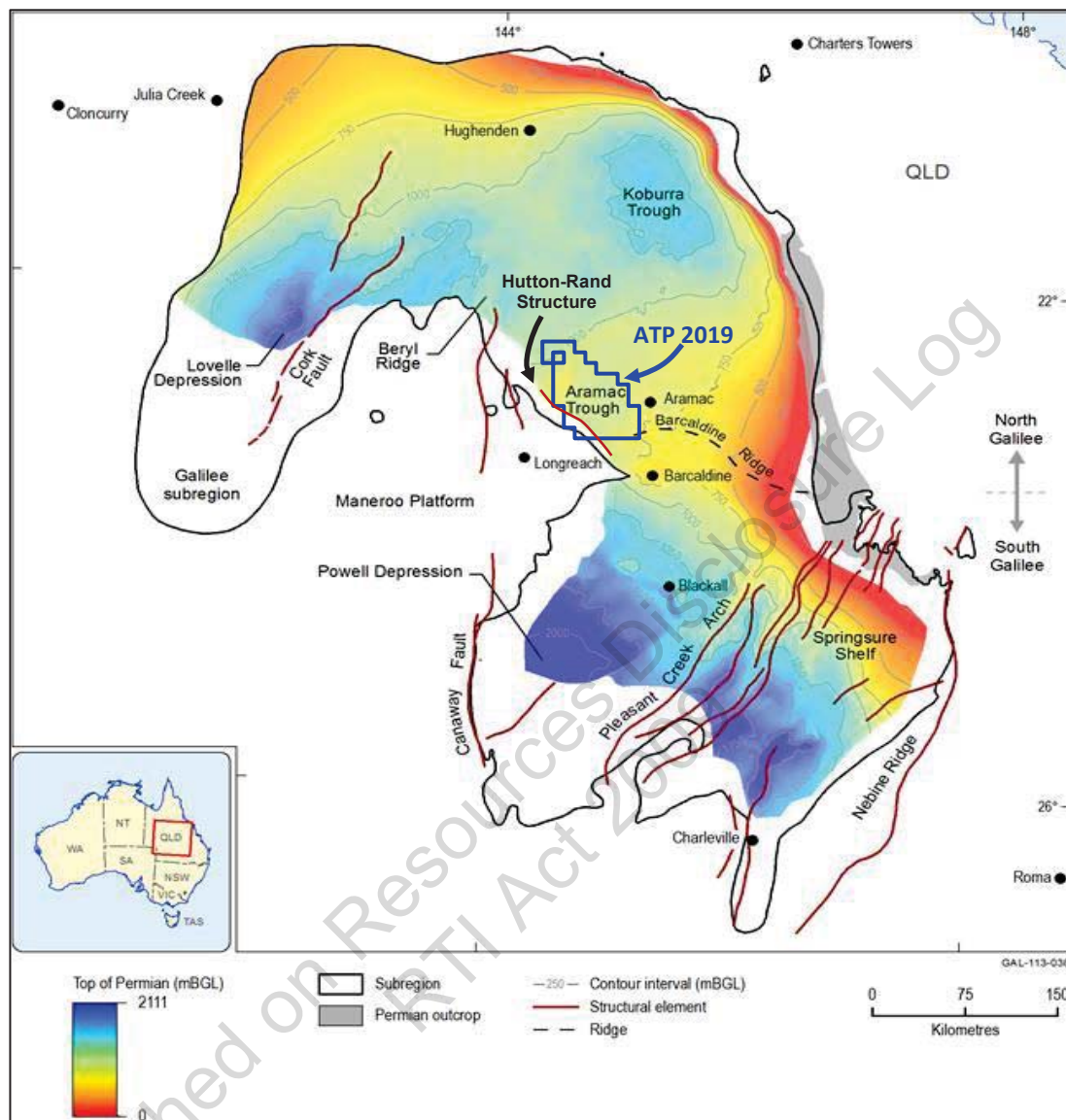


Figure 5. Galilee Basin structural architecture (Moya, *et al* 2014).

which provided sufficient accommodation space to emplace the full Galilee Basin stratigraphic section across the ATP 2019 area.

The northwest flank of the Aramac Trough is marked by the Maranthona Monocline, while the southeast flank is a more subtle flexure that dips upwards towards the southern margins of the Koburra Trough.

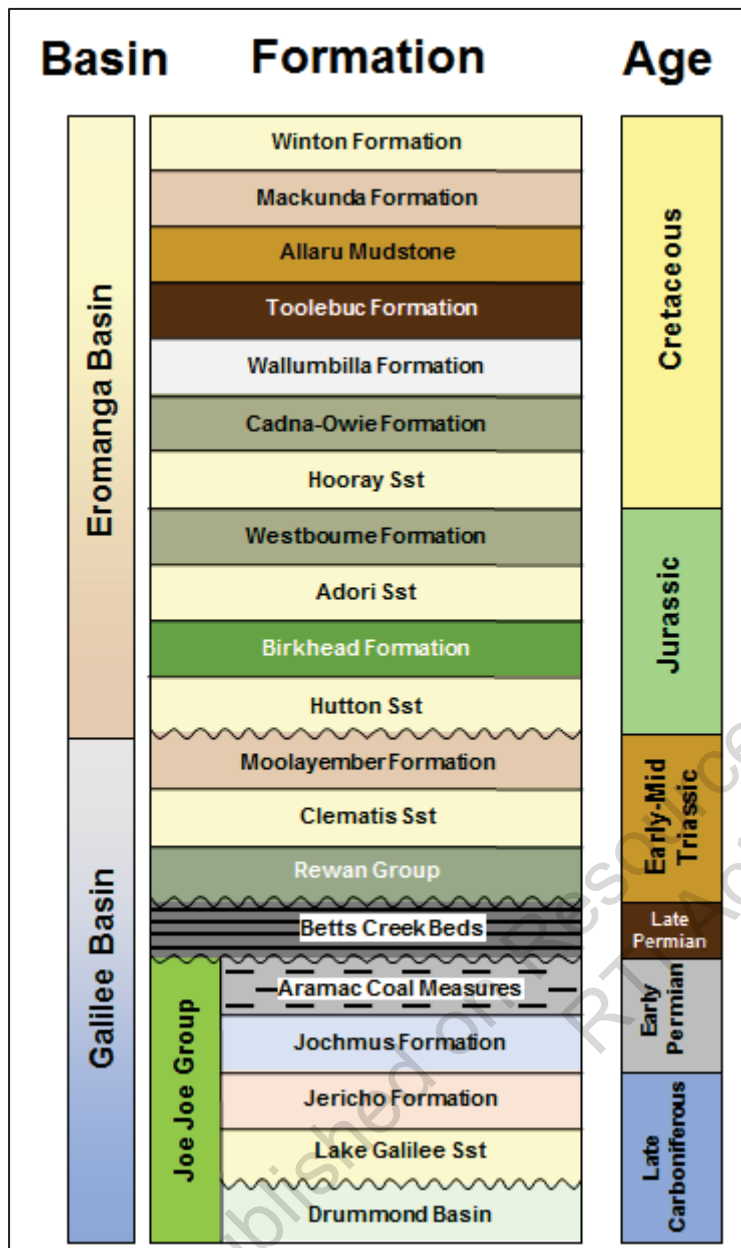


Figure 6. Aramac Trough stratigraphic column.

The overlying, Early Permian Betts Creek Beds, which represent the primary coal seam gas target in ATP 2019, were intersected at 955mKB (97>m thick). Across ATP 2019, the Betts Creek Beds comprise seven, laterally continuous coal seams interbedded with carbonaceous shales, siltstones and sandstones of varying permeability. The R1 Seam is the shallowest and thickest at >10m, with the deeper R2 to R7 seams varying from 1m to 3m in thickness. The R3 Seam was the target reservoir in Glenaras 11L for the production borehole and was ~2.5m in thickness. The Betts Creek Beds coals are typically sub-bituminous in rank, generally dull with some brighter banding and localised fracturing.

3.3. Local Stratigraphy

The full Galilee Basin stratigraphic section has been confirmed across most of the ATP 2019 area. The gross section is thickest in the Glenaras area in the southwest of the permit, where deposition abutted the Hutton-Rand Structure, while the thinnest gross section is in the very northwest of the permit on the uppermost flanks of the Aramac Trough. In this area the basal units of the Joe Joe Group are less developed due to the higher palaeorelief during the Late Carboniferous and Early Permian.

Glenaras 11L intersected the full geologic sequence from surface to the Betts Creek R3 Seam, which was the primary target for the well. The horizontal production borehole was drilled in-seam in the R3 Seam for the full length of ~58m and so did not penetrate any deeper stratigraphy.

3.3.1. Galilee Basin Sequence

The Early Permian Aramac Coal Measures were not intersected in Glenaras 11L due to the well targeting the shallower Betts Creek R3 Seam. However, this commercially prospective coal seam gas section remains a secondary target throughout ATP 2019 and comprises interbedded coals, sandstones, siltstones and shales, deposited under marsh conditions within a larger coastal plain environment.

The Early Triassic Rewan Formation was intersected at 907mKB (38m thick) and comprise dryland alluvial sands with lesser siltstones and shales. The Rewan Formation marks the top of the Galilee Basin sequence with the remaining Triassic section, the Clematis Sandstone and the Moolayember Formation, both eroded from this location.

3.3.2. Eromanga Basin Sequence

The Middle Jurassic aged Hutton Sandstone and Birkhead Formation were the lowermost Eromanga Basin units intersected in Glenaras 11L at 787mKB (105m thick) and 708mKB (73m thick) respectively. The Hutton Sandstone predominantly comprises massive sandstones with minor shales and carbonaceous shales, deposited within a regionally pervasive, braided fluvial environment upon the Late Triassic unconformity. The Birkhead Formation represents a reduction in depositional energy and a transition to fluviodeltaic and lacustrine environments, which laid down a more heterogeneous section of typically finer grained sandstones and extensive siltstones and shales with some carbonaceous shales.

The Late Jurassic Adori Sandstone and Westbourne Formation were encountered at 687mKB (20m thick) and 661mKB (25m thick) respectively. These two formations combined effectively form a larger fining upward parasequence of higher energy fluvial sandstones and minor shales of the Adori Sandstone at the base that grade upwards into interbedded siltstones, sandstones and mudstones of the Westbourne Formation.

The shallowest Eromanga Basin sediments drilled in Glenaras 11L are Early Cretaceous in age and are made up of a series of diverse depositional environments that are both terrestrial and marine in origin. The Hooray Sandstone was intersected at 597mKB (59m thick) and is predominantly sandstone with minor siltstones and claystones, laid down under fluvial conditions. A subsequent marine transgression laid down the finer-grained sandstones and siltstones of the overlying Cadna-Owie Formation, which was intersected at 561m (34m thick). A persistent, shallow marine environment followed, which deposited the claystones and minor sandstones of the Wallumbilla Formation at 367mKB (181m thick), which were followed by the fossil-rich, marine shales of the Toolebuc Formation at 361mKB (6m thick). Finally, the shallowest formation and surface outcropping formation at Glenaras 11L was the Allaru Mudstone (355m thick), which comprises interbedded claystones and siltstones, also laid down under shallow marine conditions.

3.4. Well Objectives

Glenaras 11L was designed to be the northern flanking horizontal well in the Glenaras Multilateral Pilot, 250m northwest of Glenaras 10L. After drilling vertically from surface and into the base of the Allaru Mudstone, the intermediate borehole would be deviated to build angle to enter the Betts Creek Beds R3 Seam at ninety degrees. After setting production casing, a 550m horizontal production borehole would be directionally drilled inseam in the R3 Seam, parallel to the adjacent Glenaras 10L borehole. Upon reaching total depth, an ESP would be set in the tangent section of the 7" intermediate borehole and the inseam 6-1/8" borehole left open to optimise future production as part of the Glenaras Multilateral Pilot.

3.5. Prognosis v Actual

Formation	Prognosed		Actual		Difference (+high/-low)
	True Vertical Depth (mTVD)	True Vertical Depth Subsea (mTVDSS)	True Vertical Depth (mTVD)	True Vertical Depth Subsea (mTVDSS)	
Allaru Mudstone	4.20	218.77	4.20	218.73	0.00
Toolebuc Formation	370.46	-147.53	359.61	-136.68	10.85
Wallumbilla Formation	379.46	-156.53	365.66	-142.73	13.80
Cadna-Owie Formation	547.21	-324.28	546.75	-323.82	0.46
Hooray Sandstone	582.11	-359.18	580.33	-357.40	1.78
Westbourne Formation	641.26	-418.33	639.30	-416.37	1.96
Adori Sandstone	667.36	-444.43	664.13	-441.20	3.23
Birkhead Formation	688.96	-466.03	683.68	-460.75	5.28
Hutton Sandstone	758.96	-536.03	756.17	-533.24	2.79
Rewan Formation	869.33	-646.40	860.81	-637.88	8.52
Betts Creek Beds	900.63	-677.70	898.50	-675.57	2.13
R1 Seam	934.88	-711.95	935.19	-712.26	-0.31
R2 Seam	985.13	-762.20	987.71	-764.78	-2.58
R3 Seam	992.83	-769.90	995.55	-772.62	-2.72

Table 6. Glenaras 11L depth prognosis v actual.

3.6. Hydrocarbon Shows

No significant hydrocarbon shows were recorded during the drilling of Glenaras 11L.

4. Summary

4.1. Hydrocarbon Potential

Glenaras 11L has confirmed the laterally continuous nature of the Betts Creek Beds coal seams through the Glenaras area and their collective prospectivity for economically recoverable coal seam gas. Sufficient seam thickness and total net coal were intersected through the entire section, particularly in the targeted R3 Seam, in which the Glenaras 11L horizontal production borehole was drilled. Since drilling, Glenaras 11L has been completed as a monitoring well within the Glenaras Multilateral Pilot.

4.2. Completion

Glenaras 11L was completed with 7" casing from surface to the entry point of the Betts Creek Beds R3 Seam and then left openhole along the ~58m length of the 6-1/8" horizontal production borehole in the R3 Seam. Unfortunately, due to the unsuccessful fishing operations to retrieve the 297m of drill pipe and bottom-hole assembly from the toe of the production borehole, the well was not completed with artificial lift as planned, but has remained accessible for use as a monitoring well within the Glenaras Multilateral Pilot.

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Glenaras 12L Well Completion Report

ATP 2019P – Galilee Basin, QLD

Date: December, 2018

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1. Executive Summary

Glenaras 12L was drilled in the southern portion of ATP 2019 as part of the Glenaras Multilateral Pilot (Fig 1). The pilot is located 65km northeast of Longreach and 12km south-southwest of the junction of Aramac Creek and Rodney Creek. The Glenaras Multilateral Pilot is the third pilot in the area and is positioned 1.8km southwest of the Rodney Creek Pilot and 2.5km northeast of the Glenaras Pilot (Fig 2). The three wells in the Glenaras Multilateral Pilot have all been drilled on the seismic control line L81-3.

The Glenaras Multilateral Pilot was designed and executed to assess the coal seam gas potential of the Early Permian Betts Creek Beds using three wells (GA10L, GA11L and GA12L; Fig 3) targeting the R3 Seam. Glenaras 12L was spudded 22nd April 2018 with Easternwell 101 (Table 1) as the southern flank well in the pilot, 250m southeast of Glenaras 10L. After setting 9-5/8" surface casing at 195mKB, the 8-1/2" intermediate borehole was drilled vertically into the base of the Allaru Mudstone, where directional drilling commenced towards an azimuth of ~236° to intersect the primary target, the Betts Creek Beds R3 Seam at a hole angle of 90°. The 8-1/2" section was terminated in the R3 Seam at 1,294mKB (998.5mTVD) with an azimuth of ~236.3° and a hole angle of 89.8°.

7" casing was then run in hole to the top of the R3 Seam and the 6-1/8" horizontal production borehole drilled directionally in the R3 Seam. Drilling of the production borehole was logged while drilling using Halliburton's Geosteering Solutions technology and achieved 100% inseam penetration along the entire 403m length with no sidetracks required. Total depth of the 6-1/8" horizontal section was reached at 1,697mKB (992.47mTVD) with an azimuth of ~234.35° and a hole angle of 90.8°.

Glenaras 12L-DW1 was then planned and executed by cutting a 6-1/8" sidetrack out of the Glenaras 12L production borehole at 1,363.4mKB. After building angle to separate from the original borehole, 12L-DW1 drilled ahead inseam in the R3 Seam to 1,427mKB (995.24mTVD) with an azimuth of ~243° and a hole angle of 91.6° before becoming stuck downhole.

Following extensive failed recovery operations, coiled-tubing was run-in and after two attempts, the drill pipe was perforated and pulled free at 1,393mKB. Following retrieval of the free drill pipe, the ~34m fish comprising the bottom-hole assembly, was left in the toe of Glenaras 12L-DW1. The rig was then released on the 11th May 2018.

Since drilling, Glenaras 12L has been completed open hole along the 6-1/8" production borehole and an ESP installed downhole at the entry point into the R3 Seam to maximise drawdown on the reservoir. The well is currently on production as part of the Glenaras Multilateral Pilot as the southern flank well with Glenaras 10L positioned 250m to the northwest. Since commissioning, Glenaras 12L has recorded sustained water and gas rates.

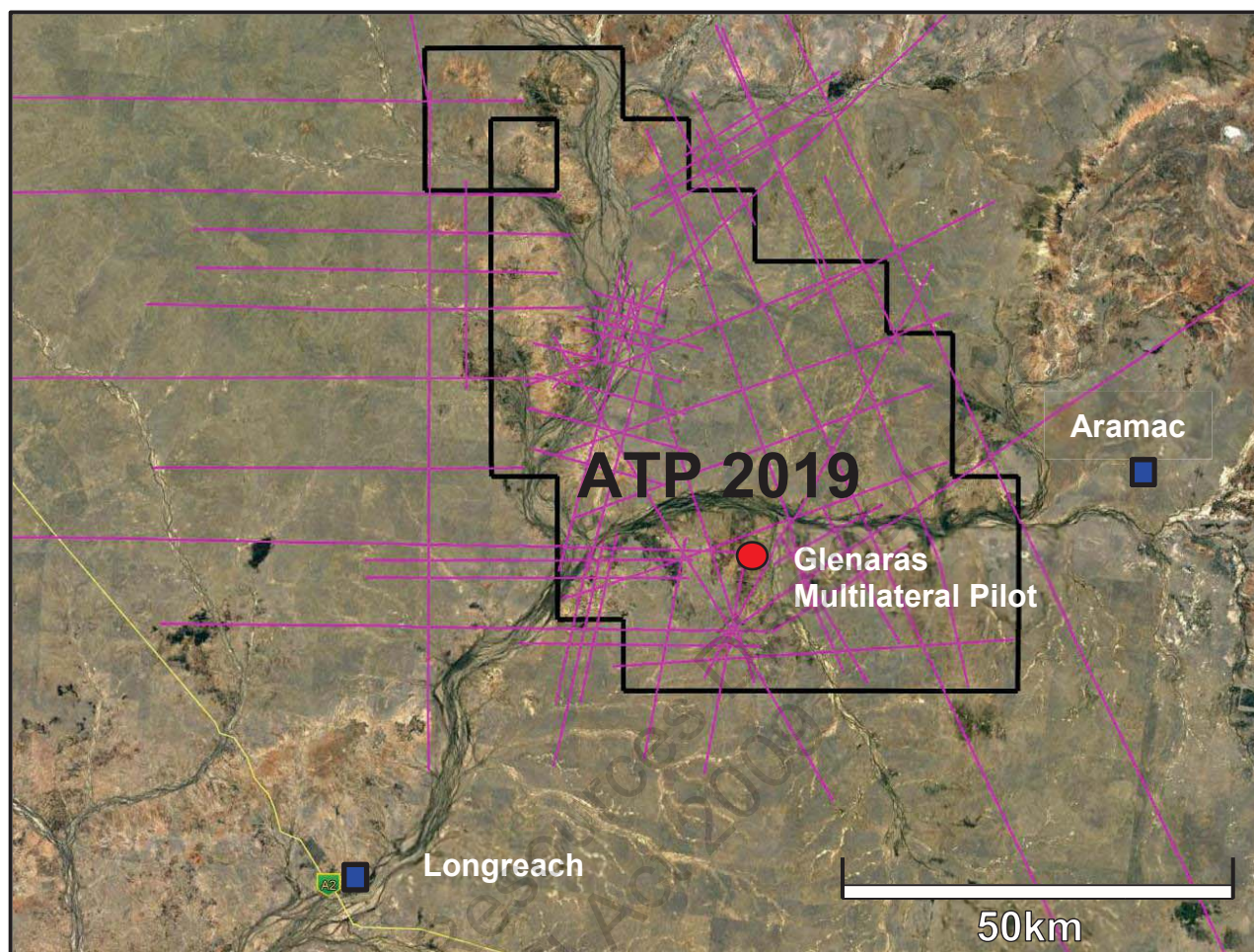


Figure 1. Glenaras Multilateral Pilot location.

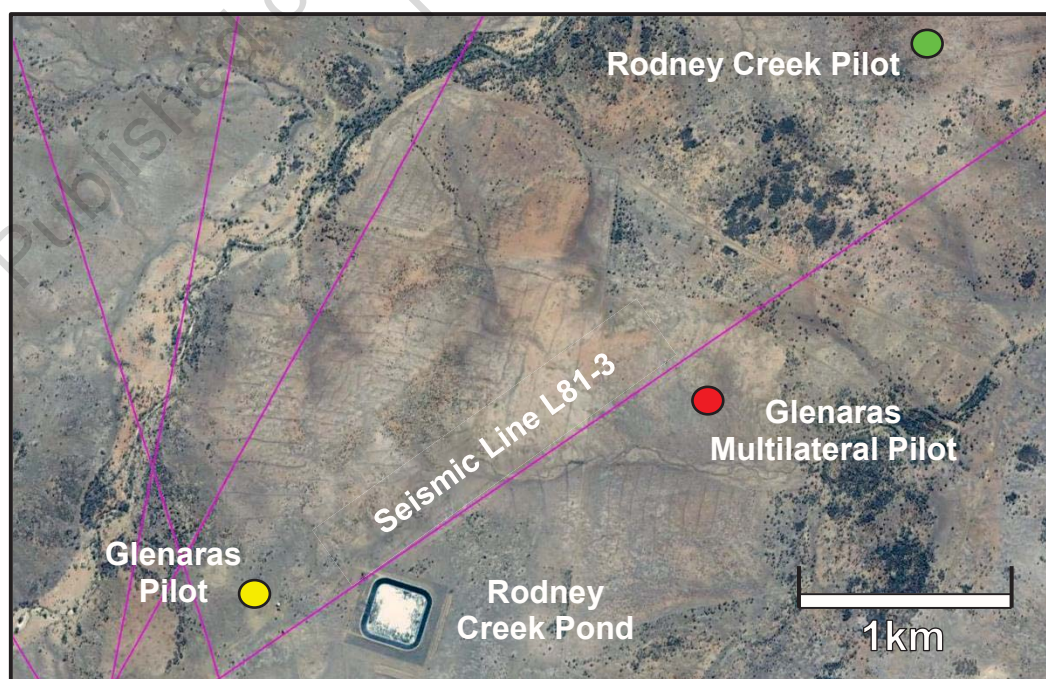


Figure 2. Glenaras 11L location.

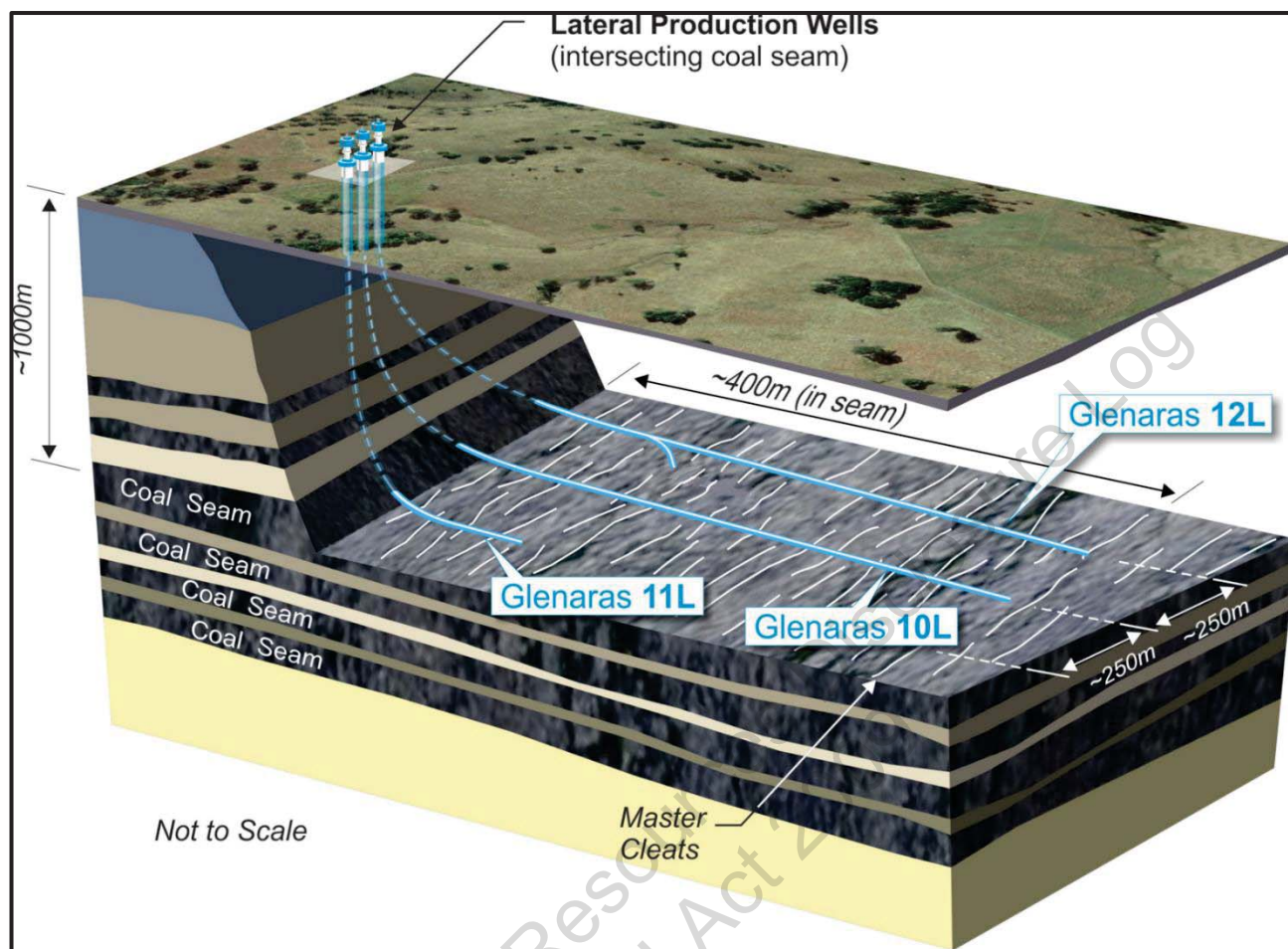


Figure 3. Glenaras multilateral pilot configuration.

2. Well Card

2.1. Drilling Data

2.1.1. General Data

Well Name	Glenaras 12L	Glenaras 12L-DW1
Permit	ATP 2019P	
State	Queensland	
Basin	Galilee	
Operator	Galilee Energy Limited (100%), GPO Box 1944, Brisbane, Queensland. 4006	
Joint Venture Partners	-	
Primary Objective	Betts Creek Beds, R3 Seam	
Secondary Objective	-	
Well Class & Type	Coal seam gas horizontal production pilot	
Well Category & Design	Multi-wellbore, deviated	
Wellbore Identifier	GA12L	GA12L-DW1
Well Status	Cased and completed and currently producing.	Openhole with downhole fish.
Drilling Rig	Easternwell, Rig 101	
Surface Coordinates	144° 45' 01.661" E, 23° 04' 32.538" S	144° 45' 01.661" E, 23° 04' 32.538" S
Surface UTM	269551.31mE, 7446325.92mN	269551.31mE, 7446325.92mN
Total Depth Coordinates	144° 44' 42.36" E, 23° 04' 54.31" S	144° 44' 50.03" E, 23° 04' 49.17" S
Total Depth UTM	269012.10mE, 7445647.68mN	269228.24mE, 7445809.22mN
Projection	UTM Zone 55	
Datum	GDA94	
Spud / Start Date	22 nd April 2018	4 th May 2018
Rig Finish / Release	4 th May 2018	11 th May 2018
Ground Level Elevation	218.67m above Mean Sea Level	
Kelly Bushing Elevation	222.77m above Mean Sea Level	
Total Depth	1,697mKB (992.47mTVD)	1,428mKB (995.24mTVD)
Production casing	Intermediate: 7" csg to top R3 Seam Production: 6-1/4" open-hole	Intermediate: 7" csg to top R3 Seam Production: 6-1/4" open-hole

Table 1. Glenaras 12L / Glenaras 12L-DW1 well data card.

2.1.2. Formations Penetrated

Formation/Member	Depths (m)			
	Measured Depth (mKB)	True Vertical Depth (mTVD)	True Vertical Depth subsea (mTVDSS)	Thickness (m)
Allaru Mudstone	4.10	4.10	218.67	358.63
Toolebuc Formation	364.73	362.73	-139.86	6.99
Wallumbilla Formation	371.91	369.72	-146.85	175.63
Cadna-Owie Formation	559.43	545.35	-322.48	34.99
Hooray Sandstone	597.15	580.34	-357.47	58.79
Westbourne Formation	660.51	639.13	-416.26	25.60
Adori Sandstone	688.13	664.73	-441.86	19.55
Birkhead Formation	709.18	684.28	-461.41	74.46
Hutton Sandstone	789.55	758.74	-535.87	97.68
Rewan Formation	900.12	856.42	-633.55	37.34
Betts Creek Beds	948.37	893.76	-670.89	46.14
R1 Seam Top	1,018.86	939.90	-717.03	24.36
Colinlea Sandstone	1,069.40	964.26	-741.39	23.44
R2 Seam Top	1,148.79	987.70	-764.83	8.30
R3 Seam Top	1,252.48	996.00	-773.13	-
Total Depth	1,697.00	992.47	-767.70	-

Table 2. Glenaras 12L formation tops.

2.1.3. Drilling Summary

Note: all depths are measured depth relative to Kelly Bushing (mKB) unless otherwise indicated.

Glenaras 12L was spudded at 06:00hrs on the 22nd April 2018 by Easternwell 101 with the surface hole drilled vertically to 195.0mKB using a 12-1/4" PDC bit and KCI mud system. The surface hole was then cased with 9-5/8", 36lb/ft K55 casing to 193.7mKB.

The 9-5/8" cement shoe was then drilled out and the intermediate borehole commenced with an 8-1/2" PDC bit and KCI brine. The top portion of the hole was drilled vertically into the base of the Allaru Mudstone, where the build-up section kicked-off. The remainder of the intermediate borehole was then drilled directionally towards the southeast with Halliburton's PGRC LWD tool to monitor the stratigraphy. The primary target, the Betts Creek R3 Seam was

encountered at 1,252.5mKB (996.0mTVD) at an angle of 89.8° and an azimuth of 236.3°. The intermediate borehole was then cased from 1,284.1mKB to surface with 7", 23lb/ft K55 casing.

The production borehole was then drilled through the 9-5/8" intermediate shoe with a 6-1/8" PDC and KCl brine mud system. The borehole was monitored while drilling with Halliburton's azimuthal resistivity and gamma ray tools to ensure the drill bit tracked exclusively through the R3 coal seam to maximise the production interval and reduce the risk of water influx from adjacent clastic intervals. Total depth for Glenaras 12L was reached in seam of the R3 Seam at 1,697.0mKB (992.5mTVD) with a hole angle of 90.8° and an azimuth of 234.35° with no sidetracks required to remain in seam.

To maximise the deliverability of the well, it was then decided to drill an additional production borehole to form a dual lateral within the Betts Creek Beds R3 Seam. This additional borehole, Glenaras 12L-DW1, was drilled as a sidetrack out of the 6-1/8" through an undercut window at 1,363.4mKB. After drilling sufficiently down towards the base of the R3 Seam to separate 12L-DW1 from the 12L borehole, the sidetrack was then turned to the right and drilled back up to realign with structural dip within the lower portion of the R3 Seam. Drilling continued without issue until 1,427mKB (995.24mTVD) at an azimuth of ~243° and hole angle of 91.6° before becoming stuck downhole.

Extensive recovery efforts were made including working extra torque into the drilling string, increased circulation on both the backside and through the string and maximum overpull, all without success. Superior's coiled-tubing unit was then brought on site to cut the drill string with an NOV rota jet assembly. The first cut and pull at 1,393.5mKB failed and so a second attempt was made at 1,391mKB, which was successful following significant overpull efforts. The free drill pipe was pulled from the hole, leaving an ~34m fish comprising the bottom-hole assembly, left in the toe of Glenaras 12L-DW1.

Both the Glenaras 12L and 12L-DW1 production boreholes were left open hole and the wellhead installed. Easternwell 101 was rigged down and released at 19:30hrs on the 11th May 2018.

TDC arrived onsite on the 21st May 2018 to complete the well. An electrical submersible pump was run-in hole via 2-3/8" tubing to 1,259mKB. The tubing was then landed and the electrical connection to the pump successfully tested. TDC was then rigged down and released on the 29th May 2018.

2.1.4. Bit Record

Borehole	Bit Run	Diameter (inches)	Type	Serial Number	Depth In (mKB)	Depth Out (mKB)	Depth Drilled
GA12L	1	12-1/4"	Ultrerra U419S	21257	12.6m	195.0m	182.4m
GA12L	2	8-1/2"	Ultrerra U516S	38348	195.0m	1,294.0m	1,099.0m
GA12L	3	6-1/8"	Ultrerra U613S	37497	1,294.0m	1,294.0m	0.0m
GA12L	4	6-1/8"	Ultrerra U613S	36249	1,294.0m	1,697.0m	403.0m
GA12L-DW1	5	6-1/8"	Ultrerra U613S	36249	1,360.0m	1,427.0m	67.0m

Table 3. Glenaras 12L / Glenaras 12L-DW1 bit record.

2.1.5. Deviation Data

See Appendix 1.

2.1.6. Drilling Fluids Summary

Borehole		Depth Interval	Casing	Specification	Data
Glenaras 12L	12-1/4" surface hole	Surface to 195mKB	9-5/8" casing	Mud weight (ppg)	8.5 – 8.8
				Total hardness (mg/Lt)	540 – 700
				Ph	8.5 – 9.0
				Funnel Viscosity (sec./qt.)	28.5 – 29
				KCl (by weight %)	2.55 – 4.0
	8-1/2" intermediate build	195mKB to 1,294mKB	7" casing	Mud weight (ppg)	8.70 – 9.05
				Hardness (Ca++ & Mg++) (mg/l)	20 - 540
				Chlorides (mg/l)	23,000 – 29,800
				pH	8.5 – 9.0
				Funnel Viscosity (sec./qt)	28 – 35
	6-1/8" production	1,294mKB to 1,697mKB / 992mTVD	Open-hole	Mud weight (ppg)	8.8 – 9.2
				Hardness (Ca++ & Mg++) (mg/l)	420 – 480
				Chlorides (mg/l)	52,000 – 90,000
				pH	9.0 – 9.5
				Funnel Viscosity (sec./qt)	28 - 29
Glenaras 12L-DW1	6-1/8" production	1,360mkb to 1,427mkb / 995mTVD	Open-hole	Mud weight (ppg)	8.8 – 9.2
				Hardness (Ca++ & Mg++) (mg/l)	420 – 480
				Chlorides (mg/l)	52,000 – 90,000
				pH	9.0 – 9.5
				Funnel Viscosity (sec./qt)	28 - 29

Table 4. Glenaras 12L / Glenaras 12L-DW1 drilling fluids summary.

2.1.7. Bottom Hole Assembly Summary

See Appendix 2.

2.1.8. Casing and Cement Report

See Appendix 3.

2.1.10. Perforations

No perforations were shot in the well. The GA12L horizontal 6-1/8" production borehole is completed open hole, while the GA12L-DW1 horizontal 6-1/8" production borehole is also completed open hole, but with the ~34m fish remaining down hole at the toe of the well.

2.1.11. Well Completion

See Appendix 4.

2.2. Well Testing

2.2.1. Wireline Logging

No wireline logs were run.

2.2.2. MWD/LWD Logging

Borehole	Hole Size	Tool	Depth Top (mKB)	Depth Base (mKB)
Glenaras 12L intermediate build-up	8-1/2"	PGRC	173.00m	1,294.0m
Glenaras 12L horizontal production borehole	6-1/8"	PCRC/GBCGC/HGBTQC/HGBRQC/HGBBQC/HGBLQC/GBXT/ARM48P-T/ARH16P-T	1,294.00m	1,697.2m
Glenaras 12L-DW1 horizontal production borehole	6-1/8"	PCRC/GBCGC/HGBTQC/HGBRQC/HGBBQC/HGBLQC/GBXT/ARM48P-T/ARH16P-T	1,284.9m	1,427.7m

Table 5. Glenaras 12L and Glenaras 12L-DW1 MWD/LWD summary.

2.2.3. Conventional Coring

No conventional cores were cut.

2.2.4. Sidewall Coring

No Sidewall cores were cut.

2.2.5. Formation Testing

No formation testing was performed.

3. Geology

3.1. Regional Geology

The Galilee Basin is located in western Queensland and is estimated to be 247,000km² in area (Fig 4). Regionally, the basin is separated from the Cooper Basin to the west by the Canaway Ridge, while the Nebine Ridge and Springsure Shelf separate it from the northern Bowen Basin to the east. The Galilee Basin's internal architecture comprises three primary depocentres (Fig 5); the Lovelle Depression in the northwest, the Koburra Trough in the northeast and east and the Powell Depression in the south. Key internal structures that have controlled the formation of these depocentres include the central Manaroo Platform and the Barcaldine Ridge, both of which represented palaeohighs at the time of initial deposition.

Formed during the Late Carboniferous and containing up to 3,000m of siliciclastic units with interbedded coals and volcanics, the base of the Galilee Basin is marked by an unconformable boundary with both the Late Devonian to Early Carboniferous Drummond and Adavale basins (Fig 6), while the upper limit is defined by an unconformable boundary with the overlying sediments of the Jurassic-Cretaceous Eromanga Basin. Despite local depositional differences in each of these discrete depocentres and subsequent erosion on local scales, the gross stratigraphy is ubiquitous across the basin.

Two major depositional periods define the Galilee Basin sequence. The earliest sequence, the Late Carboniferous to Early Permian Joe Joe Group,

comprises basal fluvial and glacially derived sands interbedded with tuffs, which are overlain by the paludal and marshland formed Aramac Coal Measures (time equivalent to the Reids Dome Beds in the adjacent northern Bowen Basin and Denison Trough).

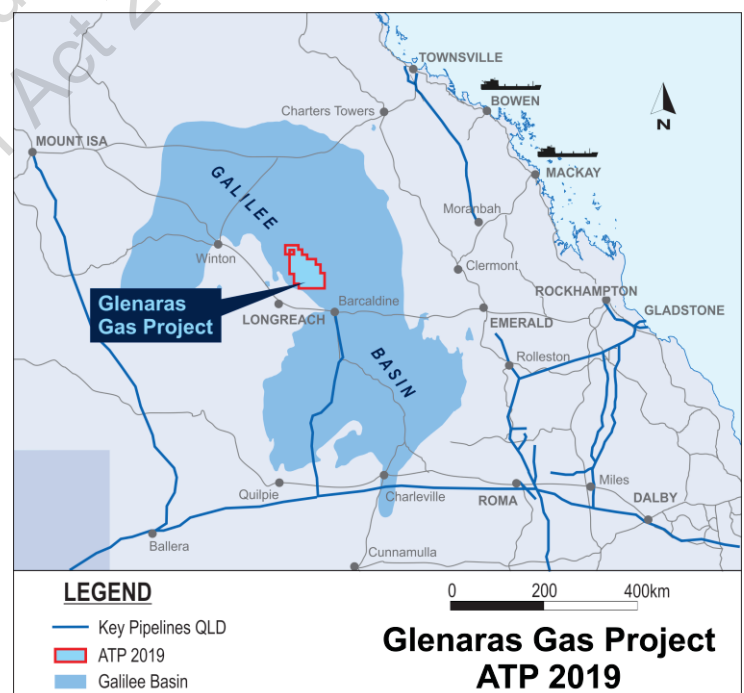


Figure 4. Galilee Basin and ATP 2019P location.

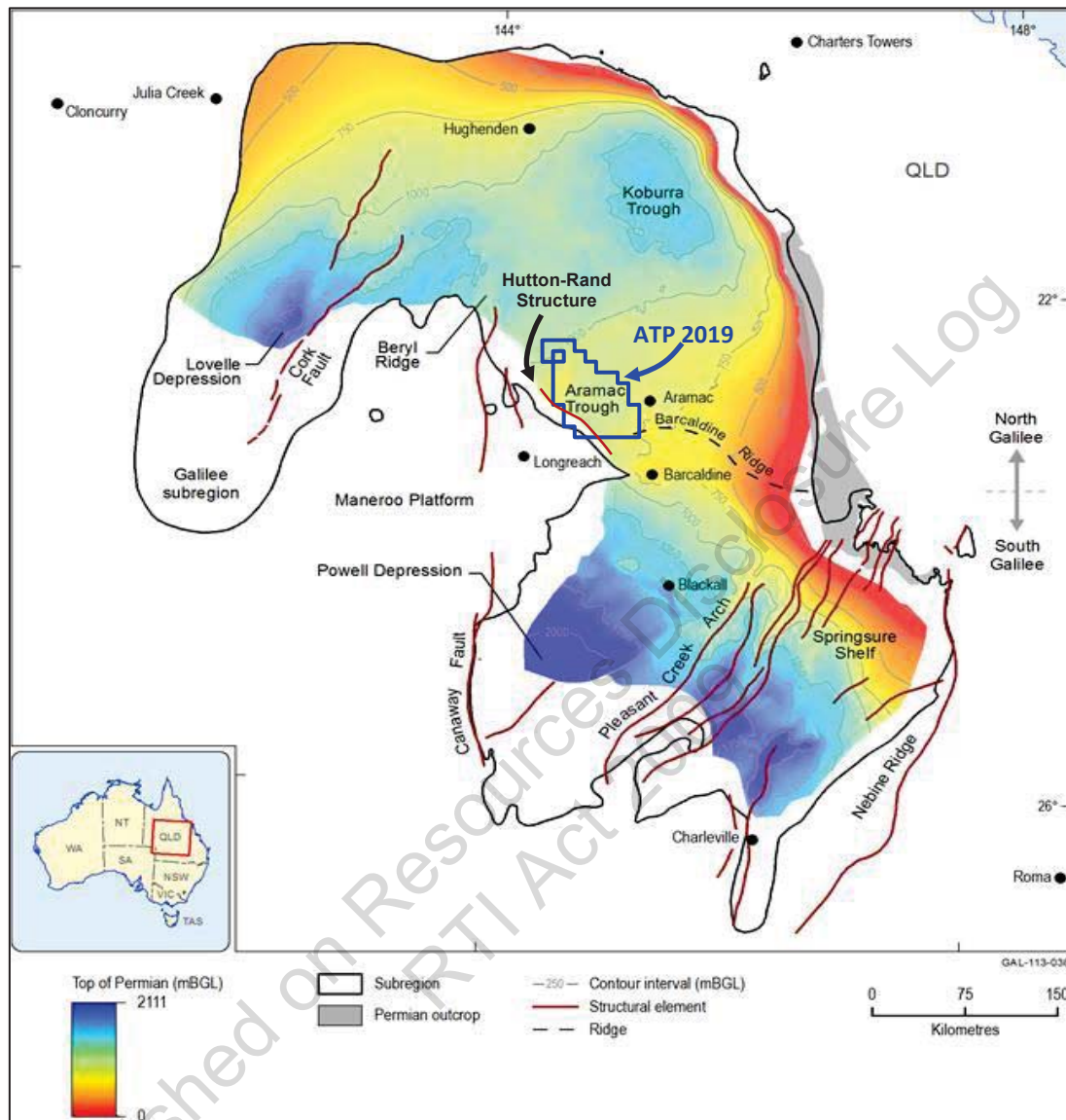


Figure 5. Galilee Basin structural architecture (Moya, *et al* 2014).

Following a major unconformity and period of non-deposition, the second period occurred during the Late Permian to Mid Triassic. The base of this sequence is represented by the coastal plain derived Betts Creek Beds (time equivalent to the Bandanna Coal Measures in the Bowen Basin) and is made up of interbedded sands, coals and mudstones. The upper limit of the Betts Creek Beds is signified by another regionally extensive unconformity that comprised significant tectonic uplift and erosion. Deposition was reinstated during the Early Triassic with the fluviially derived Rewan Group. This was in turn followed by the regionally pervasive Clematis Sandstone and Moolayember Formation. The upper limit of the Galilee Basin section is then capped by the Mid Triassic unconformity, which marks the base of the overlying Jurassic-Cretaceous Eromanga Basin.

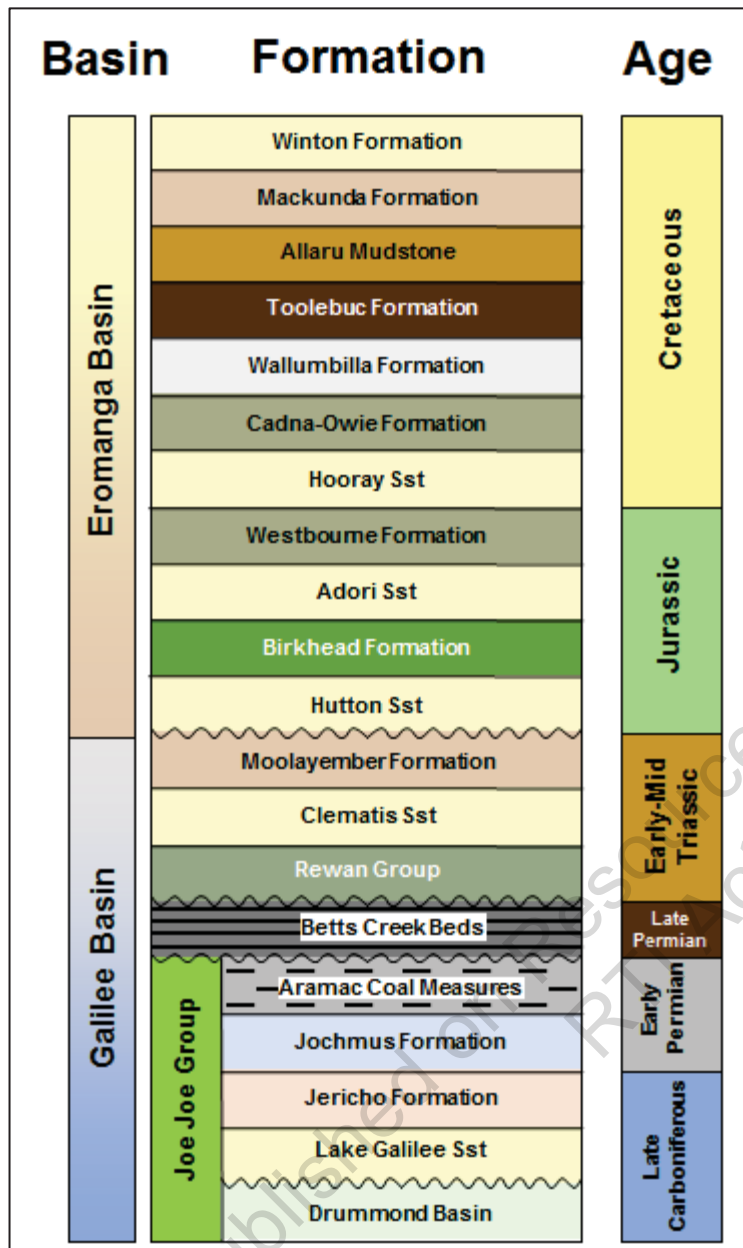


Figure 6. Aramac Trough stratigraphic column.

Hutton-Rand Structure, while the thinnest gross section is in the very northwest of the permit on the uppermost flanks of the Aramac Trough. In this area the basal units of the Joe Joe Group are less developed due to the higher palaeorelief during the Late Carboniferous and Early Permian.

Glenaras 12L intersected the full geologic sequence from surface to the Betts Creek R3 Seam, which was the primary target for the well. The horizontal production boreholes of both Glenaras 12L and 12L-DW1 were drilled in-seam in the R3 Seam for the full length of ~403m and ~67m respectively and so did not penetrate any deeper stratigraphy.

3.2. Local Structure

ATP 2019 is in the central area of the Galilee Basin, in the Aramac Trough, which is a smaller depocentre associated with the larger Koburra Trough system. The Aramac Trough is a northeast-southwest trending, localised graben that

offshoots from the Koburra Trough and dips into the Hutton-Rand Structure (Fig 5), which is a major contributing element to the basin-controlling Maneroo Platform. The Hutton-Rand Structure was a significant feature created during basin formation with continued growth along it, particularly through the Late Carboniferous to Late Permian depositional cycles, which provided sufficient accommodation space to emplace the full Galilee Basin stratigraphic section across the ATP 2019 area.

The northwest flank of the Aramac Trough is marked by the Maranthona Monocline, while the southeast flank is a more subtle flexure that dips upwards towards the southern margins of the Koburra Trough.

3.3. Local Stratigraphy

The full Galilee Basin stratigraphic section has been confirmed across most of the ATP 2019 area. The gross section is thickest in the Glenaras area in the southwest of the permit, where deposition abutted the

3.3.1. Galilee Basin Sequence

The Early Permian Aramac Coal Measures were not intersected in Glenaras 12L or Glenaras 12L-DW1 due to the well targeting the shallower Betts Creek R3 Seam. However, this commercially prospective coal seam gas section remains a secondary target throughout ATP 2019 and comprises interbedded coals, sandstones, siltstones and shales, deposited under marsh conditions within a larger coastal plain environment.

The overlying, Early Permian Betts Creek Beds, which represent the primary coal seam gas target in ATP 2019, were intersected at 948mKB (>102 thick). Across ATP 2019, the Betts Creek Beds comprise seven, laterally continuous coal seams interbedded with carbonaceous shales, siltstones and sandstones of varying permeability. The R1 Seam is the shallowest and thickest at >10m, with the deeper R2 to R7 seams varying from 1m to 3m in thickness. The R3 Seam was the target reservoir for both the Glenaras 12L and Glenaras 12L-DW1 production boreholes and was ~2.5m in thickness. The Betts Creek Beds coals are typically sub-bituminous in rank, generally dull with some brighter banding and localised fracturing.

The Early Triassic Rewan Formation was intersected at 900mKB (37m thick) and comprise dryland alluvial sands with lesser siltstones and shales. The Rewan Formation marks the top of the Galilee Basin sequence with the remaining Triassic section, the Clematis Sandstone and the Moolayember Formation, both eroded from this location.

3.3.2. Eromanga Basin Sequence

The Middle Jurassic aged Hutton Sandstone and Birkhead Formation were the lowermost Eromanga Basin units intersected in Glenaras 12L at 790mKB (98m thick) and 709mKB (74m thick) respectively. The Hutton Sandstone comprises massive sandstones with minor shales and carbonaceous shales, deposited within a regionally pervasive, braided fluvial environment upon the Late Triassic unconformity. The Birkhead Formation represents a reduction in depositional energy and a transition to fluviodeltaic and lacustrine environments, which laid down a more heterogeneous section of typically finer grained sandstones and extensive siltstones and shales with some carbonaceous shales.

The Late Jurassic Adori Sandstone and Westbourne Formation were encountered at 688mKB (20m thick) and 661mKB (26m thick) respectively. These two formations combined effectively form a larger fining upward parasequence of higher energy fluvial sandstones and minor shales of the Adori Sandstone at the base that grade upwards into interbedded siltstones, sandstones and mudstones of the Westbourne Formation.

The shallowest Eromanga Basin sediments drilled in Glenaras 12L are Early Cretaceous in age and are made up of a series of diverse depositional environments that are both terrestrial and marine in origin. The Hooray Sandstone was intersected at 597mKB (59m thick) and is predominantly sandstone with minor siltstones and claystones, laid down under fluvial conditions. A subsequent marine transgression laid down the finer-grained sandstones and siltstones of the overlying Cadna-Owie Formation, which was intersected at 559m (35m thick). A persistent, shallow marine environment followed, which deposited the claystones and minor sandstones of the Wallumbilla Formation at 372mKB (176m thick), which were followed by the fossil-rich, marine shales of the Toolebuc Formation at 365mKB (7m thick). Finally, the shallowest formation and surface outcropping formation at Glenaras 12L was the Allaru Mudstone (359m thick), which comprises interbedded claystones and siltstones, also laid down under shallow marine conditions.

3.4. Well Objectives

Glenaras 12L was designed to be the southern flanking horizontal well in the Glenaras Multilateral Pilot, 250m southeast of Glenaras 10L. After drilling vertically from surface and into the Wallumbilla Formation, the intermediate borehole would be deviated to enter the Betts Creek Beds R3 Seam near 90°. After setting production casing, a 550m horizontal production borehole would be directionally drilled in-seam in the R3 Seam, parallel to the adjacent Glenaras 10L borehole. Upon reaching total depth, an ESP would be set in the tangent section of the 7" intermediate borehole and the in-seam 6-1/8" borehole left open to optimise future production as part of the Glenaras Multilateral Pilot.

3.5. Prognosis v Actual

Formation	Prognosed		Actual*		Difference (+high/-low)
	True Vertical Depth (mTVD)	True Vertical Depth Subsea (mTVDSS)	True Vertical Depth (mTVD)	True Vertical Depth Subsea (mTVDSS)	
Allaru Mudstone	4.10	222.50	4.10	218.67	0.00
Toolebuc Formation	371.50	-149.00	362.73	-139.86	8.77
Wallumbilla Formation	380.50	-158.00	369.72	-146.85	10.78
Cadna-Owie Formation	547.50	-325.00	545.35	-322.48	2.15
Hooray Sandstone	582.50	-360.00	580.34	-357.47	2.16
Westbourne Formation	641.83	-419.33	639.13	-416.26	2.70
Adori Sandstone	667.93	-445.43	664.73	-441.86	3.20
Birkhead Formation	687.13	-464.63	684.28	-461.41	2.85
Hutton Sandstone	759.53	-537.03	758.74	-535.87	0.79
Rewan Formation	869.50	-647.00	856.42	-633.55	13.08
Betts Creek Bed	902.50	-680.00	893.76	-670.89	8.74
R1 Seam	940.80	-718.30	939.90	-717.03	0.90
R2 Seam	989.90	-767.40	987.70	-764.83	2.20
R3 Seam	999.39	-776.89	996.00	-773.13	3.39

Table 6. Glenaras 12L depth prognosis v actual.

3.6. Hydrocarbon Shows

No significant hydrocarbon shows were recorded during the drilling of Glenaras 12L.

4. Summary

4.1. Hydrocarbon Potential

Glenaras 12L and Glenaras 12L-DW1 have confirmed the laterally continuous nature of the Betts Creek Beds coal seams through the Glenaras area and their collective prospectivity for economically recoverable coal seam gas. Sufficient seam thickness and total net coal were intersected through the entire section, particularly in the targeted R3 Seam, in which the Glenaras 12L and Glenaras 12L-DW1 horizontal production boreholes were drilled. Since drilling, Glenaras 12L has been completed and placed on extended production with sustained water and gas rates.

4.2. Completion

Glenaras 12L was completed with 7" casing from surface to the entry point of the Betts Creek Beds R3 Seam and then left openhole along the ~403m length of the 6-1/8" horizontal production borehole in the R3 Seam. Glenaras 12L-DW1 was also left openhole, but with ~50% of its 67m length retaining the 34m bottom hole assembly fish, which is likely significantly impeding inflow. An electric submersible pump was also installed downhole to maximise drawdown of the reservoir

Appendix 1

Deviation Data

Published on Resources Disclosure Log
RTI Act 2009

APPENDIX 2

Bottom-Hole Assembly

Published on Resources Disclosure Log
RTI Act 2009

APPENDIX 3

Casing and Cement Report

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RTI Act 2009

APPENDIX 4

Well Completion

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APPENDIX 5

Daily Drilling Reports

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RTI Act 2009

APPENDIX 6

MWD / LWD Logs

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RTI Act 2009

APPENDIX 7

Drilling Fluids Report

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