



# **TUNA A-31**

## **FINAL WELL REPORT**

Prepared by

**Geoservices Overseas S.A.**

Engineers: G. Fawns, M. Smith, S. Willson, R. Pereira.

Esso Australia Ltd.  
12 Riverside Quay,  
South Bank, Melbourne  
Victoria 3006  
Australia  
Tel: (03) 9270-3625  
Fax: (03) 9270-3593

Geoservices Overseas SA  
Unit 8, 14-22 Farrall Road,  
Midvale, Perth  
Western Australia 6056  
Australia  
Tel : (08) 9250-2010  
Fax : (08) 9250-2715

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## **Section 1**

### **General Well Summary**

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**WELL DATA**

Operator : Esso Australia Ltd  
Platform : Tuna  
Well name : Tuna A-31  
Country : Australia  
Location : Gippsland Basin  
Structure : Tuna M-1  
Field : Tuna  
Permit : Vic / L9

Location AMG co-ordinates 5 774 227.40 mN 624 231.22 mE

Location Local co-ordinates Lat: 38° 10' 16.232" S Long: 148° 25' 5.666" E

Target Local co-ordinates 68.5 mN 2 560.1 mE

Profile : Deviated  
Reference depth : Rotary Table  
RT to Seabed : 90.72 metres  
RT above M.S.L. : 31.32 metres  
Sea-water depth : 59.40 metres  
Proposed total depth : 3214 metres  
Actual total depth : 3220 metres  
True vertical depth : 1435.28 metres  
Spudded on : 01st July 2002  
Total depth reached on : 16th July 2002

**Drilling Contractor**

Drilling Contractor : NABORS ISDL  
Rig name : 453  
Rig type : Platform

**Drilling Phases**

Diameter (inch)	From (m)	To (m)	Mud Type
12¼"	147.3	834	Seawater and Gel sweeps
8½"	834	3220	KCl / Glycol / PHPA

**Cased Hole**

Casing Diameter (inch)	Casing Type	Shoe Depth (m)
20"	Conductor Shoe	147.3 MDRT (Existing)
9 <sup>5</sup> / <sub>8</sub> "	Surface	828.7 MDRT
7"	Production	3214 MDRT

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**MUD LOGGING**

Logging Unit Number: 95

Engineers: G. Fawns, M. Smith, S. Willson, R. Pereira

**Sampling Interval**

Sample Type	Number of sets	Quantity per set	Sampling interval	From (m)	To (m)
Washed and Dried	3	100 grams	10 metres	2880	3030
Washed and Dried	3	100 grams	5 metres	3030	3220

**Cuttings Distribution**

Company	Washed and Dried Sample Set
Esso Australia	1
Victorian Department of Energy and Minerals	1
Australian Bureau of Resources	1

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## WELL SUMMARY

Tuna A-31 is a conventional well designed to optimise well spacing in the north-eastern part of the Tuna field and capture incremental M-1 oil reserves undrained by existing producers A-26ST1 and A-27. The well was drilled to a Total Depth of 3220m MDRT (1435.28 mTVDRT) in 8½" hole and completed with a single oil completion string of 3½" tubing in 7" production liner.

**Tuna A-31 was spudded at 01:30 hours on 1st July 2002 after drilling out of the 20" conductor shoe.**

After completing the rig move from West Tuna platform, a 12¼" steerable kick off assembly was made up and drilled to 406 m where it was pulled due to penetration rate. A new 12¼" steerable assembly was made up and drilled to casing point, using a Gel/Water mud system. A mud weight of 9.3 ppg was maintained by dilution with water and prehydrated Gel. The final depth for this section was 834 m. The 9<sup>5</sup>/<sub>8</sub>" casing was run and cemented at 828.7m. An 8½" LWD/MWD steerable assembly was made up and run. The shoe track and 4 m of new formation were drilled and the well displaced to an 8.8 ppg KCl/PHPA/Polymer mud before a P.I.T. was performed (12.7 ppg EMW at 436 psi with 8.9 ppg) to ESSO requirements. The well was rotary and slide drilled from 838 m down to Total Depth of 3220 m. It was necessary to pull to the shoe at 2597 m to repair a mud pump. A precautionary wiper trip was undertaken at 2982 m. Baracarb-25 and Baracarb-100 were added to the mud system prior to entering the Latrobe Formation to bridge the pore throats and reduce the likelihood of differential sticking and seepage losses.

**Tuna A-31 reached a Total Depth of 3220 m (1435.28 mTVD) at 12:45 hours on 16th July 2002.** The final survey at a depth of 3197.86 had an inclination of 72.24° and an azimuth of 87.73°. 7" production casing was run to a depth of 3214 m and was completed as a single oil string with 3½" completion tubing. Tuna A-31 was handed over to Production on 26-07-2002 at 05:00 hours.

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**WELL PROFILE**

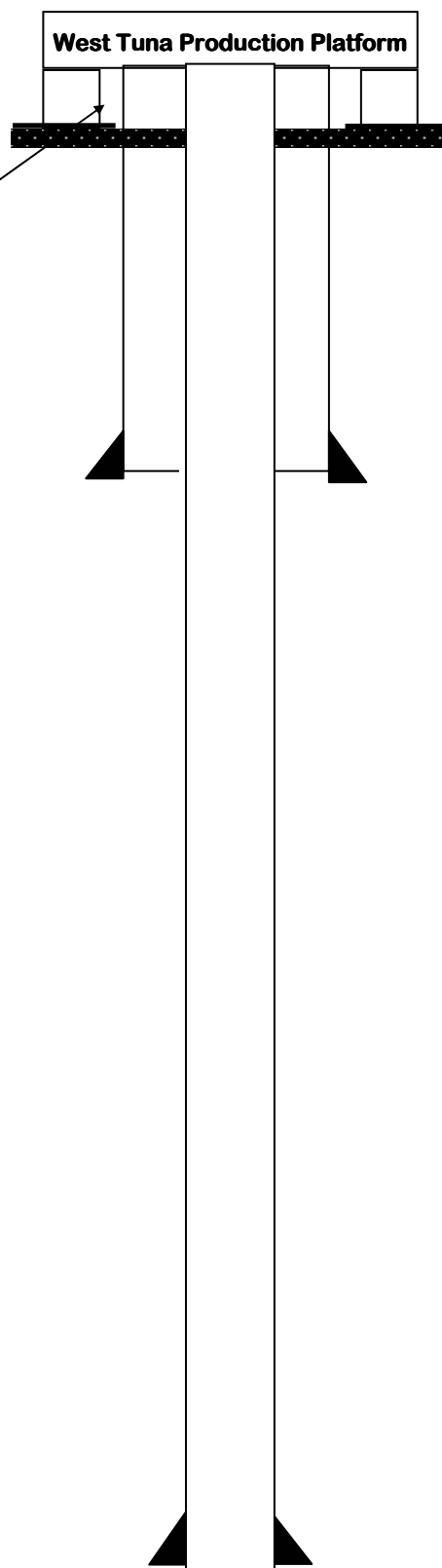
 Rotary Table to Mean Sea Level  
 31.32 m

Rotary Table to Sea Bed 90.72 m

20" conductor shoe at 147.3 m

 9<sup>5</sup>/<sub>8</sub>" Surface casing at 828.7 m

7" Production casing set at 3214 m


**Nabors Rig 453**

 Spudded A-31  
 1st July 2002  
 From 147 m

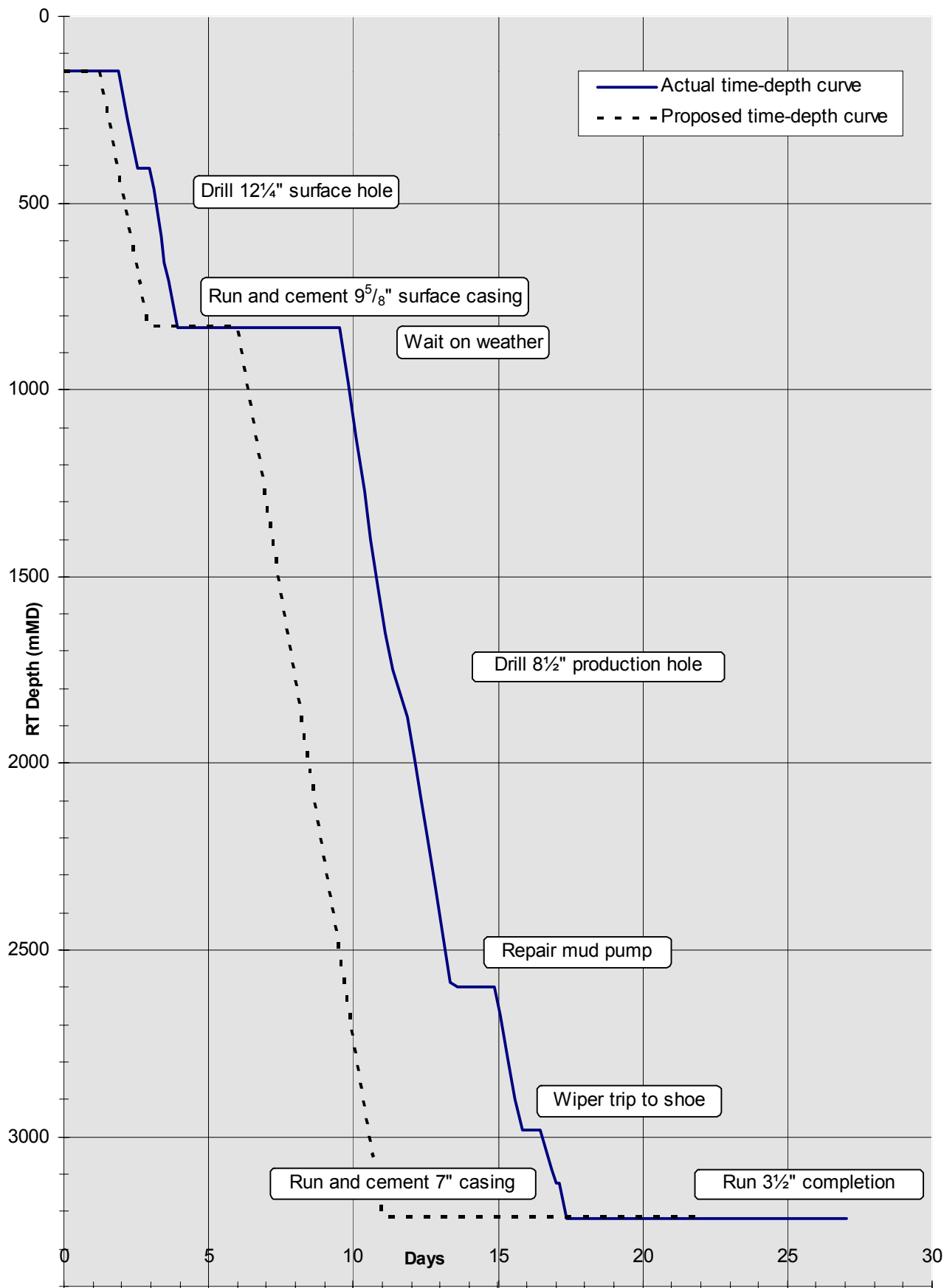
 147 m - 834 m  
 Mud Weight 9.3 ppg

 12<sup>1</sup>/<sub>4</sub>" Hole drilled to 834 m

 834 m - 3220 m  
 Mud Weight 8.9 - 10.7 ppg

 8<sup>1</sup>/<sub>2</sub>" Hole drilled to 3220 m

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**TUNA A-31 TIME-DEPTH CURVE (measured depth)**


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**BIT RUN SUMMARY**

BIT	Size (")	Type	Jets	In (m)	Out (m)	Hours	Condition
1	12¼	Security MPSF	1 x 18 3 x 20	147	406	5.05	1-1-WT-A-E/E/E-IN-NO-BHA
2RR	12¼	Hycalog DS195	5 x 18	406	834	14.25	1-2-WT/CT-A/S-X-IN-NO-TC
3	8½	Geodiamond S75HPX	7 x 14	834	3220	73.19	6-8-WT/CT-A-X-IN-LT/BT-TD

**CASING DATA**

Type	Size (Inches)	Weight (lb/ft)	Grade	Thread	Depth (mMDRT)
Conductor	20"	133	K-55	BTC	147.3
Surface	9 <sup>5</sup> / <sub>8</sub> "	47	L-80	LT&C	828.7
Production	7"	26 & 29	L-80	LT&C	3214

**CEMENTING DATA**

Casing Details	Cement Type	Dry Cement Volume (sx)	Cement Additives	Mix Water (bbls)	Slurry Volume (bbls)	Slurry Density (ppg)	Cement To/From (mMDRT)	Casing Pressure Test (psi)
9 <sup>5</sup> / <sub>8</sub> "	ABC Class G	686	0.25 gal/10bbl NF-5 14.6 gal/10bbl Econolite	212	294	12.5	Surf-829	2000
		300	0.25 gal/10bbl NF-5	38	64	15.9		
7"	ABC Class G	664	32 gal/10 bbl Halad-413L,  2 gal/10bbl SCR-100L  5 gal/10bbl CFR-3L 0.25 gal/10bbl NF-5	82	137	15.8	Surf-3214	2500

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**WELL DIRECTIONAL PROFILE**  
(From Geoservices ALS Software)

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**WELL DIARY**

<b>29th June 2002</b>	Change over from rig move to well Tuna-A31 at 05:00. Pick up and make up stands of 5" HWDP and DP.
<b>30th June 2002</b>	Make up stands. Run and set MCT housing in wellhead and jet. Pressure test. Make up BHA. Rig up Schlumberger / SDI.
<b>1st July 2002</b>	Displace hole to 8.8 ppg mud. Drill out 20" conductor shoe from 145 m to 147 m. Drill and steer 12¼" hole from 147 m to 406 m, with Gyro surveys. Rig down Schlumberger equipment. Flow check, circulate bottoms up and pull out of hole. Rack back BHA and lay out bit #1. Make up bit #2. Align UBHO and test MWD tool.
<b>2nd July 2002</b>	Service rig. Inspect monorail. Change out damaged jars. Run in hole with bit #2 to 406 m. Drill and steer 12¼" hole from 406 m to 830 m.
<b>3rd July 2002</b>	Drill 12¼" hole from 830 m to 834 m. Rotate and work string while circulating hole clean. Pull out of hole to 20" casing shoe. Work string while circulating bottoms up. Run back to bottom, circulate and spot pill. Pull out of hole. Rig up casing equipment and prepare to run 9 <sup>5</sup> / <sub>8</sub> " casing. Run casing as per program.
<b>4th July 2002</b>	Continue to run casing as per program and land out. Rig up cement head and set down. Rig up lines and circulate casing volume 1½ times. Cement casing as per program. Bump plug and wait on cement. Change out BOP rams. Nipple down flowline. Slack off casing weight and rig down cement head and lines. Back out landing joints. Rig down Weatherford equipment and casing running gear. Change pump liners. Nipple up BOPs.
<b>5th July 2002</b>	Remove and lay out cement sleeve. Make up lower riser and BOPs. Unable to centralise BOPs due to deck beam. Lay out bails, stabbing board etc. Rig up hose from choke manifold to BOPs. Lay out drillpipe. Mix new mud. Change pump liners to 6". Nipple down BOPs. Disconnect and flip riser. Reconnect riser. Nipple up BOPs. Install flowline and trip tank lines. Function test koomey unit. Check monorail. Wait on high winds. Troubleshoot electrical fault on drawworks. Service choke manifold valves. Complete commissioning on BOP, koomey unit and remote's as per Esso requirements.
<b>6th July 2002</b>	Pressure test rams, standpipe, choke manifold and lines to 300/3000 psi. Rig down lines. Troubleshoot electrical fault on drawworks. Function test drawworks - OK. Rig down test assembly and run wear bushing. Start laying out old BHA. Shut down crane due to high winds > 50 knots. Conduct rig maintenance while waiting on weather.
<b>7th July 2002</b>	Continue conducting rig maintenance while waiting on weather. Slip and cut drill line. Unload workboat. Lay out 8" DCs from derrick. Service rig. Pick up 5" drill pipe.
<b>8th July 2002</b>	Continue to pick up 5" drill pipe. Pick up motor. Make up bit #3 and new BHA. Run in hole and tag cement at 795 m. Drill out cement and shoe track to 828 m, displace to KCl/PHPA/Glycol mud. Continue drilling cement to 834 m and drill new 8½" hole to 840 m. Pull back to 828 m and conduct PIT (EMW = 12.7 ppg). Drill, steer and survey 8½" hole from 840 m to 985 m.
<b>9th July 2002</b>	Continue to drill, steer and survey 8½" hole from 985 m to 1527 m.
<b>10th July 2002</b>	Continue to drill, steer and survey 8½" hole from 1527 m to 1851 m. 450 psi pump pressure loss while drilling. Rotate and work string while investigating pressure drop. Check pumps - OK. Pull out of hole wet to look for washout. Find washout in drill pipe at 1678 m. Lay out pipe and pick up new joint. Circulate string, check pump pressure - OK. Run in hole to 1851 m, rotate and circulate bottoms up. Continue to drill, steer and survey from 1851 m to 1877 m.
<b>11th July 2002</b>	Continue to drill, steer and survey 8½" hole from 1877 m to 2333 m.

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<b>12th July 2002</b>	Continue to drill, steer and survey 8½" hole from 2333 m to 2596 m. Observe pressure loss. Pump failure. Hold crew meeting while circulating hole clean with pump #2. Flow check well and pull out of hole to 2073 m. Excess overpull. Run in hole to 2133 m. Rotate and work pipe while circulating hole clean. Backream from 2133 m to 2044 m. Pull out of hole from 2044 m to tight hole at 1566 m (30K overpull), 1730 m, 1656 m, 1620 m and 1590 m (all 20K overpull). Run in hole 2 stands from 1566 m to 1646 m. Rotate and work stand while circulating hole clean. Backream from 1646 m to 1524 m (tight spot at 1566 m). Pull out of hole from 1524 m to tight spot at 1477 m (30K overpull). Run in hole 2 stands from 1477 m to 1526 m. Rotate and work stand while circulating hole clean.
<b>13th July 2002</b>	Backream from 1526 m to 1323 m (tight spot at 1477 m). Pull out of hole wet from 1323 m to 809 m (tight spot at 1290 m, 1240 m and 1141 m; all 20K overpull. Circulate bottoms up at 809m. Slip and cut 80' drill line. Conduct maintenance while waiting on crane/boat. Crane unload and backload 2 boats. Remove electric motor from mud pump #1 and install new motor and associated equipment. Commission and function test. Circulate bottoms up and test mud pump at 809 m. Run in hole from 809 m to 1591 m. Rotate and work string while circulating hole clean at 1591 m (excess cuttings at shakers). Run in hole from 1591 m to 2133 m. Rotate and work string while circulating hole clean at 2133 m (excess cuttings at shakers). Run in hole from 2133 m to 2557 m.
<b>14th July 2002</b>	Wash and ream from 2557 m to 2596 m while circulating hole clean. Drill, steer, and survey 8½" hole from 2596 m to 2644 m. Rotate and work string while changing shaker screens on shaker #1. Drill, steer and survey from 2644 m to 2982 m. Rotate and work string and rack back 1 stand while circulating hole clean.
<b>15th July 2002</b>	Circulate hole clean. Rack back 1 stand every ½ hour to 2870 m, flow check and slug pipe. Pull out of hole to shoe. Circulate hole clean. Run in hole to 2927 m. Precautionary wash and ream to bottom. Rotate and work string to clean up shakers. Drill, steer and survey 8½" hole from 2982 m to 3088 m.
<b>16th July 2002</b>	Drill, steer and survey 8½" hole from 3088 m to 3123 m. Rotate and work string, racking back 1 stand every ½ hour whilst adding Finagreen. Run in hole from 3010 m to 3123 m. Drill ahead to TD of 3220 m. Rotate string and circulate 2 times Latrobe volume. Flow check and backream to 3010 m. Rotate and circulate whilst backreaming to 2800 m. Slug pipe and pull out of hole to shoe.
<b>17th July 2002</b>	Continue to pull out of hole to shoe and circulate hole clean. Cut and slip drilling line at shoe and conduct rig service. Run in hole to 3180 m. Precautionary wash and ream to bottom. Rotate and work string whilst circulating. Flow check and pull out of hole to 2048 m. Layout SuperG DP Pull out of hole to 809 m and circulate. Pull out of hole, remove source and layout tools. Remove wearbushing and change out rams.
<b>18th July 2002</b>	Continue to change out rams. Run combination tool and pressure test BOPs. Rig up for 7" casing run. Run shoe track. Run 7" production casing to 809 m. Pick up LaFleur casing fill up tool and continue to run casing.
<b>19th July 2002</b>	Continue to run 7" production casing to 3194 m. Layout LaFleur, break circulation and land out in MC2. Rig up cement head and lines. Circulate while Howco start unit, pressure test. Pump seawater and spacer. Bottom plug doesn't drop, replace. Pump and displace cement, don't bump plug. Bleed back and floats hold. Apply 300 psi to annulus. Layout cement head and casing running gear, while wait on cement.
<b>20th July 2002</b>	Jet BOPs and wellhead. Make up and run seal assembly. Install test plug. Layout 5" DP. Retrieve test plug. Rig up Howco lines. Rerun test plug. Continue to layout 5" DP. Retrieve test plug. Howco break circulation, pressure test lines and casing. Change rams and TDS to 3½". Make up and run test assembly. Pressure test BOP and manifolds.

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<b>21st July 2002</b>	Continue to pressure test BOPs. Run wearbushing. Run 7" casing scraper on HWDP. Run in hole picking up 3½" DP.
<b>22nd July 2002</b>	Continue to run in hole with scraper, tag cement at 3157 m. Pull back and work scraper over the interval of 3100 m to 3130 m. Drill cement from 3157 m to float collar at 3188.5 m. Circulate hole clean, pump high viscosity pill and seawater around. Displace well to inhibited brine. Pressure test casing to 2500 psi and pull out of the hole to 3049 m. Cut and slip drilling line. Continue to pull out of the hole. Make up and run SXAR gun assembly on tailpipe and packer assembly.
<b>23rd July 2002</b>	Run in hole with SXAR gun assembly on tailpipe and packer assembly to 3157 m. Space out and put string in tension. Rig up Schlumberger wireline and side entry sub. Run in with GR/CCL and correlate at 3158 m. Pull wireline out of hole and rig down. Drop, pump and seat ball with Howco. Pressure up and set packer. Pick up and shear off the packer. Pull back to 3101 m and make up side entry and blank sub. Pressure up and expend ball seat. Break down side entry and space out assembly. Pull out of hole, laying out 3½" DP.
<b>24th July 2002</b>	Continue to pull out of hole, laying out 3½" DP. Break down running tool and retrieve wearbushing. Jet BOPs and MC2. Rig up Weatherford gear. Make up seal assembly and run in hole with 3½" completion tubing.
<b>25th July 2002</b>	Continue to run 3½" completion tubing. Sting into 7" packer. Perform space out. Land tubing hanger. Close SSSV, install BPV. Nipple down BOP and riser. Install Xmas tree.
<b>26th July 2002</b>	Continue to install Xmas tree and pressure test. Rig up Cameron lube and retrieve BPV. Pressure test tubing to 2300 psi, lock in and pressure test production annulus to 2000 psi. Bleed off pressures and rig down lines. Replace main deck grating.

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## **Section 2**

### **Geological Summary**

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**FORMATION TOPS**

DESCRIPTION	MD (m) - RT	TVD (m) - RT	TVD (m) - SS
Top of Gippsland Limestone	Not Applicable		
Top of Lakes Entrance	2269	1129.5	1098
Top of Latrobe Group	3038	1376.5	1345
Top of Coarse Clastics	3118	1402.5	1371
<b>TOTAL DEPTH</b>	<b>3220</b>	<b>1435.28</b>	<b>1403.78</b>

**GEOLOGICAL SUMMARY****GIPPSLAND FORMATION:**

147m - 840m

**CALCARENITE****CALCARENITE:**

Light grey, light olive grey, occasional off white and light brown, very fine to fine grained, argillaceous in part, fossils and shell fragments, trace to minor glauconite, trace to minor carbonaceous specks, rare disseminated pyrite, soft to moderately hard, friable in part, poor visual porosity, no fluorescence.

840 m - 1700 m

**CALCISILTITE and CALCILUTITE****CALCISILTITE:**

Very light to medium grey, argillaceous, occasional grading to Calcilutite, common fossil fragments, rare carbonaceous specks, rare calcite crystals, soft to dispersive, sub-blocky to amorphous, poor visual porosity, no fluorescence.

**CALCILUTITE**

Very light olive grey to light grey, rarely medium grey, trace fossils and fossil fragments, minor to trace disseminated and nodular pyrite, trace calcite grains, trace carbonaceous specks, very soft to dispersive, occasionally firm, amorphous to sub-blocky.

1700 m - 2269 m

**MARL****MARL**

Light to medium grey, occasionally light olive grey, argillaceous, silty in part, trace carbonaceous specks, trace pyrite, trace fossils, soft to occasionally firm, blocky to sub-blocky.

**LAKES ENTRANCE FORMATION:**

2269 m - 3038 m

**CALCAREOUS CLAYSTONE****CLAYSTONE**

Light to medium grey, rarely very light grey, very calcareous, silty in part, trace Ooids, trace Foraminifera, trace to rare disseminated pyrite, trace glauconite, soft to firm, sub-blocky to amorphous.

**LATROBE FORMATION:**

3038 m - 3118 m

**Interbedded CLAYSTONE and SANDSTONE****CLAYSTONE**

Predominantly light to medium brown, yellowish brown, mottled off white and light green, light to dark grey, silty, locally calcareous, occasional carbonaceous material, fine to medium quartz, locally common very fine pyrite, very soft to dispersive, amorphous.

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**SANDSTONE**

Medium to dark brown, light brown, light yellow, very fine to dominantly fine grained, moderately sorted, sub-angular to sub-rounded, moderate to strong calcareous cement, common to abundant argillaceous to silty matrix, occasional glauconite, locally rare carbonaceous material, friable to moderately hard aggregates, poor visual porosity, no fluorescence.

**COARSE CLASTICS:**

3118 m - 3220 m

**SANDSTONE with CLAYSTONE**

**SANDSTONE**

Quartzose, clear to translucent, milky to off white, occasionally yellowish brown, fine to very coarse, poorly sorted, sub-angular to sub-rounded, occasionally very angular and fractured grains, trace weak siliceous and pyrite cement in part, locally common off white argillaceous matrix, predominantly unconsolidated, good inferred porosity, no fluorescence.

**CLAYSTONE**

Very light to light grey, off white, light yellowish brown, locally slightly calcareous, silty in part, trace to rare pyrite, minor fine carbonaceous material, soft to dispersive, amorphous to locally sub-blocky.

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## GAS REPORT

Minor gas was recorded after drilling out from the conductor at 147 m and was most likely due to seepage from surrounding wells. This gas soon disappeared and the first consistent readings were recorded at 320 m. This gas, consisting of C<sub>1</sub> (Methane), started at trace amounts and gradually increased to 5 units at 834 m which was the bottom of the 12¼" hole section. For the rest of the Gippsland Limestone/Marl section, the background gas levels remained very low at around 5 units.

In the Claystone of the Lakes Entrance formation there was little change in the gas trend or character. The gas detected was C<sub>1</sub>, ranging from 1 unit to 8 units and consistently below 5 units.

On penetrating the Latrobe formation at 3038 m, there was a marked increase in gas levels, from 5 units to an initial peak of 34 units at 3046.5 m. The composition of the gases also changed with an increase in heavier gases (C<sub>2</sub> to C<sub>5</sub>), indicating a hydrocarbon bearing lithology. Higher peaks were detected on penetration of the first sandstone lithology, a maximum 94 units being recorded. The gas level decreased, while the wetness increased, on entering the Coarse Clastics indicating a gas poor, oil enriched zone.

Connection gas was detected from 1390 m to 3038 m and ranged from 1 unit to 3 units above background gas. Any connection gas in the Latrobe was masked by hydrocarbon gas overprinting.

Localised increases in background gas are attributable to both lithology variations and the penetration rate which was dependant upon the drilling method, being either rotary or slide, carried out at the time. No CO<sub>2</sub> or H<sub>2</sub>S was detected while drilling Tuna A-31.

### Gas peaks through the Latrobe Group

Depth metres	Total Gas units	C <sub>1</sub> %	C <sub>2</sub> %	C <sub>3</sub> %	iC <sub>4</sub> %	nC <sub>4</sub> %	iC <sub>5</sub> %	nC <sub>5</sub> %
3046.5	34	0.48	0.02	0.01	Trace	Trace	Trace	Trace
3057	49	0.65	0.04	0.02	Trace	Trace	Trace	Trace
3066.5	64	0.78	0.05	0.02	Trace	Trace	Trace	Trace
3072.5	91	1.10	0.07	0.03	Trace	0.01	Trace	Trace
3081.5	48	0.62	0.05	0.02	Trace	0.01	Trace	Trace
3109.5	94	0.92	0.06	0.03	Trace	0.01	Trace	Trace
3133	26	0.27	0.02	0.01	Trace	Trace	Trace	Trace
3143	17	0.18	0.01	0.01	Trace	Trace	Trace	Trace
3165	21	0.17	0.01	0.01	Trace	Trace	Trace	Trace

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