DRILLING PROGRAMME

Grayling-1
Permit: VIC/P 54

DOCUMENT APPROVAL

REV No	DATE	REVISION	APPROVALS		
			Originator	Checked By Owner	Approval Authority
0	25/10/2004	ISSUE	CC	CC	JBM

Holders of Controlled Copies

1. Perth Library
2. Drilling Manager
3. Drilling Materials Superintendent
4. Operations Manager, Ocean Patriot
5. Senior Toolpusher, Ocean Patriot

Controlled Copies Issued as Attachment to Longtom-2 Application for Permission to Drill

1. Exploration Manager
2. Senior Drilling Engineer
3. Drilling Supervisor, Ocean Patriot
4. Operations Geologist
5. Wellsite Geologist
6. DPI (3 x CD)
7. Nexus Energy

Holders of Uncontrolled Copies:

1. Assistant Materials Controller
2. Rig Copies (Mud Engineer, Cementing Engineer, Casing running Company, Directional & MWD Engineers, Mud Loggers, Test Engineer). Send direct to service companies for distribution.
3. Apache Shorebase Supervisor – Melbourne

Holders of Uncontrolled Copies of "Programme Summary" & "Manuals, Procedures and Commitments"

4. Workboat Manager 1
5. Workboat Manager 2
6. Boat Master 1 (Pacific Wrangler)
7. Boat Master 2 (Far Grip)
8. Chief Pilot, Bristow Helicopters, Essendon

APACHE ENERGY LIMITED ABN: 39 009 301 964
Level 3, 256 St Georges Tce, Perth, Western Australia 6000
PO Box 477, West Perth, Western Australia 6872
Telephone: (08) 9422 7222 Facsimile: (08) 9422 7444

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ATTACHMENTS

Cameron Wellhead and Conductor Schematics;

- **LO-051736-01 Sheet 1 Revision 06**
- **LO-051736-01 Sheet 2 Revision 06**

Grayling-1 will be drilled in accordance with the Ocean Patriot Safety Case Bridging Document and this Drilling Programme which, as governing documents, reference the individual procedures, manuals and guidelines required for AEL drilling operations with the Ocean Patriot. The referenced documents are to be available on the Ocean Patriot, AEL's Perth office and in some cases Diamond's Perth office.

It is the Senior Drilling Supervisor's responsibility to ensure that these documents are present on board the rig prior to drilling operations commencing and to ensure that this drilling programme has been read and understood by Apache's Drilling Supervisors and Diamond's OIM and Toolpushers.

A signed copy of this page must be faxed to the Drilling Engineer in charge of the well in Perth prior to the start of a well with a ✓ (affirmative) or ✗ (negative) in the "❑" to show what is present and what is not. All persons on board the rig are to be made aware that these documents govern the work by placing a signed copy of the page on the rig's notice boards. The Bridging Document is to be read and understood by supervisory personnel on the rig.

After having confirmed with the Drilling Engineer in charge that you have the most current version of this Drilling Programme and subsequent programmes relating to activities on the well, they are to be read by the Apache Drilling Supervisors prior to the work the programme relates to commencing. Any concerns are to be raised immediately with the Drilling Engineer.

	DOCUMENT	OWNER	DOCUMENT REFERENCE
	Rig Management Documents		
❑	Bridging Document	AEL	DR-50-ID-022
❑	Well Control Manual	DOGC	Ocean Patriot
	Governmental / Permit Specific Documents		
❑	Schedule to the PSLA	AEL	AE-00-SG-002
❑	Emergency Response Plan - Gippsland Basin	AEL	AE-00-ZF-033
❑	Vessel Movement Notifications – Gippsland Basin	AEL	DR-91-IG-005
❑	Oil Spill Contingency Plan for the Permit	AEL	AE-00-EF-013
❑	Environmental Plan For Permit VIC/P 54	AEL	EA-00-RI-152
	Well Specific Documents		
❑	Site Survey		None performed
❑	Testing Programme for Grayling-1	AEL/AWT	(issued if required) DR-70-LR-002
❑	P&A Programme	AEL	Uncontrolled (issued as required)
	Apache Management Documents		
❑	Drilling Management Manual	AEL	AE-91-ID-001
❑	Drilling Standards Manual	AEL	AE-91-ID-004
❑	Drilling Process Manual	AEL	AE-91-ID-002
❑	Apache Emergency Contacts List	AEL	AE-00-ZF-034
❑	Rig Move Positioning QC Procedure	AEL	DR-00-RQ-001
❑	Incident Reporting Procedure	AEL	AE-91-IF-002
❑	Refuelling Procedure	AEL	AE-91-IQ-098 Rev3
	Technical Manuals		
❑	Cameron Wellhead Manual	AEL	Uncontrolled
The following documents are only available in the Apache Perth Office			
	Emergency Response Management Manual	AEL	AE-00-ZF-025

Name_____ Signed_____

Position Apache Drilling Supervisor Date_____ File D91.6.M2 cc Well SDE

Grayling-1 will be drilled using the VIC/P 54 Environment Plan (EP). The following guidelines detail AEL's environmental commitments for this well and must be adhered to:

Waste Disposal

- Food scraps to be macerated prior to disposal overboard.
- No disposal of debris, garbage or litter into the sea. (skips need covers to prevent wind blown rubbish - especially plastics and styrofoam cups).
- Segregate industrial waste (scrap metals / drums etc) for appropriate disposal onshore.
- Reduce, reuse and recycle waste wherever practicable.
- Waste oil and grease to be drummed and returned to mainland for recycling.
- Cooling water will be discharged at barge level (~15m above sea level) to facilitate cooling and oxygenation.
- Sewage is to be treated to a satisfactory level of treatment prior to discharge.
- Sewage treatment plant is to be maintained to ensure effective treatment.
- Solids control equipment will be optimised to ensure maximum separation of drilling fluid from cuttings.
- WBM will be used, with disposal of cuttings to seabed.

Oil And Chemical Storage Spills

- Maintain good housekeeping practices.
- Chemicals are to be stored in bunded areas away from open drains and chemical containers intact.
- In the event of a spill, take all actions to control the spill and divert deck drainage to on board containment tanks for treatment through oil in water separator.
- Ensure absorbent material is on board to use in soaking up chemical or oil spills.
- Maintain oil in water separator regularly to ensure 15ppm oil concentration alarm is functional.
- All releases of oil in water of greater than 50mg/l (averaged over 24 hour period) are to be reported to Apache Perth office within 2 hours of occurrence (these are reported to DPI).
- All spills >80L will be reported to Apache Perth within 2hours (these are reported to DPI).
- Report all spills <80L through Apache incident reporting system.
- Drip trays will be used under all machinery, fuel points and valves.
- No dispersant use without DPI approval.
- Inspections and tuning of engines and equipment should be included on a regular maintenance schedule.

Miscellaneous

- Pipe dope, which has lowest concentration of heavy metals and hydrocarbons, is biodegradable, but still meets safety and performance criteria, is to be used.
- Refuelling will be undertaken according to the Apache Refuelling Procedures (AE-91-IQ-098).
- Fill in whale observation data sheets and forward to the Environmental Manager at the end of the well.
- There will be no fishing from the drilling rig or work boats while on site.
- No workboats are to anchor in areas where sensitive seaved features or subsea pipelines occur (none known or likely in immediate vicinity of well location).

The following are the **responsibility** of **Senior Drilling Supervisor**. Management of the implementation of commitments will be performed by the stated personnel.

Commitment	Action by	Action	Timing
All guidelines and procedures will be followed.	Senior Drilling Supervisor	All guidelines and procedures in the Environment Plan will be complied with. Ensure all personnel are familiar with the environmental requirements of the EP and all guidelines and procedures outlined are being followed. Ensure personnel sign off on rig register book confirming their induction.	At all times
The risk of diesel spillage during refuelling shall be minimised.	Rig PIC / Bargemaster	Follow the refuelling procedure as referenced in the previous page.	At all times
Oil loss during production testing will be minimised.	Senior Drilling Supervisor	Follow guidelines for minimising production testing fallout. These are contained in the EP.	During well testing.
All personnel on site will undergo an induction and education program.	Rig PIC/ Medic/ Safety Off.	Outline the environmental management requirements as referenced in the previous page.	To be given to all personnel during their induction to the rig.
Post copies of AEL's environmental commitments	Rig PIC/ Medic / Safety Off.	Post copies of the environmental commitments outlined on the previous page on all notice boards.	Prior to the start of the well.
A debris survey shall be conducted.	Senior Drilling Supervisor	A remotely operated vehicle will be used. A report and video will be submitted to Apache.	At end of drilling program, prior to rig moving off site.
The following is to be recorded on the environmental spreadsheet and results reported to Environmental Manager at end of well. • Volumes and disposal method for all drilling fluids. • Volume of pipe dope. • Volume and type of waste taken off the rig. • Volume of waste oil taken off the rig.	Senior Drilling Supervisor	Record details on environmental spreadsheet daily.	At all times.

The following are the **responsibility** of the **Environmental Manager**

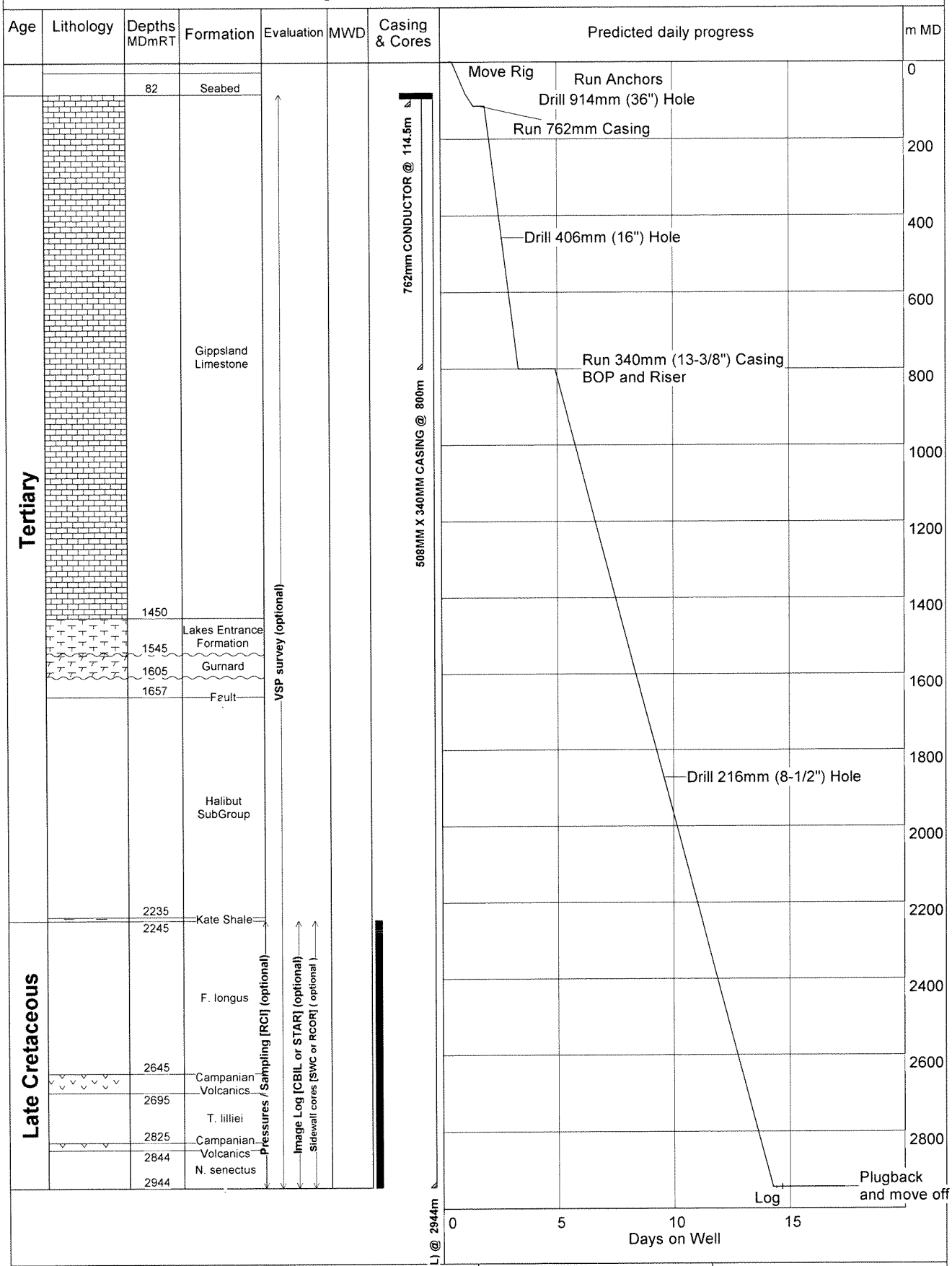
Commitment	Action	Timing
An Environmental Plan shall be prepared for drilling activities.	The EP shall be made available to all personnel involved in a drilling program.	Completed
Responsible Drilling Engineer to ensure all environmental commitments are met.	A list of the EP commitments to be given to the responsible Drilling Engineer.	Completed
Well details and oil spill trajectories have been prepared.	Site specific environmental data and trajectories will be prepared and submitted to DA in the EP for the well	Completed
An oil spill contingency plan will be available.	The OSCP will be made available to all personnel on the rig. The projected trajectories will be included in the EP for the well	Immediately.
Conduct Environmental Audit of rig every six months whilst under contract to Apache.	Audit	6 monthly
Report Greenhouse Gas emissions data to Federal Government annually.	Measure and Report	Ongoing

The following are the **responsibility** of **Legal Counsel**

Commitment	Action	Timing
Apache and each of the Participants will hold extensive insurance for liability, control of well and clean-up.	Certification of currency of insurance in accordance with directions from the DA.	Prior to the commencement of the drilling program.

APACHE ENERGY LTD Document No DR-70-LD-002	Grayling-1	Vic P 54

Programme Summary in Measured Depth



Proposed water depth (uncorrected)	57m
Actual Water Depth (AHD)	57m
RT to AHD	25m
RT to Seabed	82m
Seismic line	Inline 3708 Xline 7845
TD	2944mTVDRT 2944mMDRT
Datum: GDA 94	

Surface and Target Location	
Latitude	38°09'40.24" S
Longitude	148°17'35.95" E
GDA94	5,775,511.5 mN
	613,303.2 mE

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Rig Move / Mooring / Pre-Spud

Grayling-1 commences when the last anchor is bolstered on the rig from the previous well, Longtom-2. This time will be recorded in the IADC log & Apache Daily Drilling Report (DDR) and accompanied by Statement of Facts (SOF's) for the rig, both vessels, and all applicable service companies with equipment or products on board. The Grayling-1 well will be drilled in direct continuation from Longtom-2, also in Vic/P 54.

1. Tow rig to the Grayling-1 location. This is approximately a 3.5nm tow. The rig will be towed at drilling draft. Leave as much BHA / drillpipe in the derrick as possible.
2. Grayling-1 surface location is within an "area to be avoided" as shown on admiralty charts. This area has been designated by AMSA around the existing Gippsland Basin infrastructure in order to minimise the amount of sea traffic passing close to and between the platforms. Avoiding this area is not a legal requirement, just recommended, and contacting those companies with infrastructure in the area is a courtesy. Due regard should be given to this area when developing the detailed rig move plan to location. This also means there will be additional notifications required prior to and while moving the rig, as well as notifications required by the workboats when passing through the area on the way to / from Port Melbourne.

   See detailed "Vessel Movement Notifications – Gippsland Basin" procedure, DR-91-IG-005. An outline of this procedure is below.

   - Ensure that the Drilling Engineer in Perth has corresponded with both the ESSO Longford Control Room and Barry's Beach Shore Base the week prior to the move. In that correspondence the ESSO Operations manager will be advised of the planned route for the move on to location, approximate timing of the move and proposed final surface location.
   - Ensure that the Drilling Engineer in Perth has issued the "Notification / Application to move the MODU" (in accordance with normal Apache Drilling Process) to the DPI (amongst others), but has also copied both the ESSO Longford Control Room and Barry's Beach Shore Base on the impending move.
   - Ensure Ocean Patriot radio operator copies both the ESSO Longford Control Room and Barry's Beach Shore Base on "Position Update" faxes during the tow.
   - This same process applies to the tow from Grayling-1 out of the "area to be avoided".
   - Workboats should notify Barry's Beach Shore Base each time they are going to pass through the "area to be avoided".
3. See detailed rig move and anchoring procedure for details on move on (and off) location, and operations to be performed whilst anchoring. Generally;
   - Run primary anchors.
   - Whilst running secondary anchors depending on weather / time constraints, M/U BHA and drill ahead TGB, pick up drillpipe (this rig not configured to pick up pipe whilst drilling).
4. Position rig onto location within a 10m radius of the Grayling-1 location (via anchor tensioning). Final rig heading is to be confirmed and included in the rig contractor's mooring plan.
   - A differential GPS positioning system will be used to determine the final rig position.
   - The rig position is to be verified by Apache Drilling Supervisor using the hand held GPS according to Apaches Rig Move Positioning QC Procedure DR-00-RQ-001.
   - Ensure that all positioning information references GDA 94, the Apache standard datum.

5. Report the following in the DDR, and send in the actual Rig Positioning/Surveying contractors summary sheet showing:
   - Rig Heading
   - Distance and bearing from the proposed location
   - Final Anchor positions and chain lengths run
6. Make up cement stinger for 762mm (30") conductor on HWDP and stand back in derrick.
7. Make up a landing string and stand back.
8. After the primary anchors have been run, complete the preparation of the drill ahead TGB (Bear Trap) as per **Cameron procedures**, and BHA (660mm (26") bit and 914mm (36") hole opener) and run same suspending off bottom until final positioning and tensioning is complete.
   - **If a trial unlatch of the Bear Trap is performed at surface, conduct a JSA. Nothing should be placed within the boundary of the template once safety pins are removed, as the arms can now be released.**
   - **The TGB latch block will be positioned between the 36" hole opener and first stabiliser.**
   - **Avoid stopping in wave zone whilst running – concern is that wave motion in splash zone may cause unlatching.**
   - **10,000lbs ±50% applied to striker plate will release Bear Trap TGB.**
   - Prepare conductor and PGB as much as possible off critical path.
   - Paint drill bit white.
   - An Anderdrift tool will be made up in the BHA, with a Totco ring run as a contingency.
   - Offset well information indicates use of TGB will avoid WOC time on conductor job. Closely observe drilling and TGB bullseye to confirm if this will be the case.
9. Pre-Tension anchors as per Ocean Patriot procedures.

660mm (26") x 914mm (36") Hole Section

Note: some of these operations may be conducted while running and pre-tensioning anchors.

Water depth: +/- 57m
Seabed depth: +/- 82 RT
Section TD: +/- 115.5 mRT (casing strap plus 1m)

10. Lower the suspended BHA & TGB and tag seabed.
11. If any doubt exists as to whether the string is hanging vertically take an inclination survey prior to releasing Bear Trap. Be prepared to wait for slack tide if necessary. This is not expected to be necessary, with 10yr return period surface currents estimated (computer modelled) at <1.7knots (<1.4knots near seabed).
    - Report datums and final co-ordinates on the IADC log and DDR once these are known. (ie once the rig-positioning contractor has advised survey results).
12. Release Bear Trap and spud well, recording the time in the IADC Daily Drilling Report. Check and record the TGB bullseye reading. Use reduced flow rate and WOB until the first collar is buried.

13. Drill 660mm (26”) x 914mm (36") hole to section TD. This depth is to be adjusted to suit the actual length of the 762mm (30") conductor string and rathole. Pump a 8m3 (50bbl) sweep every 5m.
    - Take an anderdrift survey after first 12m of drilling. If angle >1degree consider reaming drilled hole.
14. Drill to bit depth (rather than hole opener depth), as casing to be run is tapered to 508mm (20”).
15. At TD, pump a 16m3 (100 bbl) gel pill and sweep hole clean. Displace hole to PHG and take anderdrift survey. If survey angle >1 degree consider reaming drilled hole. Totco ring has been included in BHA as backup to anderdrift tool.
16. Perform a check trip. Circulate and re-displace hole to PHG and POOH.

762mm (30") x 508mm (20”) Casing and Cement.

17. Rig up to run 762mm (30") conductor. See conductor stackup attachment (LO-051736-01 Sheet 1, Revision 06 and Sheet 2, Revision 06) for string details.

- 508 mm (20”) shoe should be painted white.
- Stripes at 1 metre intervals should be painted on 762 mm (30”) casing.
- Grease upper most metre of 30” for ease of future abandonment.

18. Place PGB on spider beams in moonpool. Run 762 mm (30”) x 508mm (20”) shoe joint, 762 mm (30”) intermdiate joint, and 30” housing joint through PGB.
19. M/U drillpipe stinger below 30” Running Tool, M/U R/T to housing. Drillpipe stinger will be run inside 30” casing.
20. Lower WH housing into PGB and Latch. Attach guide lines – paint white.
21. Lower conductor into sea, fill and close ball valves (remotely as per Cameron procedure – no man riding).
22. Run casing and land PGB into TGB.
    - Check bullseyes before cementing. Should be less than 1.5 degrees before setting conductor.
23. Cement 762mm (30") casing as per cementing programme.
    - Observe for cement returns using ROV. Place dye in last 10bbls of preflush to make this observation easier.
24. Release running tool, flush and POOH. L/D R/T. If there is doubt over the TGB/seabed interaction, consider WOC prior to releasing.
    - Check bullseyes with ROV and report in DDR.
25. Lay Out 660 mm (26”) x 914mm (36") BHA.
    - NOTE: The 203mm (8”) collars will be used in the next hole section.

406mm (16") Hole Section.

Section TD: ±805 mRT

Mud Type: Seawater with high viscosity sweeps

26. Make up 406mm (16") BHA as per the BHA programme.
    - Directional, Gamma Ray, Resistivity and Sonic MWD will be in the BHA.
27. Ensure enough drill pipe is picked up to reach section TD – the Ocean Patriot is not set up to pick up drillpipe whilst drilling.
28. Fit guide ropes above bit on BHA and attach to guidelines.
29. Deploy ROV to assist in stabbing into wellhead. RIH and drill out cement, once surface samples indicate cement is hard.
30. Drill to section TD using seawater and a minimum of 8m3 viscous sweeps every 15m or more often as required. Every second sweep should be PHG, alternating with flocculated PHG. Guar Gum can be held in contingency for sweeps if required. Every effort should be made to ensure that the hole is cleaned adequately.
    - Be generous on the sweeps – problems were experienced on this hole section on Longtom-1 where only a small volume of sweeps were pumped (2 to 2.5m3 per 15m). Tight hole was experienced as well as an unsuccessful intermediate logging run. A wiper trip was also required to remove fill.
    - Expect full returns to seabed for whole of section, so sweeps are essential (no loss zone to take cuttings).
    - Take inclination surveys at least every 300m using MWD. Actual section TD should be based on the measured casing tally, with around 10 metres rathole.
    - This whole section is Limestone. Sunfish-2 reported 100% calcarenite down to 400m, where the lithology changes to include claystone at quantity increasing with depth. Claystone occurs at up to 50% to section TD, more commonly at around 20-30%. This change in composition corresponds with a change in the ROP on Sunfish-2 (drilled with a tricone). PDC will be used on this well.
31. At TD sweep hole clean with 20m3 (100-150bbl) hi vis mud consisting of 50% PHG and 50% flocculated gel.
32. Consider displacing well to 1.15SG KCL/PHA mud from TD to 400m. This will leave the reactive section covered by the inhibitive pill.
33. POH and check drillpipe tally using the average stand method.
    - Wiper trip if hole conditions dictate. No intermediate wireline logging will be conducted, so wiper trip should not be necessary.
    - If wiper trip is made, repeat step 31.
34. Use ROV to monitor trip out of the hole. If a cuttings mound is observed on the PGB, attempt to wash it away with the ROV. Considering full returns are expected for the whole 406mm (16”) hole section, this may be necessary. Since there is a PDM in the string do not circulate through the bit to wash away the cuttings, to avoid possible contact with wellhead housing/posts etc.
35. Leave the BHA racked back in the derrick in case a wiper trip is required due to problems running casing.

340mm (13 3/8") Casing and Cement.

Casing Details: 340mm (13-3/8”) 508mm (20”)

	101 kg/m (68 ppf) L-80, BTC	301 kg/m (202 ppf)
Burst:	34.6 MPa (5020 psi)	33.8 MPa (4900 psi)
Collapse:	15.6 MPa (2270 psi)	28.1 MPa (4070 psi)
Tensile:	705 MT (1,556 klbs)	1516MT (3,342 klbs)

WellHead Housing: 18 ¾" Cameron STC-10 with 20" O.D. x 1" Wall thickness X-56. 25' long extension joint crossed over to 13 3/8" O.D. L 80, 68 ppf BTC pin down.

- See conductor stackup attachment (LO-051736-01 Sheet 1, Revision 06 and Sheet 2, Revision 06) for string details.
- Run the 18-3/4" x 13.375" wearbushing in place.

36. Run 340mm (13 3/8") casing:
    - Paint the shoe joint off the critical path.
    - Paint 1m lines on the next joint.
    - PDC drillable float collar and shoe, plus the Shark Bite system for preventing cementing plug rotation on drilling out to be used.
    - Ensure casing circulating head is installed on the top drive when running casing in open hole.
    - Wash down at least the last joint of casing.
    - Circulate a minimum of 1 casing volume prior to cementing.
    - Land out on TGB.
37. Cement 340mm (13 3/8") casing as per cementing programme.
    - Displace cement with seawater.
    - Test casing when plug bumps to 27.6 MPa (4000 psi) for 15 minutes.
    - Monitor for returns during cement job.
38. L/O 406mm (16") BHA.

Run and Test BOP and Riser.

- Maximum anticipated surface pressure assuming the entire wellbore is evacuated to gas will be less than 27.6 MPA (4000 psi) (if kick taken from TD).
- The BOP stack will have been completely pressure tested on the stump to full working pressure as per the Ocean Patriot procedures off the critical path, and will be tested again once run.
- A record of any prior key seating in flex joint and BOPs is to be maintained. The AEL Drilling Supervisor is to witness any measurements and obtain photographs.
- BOP stack ram configuration to be as follows:
  - ⇔ Blind/Shear Rams
  - ⇔ Variable bore rams (3 ½" to 5")
  - ⇔ Pipe rams - 5"
  - ⇔ Pipe rams - 5"
- Paint (black) stripes on ID of VX ring to provide visual indication for ROV prior to landing BOP.
- Ensure that the flex joint running tool is in good condition and ready to run.
- Ensure landing string of 5" S135 drill pipe is ready to run BOP's (as per Ocean Patriot Procedures).

- Ensure both riser and wellhead connectors are serviced as per Diamond's procedures. Record the travel of the indicator for future reference.
- Dress wellhead connector with new VX ring. Make sure the retaining dogs are fully operational.
- Use driller's indicator gauge weight for riser tension calculations.
- Tension guidelines as per Ocean Patriot procedures whilst running BOP.
- Ensure riser tension is maintained and increases for mud weight applied.
- Be sure to strap riser prior to running, to aide in accurate establishment of Hard Line (Line of fixed and known length from a point on riser below slip joint - useful for landing wellhead seals etc).

39. Rig up to run BOP and riser. Hold JSA.
40. Function test BOP's through both control pods.
41. Prepare BOP Stack and LMRP in moonpool. Rig up guidelines/posts to run BOP.
42. Winch off location. Run BOP. Pressure test choke and kill lines after the BOP's have passed through the splash zone to the maximum test pressure required (27.6 MPa (4000 psi)). Carry on running BOP on riser.
43. Pick up and run slip joint on landing string. Attach tensioner lines to the slip joint. Attach choke and kill lines at moonpool and test. Pressure test moon pool jumper hoses after installation and prior to landing BOP.
44. Space out to allow slip joint to be at its mid-stroke while the rig is at survival draft.
45. ROV to inspect wellhead, confirm guide base inclination and confirm that the VX ring is still in place in wellhead connector.
46. Winch back over Wellhead when making up the slip joint and land the BOP's. Perform a 50 klbs (or as agreed with Diamond) overpull test to verify latch after visual ROV confirmation of locked position. Check Bullseye angle and record in IADC and DDR.
47. Unbutton slip joint and stroke up to rig floor. Lay down landing joint.
48. Install diverter.
49. Establish Hard Line to rotary table. Ensure it is of a length greater than required even when at high tide.
50. Function test all BOP elements on both pods. Conduct full BOP test as outlined in test schedule on 'Casing' table. Test BOP/wellhead connection to the same low/high values as the rams – measure volumes pumped carefully against pressure recorded.

216mm (8 1/2") Hole Section.

51. Make up 216mm (8 1/2") BHA as per the BHA programme.
52. RIH and drill out cement plus 3 meters of new hole. Change over to IdcapD system whilst drilling out the last of the shoetrack (as long as cement is not green) and before entering new formation, as per mud engineer's instructions. The mud will be pretreated with bicarb, and citric will be available if required, to handle the effects of the cement contamination.
53. Perform formation integrity test (FIT) to 1.80 SG EMW. An FIT of 1.80 SG EMW gives a kick tolerance of 57bbls (9m3) at the highest estimated pore pressure (which is known from pressures taken via wireline in Sunfish-2).

54. Drill ahead to TD.

    - There are three target zones; F. longus, T. lilliei, and N. senectus. Based on RFT data from Sunfish-2 all sands are expected to be of the same pressure regime and are on the same pressure gradient. The sands are of the same geological age, and are all part of the Late Cretaceous grouping.

      Note: nevetherless the well design, as a contingency, has the ability for 244mm (9-5/8") casing to be run if desired due to well problems or unexpected geological character. In this case the well would need to hole opened to 311mm (12-1/4").

    - A fault has been identified on seismic at 1657m. This may result in lost circulation, although it is not flagged as a 'major' fault. In addition the wellbore is prognosed to intercept the fault near the tip (end), which should minimise losses, if any.

    - Chert and dolomite were encountered in Sunfish-2 from 2540m. Grayling-1 is around 7km from Sunfish, so it is not possible to predict whether this will again be observed in this well. This hole section may require several runs to drill. Ensure a selection of TCI and heavy set PDC bits are on board.

    - If coring is required, the well will be sidetracked. Motor should be available for this eventuality. Consider running an Andergauge 'Agitator' in a sidetrack.

    - Be aware of any increasing hole inclination. Longtom-1 had less than 2degrees inclination to 1000m, but had built to 7.5degrees by TD of 2242m (measured by Totco).

    - Take inclination surveys at least every 100m using MWD to monitor drift.

    - Actual section TD will be determined by Exploration department, and is usually 50-75m below the lowest hydrocarbon found.

    - In the event of indications of hydrocarbons, the TD may be deepened as required to ensure an adequate sump for liner (35m), and leave a sump to drop perforating guns in the event that the well is tested. Sump required will depend on test intervals and length of perforated interval, which will not be known till the section is drilled.

    - All three target horizons are a circle of 50m radius.

55. Circulate hole clean and POH using average stand length method to check depth.

    - At the request of the well-site geologist in the event of indications of hydrocarbons, a "repeat section" may be conducted with the FEWD tool during any trip out occurring after the reservoir section has been drilled. This will take the form of POOH until the FEWD tools are 3m above the top zone specified by the geologists, and tripping in (no rotation or circulation required) at 100m/hr until the highest FEWD tool is 3m below the lowest zone specified. If there are multiple zones, then the drill string should be tripped normally between the zones, restarting 3m above the next zone. Do not round to the nearest stands as this will add to the time taken for the log.

    - If there is any chance a liner will be run, drop a hollow drift down drillpipe of 63mm (2.5") prior to POH (or drop once POH to point where pipe that will be used for liner run is still in hole).

56. Make a wiper trip if hole conditions dictate, otherwise continue to POOH and rig up for electric wireline logging.

57. Run electric logs as per programme. Only a vertical incidence seismic log is planned in the 'dry hole' case. Pressure logging (RCI), percussion or rotary sidewall cores (SWC or RCOR), and image log (CBIL/STAR) are all possible in a discovery case.

58. Rig down logging tools.

Options once at TD;

Sidetrack and Core, Test Well or Plug and Abandon

In the event of a significant hydrocarbon discovery, the well may be sidetracked to cut and recover conventional core. In this case the hydrocarbon zone will be cemented off and likely a kickoff plug will be set. A well test may also be performed.

Separate **Sidetrack and Core, Well Test or Plug and Abandonment** programmes will be provided as required. If the well is to be tested, 7" casing will be run back to the wellhead. The well will then be plugged and abandoned after the well test. If no test is to be conducted, abandonment procedures will commence immediately after logging.

178mm (7") Casing, Cement, Cleanout (Only run if well is to be tested)

Consider a wiper trip if an extensive RCI programme has been carried out. From previous experience there can be a significant amount of gas introduced to the wellbore by the RCI sampling.

59. R/U to run 178mm (7") casing. Summary of string;
    - Shoe
    - 3 joints
    - Float and Landing Collar
    - Joints
    - 2 x pup joints above reservoir as a marker for perforating calibration (NO RA pip tag)
    - Joints
    - Wellhead Hanger (244mm with 178mm adaptor)
    - Landing String
60. Run 178mm (7") casing. Note:
    - Run 2 centralisers per joint to 50mTVD above top reservoir, and 1 per joint to 100mMD thereafter.
    - Ensure casing circulating head is installed on the top drive when running casing in open hole.
    - Prior to entering open hole with casing, record up/down weights, torque, flow rates and pressures.
61. M/U Wellhead hanger and running tool as per service engineers instructions.
62. *Note:* Weatherford subsea plug release system is required for 178mm (7") casing (Schlumberger system is unable to support this plug size).
63. Circulate clean and condition mud to optimum cementing properties (at least one annular volume) once at TD, whilst rotating and reciprocating casing if possible.
64. M/U plug dropping head. AEL supervisor to confirm plug type and size.
65. Pump preflushes and cement as per cementing programme.

- Monitor for returns during cement job.
- Release pump down dart and displace cement with mud. This mud should be well conditioned, since if a scraper run is not performed this is the mud that will be in the liner when the well is perforated.
- Upon bumping the plug on the landing collar, pressure test the casing to 27.6MPa (4000psi) for 15mins. Bleed off and check for backflow. If the plug does not bump, do not displace more than half the shoetrack volume.

66. Unlatch, POH & lay out running tool.
67. M/U and RIH casing pack off assembly.
    - Test casing pack off assembly.
    - POH.
68. This scraper / cleanout run may or may not be performed, depending whether a retrievable or permanent testing packer is run.

    P/U 178mm (7") cleanout assembly & RIH. It is planned to use the test string on this cleanout run to avoid picking up a long string of 3-1/2" pipe. Drift 4-1/2" pipe. To minimise potential thread connection damage it is important the 4-1/2" connections are correctly torqued, and the stands are wrapped in the middle to avoid excessive bowing.

    (Sufficient 3-1/2" drillpipe will need to be on hand for the event the cementing plug did not bump and cased hole drilling is required. In this case the drill out would be performed with the drillpipe and not the test string).

    - 152mm (6") Bit
    - HWDP
    - XO
    - 114mm (4-1/2") PH6 tubing
    - XO
    - 178mm (7") Scraper
    - XO
    - 114mm (4-1/2") PH6 tubing
69. Tag landing collar.
    - With bit just above landing collar, circulate 1.5x casing annular volume if felt to be necessary. More circulating may be required if there has been any plug or cement drilling.
    - Scrape testing packer setting depth whilst circulating (see detailed testing programme DR-70-LR-002).
70. POH.
71. Test well as per detailed testing programme DR-70-LR-002.

Plugging and Abandonment.

72. A more detailed Plug and Abandonment Programme will be issued after log evaluation and approval from DPI. Similarly, if testing is required, a detailed programme will be issued.
73. In the untested well case;

- The well will be abandoned by placing cement plugs in open hole across any fresh water or hydrocarbon bearing formations. Open hole plugs will be tagged with at least 7.5MT (127mm DP) or 4.5 MT (89mm DP) to ensure integrity.
- A cement plug will be set across the 340mm (13 3/8") casing shoe and tagged as above. If a significant gas column is present in the open hole, or background gas levels do not drop below a reasonable level, a cement retainer may be set at the shoe. Cement will then be squeezed below, and spotted on top of the retainer, to ensure no gas migration occurs during the plugging of the well.
- Other plugs and casing cutting will be performed as per the P&A programme.

74. In the tested case;
    - Cement plug will be placed across perforations (this assumes a retrievable packer is used). If a permanent packer is used cement will be squeezed below it and a cement plug on top.
    - Other plugs and casing cutting will be performed as per the P&A programme.
75. Pull anchors. See detailed rig moving and anchoring procedure for further detail on this infield tow.
    - Notify Esso of intent to move, planned route, timing and location as per Step 2 of this Drilling Programme.

Prior to Departure.

76. Perform a recorded ROV seabed survey to confirm casing is cut below seabed (in the case where the well is abandoned) and that seabed is clear of debris. The videotape is to be forwarded, via the SDE, to the Apache Perth Library for archiving.
77. Grayling-1 ends when the last anchor is bolstered. This time should be recorded in the IADC and DDR reports. Statements of Fact should also be taken at this time.

With reference to the Bridging Document Ocean Patriot for operations involving Ocean Patriot on this well, the following information applies. References refer to the appropriate section of the Bridging Document.

Ref 2.2.3 MARINE SUPPORT SERVICES

a) AHTS vessel details are as follows:

Name	Type	Contractor	BHP	Continuous Bollard Pull (tonne)
Far Grip	AHTS	Farstad	14,400	137 (150max)
Pacific Wrangler	AHTS	Swire Pacific	10,800	134 (152max)

b) The Shore Base will be Port Melbourne, ~270 NM from rig.
c) One way transit time to the Site will be:

Vessel	Economy	Full Steam
Far Grip	**24** hrs	**19** hrs
Pacific Wrangler	**27** hrs	**20** hrs

Ref 2.2.4 a) Helicopter details are as follows:

	Type	Capacity to rig (worst case)	Capacity from rig (worst case)
Primary	Super Puma AS332L	18	18
Back-Up	S76A Sirkorsky	10	10

b) The Helicopter Base will be Essendon airstrip, 162nm from the rig.
c) One way transit time to the Site will be:

Aircraft	Transit Time (Essendon)	Transit Time (West Sale)
Super Puma AS332L	80 mins	33 mins
S76A Sirkorsky	72 mins	30 mins

POTENTIAL HAZARDS

The following is based on Apaches previous experience and reviews of offset wells.

Potential Hazard	Potential result	Method to minimise risk
No site survey conducted	Anchor slippage. Anchor or spud on seabed obstacle – lose anchor.	No anchor slippage problems were observed on Longtom-1 or other offset wells. From inspection of admiralty charts, there are no pipelines in the immediate vicinity of the proposed surface location, the closest being over 5km distant. A search has been conducted of the "Department of the Environment and Heritage" National Shipwreck database, and no wrecks are known to exist within 10nm of the proposed location. Although there is no guarantee this database is complete, it is the most up to date available and represents a recent compilation of several databases.
Shipping Traffic	Collision	Esso will be kept informed of rig and supply vessel movements as outlined in step 2 of this programme. No common or designated shipping lanes near to drilling location. Tow plan will be submitted to AMSA and notice to mariners will be issued. The well is within the designated "area to be avoided" as shown on admiralty charts, therefore traffic will be low. Local trawling industry has been contacted and consulted with regard to the rig location and activity.
Proposed surface location is within "area to be avoided" as shown on admiralty charts	Collision with infrastructure	Infrastructure well marked on Admiralty charts. Advise Esso of intention to move rig on to and off location - as per procedure in Step 2 of this programme. Detailed tow plan will be developed, which will be reviewed by AEL and third party marine warranty surveyor.
High currents causing difficulty in running conductor & PGB & Landing BOP	Potential for delays, equipment damage or re-spud.	10yr return current model shows surface current up to 1.7 knots at this location, which is not high. A drill ahead TGB with guidewires will be run. BHA angle can be checked via anderdrift prior to spud if necessary (or backup totco).
Wellhead set at > 1° angle	Damage to Wellhead, BOPs, or Riser	Consider re-spud. Ensure wear bushings are run in WH and Flex joint. Monitor metal particles in mud returns. Anderdrift survey tool will be run. Take survey after first 12m drilled, and consider reaming hole if survey >1degree, before drilling on. Stabilisers have been included in the BHA behind the hole opener to minimise ledges.
Shallow gas during drilling below conductor.	Gas to surface, loss of rig due to fire, gas breakout under moonpool, rig pontoons.	Analysis of seismic data and nearby offset wells, indicate no closure in shallow formations that would indicate shallow gas. Seismic data. Used to check for closure. Review in the hole section shows no obvious closure and any closure smaller than the resolution of the seismic is considered unlikely. Review Offset wells. Drilling on offset wells did not given any indication of shallow gas. Longtom-1 is only 500m separated from this well.

POTENTIAL HAZARDS

Sticky more argillaceous limestone (calcisiltite compenent) for deeper 'third' of 406mm hole section being drilled with seawater (and sweeps).	Difficult trip out of hole. Unable to run casing.	Drill as quickly as possible and avoid intermediate logging run. Pump adequate volume of sweeps whilst drilling section to ensure hole is clean. Circulate thoroughly clean at TD with sweep. Consider displacing well to KCl/PHPA from TD to above section with higher claystone content.
Bit balling straight out of casing shoe on Longtom-1	POH to change/clear bit -time.	Displace from seawater to full mud system (Idcap D) whilst drilling the last of the shoetrack, but before drilling out the shoe. Run PDC bit with fewer blades and larger JSA. Optimise hydraulics and nozzle selection.
H_2S	Poisonous gas at higher concentrations	H_2S Sensors will be checked prior to drilling. Drilling contractor and mudlogging company will provide sensors (redundancy). H_2S levels will be recorded on the daily mud report. Maximum concentration before operations cease is 10 ppm in air or 20 ppm in well test stream.
Pipe Stuck	Delay time to mobilise wireline crew for running backoff if it is needed	As soon as string stuck, commence arrangements to get wireline crew to rig as soon as possible. Ensure W/L tools on board – they are part of the package.

Offset Wells	Distance from this well	Comments
Sunfish-1	8km N/W	Drilled by Esso 1974. Glomar Conception. 30 days. RT to seabed 69m Drilled 26" hole to 207m Ran and cemented 20" casing at 190m Drilled 16-1/2" hole to 847m Conducted wireline logs Ran and cemented 13-3/8" casing at 830m – cement returns to sea floor. Drilled 9-7/8" hole to 2243m Cut Core #1. Cut and recovered 8m Cut Core #2. Cut and recovered 9m Drilled 9-7/8" hole to 2307m Ran wireline logs Drilled 9-7/8" hole to 2477m Cut Core #3. Cut and recovered 9m Drilled to 2492m Ran wireline logs Plugged well – 8 plugs
Sunfish-2	7.5km N/W	Drilled by Esso 1983. Southern Cross, 23days RT – seabed 80m Drilled 26" hole to 218m with seawater. Displace to hivis. Wiper trip – bridge at 206m Attempted to run 20" casing - WOW due to 4degree roll, 4.5degree pitch – casing held up at 84m. POH. Wiper trip and hivis Ran and cemented 20" at 201m Ran BOPs on riser Drilled 17-1/2" hole to 809m with seawater and hivis sweeps Conducted one wireline run Ran 13-3/8" to 794m Conducted FIT to 2.06SG

		Drilled with a J1 (IADC 117) bit to 1435m whilst raising mud weight to 1.12SG and continued drilling to 1611m. ROP dropping from 1608m and sand in samples – bit considered unsuitable so pulled. 32m/h, condition 3-4-1/8 (teeth-bearing-gauge). Drilled with J22 (IADC 517) to 2000m at 17m/h. Pulled due to ROP, condition 3-4-I. Tight hole to 1600m on trip out. Drilled with J22 to 2335m at 10m/h (23 stand wiper trip at 2259m – hole tight). Pulled on ROP – some tight hole, condition 8-6-1/8". RIH new bit and junk basket – washed and worked basket. Drilled with J33 (IADC 537) to 2504m at 6m/h. Volcanics (2308m to 2350m) drilled at 2-9m/h. Pulled on ROP, condition 4-6-1/8". Drilled 9m in last 5hours. Pulled wear bushing, tested BOPs and re ran wearbushing. Backed out of string whilst setting bushing – fished and set bushing. Drilled with J22 to 2578m at 3m/h. Chert and dolomite from trace to 10%, 2540m to 2640m. Pulled on ROP, condition 8-4-I. Drilled with J44 (IADC 617) to 2647m at 9m/h. 8 stand wiper trip. POH. Conducted wireline logging Plugged well, cut casing and moved off location
Longtom-1	0.5 kms	A package of Longtom-1/ST1 EOW data will be on the rig on CD. Drilled by BHP in 1995 with Ocean Bounty RT – seabed 81m (56m water depth) Drilled 26/28" (bit & H/O) hole to 117mRT. Circulated and wiped Ran 30" housing, 20/24" conductor and 18-3/4" wellhead Cemented via inner string with 1.91SG Ran BOP and riser & tested Drilled 17.5" hole to 1025m at 15m/hr. Tricone pulled 0,0,NO,TD ROP 50m/h to 500m, <20m/hr from there to 1025m Drilled with seawater and hivis sweeps - full returns Only 2 pumps from 743m – reduced from 1250 to 1000gpm (18h) 100bl sweep on bottom – large amount of cuttings/cavings. 2nd 100bl sweep. 250bbl 1.06SG KCL/PHPA POH Hole not taking fluid. 50klbs OP at 928m – worked pipe POH. 100klbs OP at 550m. Worked pipe. Taking down weight at 526m. Washed and reamed. POH minimal drag. Circulated 2x riser volumes. POH – bit and roller reamers packed with sticky clay Rigged up for wireline – unable to pass 753m Wiper trip – took weight at 415m, washed and reamed. Also at 770m, 818m, 985m to bottom (apparently fill – no torque). Circulated 5hrs – cuttings and cavings. POH – no drag Ran 13-3/8" casing to 1012m – hole good. Cemented with 1.91SG slurry – full returns during job. Tested BOPs Displaced from seawater to KCL/PHA whilst drilling rathole. LOT at 1028m – 1.75SG EMW. Drilled 12.25" hole to 1034m – bit balled, attempt to clear. Hycalog DS34HG (7 bladed). No motor run. POH. New bit (4 bladed) and moved roller reamer. Drilled 12.25" hole to 1448m (18mhr) – hard pyrite (from 1438m) stopped progress. Hycalog DS40HSF 3,2,WT,PR. Rung out and eroded. POH and included more collars to increase WOB - didn't help ROP. Drilled 12.25" hole to 1915m (11m/h). Tricone pulled 1,1,WT,PR.

		POH Drilled 12.25" hole to 2242m (11.5m/h) Hycalog DS34HG 2,2,WT,PR. (7bladed) Eroded body – call TD. 7.5 degrees on Totco. Wireline logging – 6 runs P&A reservoir and set sidetrack plug Mud in very poor condition throughout this section and sidetrack. Poor 6rpm. High LGS. Poor Fluid Loss. Poor Gels. Resulted in hole problems.
Longtom-1 ST1		Drilled 12.25" hole with motor assembly; sliding (4m/h), rotating (28m/h) to 1275m. Hughes ATM-G3 0,1,RG,BHA. BHA weight stacking in slide mode. POH. Laid out stabiliser. Drilled 12.25" hole sliding and rotating to 1553m. Reed MHP13G 4,7,RG,TQ (100m past pyrite stringer of Longtom-1) TQ had been steadily increasing. POH 70klbs overpull. Laid out motor. Picked up rotary hold assembly. Drilled 12.25" hole to 1639m. Hughes ATM22GD - 0,0,NO,BHA. POH. Drilled 12.25" hole to 1655m. Hycalog DS34H - 0,0,NO,PR (7 bladed). Suspected balling. POH. Changed BHA – same PDC bit. Drilled 12.25" hole to 2445m. Hycalog DS34H - 0,0,NO,TD. PO - difficult trip. 2 x Wiper trip Tool push LWD – difficult hole P&A and moved off

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		BIT INFORMATION					BHA DETAILS	
Depth	Hole Size	Type	WOB (MT)	RPM	Nozzles	LPM (gpm)	BHA	Comments
115mTV 115mMD	914mm (36")	26" Bit 36" Hole Opener	5-15	50-120	Bit 4 x 22 HO 4 x	4500 (1200)	26" Bit 36" Hole Opener 15-3/4" Near bit Stab Anderdrift Float & Totco ring 1 x 9 1/2" DC 12" String Stab 1 x 9 1/2" DC X/O 3 x 8" DC X/O HWDP	Retaining the 12" String Stab in the assembly will allow same 9-1/2" collar stand to be run that was used on Longtom-2.
810mTV 810mMD	406mm (16")	4 blade PDC TBA	5-20 MT	100 DP 125 PDM	4 x 14 Gives HSI 5.5	3800 (1000)	PDC Bit 9-5/8" PDM (15" sleeve) Bottleneck XO 14-3/4" Stab Directional Gamma Ray Resistivity Sonic 6 x 8" DC Jars 2 x 8" DC X/O 15 HWDP	Equivalent hole section was drilled in 17-1/2" hole in Longtom-1. Longtom-1 drilled this section at 15m/h with tricone bit. ROP was 50m/h down to 500m, but less than 20m/h from there to section TD.
2,944mTV 2,944mMD	216mm (8 1/2")	5 Blade PDC TBA	5-25 MT	100 DP 100-130 PDM	5x12 Gives HSI 5.5	2082 (550)	PDC Bit 6-3/4" PDM (8-1/4" sleeve) 8-1/4" Stab Directional Gamma/Res Porosity Density Sonic 8-1/4" Stab 9 x 6-1/2" DCs Jars 2 x 6-1/2" DCs HWDP	Equivalent hole section was drilled in 12-1/4" hole in Sunfish-2. Average ROP for section 10m/h, over 6 bit runs. Encountered dolomite and chert at 2578m (dolomite as shallow as 2540m). Ensure several TCI and heavy set PDC bits are on board as backup. Consider excluding the motor from the BHA on subsequent runs if drilling proves to be hard.

Bit Information

914mm (36") x 660mm (26") Hole
This is being drilled to be able to run a 762mm (30") x 508mm (20") tapered conductor string for stability and wellhead support for the 762mm (30") Wellhead housing.

406mm (16") Hole
This section is limestone and should be fast drilling. The composition changes at around 500m and becomes slower to drill.

216mm (8 1/2") Hole
Required 6 bit runs on Sunfish-2.
May encounter chert and dolomite in deeper sections.

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Mud Programme

Surface Hole

Hole Size	Mud Type	Interval (m)	Mud wt (SG)	PV (cp)	YP (Pa)	6 rpm	10 m gel (Pa)	LGS (%)	Fluid Loss (cc)				
914mm & 660mm	Seawater /PHG	82-115	1.04			>40	>40						

Intermediate Hole

Hole Size	Mud Type	Interval (m)	Mud wt (SG)	PV (cp)	YP (Pa)	6 rpm	10 m gel (Pa)	LGS (%)	Fluid Loss (cc)				
406mm (16")	Seawater /PHG	115-810	1.04	.	.	>40	>40	.	.				

Production Hole

Hole Size	Mud Type	Interval (m)	Mud wt (SG)	PV (cp)	YP (Pa)	6 rpm	10 m gel (Pa)	LGS (%)	Fluid Loss (cc)	pH	KCl (%)	. (.)	. (.)
216mm (8-1/2")	Idcap D	810-2,944	1.15-1.20	21-23	25-30	8-10	non progressive <25	<5	<6	8.5-9.5	5	.	.

Details for Hole Sections and Guidelines

SOLIDS CONTROL AND MUD EQUIPMENT
The solids control system on the Ocean Patriot consists of the following:
-4 Thule VSM-100 linear motion shakers
-1 x rig degasser
-1 x rig desander
-1 x rig desilter
-1 x Mud Gas Separator (poor boy)
-1 x Third Party Centrifuge

914mm Hole
Drill with seawater and viscous sweeps as required for hole cleaning.

311mm Hole
Drill with seawater and viscous sweeps of 40-50bbl per 15m.
Sweep hole clean at TD with 100-150bbl hivis sweep.
Consider displacing hole back to 350m with 1.15SG 5% KCl mud.

216mm Hole
Drill with Idcap D.
Maintain LGS to 5% by the efficient use of solids control equipment. Maintain API fluid loss below 6ml.
Maintain MBT to less than 12ppb.

HOLE CLEANING:
To ensure proper hole cleaning the following philosophies should be followed throughout the drilling process:
1) Maintain flowrates as high as practical. Maximum flowrates should be dictated by wellbore hydraulics and/or equipment limitations.
2) Carefully monitor cuttings flow and character over the shakers to ensure that hole integrity and cuttings flow are as anticipated.
3) Circulate prior to POOH and ensure cuttings flow over shakers has dropped off to background level before commencing the trip.

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Casing Program

Hole Size	Casing Size	Setting Depth	Description	Weight/Grade Connections	Strength Burst (Mpa)	Strength Coll. (MPa)	Strength Tens. (MT)	Safety Factor Burst	Safety Factor Collapse	Safety Factor Tension
914mm	762mm	115mMD	30" Cameron Wellhead Housing 1 jt 30" x 1.5" WT casing & Lynx SA2 connector 1 int jt 30" x 1" WT casing & Lynx SA2 connector 30" x 20" 1" WT tapered conductor jt w/ 20" shoe	30" 680 kg/m (456 lb/ft) X52 30" 462 kg/m (310 lb/ft) X52 20" 301 kg/m (202 lb/ft) X56 Lynx SA2 connections						
406mm	340mm	800mMD	18-3/4" Cameron wellhead 1 jt 20" x 1" WT casing tapered to 13-3/8" Intermediate 13-3/8" joints Float collar 1 joint Float shoe	20" 301 kg/m (202ppf) X56 13-3/8" kg/m (ppf) L80 BTC	33.80	15.60	705.00	1.20	2.94	2.35
216mm	178mm	2,944mM	Running string Wellhead hanger Joints 2 x pup joints Joints Landing Collar Float Collar 3 joints Float Shoe	7" 43 kg/m (29ppf) L80 New Vam	33.80	48.40	306.00	1.94	1.86	1.72

Casing Design Criteria, Pressure Testing and Shoe Track Requirements

CASING DESIGN CRITERIA
762mm (30") Conductor
Structural conductor scheme based on offset wells.

340mm (13 3/8") Casing
Strength properties listed in table above represent the weak point value in either the 340mm or 508mm casing (depending on case), as this is a tapered string. The listed strength property value relates directly to the safety factor shown.
Kick Tolerence: 9m3 (57 bbl) at TD of hole section, based on FIT 1.8SG (Sunfish-1 FIT to 1.62SG at 830m, and Sunfish-2 FIT to 2.06SG at 794m), MW 1.2 SG, Pfm 1.04 SG.
Collapse: analysed cementing case and losses case
Burst: safety factor quoted above is SF under a "tubing leak when producing/testing" analysis. Maximum expected wellhead pressure for the well full of gas from TD (and 1.04SG reservoir pressure) is 24.4MPa (3539psi). The 20" casing burst value was used in these calculations, being lower than the 13-3/8".
Tension: worst case was on plug bump prior to cement setting and taking weight. Check was run on both the 20" and 13-3/8" sections due to different areas of application of that bump force (27.6MPa, 4000psi). The very top of the 13-3/8" has the lowest SF in tension and represents the SF shown above. SF in the 20" was 2.79.

178mm (7") casing (only run in tested case)
Critical case for collapse was plugged perforations.

PRESSURE TESTING CASING
340mm Surface Casing will be pressure tested to 27.6MPa (4000 psi).

SHOE TRACK REQUIREMENTS
762 mm (30") x 508mm (20") Casing will have a standard 508mm (20") shoe with stinger run to just above the shoe.

340mm (13 3/8") Casing will have a 1 joint shoetrack (1 joint between float collar and float shoe).

178mm casing (if run for testing) will have a 3 joint shoe track.

BOP TEST SCHEDULE : Timing as per Rig Safety Case and PSLA

Diverter - 508mm(20")	476mm(18.75") 103MPa(15k psi)	MPa		MPa
~	Rams	1.4/27.6 (200/4000)	Choke & Kill Line & Manifold	1.4/27.6 (200/4000)
	Annular	1.4/20.7 (200/3000)	Surface drilling equipment	1.4/27.6 (200/4000)

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Cementing Programme

Hole & Casing Size	Type	Desc.	Recipe	Cement tops & Bottoms	Weight (SG)	Yield (ft3/sk)	XS cmt	Thick Time (hrs)	Job Time (hrs)	BHST degC
914mm 762mm 115mMD	G	Tail	Class G cement Seawater 0.01 gal/sk D047 antifoam 1-2% BWOC CaCl2 Accelerator	TOC Returns to seabed 82.00m BOC 114.50m	1.90	1.19	300% over Gauge	2h	1h	12.0
406mm 340mm 800mMD	G	Lead	Provisional Class G cement Seawater 0.01 gal/sk D047 Antifoam 0.42 gal/sk D075 Extender	TOC . 400.00m BOC 100m above shoe 700.00m	1.5	2.23	10% over Gauge	3h 30m	1h 40m	40.0
406mm 340mm 800mMD	G	Tail	Provisional Class G cement Seawater 0.03 gal/sk D175 Antifoam 0.08 gal/sk D145 Dispersant 0.30 gal/sk D193 FLAC	TOC 100m above shoe 700.00m BOC Casing shoe 800.00m	1.9	1.16	30% over Gauge	2.5h	1h 15m	40.0
216mm 178mm 2,944mMD	G	Lead	Drill Water 2.5% BWOC D020 Bentonite 0.01 gal/sk D047 Antifoam 0.05 gal/sk D110 Retarder	TOC . 1,450.00 m BOC 50m above top HC Sand 2,744.00 m	1.5	2.12	10% over gauge	5h	1h	130.0
216mm 178mm 2,944mMD	G	Tail	Drillwater 0.08 gal/sk D080 Dispersant 0.05 gal/sk D175 Defoamer 1.70 gal/sk D600G Gasblok	TOC . 2,744.00 m BOC 2,944.00 m	1.9	1.17	10% over gauge	2.5h	1.25h	130.0

Details for Cement Jobs

TEMPERATURE
Temperatures are based on field data from Sunfish-2 and Longtom-2 and correspond to a gradient of 4.2 deg C/100m from seabed, w/ 10 deg C at sea bed.
Temperature at TD (2944m) is estimated to be 130 deg C.

PLUG AND ABANDON PROGRAM
Plug recipes will be provided for all plugbacks prior to job.

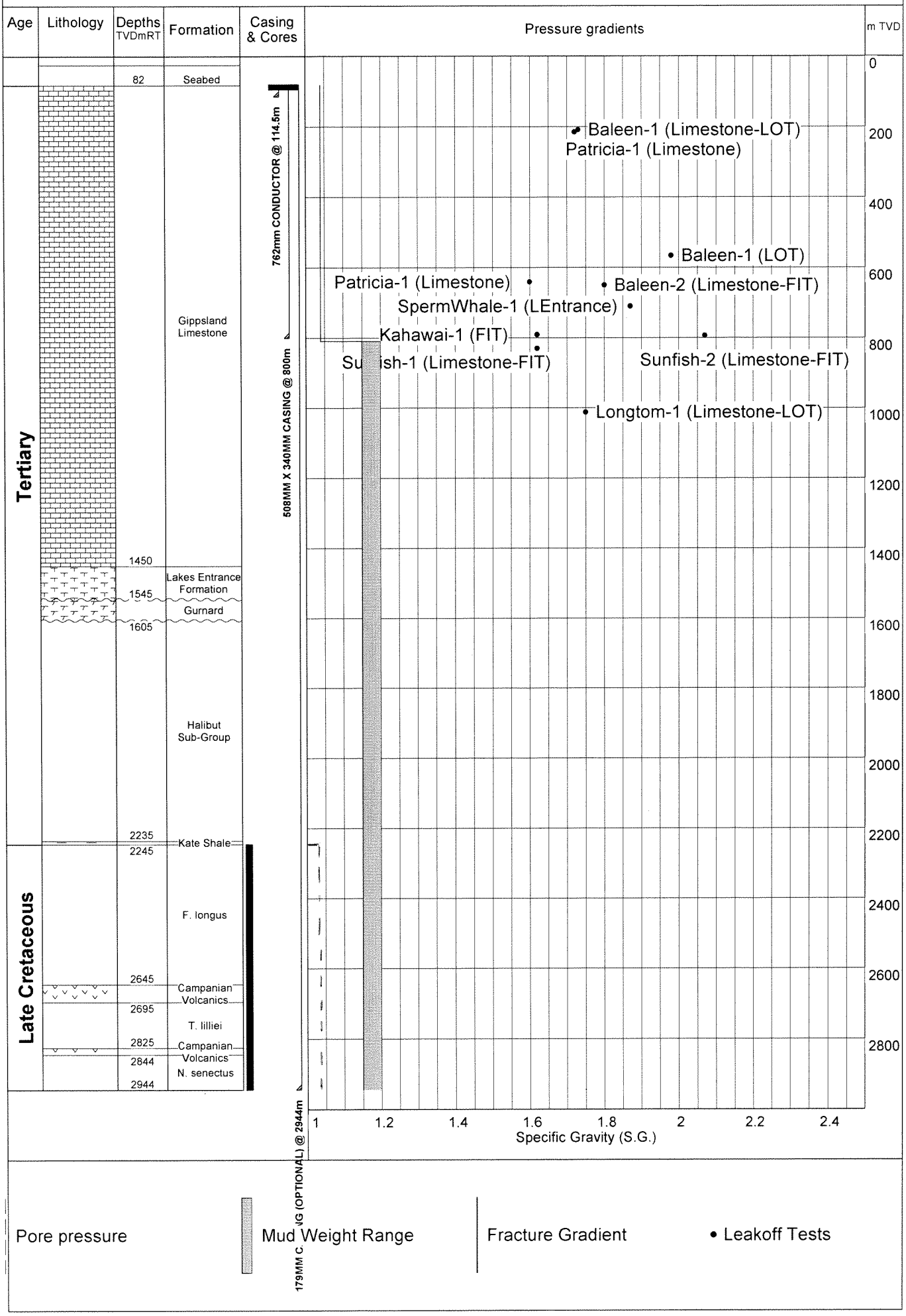
APACHE ENERGY LTD Document No DR-70-LD-002	Grayling-1	Vic P 54

Centraliser Programme

Hole Size	Casing Size	Type	Interval	Location	No.	Comment
406mm	340mm	Double Bow	800 - 770m	Stop Collars	6	2 per joint first 3 joints
		Double Bow	770 - 700m	Stop Collars	7	1 per joint across remainder of tail
				Total	**13**	
216mm	178mm	.	2,944 - 2,245m	stop collars	30	1 per second joint
				Total	**30**	

APACHE ENERGY LTD Document No DR-70-LD-002	Grayling-1	Vic P 54

Pressure Summary in True Vertical Depth



SERVICE COMPANIES

BITS	VARIOUS
CASING & CEMENTING ACCESSORIES	WEATHERFORD / DOWELL SCHLUMBERGER
CASING CUTTING	SMITH SERVICES
CASING RUNNING	WEATHERFORD
CEMENTING	DOWELL SCHLUMBERGER
COMMUNICATIONS	RIGNET
CORE ANALYSIS	TBA
CORING	SDBS
DIRECTIONAL DRILLING CONTRACTOR	HALLIBURTON – Sperry Sun
DIVING/ROV	FUGRO
DOWNHOLE TOOLS	VARIOUS
DRILLING CONTRACTOR	DIAMOND
DRILLING FLUID	MI
ELECTRIC LOGGING	ATLAS
FIXED WING AIRCRAFT	TBA
FUEL	SHELL
HELICOPTERS	BRISTOWS
JARS	SMITH SERVICES
MUD LOGGING	SPERRY SUN
MWD / FEWD	HALLIBURTON – Sperry Sun
OIL SPILL RESPONSE EQUIPMENT	AMOSC / AMOSPlan (Mutual Aid)
RIG POSITIONING	THALES
RIG POSITIONING – QUALITY CONTROL	APACHE DRILLING SUPERVISOR
ROAD TRANSPORT	OGT / TOLL
SAFETY CALLS	RIGNET 'DEADARM' (PART OF COMMS PACKAGE)
SHORE BASE OPERATOR	OPC, MELBOURNE – WHARF 27
SITE SURVEY	NA
SOLIDS CONTROL	DFE
STANDBY BOAT	N/A
TESTING (DOWNHOLE)	HALLIBURTON/EXPRO
TESTING (SURFACE)	EXPRO
VELOCITY SURVEY	CGG (atlas)
WEATHER FORECASTING	BUREAU OF METEOROLOGY
WELLHEAD	CAMERON
WORKBOATS	SWIRE PACIFIC / FARSTAD

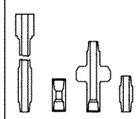
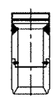
ATTACHMENTS

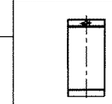
Cameron Wellhead and Conductor Schematics;

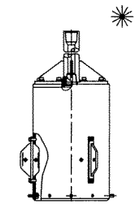
- LO-051736-01 Sheet 1, Revision 06
- LO-051736-01 Sheet 2, Revision 06

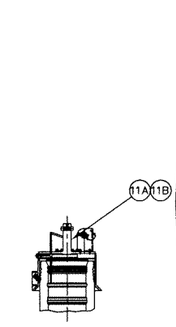
RUNNING TOOLS

✳ NOT REQUIRED FOR THIS CAMPAIGN.

 SEAL ASSY RETRIEVAL TOOL (SART) P/No.225310-01	 CHSART, 18-3/4" 4-1/2" RUNNING THD P/No. 2019025-01	 WEAR BUSHING, 18-3/4" x 13-3/8" P/No. 2209400-01	 WEAR BUSHING, 18-3/4" x 9-5/8" P/No. 262373-01
 JETTING TOOL P/No. 254658-01 OR 262466-01	 RUNNING TOOL, EMERGENCY DRILL PIPE, P/No. 612548-04	 RUNNING TOOL,'J' SLOT, F/ WELLHEAD CAP P/No. 667811-01-01	 EMERGENCY DRILL PIPE HANG-OFF TOOL P/No. T.B.A.
 BOLL WEEVIL TEST TOOL P/No. 262351-03 OR P/No. 262351-01	 30" CONDUCTOR RUNNING TOOL P/No. 224706-01	 18-3/4" STC-10 MILL & FLUSH TOOL P/No. 263113-01	 18-3/4"WEIGHT SET TEST TOOL P/No. 262485-01
 WEAR BUSHING 18-3/4" x 13-3/8" P/No. 2070896-01	 18-3/4" HOUSING, RUN/TEST TOOL P/No. 262912-06	 18-3/4" HOUSING, RUN/TEST TOOL P/No. 262395-05	 WEAR BUSHING, RUN/RETRIEVAL TOOL P/No. 262287-01

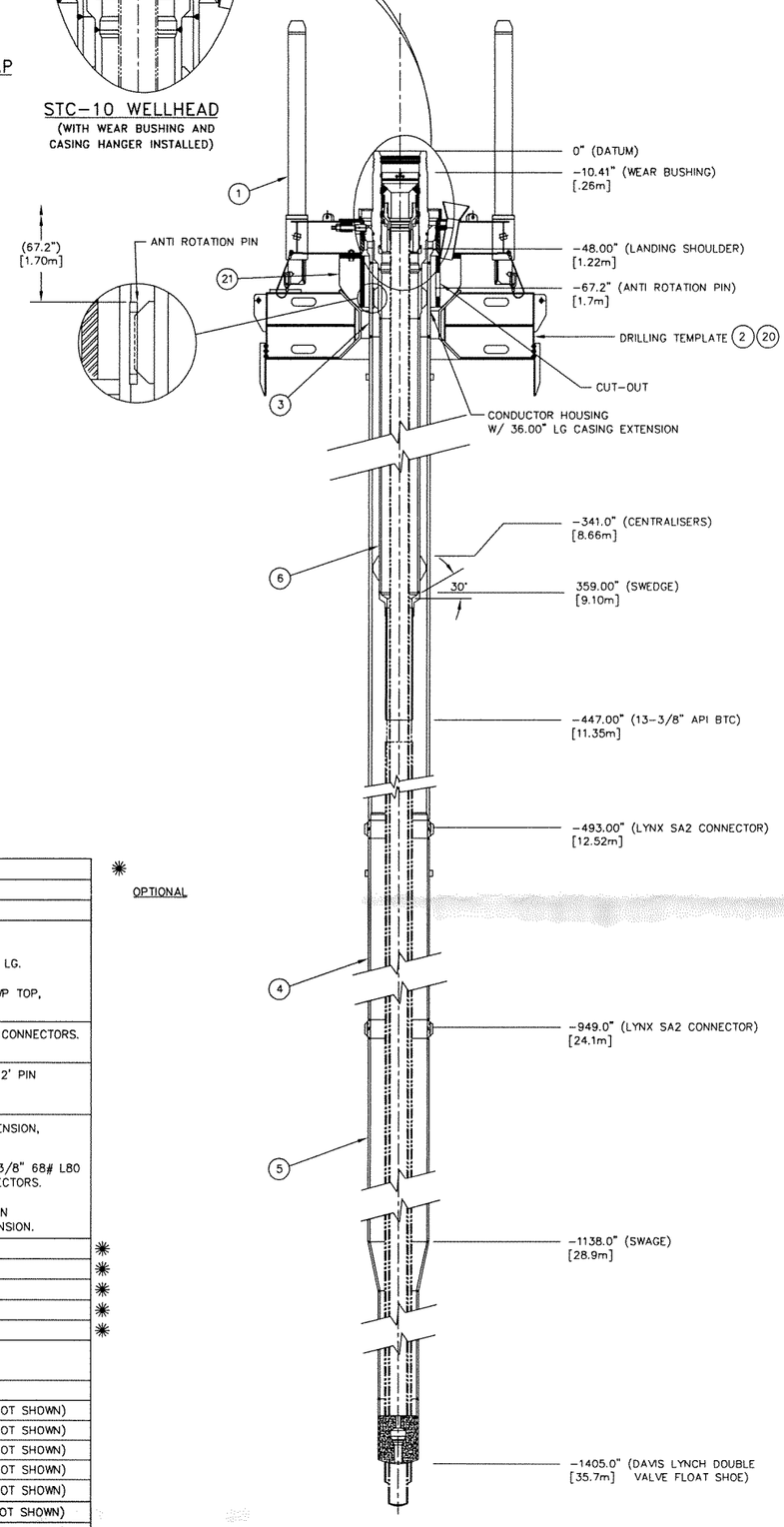

WEAR BUSHING, 18-3/4" STC-10 P/No. 262271-01

✳

RRGB RUNNING/ RETRIEVAL TOOL P/No. 262903-01



WELLHEAD CAP

STC-10 WELLHEAD
(WITH WEAR BUSHING AND CASING HANGER INSTALLED)



EQUIPMENT

✳ OPTIONAL

ITEM	PART NUMBER	LOWER LEVEL	DESCRIPTION	
1	2209772-01		ASSEMBLY, PERMANENT GUIDE BASE, W/ ROTATING POST TOPS.	
2	2071205-01		ASSEMBLY/WELDMENT, TOOL-LESS DRILLING TEMPLATE. W/ 'BEAR TRAP'	
3	2209795-01		WELDMENT , 30" CONDUCTOR HSG 'STC-10' W/ 30" x 1.50" WALL X-52 CASING. W/ 'LYNX SA-2' BOX CONNECTOR W/ ANTI ROTATION KEY.	
		2071066-03	30" CONDUCTOR HOUSING, STC-10 W/ 30" x 1.5" W.T. CASING EXTENSION x 36.00" LG. W/ ANTI ROTATION KEY	
		2740625-01	HOUSING JOINT, 30" x 1.5" W.T. X52 x 408" OAL. W/ 'LYNX SA-2' BOX DOWN x BWP TOP, C/W ELEVATOR RING, DOUBLE WRAP HANDLING SLINGS AND PROTECTOR.	
4	2740626-01		INTERMEDIATE JOINT, 30" x 1.0" W.T. X52 x 456" OAL. W/ 'LYNX SA-2' PIN x BOX CONNECTORS. C/W ELEVATOR RING, DOUBLE WRAP HANDLING SLINGS AND PROTECTORS.	
5	2740627-01		SHOE JOINT, 30" x 1.0" W.T. X52 x 20" x 1.00" W.T. X56 456" OAL. W/ 'LYNX SA-2' PIN CONNECTOR x DAVIS LYNCH DOUBLE VALVE FLOAT SHOE. C/W ELEVATOR RING, DOUBLE WRAP HANDLING SLINGS AND PROTECTORS.	
6	2209796-01		WELDMENT, 18-3/4" HOUSING WITH 'VETCO 'H4' PROFILE TOP, W/ HEAVY WALL EXTENSION, W/ CASING EXTENSION, 20" x 1.00" W.T. SWAGED TO 13-3/8" CASING BTM.	
		2740628-01	CROSSOVER JOINT, 20" x 1.0" W.T. X56 x 240" LG W/ BWP TOP x SWEDGE TO 13-3/8" 68# L80 API BUTTRESS PIN x 72" LG. C/W C/W DOUBLE WRAP HANDLING SLINGS AND PROTECTORS.	
		2209725-01	18-3/4" STC-10 HOUSING, W/ VETCO 'H4' PROFILE TOP, W/ HEAVY WALL EXTENSION W/ CENTRALISING FINS W/ 20" O.D. X 1.00" WALL X-56 X 3FT. LONG CASING EXTENSION.	
7	2071009-01		CASING HANGER, 18-3/4" x 9-5/8" NEW VAM 47#.	✳
8	263089-01		HANGER ADAPTOR, F/ 9-5/8" HANGER TO LAND IN MID POSITION.	✳
9	263118-01		SEAL ASSEMBLY, 'SPECIAL' STC-10 W/O EXTENDED NOSE. (EXPLORATION ONLY)	✳
10	262502-01		18-3/4" STANDARD SEAL ASSEMBLY, STC-10 WELLHEAD SYSTEM.	✳
10A	262502-04		18-3/4" EMERGENCY SEAL ASSEMBLY, STC-10 WELLHEAD SYSTEM.	✳
11A	2209395-01		WELLHEAD CAP, 18-3/4" STC-10 W/ VETCO 'H4' STYLE TOP. C/W BIOCIDE STICKS, & SINGLE PORT DUMMY HOT STAB AND RECEPTACLE.	
11B	604736-08		WELLHEAD CAP ASSY, VETCO 'H4' PROFILE.	
12	2209283-01		'BULLS' EYE' SLOPE INDICATOR	(NOT SHOWN)
13	2740365-01		SET, RELEASE BOLTS, F/ 30" 'SA' LYNX BOX CONNECTOR.	(NOT SHOWN)
14	2740366-01		'O' RING SEAL, F/ 30" 'SA' LYNX BOX CONNECTOR.	(NOT SHOWN)
15	2740367-01		LIP SEAL, F/ 30" 'SA' LYNX BOX CONNECTOR.	(NOT SHOWN)
16	680186-02		SHEAR PIN,1/2" W/ NOTCH, 10000 lbs DOUBLE SHEAR.	(NOT SHOWN)
17	647989-01		ANCHOR GUIDELINE (SPEAR)	(NOT SHOWN)
18	680185-01		CAP, 3/4" GUIDELINE LOCKDOWN.	(NOT SHOWN)
19	018492-31		'O' RING, (PART OF ANCHOR)	(NOT SHOWN)
20	2070852-01	(BACK-UP)	ASSEMBLY, DRILLING TEMPLATE (TGB) ,W/ LIFTING GUSSETS & CHAIN RETENTION POSTS.	
21	2209790-01		ASSY, GIMBLE, F/ PERMANENT & RETRIEVABLE GUIDE BASE.	

TOOL SKIDS
(NOT SHOWN)

ITEM	PART NUMBER	DESCRIPTION	
1	2740512-01	TRANSPORTATION TOOL SKID	(NOT SHOWN)
2	2740512-02	TRANSPORTATION TOOL SKID	(NOT SHOWN)
3	2740512-03	TRANSPORTATION TOOL SKID	(NOT SHOWN)
4	2740512-04	MAINTENANCE SKID	(NOT SHOWN)

PIPE & CONNECTOR CAPACITIES

Pipe	Weight/ft (lbs)	I.D. (inches)	Tensile yield (Kips-ft)	Bending yield (Kips-ft)	Burst (psi)	Collapse (psi)
30" x 1.5" X52	456	27	6984	3950	4550	2890
30" x 1.0" X52	310	28	4738	2770	3030	1630
20" x 1.0" X56	202	18	3342	1260	4900	4070

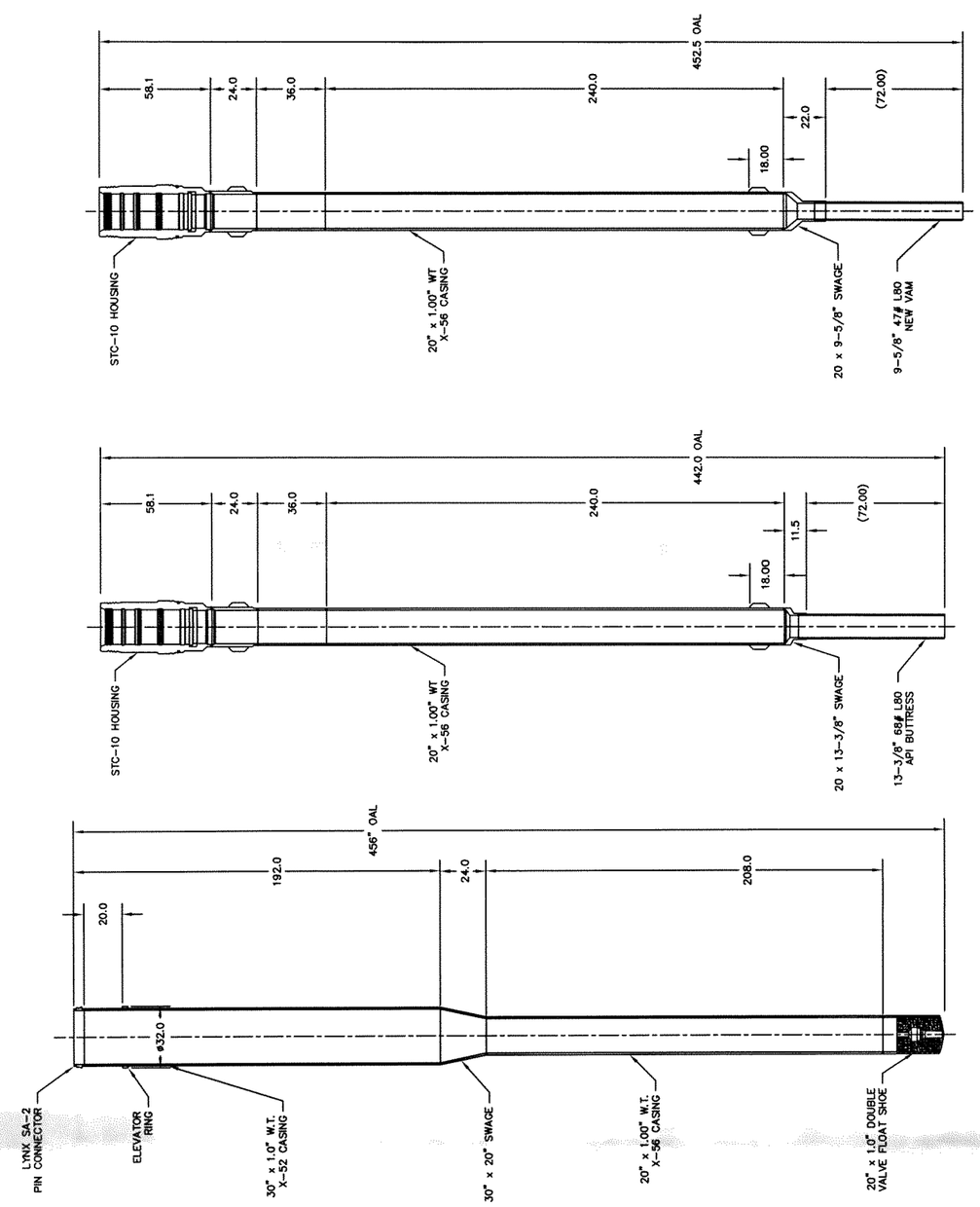
Connector	O.D. (inches)	I.D. (inches)	Tensile yield (Kips-ft)	Bending yield (Kips-ft)	Burst (psi)
30" x 1.0" LYNX-SA2	33.5	28	3200	2800	1500

CAD

Cameron Australasia Pty. Ltd.
Subsidiary of Cooper Cameron Corporation.
P.O. Box 789, ST. ALBANS, Vic. 3021
A.C.N. 004 729 631 Tel: (03) 9361-4444
Fax: (03) 9361-4400
CAMERON

OCEAN PATRIOT – CONSORTIUM CAMPAIGN
APACHE – SCOPE OF SUPPLY (GRAYLING)
CASING PROGRAM 30" x 20" x 13-3/8" x 9-5/8"

Drawn by:	Date:	Scale:	Drawing Number SHT 1 OF 4	Rev.
J. RAMAGE	30/07/2004	N.T.S.	LO-051736-01	06



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OCEAN PATRIOT – CONSORTIUM CAMPAIGN
APACHE – SCOPE OF SUPPLY
CASING PROGRAM 30" x 20" x 13-3/8" OR 9-5/8"

Drawn by:	Date:	Scale:	Drawing Number SHT 2 OF 4	Rev.
J. RAMAGE	30/07/2004	N.T.S.	LO-051736-01	06