DRILLING PROGRAMME

LOCATION 31/2-E

31/2-6

A/S NORSKE SHELL
LICENCE 054

NORSKE SHELL E & P, FORUS.

DRILLING PROGRAMME

CONFIDENTIAL

LOCATION: 31/2-E
WELL: 31/2-6
RIG: BORGNY DOLPHIN

PRODUCTION LICENCE No.: 054
ESTIMATED DAYS: 100 (inc.Prod. Test).

TOLERANCE: 75 m all round
CO-ORDINATES OF LOCATION
60 deg 54' 14,2" N
03 deg 38' 49,8" E

DERRICK FLOOR ELEVATION: 25 M. ABOVE MSL; 363 M. ABOVE SEA BED

HOLE SIZE (INS)	HOLE DEPTH (metres)	CASING SIZE/WT/GRAD/CPLG	CEMENT Req'd on Board (Tons)	CEMENT Type/Mixwater	CEMENT REMARKS	MUD S.G. (PSI/1000')	MUD REMARKS	LOGGING
36"	460	30"/1"WT/310/X-52 ATD-RB Squnch	150	Class "G" S'water	See Enclosure 2 A	1.03 (445)	Seawater + Viscous Pills (+/- 100 MF)	None.
26" See note 3	820	20"/133/K55 Vetco LS-LH	220	Class "G" S'water	See Enclosure 2 B	1.03 (445)	Gelled seawater + Viscous pills	(In 17½" Pilot Hole) ISF/SONIC/SP/GR FDC/CNL/CAL/GR
17½"	1485	13-3/8"/72/L80/BTC	150	Class "G" F'water	See Enclosure 2 C	1.26 (545) to 1.31 (567)	KCL/Polymer system KCL: +/- 35 ppb MF: 50-60 secs PV/YP: 20-25/15-20 WL: Less than 10 ccs	ISF/SONIC/SP/GR FDC/CNL/CAL/GR SWS as required.
12-1/4"	1760	9-5/8"/47/L80/VAM	100	Class "G" F'water	See Enclosure 2 D	1.14 (495)	KCL/Polymer system from 17½" section dispersed with Lignosulphonates. MF: 50-60 PV/YP: 20-25/15-20 WL: Less than 5 ccs	ISF/SONIC/SP/GR FDC/CNL/CAL/GR MSFL/DLL/CAL/GR HDT RFT's as required. SWS's as required. CBL on 13-3/8" casing.
8½"	2525	7"/29/N80/BTC Liner if required.	100	Class "G" F'water	To be advised.	1.14 (495)	As for 12-1/4" section See note 7.	ISF/SONIC/SP/GR FDC/CNL/CAL/GR HDT RFT's as required. SWS's as required. CBL on 9-5/8" casing. Velocity Survey.

FORMATION TOP	m. T.V. B.D.F
Seabed (Quarternary/Eocene)	363
Eocene	875+/- 10
Palaeocene	1185 +/-15
Cretaceous	1455 +/-20
Jurassic Sandstone Group	
Upper Jurassic ✗	1505 +/-10
Seismic Flatspot	1573
Middle Jurassic	1595 +/-30
Mid. - Lower Jurassic	1935 +/-20
Dunlin Unit Equivalent	2040 +/-20
Statfjord Formation	2205 +/-25
Triassic Red Beds	2405 +/-50
TD	2525

✗ Primary Target

NOTES:

1) All mud weights are to adjusted in the light of hole problems (ie. sloughing shales, high mud gas readings etc.)

2) Formation leak off tests are required below 20", 13-3/8" and 9-5/8" casing shoes.

3) 17½" pilot hole is to be drilled to 20" casing depth and logged for shallow gas prior to pulling the MR and opening the hole to 26".

4) Cutting Collection: Every 10 m below the 30" casing shoe. Every 3 m below 1200 m.

NOTES:

5) Coring will commence in the L. Cretaceous to ensure coring the clay/sand interface and to continue until at least one core is taken in the water zone.

6) Estimated pore pressure is +/- 2280 psi at 1506 m BDF.

7) If hydratable clays are encountered the mud will be broken over to a Gypsum/Lignosulphonate system.

8. From shallow seismic there is an indication that shallow gas may be encountered at +/- 875 m BDF.

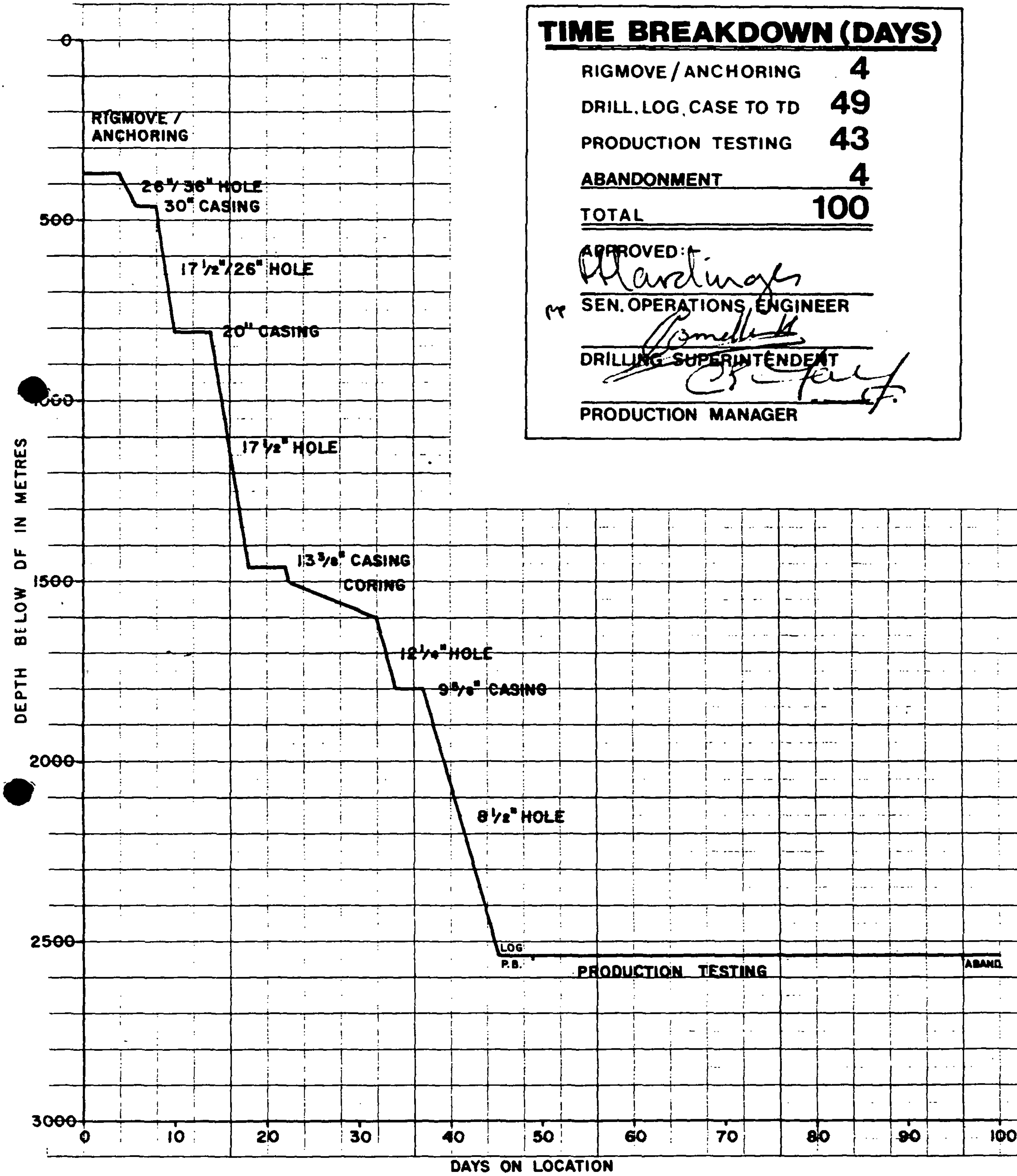
SIGNED BY: PRODUCTION MANAGER

CHIEF PETROLEUM ENGINEER — EXPLORATION MANAGER — HEAD OF DRILLING SPPF, FORUS.

DATE: 6.3.81.

G 566

31/2-E DRILLING PROGRESS CURVE



TIME BREAKDOWN (DAYS)

RIGMOVE / ANCHORING	4
DRILL. LOG. CASE TO TD	49
PRODUCTION TESTING	43
ABANDONMENT	4
TOTAL	100

APPROVED:

SEN. OPERATIONS ENGINEER

DRILLING SUPERINTENDENT

PRODUCTION MANAGER

A/S NORSKE SHELL

DRILLING PROGRAMME - LOCATION 31/2-E

A. GENERAL

1. Location

a) A/S Norske Shell - Block 31/2 - Production Licence 054

b) Preliminary surface co-ordinates (centre of location corresponding to SP 720 on seismic 8007-152

GEOGRAPHICAL

60 deg 54' 14,2" N
03 deg 38' 49,8" E

Tolerance: 75 metres all round.

2. Base

Tananger Shore Base to Location	269 kms
Bergen Shore Base to Location	119 kms

3. Depth References

a) All depths are given with respect to the rotary table of the drilling vessel at the specified drilling draught.

b) Expected water depth at location is +/- 340 m (MSL-seabed).

c) For drilling, the barge draught will be c.25.0 m.

d) Distance from rotary table to MSL is taken as +/- 25 m for this programme but will be measured on site.
Distance from rotary table to seabed is taken as +/- 365 m for this programme but will be measured on site.

4. Type of Well

Exploration well.

5. Total Depth

TD in Triassic Red Beds is anticipated to be +/- 2500 m SS.

6. Drilling Installation

"Borgny Dolphin" - Aker H-3 semi-submersible.

7. Objectives

I) To test the gas accumulation at its north-eastern most margin.

II) To evaluate the lateral variation in reservoir parameters.

III) To test the oil zone in a good sand reservoir.

IV) To "prove" hydrocarbon communication between blocks 31/2 and 31/3. ?

V) To get reliable geologic tie to the seismic reflectors to allow for accurate lateral extrapolation of well data.

8. Progosis

Formation Tops	Lithology	Depth TVBDF	Seismic Tolerance
Seabed (Quarternary-Eocene)	Clay,claystones	365	
Eocene	Claystones,sand-stones	875	+/- 10
Palaeocene	Tuffaceous clay-stones,silty clay-stones. Marls.	1185	+/- 30
Cretaceous	Marls and lime-stones	1455	+/- 20
Kimmeridge Clay Formation - thin or absent			
Jurassic Sandstone Group			
Upper Jurassic	Medium-coarse, unconsolidated sandstones.	1505	+/- 5
Base gas column		1573	
Middle Jurassic	Very fine,micaceous sandstones,coarser at base	1595	+/- 20
Mid. - Lower Jurassic	Sandstones,clay-stones,coals and marls.	1935	+/- 20
Dunlin Unit Equivalent	Silty/sandy clay-stones.Sandstones at base.	2040	+/- 20
Statfjord Formation	Fine - medium sand-stones with coals at base.	2205	+/- 30
Triassic Red Beds	Claystones and sandstones	2405	+/- 40

TD +/- 2525 m BDF

9. Pressure

From data gained in the drilling, the subsequent electric logging and RFT pressure measurements made in 31/2-1, and from the production tests performed on 31/2-2 and 31/2-3 it was found that these wells are hydrostatically pressured.

The proposed location 31/2-E is located in a separate fault block some 15 kms and 7,5 kms NNE of 31/2-1 and 31/2-3 respectively. The seismic flatspot can be traced across the faults at the same depth indicating that the faults are non-sealing. Therefore, the location 31/2-E is considered to be in the same hydrostatically pressured regime. (See Encl. 3).

10. Mud Resume

The 36" hole section is to be drilled with a seawater and viscous pill combination.

The 17½" pilot hole for the 26" hole section is to be drilled with an unweighted gelled water mud combined with the frequent spotting of viscous pills. The 17½" pilot hole will be opened up to 26" using seawater and viscous pills, with the riser removed and returns to seabed.

Note:
Prior to pulling put of the 17½" pilot hole and 26" hole for logging and the running of 20" casing respectively, mud of 1.40 SG is to be spotted in the open hole section, to ensure hole stability.

The 17½" hole section will be drilled with a KCL/Polymer mud system with a mud weight of 1.26 - 1.31 SG (.545 - .567 psi/ft)

Note:
From experience gained on wells 31/2-1,2 and 3 a mud weight of 1.31 SG was required to stabilize this hole section.

For the 12-1/4" hole section the KCL/Polymer mud will be dispersed by the use of Lignosulphonates. A mud weight of 1.14 SG (.494 psi/ft) will be used in this section.

Note:
This mud weight will exert +/- 100 psi overbalance on top of the main reservoir in the event of the riser being disconnected.

The 8½" hole section will be drilled with a dispersed Lignosulphonate mud system with a mud weight of 1.14 SG (.494 psi/ft).

Note:

1) Mud weights mentioned are a guide only and are liable to change if hole conditions dictate.

2) If hydratable clays are encountered in the 12 1/4" or 8½" hole sections, the mud will be "broken over" to a Gypsum/Lignosulphonate mud system.

Detailed mud properties and parameters will be specified in a separate mud programme.

11. <u>Well Control</u>

A diverter will be hooked up to the riser during the drilling of the 17½" pilot hole for 20" casing.In addition, 1.4 SG mud (.600 psi/ft) should be available during this diverter drilling in case flows are encountered. Cement will also be available on the rig for use in an emergency.Pressure control will be maintained from the 20" casing point to TD in accordance with the well control policy.

12. Deviation Control

Magnetic single shot surveys will be taken every 90 metres, to concide with bit trips where possible. The well path is to be calculated using the "Minimum Radius of Curvature" Method.

13. Casing Summary

Size	Grade	Weight	Coupling	Interval BDF
30"	X-52,1" WT	310 lbs/ft	ATD-RB Squnch	Seabed - 450 m
20"	K-55	133 lbs/ft	Vetco LS-LH	Seabed - 810 m
13-3/8"	L-80	72 lbs/ft	BTC	Seabed -1450 m
9-5/8"	L-80	47 lbs/ft	VAM	Seabed -1750 m

N.B. The 13-3/8", L-80, 72 lbs/ft, BTC casing will be specially drifted at the mill (during manufacture) and again at the rig (before running)to ensure it will pass a 12-1/4" bit.

14. Wellhead Equipment

Cameron 18-3/4", 10,000 psi wellhead equipment will be used.

15. Formation Gradient Tests

Leak off test will be made after drilling 5 metres of new hole below 20", 13-3/8" and 9-5/8" casing shoes.

16. Casing Accessories

The 30", 20", 13-3/8", 9-5/8" casing scheme will be used.Casing attachments will be as follows:

30" Float shoe.

20" Float shoe + float collar one joint above shoe Two spring centralizers on the shoetrack and 3 on the next 6 joints (one per two joints). Two rigid centralizers equally inside 30" conductor.

13-3/8"	Float shoe + float collar one joint above shoe. 10 spring centralizers - 2 on shoe joint, 6 on the next 12 joints (one every second joint) and 2 inside 20" shoe, spaced 1 joint apart.
9-5/8"	Float shoe + float collar 2 joints above the shoe. Two spring centralizers on the shoe track, 1 centralizer per 3 joints up to the base of the reservoir, 1 centralizer per joint across the reservoir, 1 centralizer per 3 joints up to the 13-3/8" shoe and 1 rigid centralizer per 3 joints over the first 100 m of 9-5/8" inside the 13-3/8" casing.

Casing test pressures will be as follows:

20"	1000 psi for 15 mins
13-3/8"	3000 psi for 15 mins
9-5/8"	4000 psi for 15 mins

Pressure tests on the 13-3/8" and 9-5/8" casings to be done immediately after bumping the top plug. The casing may be restested using an RTTS packer set below the top of cement around the particular casing if there is concern over the casing being worn.

Cement calculations: See enclosure 2.

B. SUMMARY OF OPERATIONS

1. Pre-Spud Phase

Site Survey

A combined seafloor and high resolution seismic surcey was carried out by Geoteam A/S In May/June 1980.

The seafloor survey covers an area of approximately 6 x 7 kms around the proposed well location, and the area was surveyed with echo sounder, side scan sonar and analog boomer. No obstructions which may cause any problems to drilling were observed.

The high resolution seismic surveys covers an area of 2 x 4 kms centred on the location. In the northern part of the survey area a seismic reflection interpreted as a possible gas charged sand was observed between 880 - 950 m (SS). This is possibly the same as the anomaly observed on deep seismic data at 850 m (SS) and indicated as a possible gas pocket in the prognosis.

(Ref: Geoteam report 6574.01 and 02 2.7.80)

2. Rig Positioning

The rig will be brought on to location utilizing Decca Pulse-8 with HP minicomputer. All anchors will be run out plus/minus 1450 m. The rig will be positioned with a heading of 315 deg (T). After anchors have been set, eachanchor will be tested to plus/minus 400,000 lbs for 1 hour. After a satisfactory mooring test, approximately 250,000 lbs will be held on all anchor chains.

The final coordinates will be determined with an accuracy of 10 m (RMS) using Satnav.

3. <u>Spudding in, drilling 36" hole and running 30" Casing</u>

1. Check the seabed condition by an observation dive.

2. Set TGB (with 5 m skirt) at slack tide. A Regan slope indicator is to be run on the TGB running tool to give an indication of the TGB angle. The TGB guide lines are to be marked at the spider deck level so that any subsequent sinking or tilting will be detected.

   Note:
   Calculate the DF - seabed distance and Mean Sea Level (MSL) after landing the TGB,taking into account the drilling draught and tidal variation.

3. Make up a 36" hole opener and 26" pilot bit assembly (a monel collar to be included for MSS). Drill down to 30" casing setting depth, taking a MSS after the first Kelly down. Additional surveys will be carried out as necessary,depending on hole angle. If hole angle is greater than 1½ degree then contact base, where the various options will be considered.

   Before POH to run 30" casing circulate high viscosity mud in the hole,using 200% excess.

4. Run 30" casing plus MGB equipped with a Regan slope indicator (to be installed in the middle of a side beam, as close to the beam as possible). Install a second Regan slope indicator on the 30" running tool. Ensure that the slope indicators are properly level and zeroed and will be visible to the subsea TV.

5. When the 30" casing is landed observe the angle with the subsea TV camera. If the angle is 1 degree or less, cement the casing using 200% excess cement.

6. WOC. Divers to check cratering around the guide bases with an observation dive. Run a check-totco in 30" running tool. (Install a totco ring in a sub below the running tool).

7. If excessive cratering is observed,re-cementing around the guide base or seabed may be considered prior to drilling out of the 30" casing. Or if this problem is anticipated,consider using 300% excess cement instead of 200%.

Note:

a) For the single stack system the angle of the MGB and BOP stack, and the base being level, are of utmost importance and good support is required to carry the very heavy load of the stack.

b) Observe operations such as the penetration test, placing of TGB and MGB, spudding in, stabbing in, drilling with returns to seabed,cementing of the 30" and 20" casing, with the rig's underwater TV camera.

c) Maintain a tension in the anchor chains at the upper limits until the 30" casing is cemented, in order to minimize rig offset. Otherwise,the stack and conductor could be set under an angle which could lead to serious damage to the U.W. equipment.

d) Ensure that the tension of the guide lines is optimum so that the TGB will not be lifted on one side or be tilted by excessive uneven guide line tension.

e) It is evident that the weather conditions should be moderate for most of these above operations.

4. Drilling 26" hole and running 20" casing

1. Drill out cement in 30" casing and 36" pocket with 26" hole opener and 17½" pilot bit with a stabilizer at 20 m and start 17½" pilot hole. POH and lay down 26" hole opener.

2. Run 30" pin connector and dump valve complete with flex joint on 21" riser. Use minimum required tension on ruckers. Fill up riser with seawater and observe fluid level.

3. Make up 17½" pilot hole drilling assembly. Use a float sub, with the float installed, and run in the hole.

4. Close diverter around drill pipe, and circulate through diverter lines to check the diverter equipment, gradually building up to maximum circulating rate. Open diverter packing.

5. Drill 17½" pilot hole to the 20" casing setting depth,allowing for a 10 m pocket.
   Note:
   This section is to be drilled using an unweighted gelled mud and the weight of annular returns is to be continuously monitored. If the weight of annular returns causes losses or exceeds 1.10 SG (475 psi/1000 ft) stop drilling and circulate the hole clean. It is evident that the ROP will have to be controlled whilst drilling this section.

6. Perform a check trip to the 30" shoe and back to bottom, clean out any fill and spot viscous mud of 1.4 SG (606 psi/1000 ft) in the open hole section prior to pulling out of hole for logging.

7. Rig up Schlumberger and log as programmed.
   Note:
   Inspect the logs for indications of shallow gas prior to continuing with the programme. If any indications of shallow gas are observed then call Base and a revised programme will be issued.

8. Rig down Schlumberger and run in hole to TD. Circulate the hole volume to seawater and open the dump valve. Observe well static for ½ hour and then spot high viscosity mud in the open hole section.

9. Pull out of hole and retrieve the 30" pin connector.

10. Pick up a 17½" pilot bit and 26" hole opener with a 26" stabilizer at 10 m and 30 m above the bit. Open the hole up to 26" using seawater and viscous pills.

11. Run and cement 20" casing as per programme.
Note:
Use a long drillpipe stinger (+/- 60 m above the float collar) inside the casing.

12. Unlatch the running tool,pick up until the bottom of the stinger is just below 18-3/4" housing. Wash in and around the housing with seawater prior to retrieving the running tool.

13. Install the 18-3/4" BOP stack and 21" Marine Riser. Test BOP stack,complete with casing. For stack test procedure see "Stack Testing" item C.Make up drill pipe hang off assembly and circulating head assembly. Install wearbushing.

Notes on Diverter Drilling

a) Diverter systems are fitted on offshore rigs to provide a means of controlling the flow should shallow pressures be encountered whilst drilling for the first casing string (surface casing).

b) The diverter system is not a blowout preventer. It is not designed to hold pressure, but instead, to direct the flow overboard. The controls of the flowline valves are manifolded in such a way that it is impossible to hold any pressure in the diverter. The downwind blow-off line must always be open.

c) Severe Losses

If severe losses are encountered while drilling with returns to surface pull out and drill a 12-1/4" pilot hole instead of 17½" and restrict penetration rates to obtain the lightest possible annular returns. If severe losses are continuing, open the dumpvalve and drill a 12-1/4" pilot hole with returns to seabed.

If gas is encountered whilst drilling 12-1/4" pilot hole with seawater and returns to seabed, spot heavy mud and inform Base.

d) Gas Flow (No Losses)

If any flow of gas is encountered whilst drilling the 17½" pilot hole, drill to 20" casing point with required mud weight. Circulate hole clean and make check trip. Circulate, drop Totco and pull out of hole. Run logs as required. Make up 26" hydraulic under-reamer with 17½" stabilizer 20 m above under-reamer.

Under-ream 17½" hole to 26". Circulate and increase mud weight on bottom to compensate for the loss in hydrostatic head as a result of the removal of the Marine Riser later on. Check trip to shoe. Run back to bottom. POH.Run BGT to check holesize. RIH with bit and under-reamer. Circulate, if required. Observe well. Open dump valve. Fill up Marine Riser with seawater to give a column equal to the water depth. After level in Marine Riser is equalised to sea level, observe well in Marine Riser and check flow on open dump valve with TV. Close dump valve. Make another check trip, circulate and pull back to pin connector, circulate to seawater. POH. Retrieve Marine Riser. Stand back 18-3/4" housing in derrick. Make additional check trip prior to running 20" casing.

e) <u>Gas Flow and Severe Losses</u>

If any flow of gas is encountered whilst drilling the 17½" pilot hole with returns to surface, and the required increased mud weight to counteract the gas flow causes severe losses, then inform Base.

Note:

There should be sufficient barytes and SAPP onboard to allow for the setting of baryte plugs.

Further programme will be advised in this case.

5. <u>Drilling 17½" hole and running 13-3/8" casing</u>

Note: Due to concern about the possibility of shallow gas being encountered at +/- 875 m a 12 1/4" pilot is to be drilled through the interval prior to drilling 17 1/2" hole.

1. Drill out float collar, shoe track and shoe with a 17 1/2" bit. Drill 5 m of new hole and carry out a formation leak off test. POH.

2. Pick up a 12 1/4" drilling assembly and RIH. Drill 12 1/4" hole to +/- 1050 m POH.

NB Exercise extreme care while drilling though this interval and monitor closely for any evidence of increasing gas readings and/or pore pressure. Perform a flow check upon any increase in drilling rate. Advise Base immediately of any significant changes and a revised programme will be issued.

3. Pick up a 17 1/2" drilling assembly and RIH. Open up the 12 1/4" pilot hole to 17 1/2". Drill 17 1/2" hole to programme depth.

4. Log as per programme. Make up 13-3/8" hanger with subsea cementing assembly (top plug only) and stand back in derrick.

5. Make checktrip, pull wearbushing and run 13-3/8" casing to landing point, leaving 10 m pocket at below the 13-3/8" shoe.

6. Cement 13-3/8" casing as per programme. Clean out the stack area prior to pulling out with the running string.

7. Carry out stack and casing tests as per "Stack Testing" Item C. Install wearbushing. Make up drillpipe hang-off assembly and circulating head assembly. Carry out a kickdrill.

6. Drilling 12-1/4" hole and running 9-5/8" casing

1. Drill out float collar, cement and shoe. Drill 5 m of new hole, and carry out a formation leak off test.

2. Drill 12-1/4" hole to programmed depth. Bit weight, RPM, bit selection and bottom hole assembly to be determined on site for optimum penetration rate.
   Note:
   Coring will commence using fibreglass sleeves in the L.Cretaceous limestones and marls and will continue until at least one core has been taken in the water zone.

3. Carry out logging programme, including wire line tests if necessary. Make up 9-5/8" hanger with subsea cementing assembly (top plug only) and stand back in derrick.

4. Make check trip, pull wearbushing and run 9-5/8" casing to landing point, leaving a 10 m pocket below the 9-5/8" shoe.

5. Cement the 9-5/8" casing as per programme. Clean out the stack area prior to pulling out the running tool. Whilst displacing, (in turbulent flow at 250 ft/min or higher), returns are to be monitored closely. If losses are observed adjust pump rates accordingly.

6. Carry out stack and casing tests as per "Stack Testing" Item C. Install wearbushing. Make up drillpipe hang-off and circulating head assembly. Carry out a kickdrill.

7. Drilling 8½" hole

1. Drill out float collar, shoetrack and float shoe. Drill 5 m of new hole and carry out a formation leak off test.
   Note:
   An RTTS will be set inside the 9-5/8" casing to avoid damaging the cement bond across the reservoir.

2. Drill 8½" hole to T.D. with a mud weight as dictated by hole conditions.
   Note:
   Coring will commence on the occurence of good hydrocarbon shows and will continue until at least one core is taken in the water zone.

3. Rig up Schlumberger and carry out the logging programme, including wireline tests if necessary.

4. Dependent upon the results of the logs and wireline tests the hole will either be plugged back to allow for testing of the upper reservoir or a 7" liner will be set to allow testing of a lower reservoir.

8. Abandonment

1. If there is open hole below the last casing then all porous zones in the open hole interval will be isolated with cement plugs extending 30 m above and below each zone. In addition a cement plug, extending 30 m above and below the casing shoe, shall be set. A mechanical bridge plug may be set in the lower part of the casing but not more than 50 m above the shoe. A 15 m cement plug must be placed on top of the bridge plug. The plugs at the last casing shoe shall be tested to 1000 psi differential pressure.

2. Perforations shall be isolated by means of a mechanical bridge plug and squeeze cemented, or a cement plug shall be placed across the perforations extending 30 metres above and below the perforated interval or down to a casing plug whichever is less.

3. Cement plugs of at least 30 metres shall be placed in the smallest casing string extending to seabed. These plugs shall be placed at the level of the 13-3/8" casing shoe and the 20" casing shoe.

4. A cement plug of at least 50 metres, with the top of the plug not more than 50 metres below the sea floor, shall be placed in the smallest string of casing extending to the sea floor.

5. Casing strings and other installations extending above the sea floor must be removed to a depth of at least 5 metres below the ocean floor.

6. The sea floor in the vicinity of the borehole will be inspected by TV/observation dive to ensure that no obstructions remain on the sea bed which may cause danger or impediment to fishing or shipping.

7. A specific abandonment/suspension program will be prepared and issued when the well reaches total depth.

C. STACK TESTING

The regular tests of the BOP Stack in service have to be limited to the following pressures, unless differently advised by the base.

18-3/4",10.000 psi BOP Stack

1.	Pipe Rams	:	5000 psi
2.	Blind Rams	:	Casing test pressure, as specified in Item A-16
3.	Kill/choke lines and valves	:	5000 psi
4.	Annular preventers	:	2000 psi around 5" DP 1500 psi around 3-1/2" DP

a) Tests 1,3 and 4 to be carried out with a boll weevil tester run on DP and landed in the wellhead.

b) Test 2 to be carried out only when the cement of the last casing is not yet drilled out.

Accumulator Tests

The accumulators must have sufficient capacity to be able to close, open and close all preventer with both air and electric charge pumps off, and then still have enough pressure left to provide working fluid for 25% of one closing function. Minimum recharge time from above condition with both air and electric pumps running should be in accordance with manufactorer's specifications. A note that this test has been carried out (and results) must be made in the Drilling Report and on weekly BOP test checklist. For frequency see (this Section) item 10.

Notes on Testing

1. The BOP stack has to be tested on all functions and all rams tested to the full rated WP at surface prior to running the Stack.However, the blind/shear rams will be teste only on orders of Base, but at least once per month during a routine stack test.

After the surface tests all Cameron clamp connections and all studded connections must be checked for tightness.

2. All pressure tests to be carried out with water, unless differently advised by Base.

3. All surface equipment has to be satisfactorily pressure tested prior to testing the BOP stack underwater.

4. When running the Marine Riser with integral kill-and choke lines, the kill-and choke lines can be tested while running in at various stages. This should be done at least twice, firstly as soon as the stack is below sea level, and secondly, just before landing the stack.

5. When testing the BOP stack underwater with a boll weevil test tool in the wellhead, use the vented red-painted test single.

6. The test pressure should be kept on for 15 minutes, and the acceptable pressure drop over this 15 minutes period is 10% of the initial test pressure, provided that the pressure remains constant for the next 5 to 10 minutes.

7. All pressure tests to be recorded on pressure recorder charts. A record is to be kept of the volumes required to obtain the test pressure, and of the volumes returned when bleeding off.

8. The opening/closing times and the volumes of hydraulic operating fluid required for the operation of the various underwater stack components (such as: rams, kill and choke valves, annular preventers, hydraulic connectors,etc.) should be recorded during testing of the stack underwater. These results should be compared with the normal opening/closing times and volumes required of the hydraulic system. Any major differences are in indication that the system is not operating "normally" and may require further investigations and/or repairs.

9. The testing of 10,000 psi BOP stack will be done to 5000 psi only,at the weekly routine BOP test underwater. If higher test pressures are required then, depending on the well programme, the test pressure will be increased to the value required and carried out with a boll weevil test tool, e.g. subjecting the seals of the seal assembly to the same pressure as the BOP stack, or by means of a weight set tester, subjecting only the stack to the required test pressure.
Run 2 stands drill collars below the weight set tester to assist in shearing the pins with set down weight.

   See item 1 on blind/shear rams.

10. Accumulator tests (as described previously) should be done either on request of Base, or after repair have been done to the accumulator system, i.e. bottles, bladders, pumps, etc.

D. EVALUATION REQUIREMENTS

1. Cutting Samples

Ditch cuttings to be collected every 10 m below 30" casing down to 1200 m, and every 3 m thereafter. The following samples will be required for partners/ government bodies:

a) 6 x small cuttings bags of washed dried samples.
b) 4 x 2 kilograms bags of wet samples.

1 x 2 kilogram bag of wet samples from each interval should be kept on board until the well has reached TD when the complete set should be sent in. Otherwise, samples should be sent ashore ASAP, marked for attention of EPXV/1,Tananger.

2. Coring

a) Jurassic Sandstone Group

Interval 4 :
Coring is to commence immediately above the reservoir, i.e. in the L.Cretaceous limestones and marls, and is to continue until at least one core is taken in the water zone. Approximate interval is 1490 - 1600 m BDF.

b) Deeper Reservoir Intervals

Coring is to commence on occurence of good hydrocarbon shows in sands and is to continue until at least one core is taken in the water zone.

3. Logging Programme

At 20" casing depth	ISF/SONIC/SP/GR (GR to seabed) FDC/CNL/CAL/GR
At 13-3/8" casing depth	ISF/SONIC/SP/GR FDC/CNL/CAL/GR SWS (as required)
At 9-5/8" casing depth	ISF/SONIC/SP/GR FDC/CNL/CAL/GR MSFL/DLL/CAL/GR HDT RFT's (as required) SWS (as required) CBL (on 13-3/8" casing)
At T.D.	ISF/SONIC/SP/GR FDC/CNL/CAL/GR HDT RFT's (as required) CBL (on 9-5/8" casing) SWS (as required) Velocity Survey

Note: Intermediate logs may be required to be run in the 12-1/4" hole section.

4. Testing Programme

Production tests as required. Specific programmes will be advised.

E. CASING DESIGN

Casing designs are presented for the 20", 13-3/8" and 9-5/8" casings (See Encl. 1.0.)

The following assumptions apply:

1. For tension, a design safety factor of 1.6 is used, neglecting buoyancy in the drilling fluid.

2. Bi-axial effects have been neglected except in the case of the lowering of collapse resistance caused by tension. No allowance is given for the increase of burst resistance caused by tension.

3. For burst, a design safety factor of 1.1 is employed. The pressure distribution for the burst loading assumes a 40% evacuation of mud from the well by a kick.

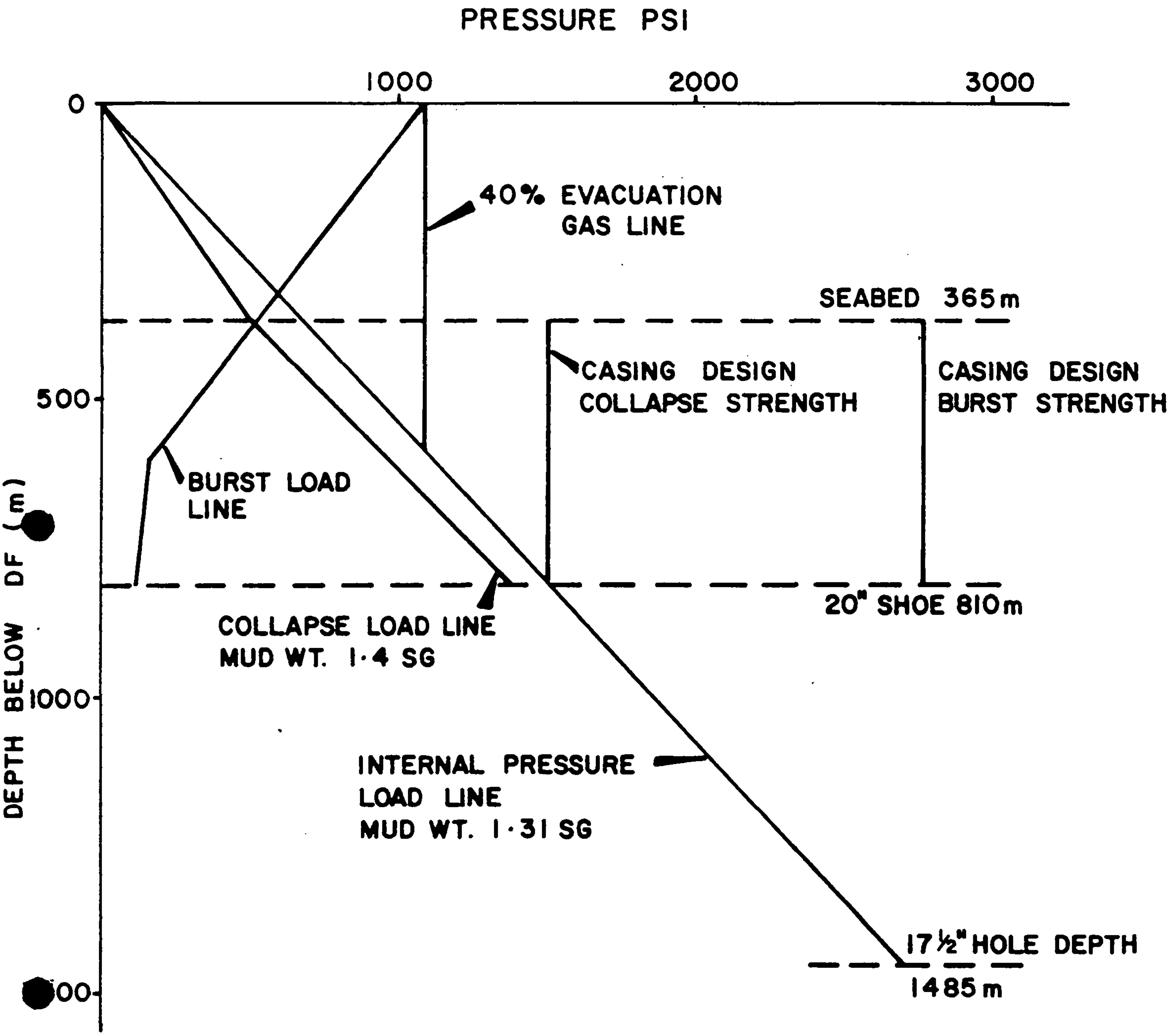
4. For collapse, a design safety factor of 1.0 is employed. Total evacuation of the casing is assumed for the design.

5. In the production test design for casing burst, a tubing leak is assumed putting full THP on the tubing/casing annulus.

F. GLOSSARY OF ABREVIATIONS

BDF	:	below derrick floor
BGT	:	borehole geometry tool
BOP	:	blow out preventer
FS	:	fail safe (as in FS valve)
ID	:	internal diameter
MF	:	Marsh funnel (mud viscosity)
MGB	:	main guide base
MSL	:	mean sea level
MSS	:	magnetic single shot
OD	:	outside diameter
PPG	:	pounds per US gallon
PV	:	plastic viscosity
SS	:	sub sea
TGB	:	temporary guide base
TMCM	:	Transverse Mercator, Central Meridien
UGF	:	universal guide frame
WHP	:	wellhead pressure
YP	:	yield point

20" CASING DESIGN 31/2-E



FOR 20", 133 LB/FT, K55, VETCO LS-LH CASING

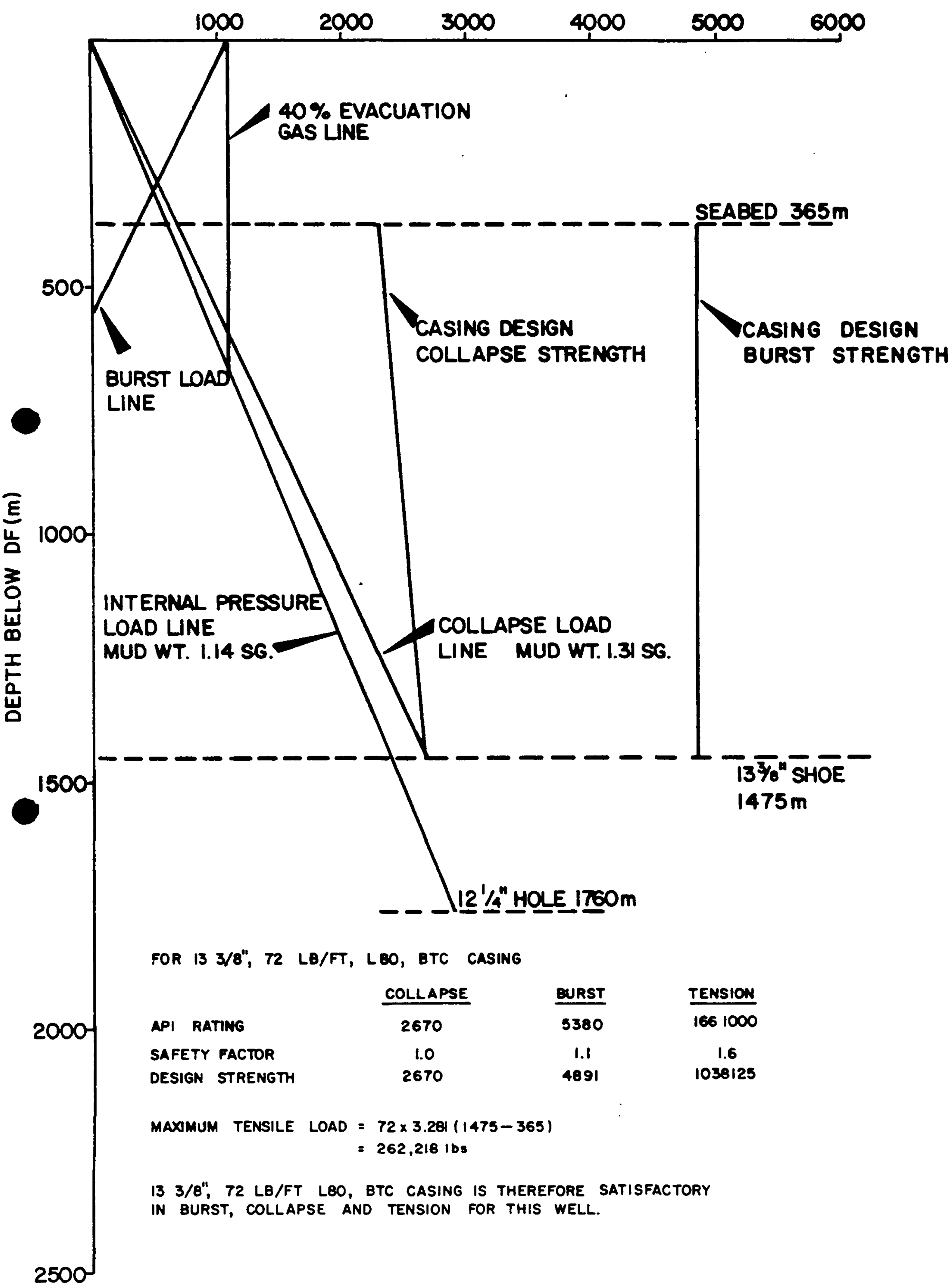
	COLLAPSE	BURST	TENSION
API RATING	1500	3060	2,123,000
SAFETY FACTOR	1.0	1.1	1.6
DESIGN STRENGTH	1500	2782	1,326,875

MAXIMUM TENSILE LOAD = 133 x 3.281 (810 − 365)

= 194,186 lbs

20" 133 LB/FT, K55, VETCO LS-LH IS THEREFORE SATISFACTORY IN BURST, COLLAPSE AND TENSION FOR THIS WELL.

13 3/8" CASING DESIGN 31/2-E



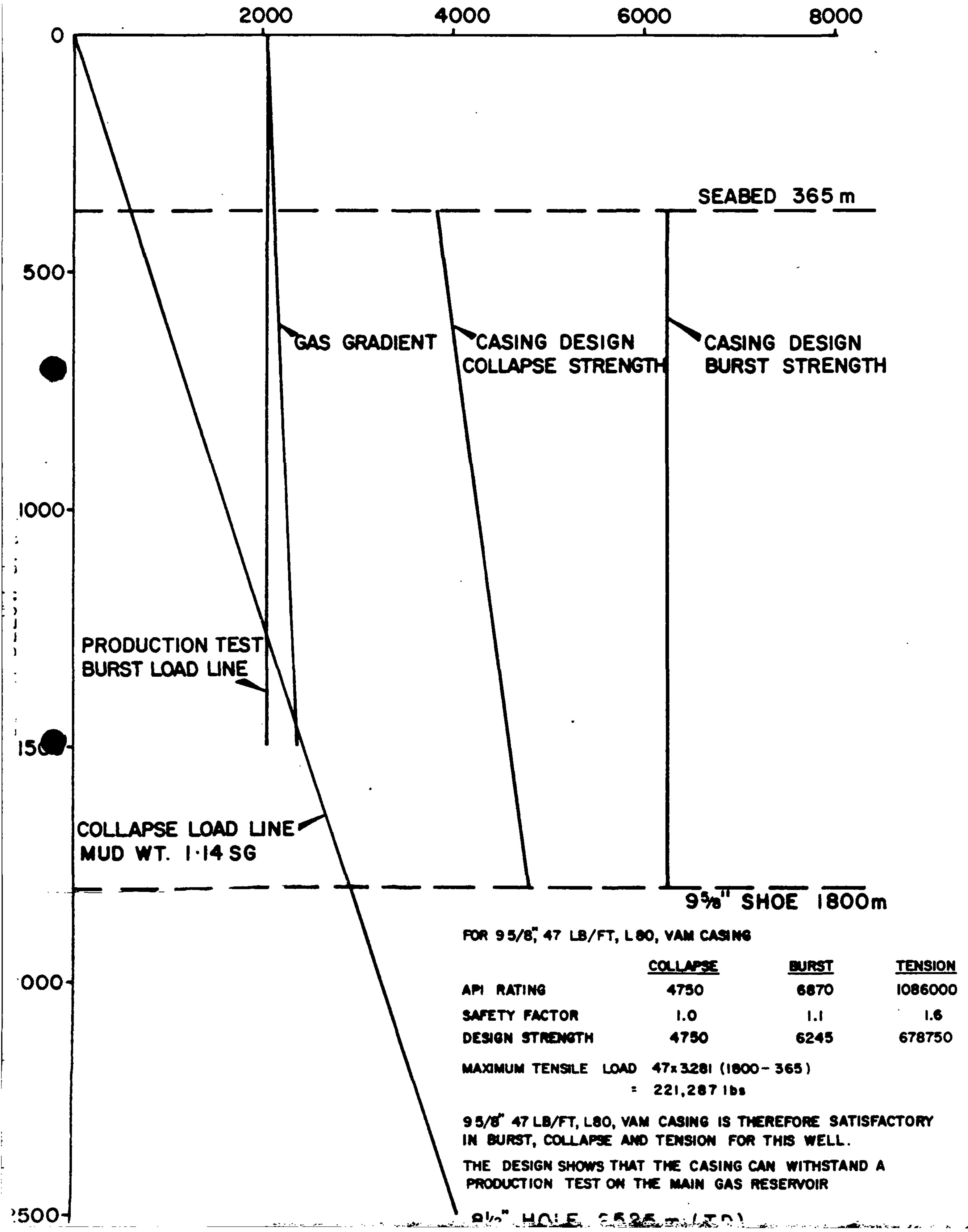
FOR 13 3/8", 72 LB/FT, L80, BTC CASING

	COLLAPSE	BURST	TENSION
API RATING	2670	5380	166 1000
SAFETY FACTOR	1.0	1.1	1.6
DESIGN STRENGTH	2670	4891	1038125

MAXIMUM TENSILE LOAD = 72 x 3.281 (1475 − 365)
= 262,218 lbs

13 3/8", 72 LB/FT L80, BTC CASING IS THEREFORE SATISFACTORY IN BURST, COLLAPSE AND TENSION FOR THIS WELL.

9 5/8" CASING DESIGN 31/2-E



FOR 9 5/8", 47 LB/FT, L80, VAM CASING

	COLLAPSE	BURST	TENSION
API RATING	4750	6870	1086000
SAFETY FACTOR	1.0	1.1	1.6
DESIGN STRENGTH	4750	6245	678750

MAXIMUM TENSILE LOAD 47 x 3.281 (1800 - 365)
= 221,287 lbs

9 5/8" 47 LB/FT, L80, VAM CASING IS THEREFORE SATISFACTORY IN BURST, COLLAPSE AND TENSION FOR THIS WELL.

THE DESIGN SHOWS THAT THE CASING CAN WITHSTAND A PRODUCTION TEST ON THE MAIN GAS RESERVOIR

CEMENT CALCULATIONS

30" Cememtation

Extended Norcem Class "G" cement of lead slurry weight 13.2 ppg and 10 m of 15.8 ppg tail slurry above the shoe are to be used. The casing is to be cemented back to seabed, and an excess of 200% is to be used over open hole intervals. Cement displaced to 10 m above shoe.

Data

Casing 30" 1" WT/VETCO "ATD-RB"
30" shoe 450 m BDF
36" hole 460 m BDF

Lead Slurry Volumes

i)	36" x 30" annulus	= (440 - 365)x3.281x2.1598x3	= 1594.4	cu.ft.
	Cement required	= 1594.4 /1.89	= 843.6	sxs
			= 35.9	m/t
	Mixwater required	= 843.6 x 10/42	= 200.9	bbls
			=	

Tail Slurry Volume

i)	36" x 30" annulus	= (450-440)x3.281x2.1598x3	= 212.6	cu.ft.
ii)	36" pocket	= (460-450)x3.281x7.0686x3	= 695.8	cu.ft.
iii)	30" casing fill	= 10 x 3.281 x 4.2761	= 140.3	cu.ft.
		Total slurry	1048.7	cu.ft

Cement required	= 1048.7/1.17	= 896.3	sxs
		= 38.2	m/t
Mixwater required	= 896.3 x 5.15/42	= 109.9	bbls
$CaCl_2$ required	= 896.3 x 94 x 0.03/2205	= 1.15	m/t

20" Cementation

Extended Norcem Class "G" cement of lead slurry weight 13.2 ppg, and 60 m of tail slurry above the shoe, of weight 15.8 ppg are to be used. The casing is to be cemented back to seabed and an excess of 100% is to be used over open hole intervals. Cement to be displaced to 10 m above the float collar.

Data

Casing 20"/133 lbs/ft/K55/VETCO LS-LH
30" shoe at 450 m BDF
36" hole at 460 m BDF
20" shoe at 810 m BDF
26" hole at 820 m BDF

Lead Slurry Volumes

i) 30" x 20" annulus	= (450-365)x3.281x2.0944	=	584.1 cu.ft.
ii) 36" x 20" annulus	= (460-450)x3.281x4.8869x2	=	320.7 cu.ft.
iii) 26" x 20" annulus	= (750-460)x3.281x1.5053x2	=	2864.6 cu.ft.
	Total slurry volume	=	3769.4 cu.ft.
Cement required	= 3769.4 /1.89	=	1994.4 sxs
		=	85.0 mt
Mixwater required	= 1994.4 x 10/42	=	474.9 bbls

Tail Slurry Volumes

i) 26" x 20" annulus	= (810-750)x3.281x1.5053x2	=	592.7 cu.ft.
ii) 26" pocket	= 10 x 3.281 x 3.6870 x 2	=	241.9 cu.ft.
iii) 20" casing fill	= 10 x 3.281 x 1.9133	=	62.8 cu.ft.
	Total slurry volume	=	897.4 cu.ft.
Cement required	= 897.4/1.17	=	767.0 sxs
		=	32.7 mt
Mixwater required	= 767.0 x 5.15/42	=	94.0 bbls
$CaCl_2$ required	= 767.0 x 94 x 0.02/2205	=	0.65 mt

13-3/8" Cementation

Extended Norcem Class "G" cement of lead slurry weight 12.2 ppg, and 100 m of tail slurry above the shoe, of weight 15.8 ppg to be used. The casing is to be cemented back to 150 m inside the 20" casing using 20% excess on open hole volumes. Cement will be displaced to a float collar c. 13 m above the shoe.

Data

- Casing 13-3/8"/72 lb/ft/N80/BTC
- 20" shoe at 810 m BDF
- 26" hole at 820 m BDF
- 13-3/8" shoe at 1475 m BDF
- 17½" hole at 1485 m BDF

Lead Slurry Volumes

i)	20" x 13-3/8" annulus	=(810-660)x3.281x0.9377	= 461.5 cu.ft.
ii)	26" x 13-3/8" annulus	=(820-810)x3.281x2.7113x1.2	= 106.7 cu.ft.
iii)	17½" x 13-3/8" annulus	=(1375-820)x3.281x0.6946x1.2	= 1517.8 cu.ft.
		Total slurry volume	= 2086.0 cu.ft.

Cement required	= 2086.0/2.30	= 907.0 sxs
		= 38.7 mt
Mixwater required	= 907.0 x 13/42	= 280.7 bbls
	=	=

Tail Slurry Volumes

i)	17½" x 13-3/8" annulus	=(1475-1375)x3.281x0.6946x1.2	= 273.5 cu.ft.
ii)	17½" pocket	=10 x 3.281 x 1.6703 x 1.2	= 65.8 cu.ft.
iii)	13-3/8" shoe track	=13 x 3.281 x .8314	= 35.5 cu.ft.
		Total slurry volume	= 374.8 cu.ft.

Cement required	= 374.8/1.17	= 320.3 sxs
		= 13.7 mt
Mixwater required	= 320.3 x 5.15/42	= 39.3 bbls

9-5/8" Cementation

Norcem Class "G" cement at 15.4 ppg slurry weight will be used at the main slurry up to 1300 m. 50 bbls (262 m) of 13.5 ppg scavenger slurry (Class "G") is to be pumped ahead of the main 15.4 ppg slurry. A 20% excess is to be used over open hole intervals, and cement is to be displaced to a float collar c.25 m above the shoe.

Data

Casing 9-5/8"/47 lb/ft/L80/VAM
13-3/8" shoe at 1475 m BDF
17½" hole at 1485 m BDF
9-5/8" shoe at 1800 m BDF
12-1/4" hole at 1810 m BDF

15.4 ppg Slurry Volume

i)	13-3/8" x 9-5/8" annulus (1475-1300)3.281x.3262	= 187.3 cu.ft.
ii)	17½" x 9-5/8" annulus (1485-1475)3.281x1.1651x1.2	= 45.9 cu.ft.
iii)	12-1/4" x 9-5/8" annulus (1800-1485)3.281x.3132x1.2	= 388.4 cu.ft.
iv)	12-1/4" pocket 10x3.281x0.8185x1.2	= 32.2 cu.ft.
v)	9-5/8" shoe track 25 x 3.281 x 0.4110	= 33.7 cu.ft.
	Total slurry volume	= 687.5 cu.ft.

Cement required	= 687.5 /1.24	= 554.4 sxs
		= 23.6 mt
Mixwater required	= 554.4 x 5.24/42	= 69.2 bbls

Additives to be advised.

13.5 ppg Scavenger Slurry Volumes

i) 13-3/8" x 9-5/8" annulus(1300-1058)3.281x.3262 = 280.4 cu.ft.

Cement required	= 280.4/1.68	= 166.9 sxs
		= 7.12 mt
Mixwater required	= 166.9 x 8.29/42	= 32.9 bbls

Additives to be advised.

WELL 31/2-E

ENCL. 3

ESTIMATED PORE PRESSURE AND FRACTURE GRADIENTS SHOWING THE DEGREE OF UNCERTAINTY