THE SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA

Forcados Yokri-123L

Sand Cleanout, Perforation Extension and Sand Consolidation Proposal

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Reviewed By:						
Mude, Jonathan **SWAMP WEST LTRO LEAD**	Okoro Chidi **SWAMP WEST WRFM LEAD**	Ugboaja, Remmy **PG DISCIPLINE PRINCIPAL (ONSHORE)**	Wakama, Miebaka **PT DISCIPLINE PRINCIPAL (ONSHORE)**	Williams, Omolara **PP DISCIPLINE PRINCIPAL (ONSHORE)**	Ukauku, Ikwan **RE DISCIPLINE PRINCIPAL (ONSHORE)**	Avbovbo, Dafesuoro **HEAD WELL INTERVENTION, SWAMP /OFFSHORE**
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UIO/G/DNW	UIO/G/PNW	UIO/G/DEG	UIO/G/DET	UIO/G/DEP	UIO/G/DER	PTW/O/NG

Approved By
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UIO/G/DNW

WELL	**FORCADOS-123L**
TYPE OF JOB	**PERFORATION EXTENSION, SAND CLEANOUT/CONSOLIDATION AND ACIDIZING PROPOSAL**
OBJECTIVE	To restore production from FORC123L on the D9400L reservoir by carrying out sand cleanout, perforation squeeze, perforation extension and sand consolidation. The job is expected to unlock risked potential of 623 bopd and 2P additional reserves of 0.95 MMstb.

SAND	INTERVAL	PROPOSAL
D9400L	5960–5970 ftah; 5377–5385 ftss 5947 – 5957 ftah; 5367 – 5375 ftss	Sand cleanout, Perf squeeze Perforation and sand consolidation

WELL HISTORY/PRESENT STATUS

The well was initially completed as a Two String Dual producer (SSS) on the D3000L and D9400L in September 1989. The well is currently producing on the short string.

This proposed rigless re-entry is primarily to carry out sand cleanout, perforation squeeze, perforation extension and sand consolidation on the D9400L in order to restore the interval back to production. Perforation extension will also be carried out to unlock attic volumes available to the well.

INTERVAL HISTORY / PRESENT STATUS/ JUSTIFICATION

FORC 123 D9.400 (5960 - 5970 ftah ; 5377 - 5385 ftss) : IGP:

Interval came on stream in 1991 ex- completion on bean 16/64" and produced at ca.800 bopd. Interval was beaned up to choke 32/64" where it attained a peak production of 1200 bopd in August 1992. Water broke through in 1996 shortly after bean up to bean 40/64" and interval was beaned down to 36/64". The rapid water increase was followed by production decline and interval quit production in 1997. Interval has a history of high sand production. SG Survey was done December 2008 and interval was drifted to XN nipple at 5939 ft. Sinker bar run was however reported held up at 3245 ft. LIB run revealed no impression. Interval was also successfully drifted in Aug 2012 (1.86" GC) to the XN nipple. Open up of Interval was attempted in 2012 based on high CITHP but could not sustain flow. Last intervention also confirmed no ScSSSV in hole. Interval last produced 740 bopd at 46% BSW in 1996.

FORC 123 D3.000 (5316 - 5326 ftah ; 5330 - 5340ftah/ 4844 - 4852 ftss; 4856 - 4866ftss) : IGP:

Interval came on stream December 1990 ex-completion at 500 bopd on bean 16/64" and was ramped up to 1150 bopd on bean 36/64" in 1992. Water production commenced shortly after bean up and increased steadily till the interval was producing about 80% BSW in 2005. A reduction in BSW was observed when the interval was opened up post re-entry on bean 28/64". This was probably due to cone recession as the BSW increased rapidly to pre-2005 levels. Interval is currently producing 230 bopd at 77% BSW.
This interval is constrained by HBSW and Low THP. Production was characterized by occasional sand peaks and production decline.

Proposed Action & Justification

FORC-123L has had history of high sand production from the onset. It is suspected that produced sand has filled the well bore and possibly the tubing causing an obstruction to flow. HUD observed during 2008 SG survey may have been as a result of a sand bridge. The abrupt quitting of the well inspite of heathly pressures and moderate BSW can also be explained by restriction caused by sand in the tubing and wellbore.

A review of the production performance of FORC-123L indicates the water cut development in the interval is not very mature. The sharp increase in BSW observed just before the well quit is mostly likely due to coning effect brought on by bean up. FORC-29S which is completed deeper than this well is currently producing at 65.4% effectively ruling out bottom water as the water production mechanism in FORC-123L. There was also a gradual decline during the period of stable production on the same bean suggesting formation damage.

Production of FORC-029 also confirms the volumes available for production in FORC-123L as well as the 20 ft attic oil which will be targeted in the perforation extension.
** The end of the tubing string is at 5943 ftah, which is covering the top part of the D9400L sand, therefore, the advised perforation extension interval is 10 ft (between 5947 – 5957 ftah).*

The activity proposed is to carry out sand clean out of the tubing and casing with coild tubing followed by perforation of extension. The existing perforations will then be squeezed off prior to perforation. Chemical sand control with the Sandtrap ABC will be pumped to consolidate the sand and allow production from the reservoir. Rewards from this activity is 623 bopd risked production and (2P) reserves of 0.95 MMstb.

SHORT DESCRIPTION OF WORK

1. Hold safety meeting and discuss scope of job.
2. Check and record wellhead pressures (CITHP and CHP). If CHP is observed, report to base, otherwise proceed to step 3.
3. Shut in well and rig up wireline lubricator on well.
4. Make a drift to the expected sand HUD, which is at 3245 ftah.
5. RIH CT and carry out sand cleanout to 5982 ftah (to top of the bottom Baker DAB packer) and circulate bottoms up until returns are clear of sand grains.
6. Carry out Perforation Squeeze across the interval interval 5960 – 5972 ftah using BackStop $^{@}$Resin (as per proposed recipe in Attachment 9A). Allow the BackStop $^{@}$Resin to cure for 24 hours.
7. Perforate the interval 5947 – 5957 ftah (To be confirmed by GR and CCL).
8. Carry out Sand Consolidation treatment of the D9400L interval using Sand Trap (as per proposed recipe in Attachment 9B).
9. Open up well on 20/64” choke and carryou out well test to establish initial well performance. If well does not flow naturally, nitrogent lift well to flow.
10. Hand over well to production operations.

COST ESTIMATE

Activity	Value ($ Mln)	Estimated Time (Days)	Remark
Location Preparation	0.00	N/A	
CT cost/Activities	0.60	6	Include sand clean out and possible Nitrogen Lift. Including Mobilisation and demobilisation
Chemicals	0.03		
Facility cost	0.00	N/A	New facility is not required.
TOTAL	**0.63**	**6**	

RESERVOIR/WELL DATA

S/N	WELL/SAND:	UNIT		FORC123L (D9400L)
1	a) Perforated interval	ftah	***PTC***	5960 - 5970 5377 - 5385
	b) Perforated interval	ftss		5936 – 5940
	c) Proposed Perforation interval	ftah		5947 – 5957
				5358 – 5361
	d) Proposed perforation interval	ftss		5367 – 5375
2	a) Maximum Deviation Angle and Depth	° @ ft	***GEO***	37 deg @6155
	b) Derrick Floor Elevation	ft		84
	c) Vertical Correction to mid Perforation + DFE	ft		-
3	a) Last Production Rate	bopd	***PTC***	730
	b) Estimated Potential	bopd		623
	c) Estimated Gain	bopd		623
4	a) Reference Depth for Reservoir Pressures	ftss	***RES***	5450
	b) Original Reservoir Pressure	psig		2370
	c) Present Reservoir Pressure (based on 2012 BHP acquisition)	psig		2165
	d) Present Pressure Gradient	psi/ft		0.36
	e) Bubble Point Pressure	psig		2329
	f) Specific Gravity of Oil 60/60	SG		0.901
	g) Oil Viscosity at Reservoir Condition	cP		1.6
	h) Solution Gas-Rsi (initial condition)	scf/stb		332
	i) Formation Volume Factor (initial condition)	-		1.169
	j) Static Reservoir Temperature	° F		166
5	a) Other Wells Producing From the same Block	-	***RES/***	FORC029S
	b) Daily Production From Block (@ 1/1/2014)	bopd	***PTC***	1349
	c) Ultimate Recovery from block (@ 1/1/2014)	MMstb		18.04
	d) Cumulative Production From Block (@ 1/1/2014)	MMstb		13.19
	e) Cumulative Production From Well (@1/1/2014)	MMstb		1.71
	f) Remaining/Dev Reserve From Well	MMstb		0.32
6	a) Porosity	%	***PHY***	30
	b) Shale Percent	%		15
	c) HC Saturation	%		81
	d) Permeability	mD		2941
	e) Vertical Permeability/Horizontal Permeability	Kv/Kh		0.31
	f) Sand Thickness as per PDL	ftvd		62
	g) Net Oil Sand	ftss		73.9
	h) Net/Gross Ratio	%		80
	i) Original estimated GOC in Well (or Reservoir)	ftss		N/A
	j) Present estimated PGOC in Well (or Reservoir)	ftss		N/A
	k) Change in GOC from original GOC	ft		N/A
	l) Distance Between Highest Perforation and PGOC	ft		N/A
7	a) Original Estimated OWC in Well (or Reservoir)	ftss	**PHY**	5470
	b) Present Estimated OWC in Well (or Reservoir)	ftss		5418(WUT FORC-141; 2002)
	c) Change in OWC From Original OWC	ft		52
	d) Distance Between Lowest Perforation and POWC	ft tvd		33
8	a) Tubing Size/Weight	in/ibs/ft	**PTC**	2.375/4.7
	b) Casing Size/Weight	in/ibs/ft		7”/29
	c) Shot Per Foot Density (SPF)	in		6
9	a) Average Hole Size across Completion Interval	in	**PHY**	-
10	a) Is there a barrier between top of completion interval and the present estimated GOC.		**GEO**	- NO
	b) Is there a barrier between lowest completion interval and the present estimated OWC.			NO

RESERVES ESTIMATION

The table below summarises the rewards for the FORC-123L restoration activity.

RESERVOIR	RESERVES (2P): 31/12/14)	INITIAL RATE (risked) bopd
D9400L	0.95	623

The methodology used in estimating expected reserves to be develop by FORC 123L on the D9400LMNO was based on analogue volumetric estimation. The proposed perforation is expected to open up the attic oil volume of the target reservoir blocks D9400LMN for production, it will also produce any remaing volume associated with the existing perforation to be squeezed off. The STOIIP to be accessed by the perforation was calculated from top of the proposed peforation (5358ftss) to the top perforation of existing current producer FORC 029S (5358ftss).

The D9000LOMN reservoir was used as an analogue for the subject D9400LOMN reservoir

	Reservoir	Por-avg	perm-avg	Kv/Kh-avg	Thck-avg	Sh-avg	SQRT(K/phi*u)	average depth	Viscosity
		%	mD		ft	&		ft	cP
Analogue	D9000LOMN	28	1448	0.4	55	80	53	5300	1.84
Subject	D9400LOMN	29	2560	0.5	52	77	75	5400	1.59

Table 1: HC volumes; Rock & Fluid Properties for D9000LMNO and D94000LMNO

The RF estimated (attachment 9) of the analogue reservoir (D9400) was applied to the STOIIP in estimating the expected reserves for the D9400LMNO (target) reservoir with prior production from FORC-123L production discounted. This resulted in a 2P volumeof 1.09MMstb for the FORC-123L after the proposed activity is carried out.

										RF			DUR				Reserves (-123L Prod)		
Drainage Point	Reservoir	Analogue	Analogue Drainage Area (Acre)	GRV (acre.ft	N/G	PHI	Soi	Boi	STOIIP (MMstb)	1P	2P	3P	1P (MMstb)	2P (MMstb)	3P (MMstb)	123L Prod (MMstb)	1P (MMstb)	2P (MMstb)	3P (MMstb)
FORC 123L	D94LMNO	D90LMNO	162.00	3363.20	0.95	0.29	0.77	1.16	4.73	0.55	0.56	0.58	2.56	2.66	2.75	1.711	0.85	0.95	1.04

Table 2: Summary of DUR estimate for FORC 123L (D9400L) Target.

POTENTIAL ESTIMATION:

The well performance software, Prosper was used to model the production performance of this well using. The SPOT model was used to describe the IPR for new perforations on the D9400L interval. The PI derived from the SPOT model was risked by 70% and used for all further analysis. Effect of the stimulation activity was not considered in the potential estimation.

At open up, it is expected for the cone to have recceeded hence a BSW of 0% is expected. This is consistent with the production of history of the well prior to the bean up in 1995. Operating bean is expected to be 28/64" with an expected drawdown of 178 psi.

BEAN UP SEQUENCE

ESTIMATED ON STREAM : July 2015
STATUS OF FLOWLINES : Ok
TO BE HOOKED UP TO : FORC/2
(In case of more than one interval, each should have a bean up sequence).

INTERVAL (ftah)	ESTIMATED TECH. POT. (bopd)		WEEK				
D6.000H: 6538-6558	623		1	2	3	4	5
		BEAN SIZE (/64")	20	24	28	32	36
		GROSS OIL RATE (bpd)	626	841	1041	1216	1356
		NET OIL RATE (bopd)	626	841	1041	1216	1356
		BSW (%)	0	0	0	0	0
		THP (psi)	516	476	467	411	374

Six weeks test on various bean sizes required for DPR allowables.

PRODUCTION FORECAST

The Production forecast for FORC-123L on D9400L was estimated using the HFPT tool. An initial well potential of 623 bopd was used, and abandonment conditions were evaluated from the well model using the PROSPER tool. The forecast takes account of the deferments in the field (based on OP14 premise) and also assumes that the well will come on-stream by July 2015 based on the Q2-2014 STOG sequence.
The yearly-average production forecast is as presented below:

FORC-123L (D9400L) Production Forecast (Offtake)

Profile Type	2015	2016	2017	2018	2019	2020	2021	2022	2023
Flare Gas (Mscf/d)	9.06	35.41	33.01	30.40	27.74	25.44	23.16	21.25	1.73
Gross (b/d)	234.35	947.56	948.05	943.88	935.11	934.35	928.88	922.93	78.10
Oil (b/d)	139.54	531.71	483.29	437.30	393.95	358.09	323.93	293.08	23.57
OwnUse Gas (Mscf/d)	2.51	6.59	4.66	4.06	4.07	4.45	4.94	4.03	0.23
Prod/Inj Gas (Mscf/d)	62.90	242.68	224.72	206.72	188.99	174.06	159.32	145.67	11.78
Sales Gas (Mscf/d)	51.33	200.67	187.05	172.26	157.18	144.17	131.22	120.39	9.82
Grand Total	**499.7**	**1964.6**	**1880.8**	**1794.6**	**1707.0**	**1640.6**	**1571.5**	**1507.3**	**125.2**

HSSE/ SPECIAL WELL/LOCATION CONDITION

CONDITION OF WELLHEAD	OK
ANNULUS PRESSURE MEASUREMENT/DATE	Annulus A – 150 psi as at 16/02/2014
MAASP	Annulus A – 2858 psig
WELL INTEGRITY SUMMARY	Last well entry reported ScSSSV was not in place. To be confirmed during the activity.
CONDITION OF PRODUCTION STRINGS	Possible sand HUD in the tubing.
ANY PROBLEM DURING PRIMARY CEMENTATION OR LAST RE-ENTRY	None
SPECIAL FISHING TOOL REQUIRED	None
LOCATION CONDITION	Shallow offshore cluster
COMMON CELLAR	Same cluster as 121T [NAG Well], 122L/S, 124L/S
SEASONALLY FLOODED	NA
SIZE LIMITATION	None

RISKS AND MITIGATION

RISK	MITIGATION
Release of high pressure during pumping	• All pressure lines must be secured. Pumping lines must have safety slings at connections. Ensure pumping equipment/lines are tested and certified during pre-mob.
Poor injectivity/ excessive back pressure during pumping	• Confirm injectivity into perforations by carrying out an injectivity test with inhibited brine prior to commencement of pumping.
Wireline/CT stuck in hole	• Drift size - Use correct size of wire-line /CT drift.
Slick line breakage	• Ensure the use of certified equipment and closely monitor the weight while running slick line. • Ensure the rating of the cable is known by the operator and excessive pull on the wire should be avoided.
Loss of well control	• Use appropriate wireline BOP and fluid of appropriate gradient
Chemical spills	• All chemicals/additives should be handled with care and with the appropriate PPE
Accidental discharge of perforation gun	• Prior to arming the gun all applicable safety checks must be made, radio silence established, and approval to arm the gun obtained from the wellsite supervisor. • Unauthorized access to a location should be prevented while work with explosives is taking place.

SCON / SAND TRAP SPECIFIC

RISKS	POTENTIAL (L/M/H)	JUSTIFICATION	IMPACT ON COSTS OR REWARDS	HOW IS THE RISK MANAGED
Contamination by SCON chemicals	M	Personnel could be exposed to SCON chemicals during mixing. Community members may also be exposed if they have access to the empty chemical drums.	Health	• SCON Chemicals should be bulked in the contractors' base and transported to the field location. • Un-used chemicals should be returned to contractor base for proper disposal. • Ensure all connections are leak tight before pumping SCON chemicals • An experienced PT with the authority to stop activities in the field if HSE procedures or technical assurance is being compromised

RISKS	POTENTIAL (L/M/H)	JUSTIFICATION	IMPACT ON COSTS OR REWARDS	HOW IS THE RISK MANAGED
				should be present during the operation
Flammable hydrocarbon-methanol	M	Resin and hardener contains methanol (a hydrocarbon) which If ignited could result in fire burns	Injury to personnel, damage to equipment	• Ensure CO2 inert gas blanket on top of the mixer
Inhalation of hydrocarbon vapour	M	Resin and hardener contains methanol (a hydrocarbon) which when the vapour is inhaled can cause dizziness or unconsciousness	Health	• Ensure proper ventilation of holding tanks for chemicals and access to area should be controlled
Spill	L	Pollution of the environment	Damage to the environment	• Visually inspect all valves and connections. Ensure no leaks and check compatibility of rubbers and seals in the connections and equipments chemicals will be pumped through.

Attachments:

1. Current Well schematic
2. Proposed Well Schematic
3. Up to date Hydrocarbon distribution plots for reservoirs.
4. Latest Horizon map/cross section for the relevant sands with all wells included.
5. Full anotated production performance plot for the intervals.
6. PDL Sections
7. Inflow performance plots
8. Volume Calculations
9. Proposed Treatment Recipe
10. Analogue Recovery Factor Estimate

Attachment 1: Current Well schematic

WELL COMPLETION FOR FORCADOS YOKRI-123

ITEM	TYPE	SIZE	PSI	REMARKS
GATE VALVE	CAMERON 'FC'	2" x 2"	API 5000 PSI WP	INSTALLED
XMAS TREE	DSB	7-1/16" x 2-9/16" x 2-1/16" C/W C.L PREP.	API 5000 PSI WP	INSTALLED
XMAS TREE CAP		2"/2-1/2" TAPPED 1/2" NPT	API 10,000 PSI WP	INSTALLED
TUBING HANGER	DCB	7-1/16" x 2-3/8" HCS x 2-7/8" HCS	API 5000 PSI WP	INSTALLED
TUBING HEAD	DCB	7-1/16" x 13-5/8"	3/5000 PSI	INSTALLED
RISER SPOOL		21-1/4"x 12"	3000 PSI	INSTALLED
C.H. HOUSING	WF	20" x 21-1/4"	2000 PSI	INSTALLED
SEAL BUSHING	'X'	7" x 12"	INSTALLED AND ENERGISED	

TUBING

SIZE	GRADE	LBS/ft	TYPE	No.JTS
2-3/8"	A 95	4.7	R-2	159

SHORT STRING AT **5456** ft

INSTALLED GASLIFT VALVE			
DEPTH	VALVE TYPE	PORT SIZE	TRO

1/4" STEEL CTRL. LINE

2-3/8" HCS OTIS ALLOY FLOW COUPLING

2-3/8" HCS OTIS 'XEL' 191' LANDING NIPPLE + SSSV.

2-3/8" HCS CAMCO KBMG GASLIFT MANDRELS
1784'
2456'
2906'
3200'
3397'

2-3/8" HCS OTIS 'XA' SLEEVE (SSD) 5112'

2-3/8" HCS OTIS 'XA' SLEEVE (SSD) 5165'

2-3/8" HCS OTIS 'XN' LANDING NIPPLE 5198'

2-3/8" 'A-95' BAKER PERFORATED TUBE 5203'

4" STC BLANK LINER K55 9.5 LB/FT 5258'- 5288'
CASING

D3.0 5316'- 5326'
(IGP) 5330'- 5340'

2-3/8" HCS MODEL 'G' LOC SEAL ASSY 'GBH-22' (81-32)

2-3/8" HCS MODEL 'E' SEAL 'EBH-22'

4" STC BLANK LINER K55 9.5 LB/FT 5886'- 5948'
CASING

FCP D9.4 5960'- 5970'
(IGP)

TUBING

SIZE	GRADE	LBS/ft	TYPE	No.JTS
2-3/8"	A 95	4.7	R-2	182

LONG STRING AT **5955** ft

INSTALLED GASLIFT VALVE			
DEPTH	VALVE TYPE	PORT SIZE	TRO

1/4" STEEL CTRL. LINE

2-3/8" HCS OTIS ALLOY FLOW COUPLING

204' 2-3/8" HCS OTIS 'XEL' LANDING NIPPLE + SSSV.

2-3/8" HCS CAMCO KBMG GASLIFT MANDRELS
1763'
2438'
2826'
3119'
3314'

5107' 2-3/8" HCS OTIS 'XA' SLEEVE (SSD)

5144' BAKER MODEL 'A-5' PACKER(47 C2) +'S' SNAP LATCH 2-3/8" HCS x 2.68

5183' 2-3/8" HCS OTIS 'XA' SLEEVE (SSD)

5236' BAKER TYPE 'FBGP-1' PACKER(87/85-40) WITH TYPE 'C' GP EXTN. W/SLIDING SLEEVES (SIZE 80-40)/4" SHEAR-OUT SAFETY JOINT

5288'- 5348' 4" 'STC' SS. WWS 'GP' SCREEN 0.012" GUAGE W/K55 9.5 LB/FT PIPE

5348' 4" STC TYPE 'E-22' SNAP LATCH SEAL ASSY (80 DA 40)

5352' 7" BAKER MODEL 'DAB' PKR (84 DA 40)

5866' 7" BAKER 'DAB' GP PACKER (84 DA 40) WITH 'C' GP EXT. W/SLIDING SLEEVE (80-32) 4" SHEAR OUT SAFETY JOINT

5906' 2-3/8" HCS OTIS 'XA' SLEEVE (SSD)

5939' 2-3/8" HCS OTIS 'XN' LANDING NIPPLE

5943' 2-3/8" HYD A-95 MULE SHOE

5948'- 5978' 4" 'STC' SS. WWS 'GP' SCREEN 0.012" GUAGE W/K55 9.5 LB/FT PIPE

5978' 4" STC TYPE 'E-22' SNAP LATCH SEAL ASSY (80 DA 40)

5982' 7" BAKER MOD 'DAB' PACKER (84 DA 40)

WELL DATA

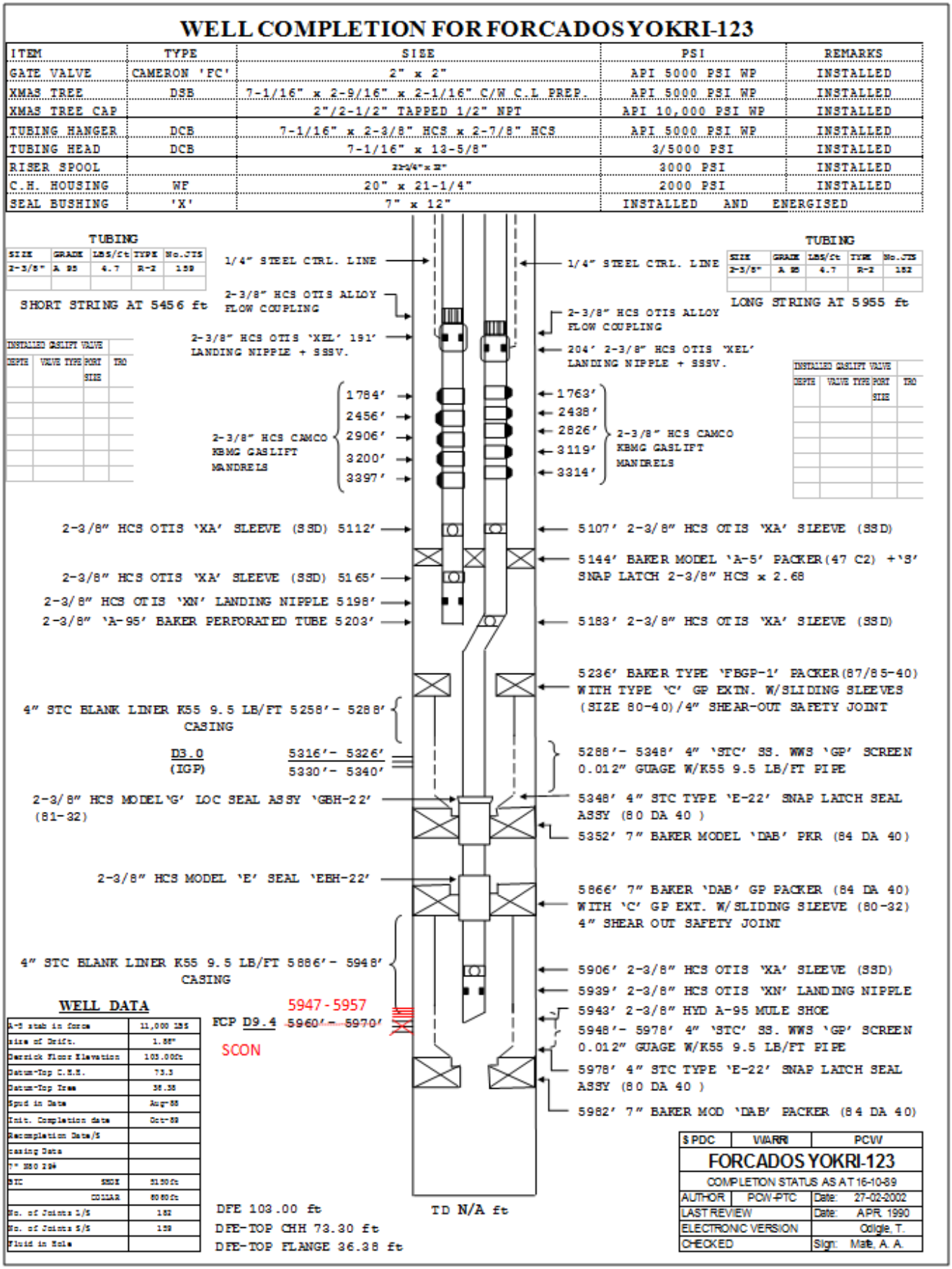
A-5 stab in force	11,000 LBS
size of Drift.	1.86"
Derrick Floor Elevation	103.00ft
Datum-Top C.H.H.	73.3
Datum-Top Tree	36.38
Spud in Date	Aug-88
Init. Completion date	Oct-89
Recompletion Date/S	
casing Data	
7" N80 29#	
BTC SHOE	5150ft
COLLAR	6060ft
No. of Joints L/S	182
No. of Joints S/S	159
Fluid in Hole	

DFE 103.00 ft
DFE-TOP CHH 73.30 ft
DFE-TOP FLANGE 36.38 ft

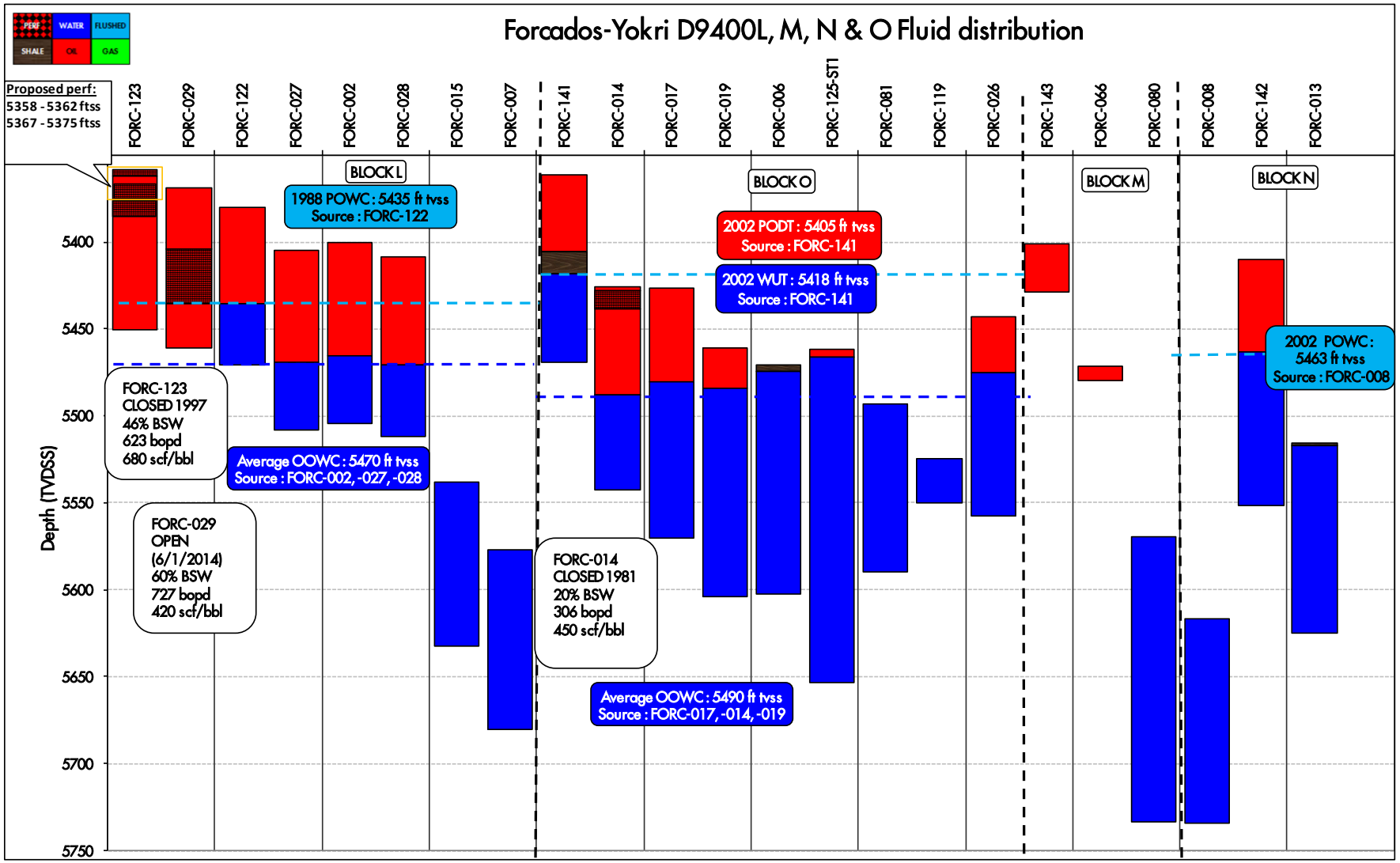
TD **N/A** ft

S PDC	WARRI	PCW
FORCADOS YOKRI-123		
COMPLETION STATUS AS AT 16-10-89		
AUTHOR	PCW-PTC	Date: 27-02-2002
LAST REVIEW		Date: APR. 1990
ELECTRONIC VERSION		Odigie, T.
CHECKED		Sign: Mafe, A. A.

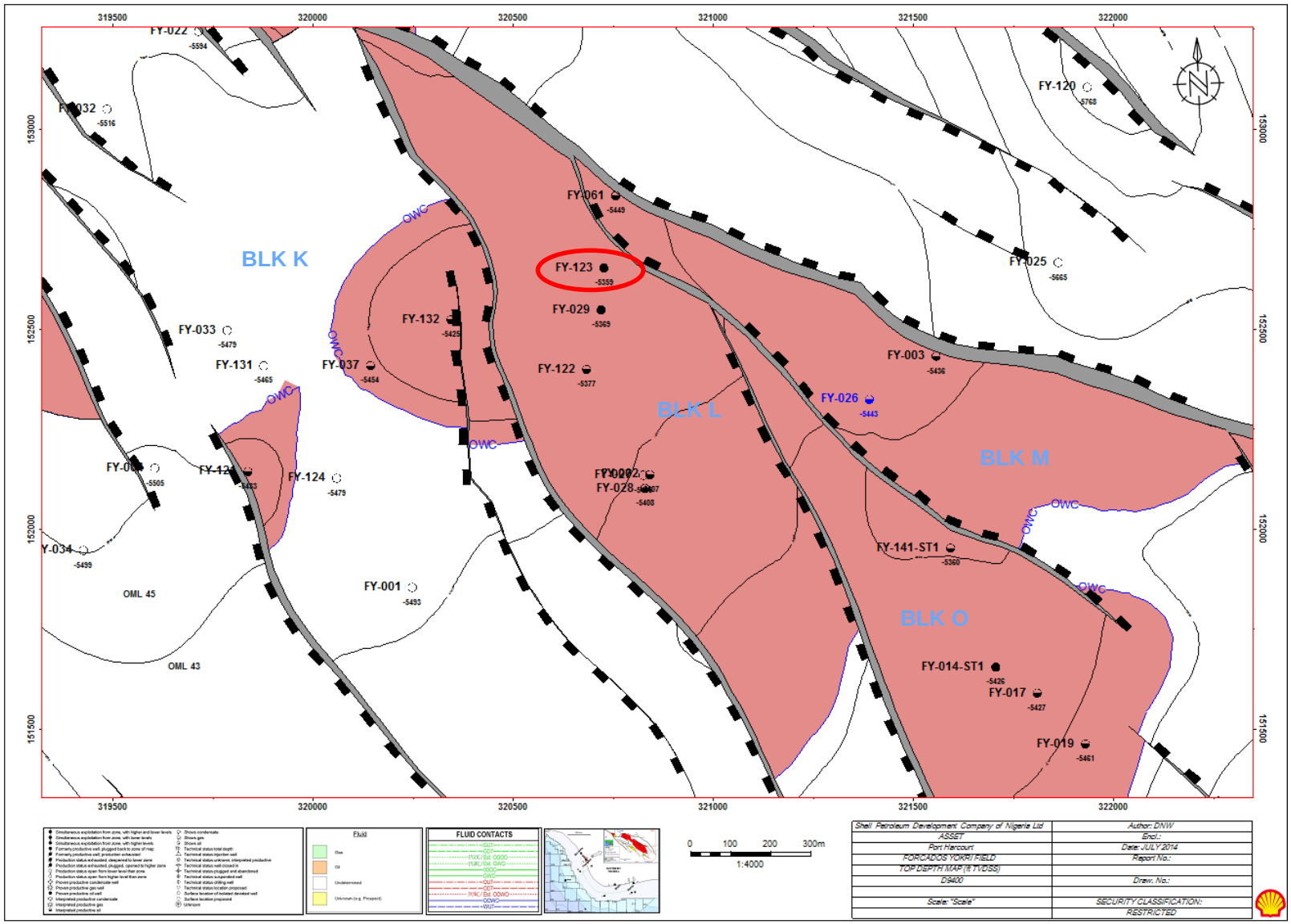
Attachment 2: Proposed Well schematic



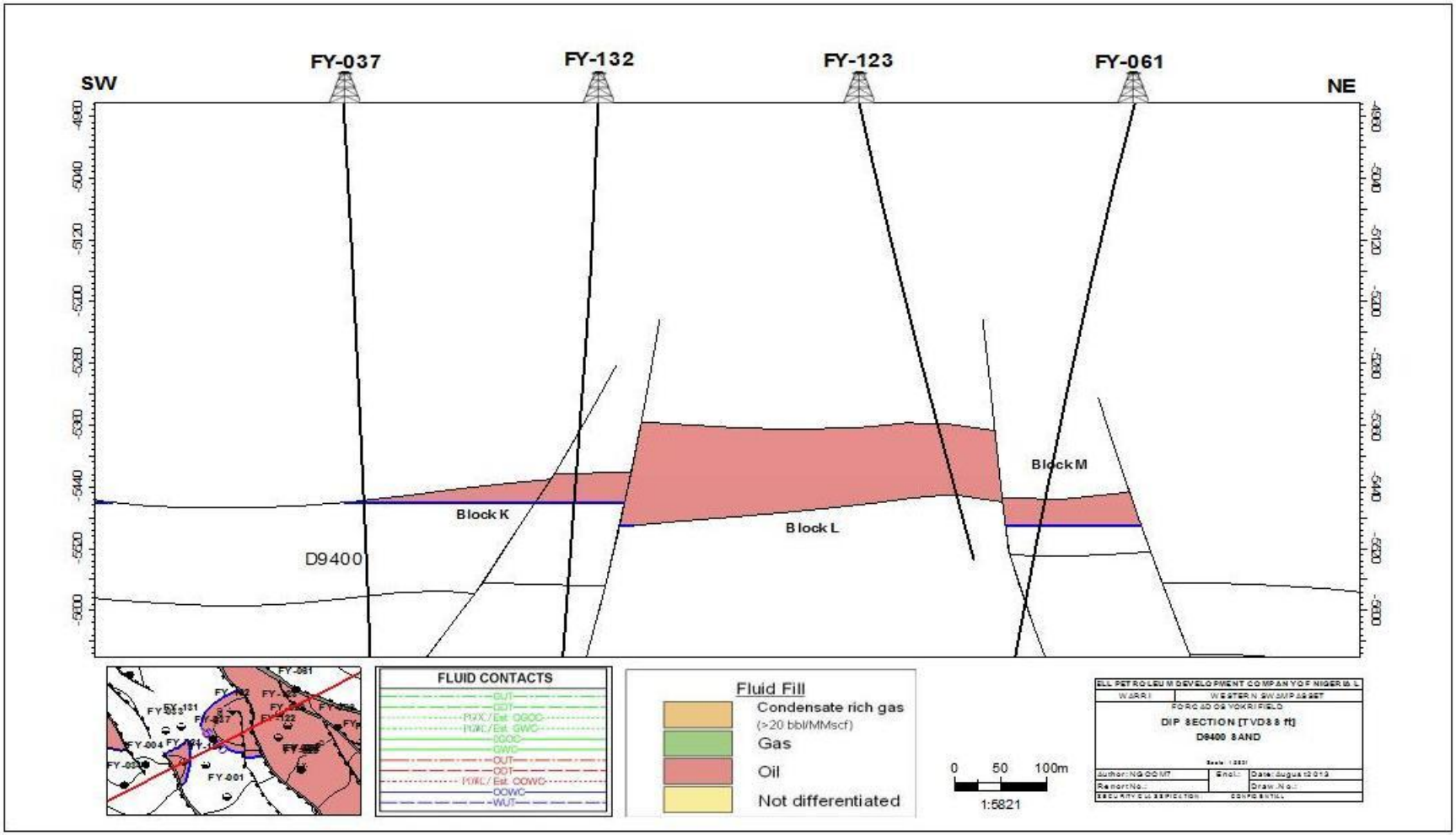
Attachment 3: D9400L Hydrocarbon Distribution plot



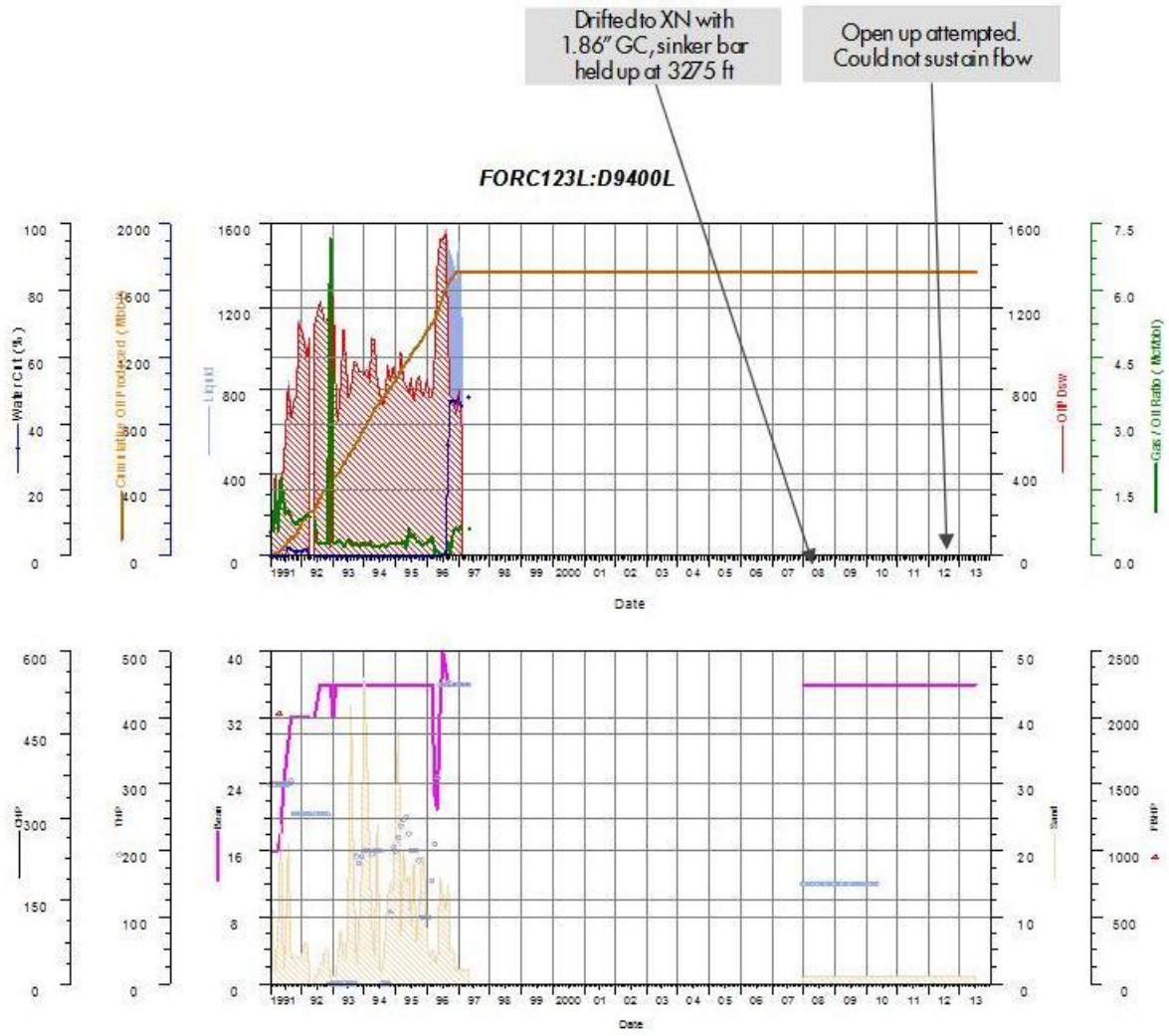
Attachment 4a: D9400 Top Structure Map



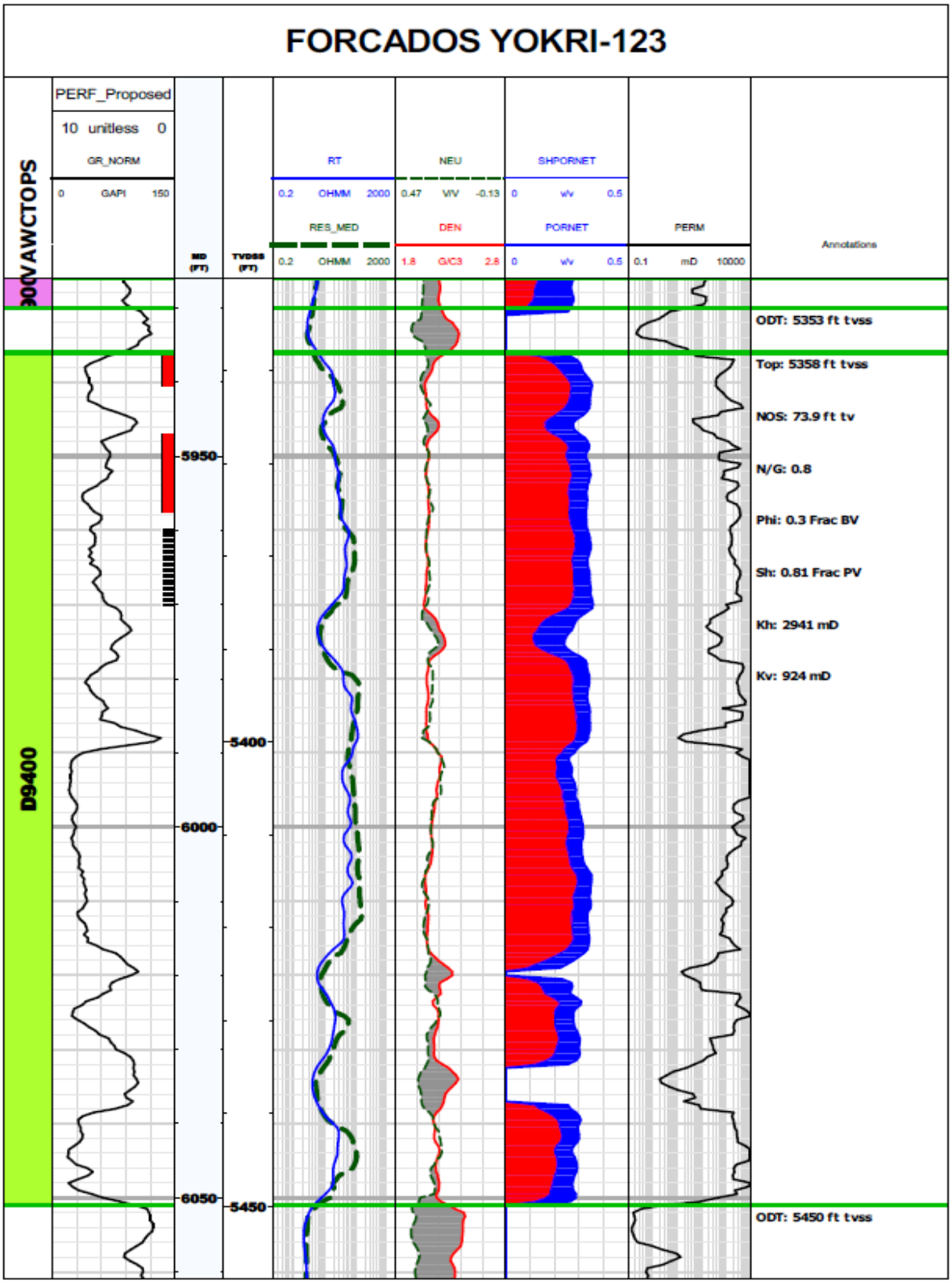
Attachment 4b: D9400L Cross Section



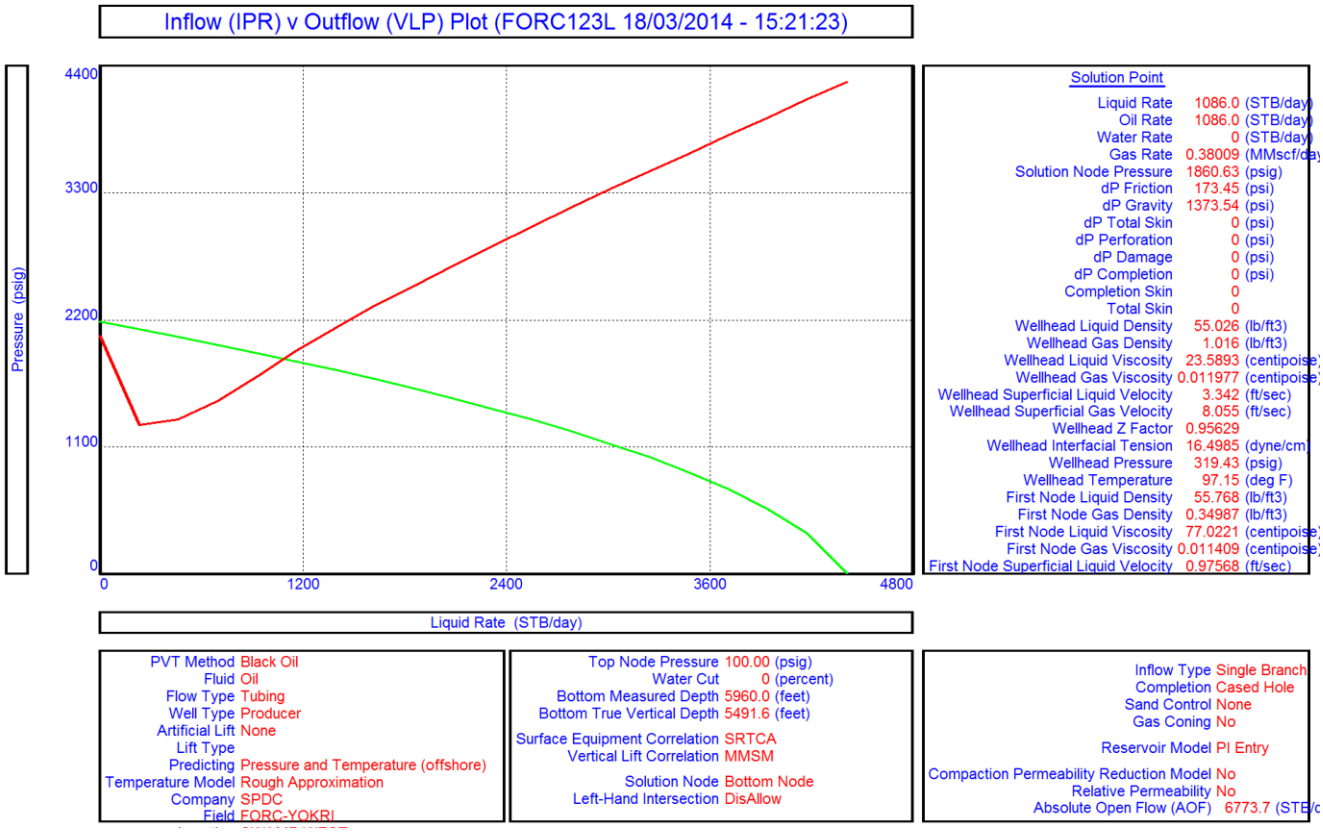
Attachment 5: FORC123L: D9400L Performance Plot



Attachment 6: FY-123: D9400L PDL



Attachment 7 : D6.000H Inflow/outflow performance plot



Attachment 8: Volume Calculations

FORC 123L				
Volume required for Viscous Pill: Zone D9400				
	Coverage			
	Casing volume	5972-5978 ftah		
	Perforation volume			
Casing capacity	Casing Size	Casing Capacity (bbl/ft)	Distance (ft)	Casing volume (bbl)
	{(7" 29lb/ft)	0.03714	6	0.22284
Use 0.15 excess volume				
Total volume required (squeeze off G3.5)				
Estimate Volume required				
Cement volume required (bbl)	**0.22284**			
Total Cement volume to be pumped (bbl)	**0.256266**	**0.3**	**(15% excess added)**	
Cement volume to be pumped (ft³)		**1**		
Volume required for BackStop: Zone D9400				
	Coverage			
	Casing volume	5960 - 5972 ftah		
	Perforation volume			
Casing capacity	Casing Size	Casing Capacity (bbl/ft)	Distance (ft)	Casing volume (bbl)
	4" Liner 9.5 lb/ft	0.01625	12	0.195
Perforation capacity: Use 1ft3 per ft of perforations	Perforations lenght	Perforations capacity (ft3)	Distance (ft)	Perfs volume (bbl)
	10	1ft3 per ft of perfs	10	1.7809439
Use 0.15 excess volume				

Attachment 9: Proposed Treatment Recipe

A.) Squeeze Off (BackStop sealant) Recipe

Well	FORC-123L
Treatment Type	Perforation Squeeze off
Reservoir – To Squeeze	Through existing IGP
Target Interval	5960 - 5972 ftah
Lead Treatment	BackStop: 2.3 bbls
Displacement	Brine: CT Volume

B.) Sand Consolidation (using SandTrap 225) Recipe

Preliminary Fluid Schedule			
Stage	Fluid Type	CT Pump Rate	Design Volume
Preflush 1	7% KCl + 0.5% ES 5	0.5 – 1.0 bpm	150 gal/ft.
Preflush 2	Musol	0.5 – 1.0 bpm	100 gal/ft.
Main Treatment	SandTrap 225	0.5 – 1.0 bpm	100 gal/ft.
Spacer	Mineral Oil/Diesel	0.5 – 1.0 bpm	100 gal
After flush	7% KCl + 0.5% ES 5	0.5 – 1.0 bpm	150 gal/ft.
Displacement	Brine	0.5 – 1.0 bpm	CT Volume

Attachment 10: Analogue Recovery Factor Estimate.

Reservoir Block	STOIIP	Drainage Point	Np (31/05/2014)	Drainage Point DUR (1P)	Drainage Point DUR (2P)	Drainage Point DUR (3P)	Reservoir DUR (2P)
D9000L	19.7	FORC 027L	12.1	15.1	15.9	16.9	15.9
D9000M	17.32	FORC 026L	6.3	7.4	7.6	7.7	8.8
		FORC 003S	1.2	1.2	1.2	1.2	
D9000N	5.09	FORC 013C	2.0	2.0	2.0	2.0	2.0
D9000O	25.69	FORC 006C	3.1	3.1	3.1	3.1	13.1
		FORC 081L	1.3	1.3	1.3	1.3	
		FORC 126L	3.3	4.2	4.7	5.5	
		FORC 141L		2.7	4.0	5.4	
Total	67.8		29.2	37.1	39.8	43.1	39.8

D9LMNO Np/STOIIP (%)		43.1
D9LMNO 1P Oil RF (%)		54.0
D9LMNO 2P Oil RF (%)		56.0
D9LMNO 3P Oil RF (%)		58.0