





Upper Bahariya Thin Laminated Low Resistivity Pay Sandstone Reservoir, Safwa Field, Abu Gharadig Basin, Western Desert, Egypt





Agenda

- > Location
- ➤ Safwa Field Overview
- > Upper Bahariya Reservoir and Sub-division
- Sabbar-1 Well Re-evaluation and Test
- Safwa NW-3 Second Well Test Results
- Conclusion and Recommendation

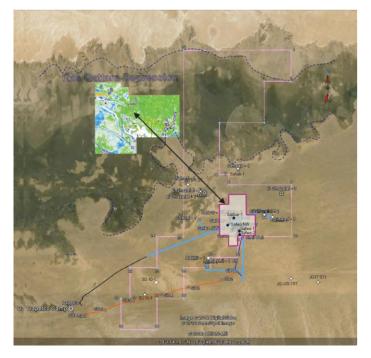


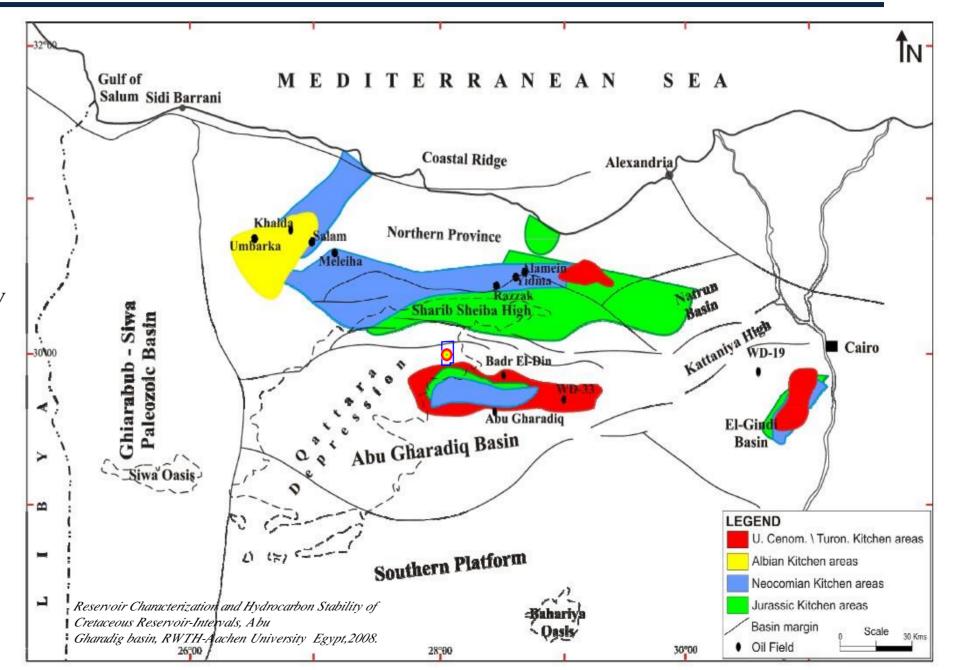


Location

Safwa oil field is located in the East Ghazalat Concession in the proven and prolific A bu Gharadig basin, Western Desert. A bout 250 Km to the southwest of Cairo.

It's located in the vicinity of several producing fields ranging from small to large size of hydrocarbon accumulation, adjacent to the NW-SE trending major Abu Gharadig fault which is throwing SW

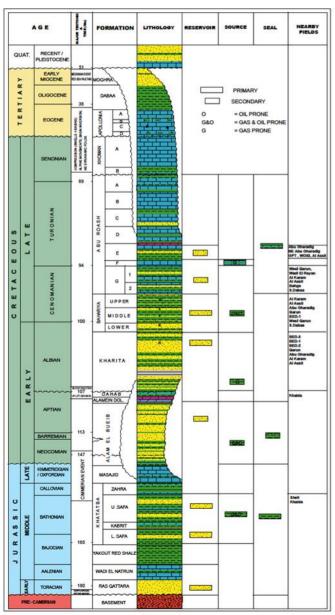


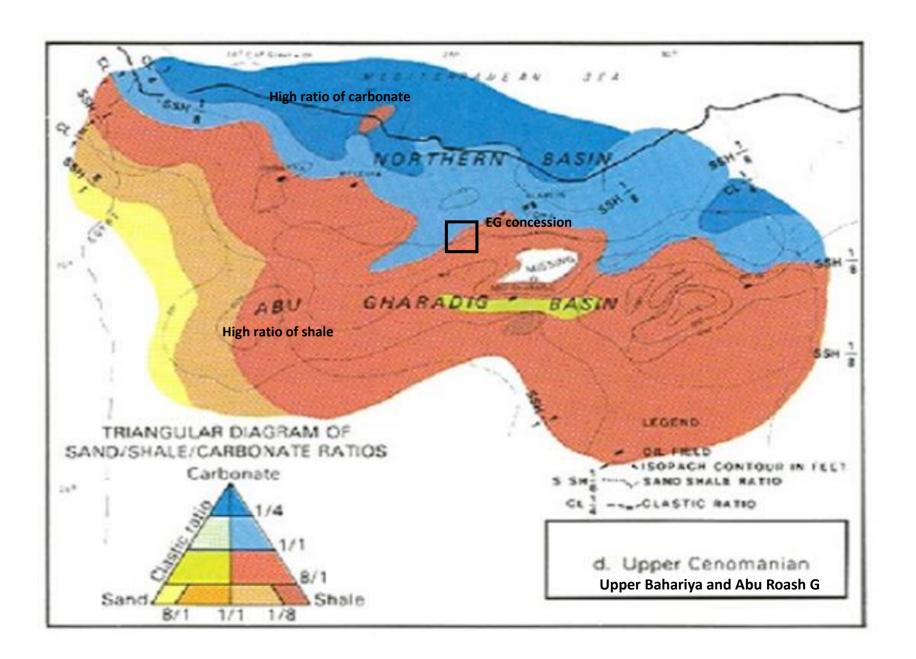






Safwa Field Overview



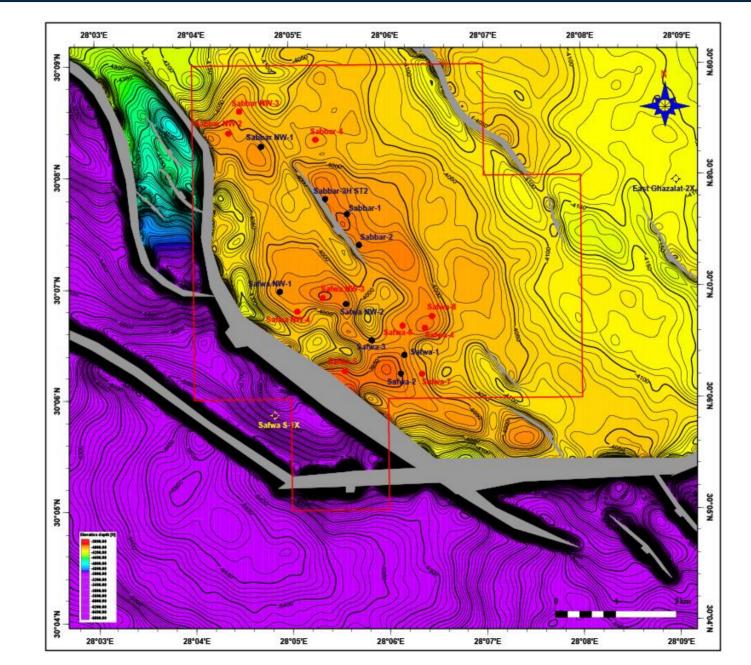






Safwa Field Overview

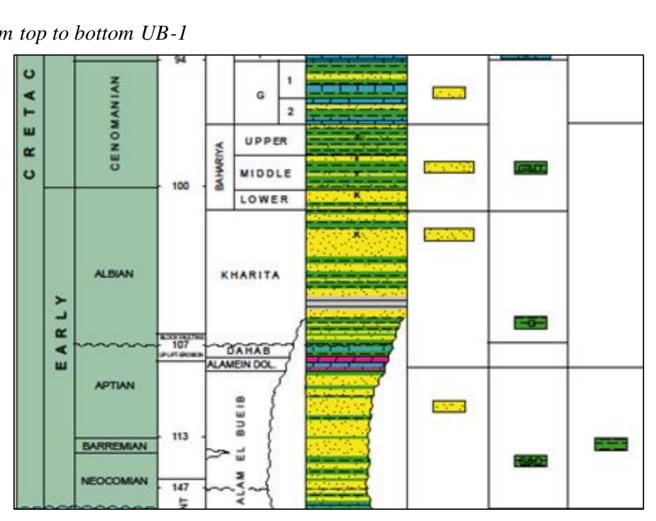
Bahariya Depth Map

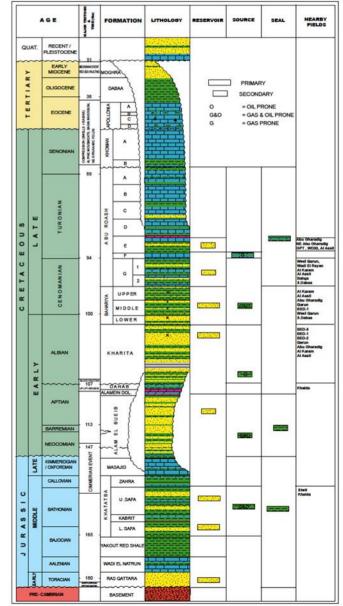






- > Upper Bahariya Reservoir and Sub-division
- ✤ Cenomania A ge
- * Mainly Siltstone interbedded with Shale and Sandstone
- Divided into eight (8) zones from top to bottom UB-1 to UB-8
- ✤ Tidal Flat Deposition

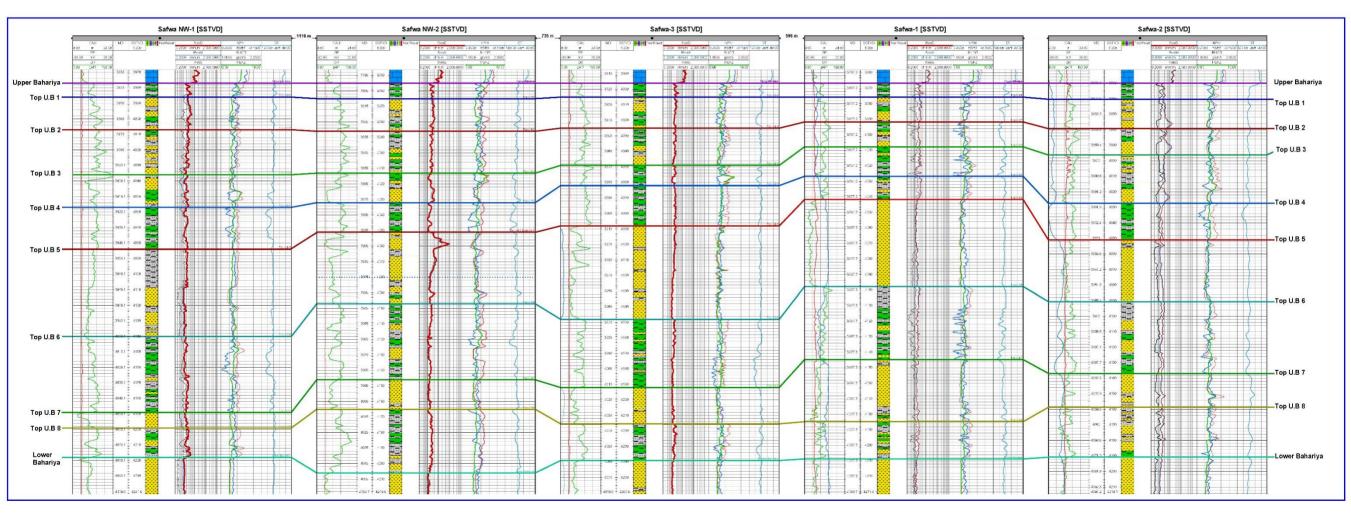








> Upper Bahariya Reservoir and Sub-division

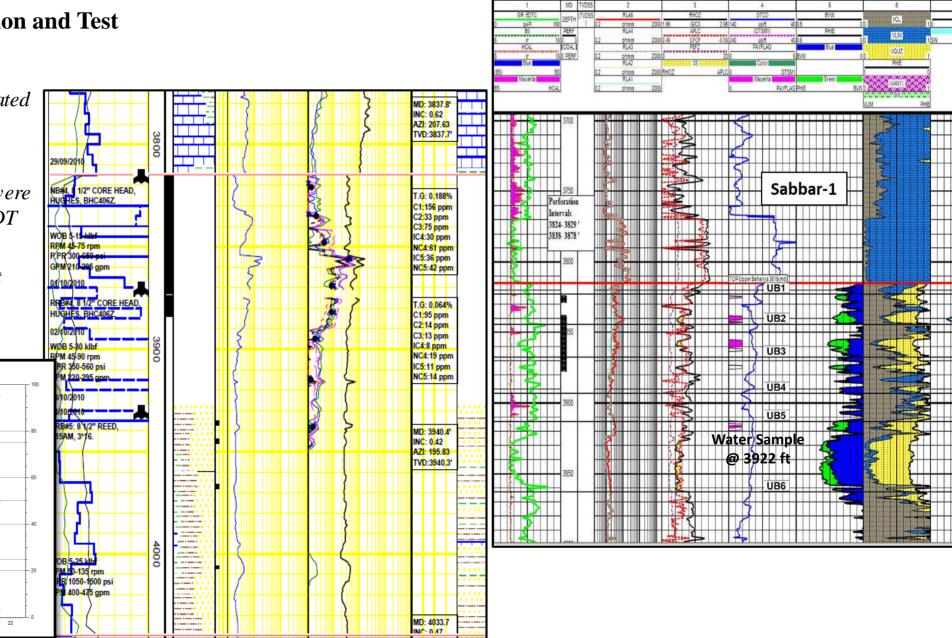


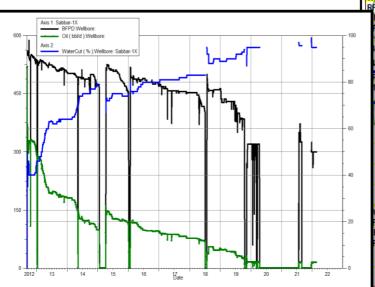




Sabbar-1 Well Re-evaluation and Test

- ✤ Drilled in 2010
- UB-1, UB-2 & UB-3 were Perforated and Produced
- ✤ Initial test results 500 bbl/d of oil
- Other upper Bahariya reservoirs were water bearing (original CPI & MDT gradient)
- ✤ Water Sample @ 3922 ft (-4050 ft TVDss)









	> 5	abba	ar-1	We	ell R	e-e	valu	ati	ior	ı a	nd	Te	st				Litho	ologic
		e data												CPI	Facies	Subfacies	Microfacies	
SAMPLE	DEPTH (ft)	N	ITROGEN RMEABILITY mD		HELIUM POROSITY	GRAIN DENSITY	Porosity By Fluid Summation	RESI	IDUAL RATION ETORT	RESI SATUP BY D	IDUAL RATION DEAN ARK	GRAIN DENSITY		ITHOLOGIC DE		Supertidal	Mud flat	Maii Brov
NO.	(11)	HORIZONTAL	VERTICAL	PROBE	%	g/cm ³	(%)	Oil	% Water	Oil	% Water	g/cm ³		KEW			wide nat	DIOV
																Intertidal	Mixed flat	Grey
Core N	<u>0.1</u>				Core In	tervals : 3814'	<u> 10" - 3873'00"</u>							Formation	Tidal falt		Sand flat	Thic
1	3814.00	0.21	0.09	0.04	13.2	2.77	15.1	0.0	70.3	0.0	67.7	2.77	S.S;	dk gn.fg.glauc s srtd,mic			Sallu llat	THIC
2	3815.00 3816.00	17.4	4.40	3.15 2.39	25.4 25.3	2.73	19.6	10.3 8.1	48.9 48.9	10.4	43.8 41.4	2.73	A.A; A.A;			Subtidal		Inve
4	3816.00	0.15	3.26	2.39	25.3	2.72	10.2	8.1 0.0	48.9	8.5 2.4	41.4 81.8	2.72	A.A; S.S;	It to dk gv.fg, ar		54511441		inve
5	3818.00	12.3	2.33	0.04	24.0	2.66	9.8	0.0	83.2	2.5	63.4	2.66	S.S;	It gy, fg, arg cmt,		Tidal and als		F :
6	3819.00	4.21	2.94	0.03	17.2	2.75	13.5	4.4	75.2	6.0	69.9	2.75	S.S;	lt gn.fg.glauc s,a		Tidal creek		Fine
7	3820.00	6.27	13.2	0.21	21.8	2.63	20.1	0.9	59.4	5.2	51.9	2.63	S.S;	dk g <u>v.,</u> v fg,arg (
8	3821.00	2.67	6.34	0.10	21.5	2.62	17.0	5.5	67.6	8.9	62.5	2.62	A.A;	frac.carb matter				
9	3822.00	7.48	1.42 Broken	1.52	22.9 18.1	2.63	18.1	5.0 3.4	57.8 60.3	8.2	49.9 51.0	2.63	A.A; A.A;	carb matter		Depth 3846'	00" 3848'	00"
10	3824.00	101	Broken	10.6	23.2	2.66	20.0	3.4 12.9	44.1	15.0	35.8	2.66	A.A; S.S:	It gv.fg.arg cmt, w c	cmt w srtd mic			
12	3825.00		Diolioli	1010	2012	2.00	2010					2.00	Mdst	n gauge ang ann, n a		and the		
13	3826.00	0.13	Broken	0.08	9.6	2.74	16.1	2.6	60.9	8.1	74.4	2.74	S.S;	It gy, fg_calc cmt,w	vcmt,w srtd,mic,carb	2	2 B	
14	3827.00												Mdst	matter				1
15	3828.00												Mdst			4		1
16 SAMPLE NO.	3829.00 DEPTH (ft)	N PEF	ITROGEN RMEABILITY mD		HELIUM POROSITY %	GRAIN DENSITY g/cm ³	Porosity By Fluid Summation	SATUR BY RE	IDUAL RATION ETORT %	SATU BY I	IDUAL RATION DEAN ARK %	GRAIN DENSITY g/cm ³	Mdst	LITHOLOGIC DES REMAR		6	6	-
		HORIZONTAL	VERTICAL	PROBE			(%)	Oil	Water	Oil	Water					8	8	
20	3833.00	616	421	85.4	27.9	2.67	21.5		42.7	10.1	36.1	2.67	S.S:	dk gy fg,arg cmt,	us and us and min		0	2
20	3833.00	797	421	80.4 52.6	31.7	2.67	21.5	11.6 10.0	42.7	10.1	36.1	2.67						and the second se
22	3835.00	315	266	13.6								2.62	A.A:	uk gy,, ig,aig chit,		10	10	-
23	3836.00			10.0	30.3	2.61	17.9	13.7	48.9	21.5		2.62	A.A; A.A;				10	1
24		724	217	13.0	30.3 32.1	2.61 2.62	17.9 20.1	13.7 12.9	48.9 38.6	21.5 14.5	41.5 37.0 36.4	2.62 2.61 2.62	A.A; A.A; A.A;	arg lam				1
	3837.00	724 Broken	217 NPP				-				37.0	2.61	A.A;			10 12 12	10	T
25	3838.00	Broken 493	NPP 63.3	13.7 14.8 22.2	32.1 30.6 30.3	2.62 2.63 2.63	20.1 17.4 21.2	12.9 15.3 13.1	38.6 46.8 39.3	14.5 19.6 18.7	37.0 36.4 47.1 46.5	2.61 2.62 2.63 2.63	A.A; A.A; A.A; A.A; A.A;	arg iam		bbar-1		T
26	3838.00 3839.00	Broken 493 321	NPP 63.3 33.8	13.7 14.8 22.2 68.0	32.1 30.6 30.3 30.1	2.62 2.63 2.63 2.65	20.1 17.4 21.2 21.5	12.9 15.3 13.1 13.9	38.6 46.8 39.3 35.9	14.5 19.6 18.7 20.1	37.0 36.4 47.1 46.5 31.9	2.61 2.62 2.63 2.63 2.63 2.65	A.A; A.A; A.A; A.A; A.A; A.A;			app		1
26 27	3838.00 3839.00 3840.00	Broken 493 321 162	NPP 63.3 33.8 18.6	13.7 14.8 22.2 68.0 28.9	32.1 30.6 30.3 30.1 27.0	2.62 2.63 2.63 2.65 2.83	20.1 17.4 21.2 21.5 19.4	12.9 15.3 13.1 13.9 9.3	38.6 46.8 39.3 35.9 35.3	14.5 19.6 18.7 20.1 13.4	37.0 36.4 47.1 46.5 31.9 32.1	2.61 2.62 2.63 2.63 2.65 2.83	A.A; A.A; A.A; A.A; A.A; A.A; A.A;	arg lam arg lam		Sabbar-1	12	
26	3838.00 3839.00	Broken 493 321	NPP 63.3 33.8	13.7 14.8 22.2 68.0	32.1 30.6 30.3 30.1	2.62 2.63 2.63 2.65	20.1 17.4 21.2 21.5	12.9 15.3 13.1 13.9	38.6 46.8 39.3 35.9	14.5 19.6 18.7 20.1	37.0 36.4 47.1 46.5 31.9	2.61 2.62 2.63 2.63 2.63 2.65	A.A; A.A; A.A; A.A; A.A; A.A;	arg iam		Sabbar-1	12	
26 27 28	3838.00 3839.00 3840.00 3841.00	Broken 493 321 162	NPP 63.3 33.8 18.6	13.7 14.8 22.2 68.0 28.9	32.1 30.6 30.3 30.1 27.0	2.62 2.63 2.63 2.65 2.83	20.1 17.4 21.2 21.5 19.4	12.9 15.3 13.1 13.9 9.3	38.6 46.8 39.3 35.9 35.3	14.5 19.6 18.7 20.1 13.4	37.0 36.4 47.1 46.5 31.9 32.1	2.61 2.62 2.63 2.63 2.65 2.83	A.A; A.A; A.A; A.A; A.A; A.A; S.S;	arg lam arg lam		S	12	
26 27 28 29	3838.00 3839.00 3840.00 3841.00 3842.00	Broken 493 321 162	NPP 63.3 33.8 18.6	13.7 14.8 22.2 68.0 28.9	32.1 30.6 30.3 30.1 27.0	2.62 2.63 2.63 2.65 2.83	20.1 17.4 21.2 21.5 19.4	12.9 15.3 13.1 13.9 9.3	38.6 46.8 39.3 35.9 35.3	14.5 19.6 18.7 20.1 13.4	37.0 36.4 47.1 46.5 31.9 32.1	2.61 2.62 2.63 2.63 2.65 2.83	A.A; A.A; A.A; A.A; A.A; A.A; S.S; Mdst	arg lam arg lam		S	12	
26 27 28 29 30 31 32	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3844.00 3845.00	Broken 493 321 162	NPP 63.3 33.8 18.6	13.7 14.8 22.2 68.0 28.9	32.1 30.6 30.3 30.1 27.0	2.62 2.63 2.63 2.65 2.83	20.1 17.4 21.2 21.5 19.4	12.9 15.3 13.1 13.9 9.3	38.6 46.8 39.3 35.9 35.3	14.5 19.6 18.7 20.1 13.4	37.0 36.4 47.1 46.5 31.9 32.1	2.61 2.62 2.63 2.63 2.65 2.83	A.A; A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst	arg lam arg lam		S	12	
26 27 28 29 30 31 32 33	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3844.00 3845.00 3846.00	Broken 493 321 162	NPP 63.3 33.8 18.6	13.7 14.8 22.2 68.0 28.9	32.1 30.6 30.3 30.1 27.0	2.62 2.63 2.63 2.65 2.83	20.1 17.4 21.2 21.5 19.4	12.9 15.3 13.1 13.9 9.3	38.6 46.8 39.3 35.9 35.3	14.5 19.6 18.7 20.1 13.4	37.0 36.4 47.1 46.5 31.9 32.1	2.61 2.62 2.63 2.63 2.65 2.83	A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst	arg lam arg lam			12 14 16 18	
26 27 28 29 30 31 32 33 33 34	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3844.00 3845.00 3846.00 3847.00	Broken 493 321 162 3.94	NPP 63.3 33.8 18.6 3.88	13.7 14.8 22.2 68.0 28.9 2.62	32.1 30.6 30.3 30.1 27.0 17.8	2.62 2.63 2.65 2.65 2.65	20.1 17.4 21.2 21.5 19.4 19.7	12.9 15.3 13.1 13.9 9.3 5.8	38.6 46.8 39.3 35.9 35.3 57.2	14.5 19.6 18.7 20.1 13.4 8.8	37.0 36.4 47.1 46.5 31.9 32.1 52.5	2.61 2.62 2.63 2.65 2.83 2.65	A.A; A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst Mdst	arg lam arg lam arg lam it <u>gy. Ig</u> arg cmt, w	v cmt , w srld,mic	S	12	
26 27 28 29 30 31 32 33 33 34 35	3838.00 3839.00 3840.00 3841.00 3844.00 3843.00 3844.00 3845.00 3846.00 3847.00 3848.00	Broken 493 321 162 3.94 	NPP 63.3 33.8 18.6 3.88	13.7 14.8 22.2 68.0 28.9 2.62 2.92	32.1 30.6 30.3 30.1 27.0 17.8 24.4	2.62 2.63 2.65 2.65 2.65	20.1 17.4 21.2 21.5 19.4 19.7 	12.9 15.3 13.1 13.9 9.3 5.8	38.6 46.8 39.3 35.9 35.3 57.2 55.7	14.5 19.6 18.7 20.1 13.4 8.8	37.0 36.4 47.1 46.5 31.9 32.1 52.5	2.61 2.62 2.63 2.65 2.83 2.65	A.A; A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst Mdst Mdst S.S;	arg lam arg lam it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w	r cmt , w srld,mic		12 14 16 18 20	
26 27 28 29 30 31 32 33 33 34	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3844.00 3845.00 3846.00 3847.00	Broken 493 321 162 3.94	NPP 63.3 33.8 18.6 3.88	13.7 14.8 22.2 68.0 28.9 2.62	32.1 30.6 30.3 30.1 27.0 17.8	2.62 2.63 2.65 2.65 2.65	20.1 17.4 21.2 21.5 19.4 19.7	12.9 15.3 13.1 13.9 9.3 5.8	38.6 46.8 39.3 35.9 35.3 57.2	14.5 19.6 18.7 20.1 13.4 8.8	37.0 36.4 47.1 46.5 31.9 32.1 52.5	2.61 2.62 2.63 2.65 2.83 2.65	A.A; A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst Mdst	arg lam arg lam it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w	v cmt , w srld,mic		12 14 16 18	
26 27 28 29 30 31 32 33 34 35 36	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3844.00 3845.00 3846.00 3846.00 3848.00 3848.00	Broken 433 321 162 3.94 6.01 114	NPP 63.3 33.8 18.6 3.88 0.43 22.4	13.7 14.8 22.2 68.0 28.9 2.62 2.96 2.96 32.8	32.1 30.6 30.3 30.1 27.0 17.8 24.4 28.1	2.62 2.63 2.65 2.83 2.65 	20.1 17.4 21.2 15. 19.4 19.7 	12.9 15.3 13.1 13.9 9.3 5.8 9.3 5.8	38.6 46.8 39.3 35.9 35.3 57.2 55.7 43.9	14.5 19.6 18.7 20.1 13.4 8.8 	37.0 36.4 47.1 46.5 31.9 32.1 52.5 52.5 52.5 50.2 50.2 36.7	2.61 2.62 2.63 2.65 2.83 2.65 	A.A; A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst Mdst S.S; S.S;	arg lam arg lam it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w	r cmt , w srld,mic		12 14 16 18 20 22 C	
26 27 28 29 30 31 32 33 34 35 36 37	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3845.00 3845.00 3846.00 3847.00 3848.00 3848.00 3849.00 3850.00	Broken 433 321 162 3.94 6.01 114 61.5	NPP 63.3 33.8 18.6 3.88 0.43 22.4 50.0	13.7 14.8 22.2 68.0 28.9 2.62 2.96 32.8 7.40	32.1 30.6 30.3 30.1 27.0 17.8 24.4 28.1 28.0	2.62 2.63 2.65 2.83 2.65 	20.1 17.4 21.2 1.5 19.4 19.7 15.9 20.6 19.2	12.9 15.3 13.1 13.9 9.3 5.8 	38.6 46.8 39.3 35.9 35.3 57.2 55.7 43.9 45.9	14.5 19.6 18.7 20.1 13.4 8.8 	37.0 36.4 47.1 46.5 31.9 32.1 52.5 50.2 50.2 36.7 39.3	2.61 2.62 2.63 2.65 2.83 2.65 	A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst Mdst S.S; S.S; S.S; A.A;	arg lam arg lam it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w	r cmt , w srld,mic		12 14 16 18 20	
26 27 28 29 30 31 32 33 34 35 36 37 37 38 39 40	3838.00 3839.00 3840.00 3841.00 3842.00 3844.00 3846.00 3846.00 3846.00 3848.00 3848.00 3848.00 3849.00 3850.00 3850.00	Broken 493 321 162 3.94 6.01 114 61.5 333 470 569	NPP 63.3 33.8 18.6 3.88 0.43 22.4 50.0 119 81.6 278	13.7 14.8 22.2 68.0 26.9 2.62 2.96 32.8 7.40 4.59 29.8 83.8	32.1 30.6 30.3 30.1 27.0 17.8 27.0 27.0 27.0 27.0 27.0 27.0 31.1 31.2 32.4	2.62 2.63 2.65 2.65 2.65 2.65 2.65 2.65 2.65 2.65	20.1 17.4 21.2 21.5 19.4 19.7 	12.9 15.3 13.1 13.9 9.3 5.8 9.7 13.4 17.6 18.6 9.9 11.3	38.6 46.8 39.3 35.9 35.3 57.2 55.7 43.9 45.9 41.2 32.0 46.8	14.5 19.6 18.7 20.1 13.4 8.8 13.4 8.8 13.4 13.4 13.4 13.4 15.5 18.0 15.5 18.0 23.7 16.1 14.4	37.0 36.4 47.1 46.5 31.9 32.1 52.5 50.2 36.7 39.3 34.0 31.6 42.4	261 262 263 263 265 265 265 265 265 265 264 274 261 262 262 262 262	A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst S.S; S.S; S.S; S.S; S.S; S.S; A.A; S.S; S.S	arg lam arg lam it gy_fg.arg cmt, w it gy_fg.arg cmt, w it gy_fg.arg cmt, w	r cmt , w srld,mic		12 14 16 18 20 22 C	
26 27 28 29 30 31 32 33 34 35 36 37 38 39	3838.00 3839.00 3840.00 3841.00 3842.00 3843.00 3845.00 3845.00 3846.00 3846.00 3846.00 3848.00 3849.00 3850.00 3851.00 3852.00	Broken 493 321 162 3.94 6.01 114 61.5 333 470	NPP 63.3 33.8 18.6 3.88 0.43 22.4 50.0 119 81.6	13.7 14.8 22.2 68.0 28.9 2.62 2.62 2.96 32.8 7.40 4.59 29.8	32.1 30.6 30.3 30.1 27.0 17.8 27.0 17.8 24.4 28.1 28.0 31.1 31.2	2.62 2.63 2.65 2.63 2.65 2.65 2.65 2.65 2.65 2.65 2.64 2.74 2.61 2.62 2.62	20.1 17.4 21.2 21.5 19.4 19.7 19.7 15.9 20.6 19.2 21.8 23.7	12.9 15.3 13.1 13.9 9.3 5.8 9.3 5.8 9.3 9.7 13.4 17.6 18.6 9.9	38.6 46.8 39.3 35.9 35.3 57.2 55.7 43.9 45.9 41.2 32.0	14.5 19.6 18.7 20.1 13.4 8.8 	37.0 36.4 47.1 46.5 31.9 32.1 52.5 50.2 36.7 39.3 34.0 31.6	261 262 263 263 265 265 265 265 265 265 265 264 274 264 274 261 262 262	A.A; A.A; A.A; A.A; A.A; S.S; Mdst Mdst Mdst Mdst Mdst Mdst S.S; S.S; S.S; A.A; A.A;	arg lam arg lam it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, w it <u>gy_fg</u> arg cmt, wcm	v cmt , w srtd,mic		12 14 16 18 20 22 C	

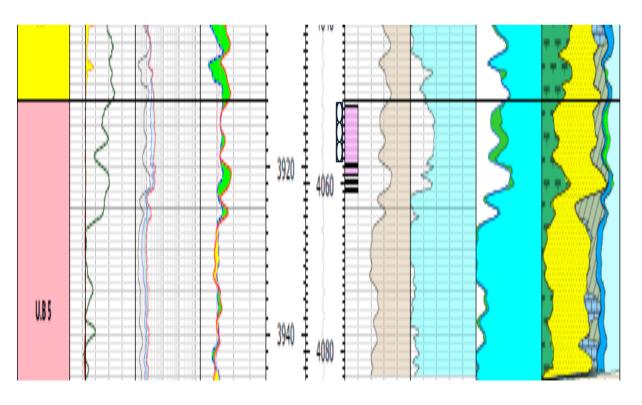
		Litho	logical associati	on of mudd	ly tidal flat			
es	Subfacies	Microfacies		Lith	ofacies			
falt	Supertidal		Main of mud and si	sed structure, gypsum, horizontal bedding.				
		Mud flat	Brown mud with sil	al, wavy bedding. Bioturbation.				
	Intertidal	Mixed flat	Greyish-green thin	er. Complex bedding. Bioturbation.				
		Sand flat	Thick sand with thin	. Double clay bands. Flaser bedding.				
	Subtidal		Inverse rhythm. Tid					
	Tidal creek		Fine-medium sand.	-bedding.				
	Depth 3846'	00" 3848'(00" 3850'00"	3852'00"	3854'00"	Sedimentary sequence model of tidal-flat		
	and the	0		200	2	Interpretation Sedimentary structure		
	2					Supertida I flat		
	The second					High Horizontal, wavy tidal bedding. Siltstone.		
	6	6	6		SZ	mud flat Middle Cross bedding.		
	8	8	8			tidal flat Flaser, lenticular, wavy bedding		
		10	10 1		0	Parallel, cross bedding. Low Ripple mark. Chevron		
		12	12	2		tidal flat structure. Reactivation		
	Sabbar-1	14	14	4	4	Shallow Large scale cross-		
	16	16	16	6	6	subtidal zone Bedding. Blocky sand Chevron structure. Reactivation surface.		
	18	18				Salata and Salata		
	20	20		RESERVED SAMPLE	d	A. Lenticular bedding		
n	22	22 C	SAM 5	RESERVI SAMPLE	Para Ci	B. Flaser bedding		
	24	24		SA		C. Waving bedding D. Herringbone cross bedding		
					Part and and	E. Reactivation surface		

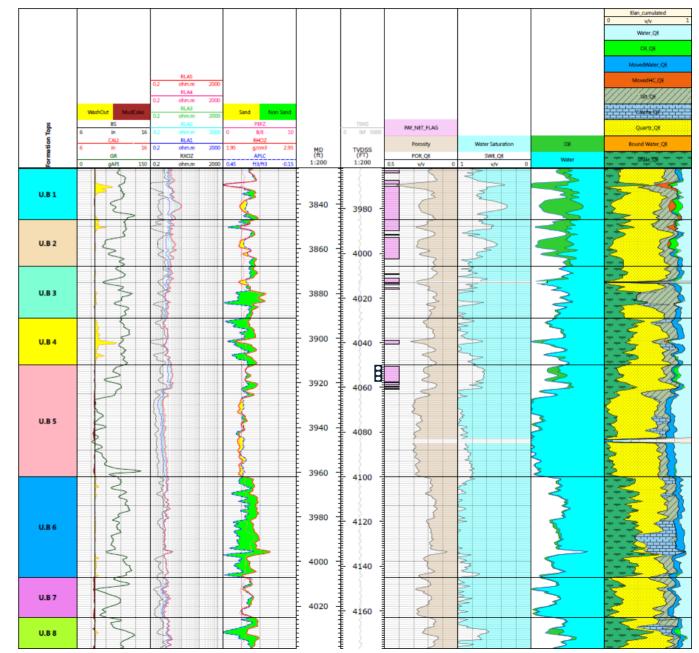




Sabbar-1 Well Re-evaluation and Test

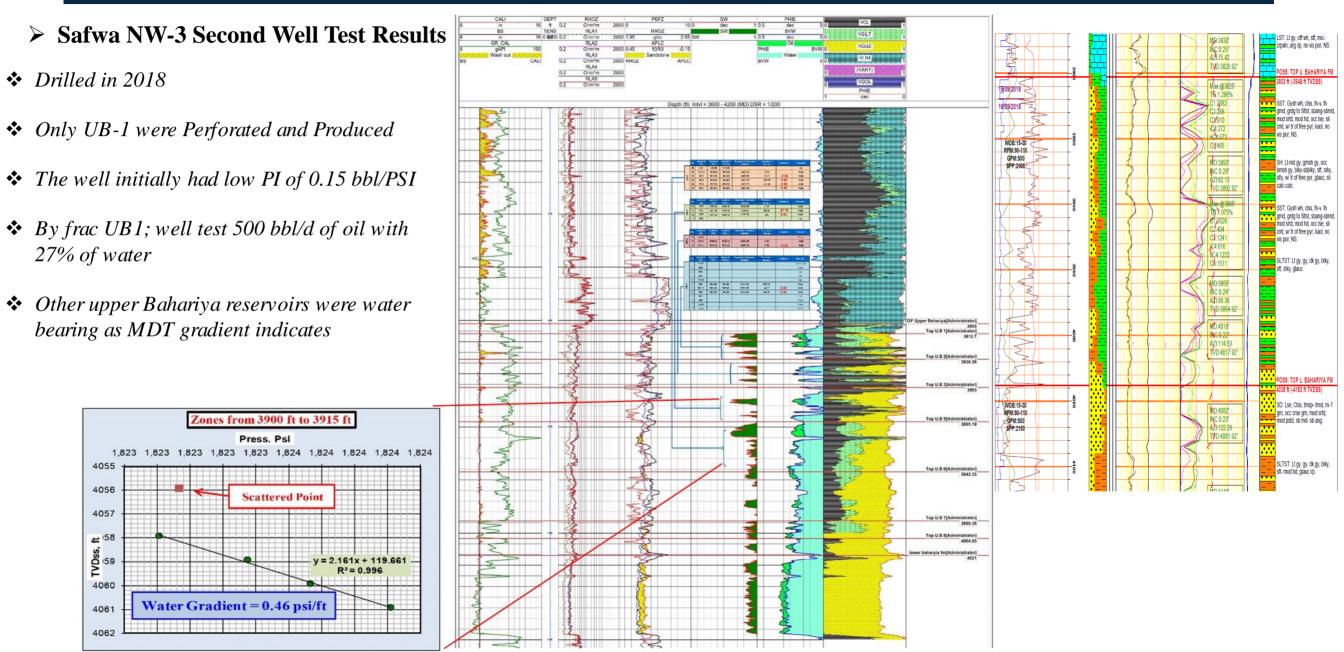
- New interpretation showed 9 feet of silty facies Net Pay with 21% porosity and SW of 67%
- ✤ The well was producing 15 bbl/d of oil with 95% water
- After perforated the new zone, the well initial tested 350 bbl/d of oil with No water









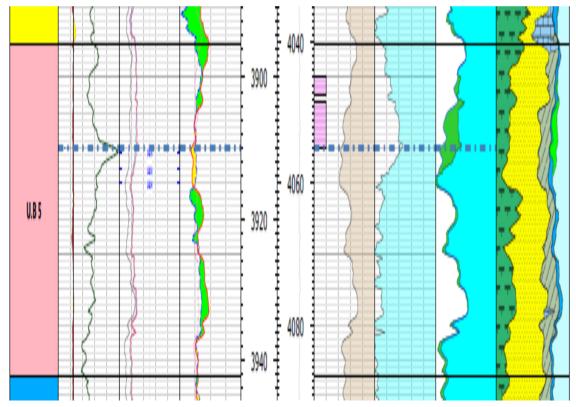


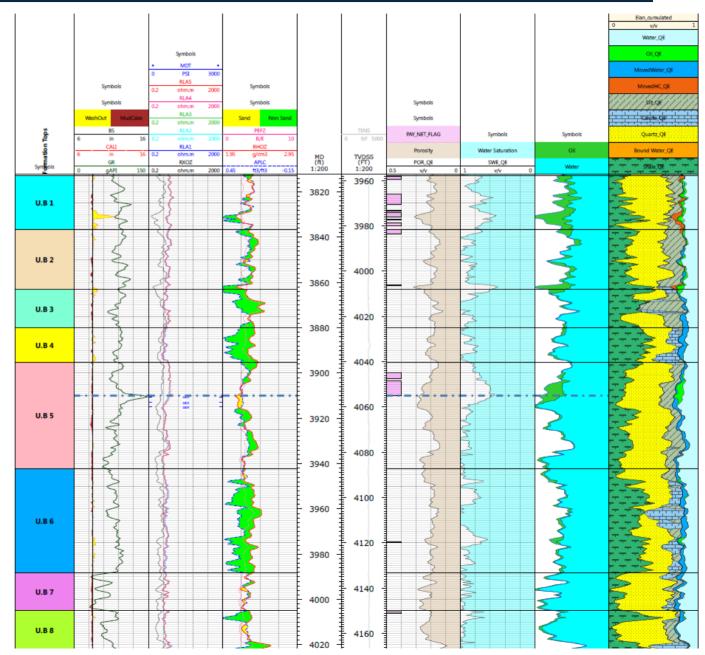




Safwa NW-3 Second Well Test Results

- New interpretation showed 8 feet of silty facies Net Pay with 24% porosity and SW of 64%
- The well was producing 10 bbl/d of oil with 90% water
- After perforated the new zone, the well initial tested 1000 bbl/d of oil with no water









Conclusion and Recommendation

- * For the complex depositional environment; the thin laminated silty sand reservoir has a good chance to produce oil
- ✤ This thin laminated reservoir will produce with resistivity of 2-3 ohm (>1 ohm)
- In the log, SW could be > 70% and well initially produce with no water
- * *Re-evaluation of all existing wells should be done without bias to conventional cut off for clear and clean reservoirs*
- In complex sedimentary facies, it will be better to acquire CMR/NMR logs to identified the thin reservoirs, as well as, irreducible and residual oil
- Select the best candidate well to test a new approach to unlock the existing and remaining potential