Evaluation of Water Salinities from Selected Wells, Rio Grande County Colorado

Prepared for
HRS Water Consultants

by
Digital Formation, Inc.

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www.DigitalFormation.com

Summary

A total of 8 wells were analyzed to evaluate formation water resistivities and salinities from open-hole logs.

Two approaches were applied:

a. Using porosity vs. resistivity cross plots (Pickett Plot)
b. Analyzing the SP logs, using temperature-corrected mud filtrate (R_{mf}) data from the log header.

The restrictions for a reliable evaluation of R_w from the SP log are:

- Correct values of R_{mf} values – log header data is often unreliable
- Recognition of intervals of clean formation for the correct determination of SSP

Values of NaCl salinity have been calculated for both Pickett Plot and R_w approaches, and show a very wide variation – from 900 ppm to 277,000 ppm.

To identify potential hydrocarbon-bearing intervals, even if at residual saturation, a net pay routine was applied using the following parameters:

- S_w = 0-70%
- V_{SH} = 0-50%
- Porosity = 5-35%

Results

AMF-1

Top porosity and SP logs 6100 ft.

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft)	Bottom (ft.)					
6100	6238	1.399	0.389	178	1,647	6,139
6233	6250	1.802	0.385	181	1,254	6,102
6350	6940	0.345	0.366	183	6,772	6,364
6940	7000	0.307	0.355	194	7,218	6,193

Calculate a hydrocarbon bearing sand from 6420 to 6490 ft. Remainder of sequence looks wet.

Beaver Mountain 1

Top resistivity and SP logs 6050.

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
6050	6240	0.346	1.482	177	6,984	1,562
6140	6495	1.042	1.59	181	2,185	1,423
6495	7000	0.554	1.474	186	4,065	1,496

Calculate hydrocarbon bearing sands 6120-6250 ft. and 6580-6610 ft.

Horseshoe Mountain 1-14

Full log suite 1100-6700.

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
1100	1200	0.66	1.733	86	7,269	2,670
1200	1300	0.757	1.741	88	6,151	2,600
1300	1450	0.838	1.643	90	5,411	2,701
1450	2000	0.677	1.535	93	6,553	2,806
2000	3000	0.62	1.246	104	6,440	3,122
3000	4000	0.34	1.155	123	10,315	2,869
4000	5000	0.655	0.951	143	4,439	3,023
5000	5845	0.178	0.845	162	15,724	3,019
5845	6080	0.277	0.902	178	8,795	2,574
6080	6230	0.368	0.453	183	6,327	5,091
6230	6692	0.687	0.713	186	3,257	3,135
6692	6700	0.797	0.823	195	2,670	2,583

Many of the clean formation intervals calculated to be hydrocarbon-bearing.

Jynnifer 1

An SP log exists over the interval 2000-7000. Top porosity log is at 4600. The SP log appears to be incorrect.

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
2000	3000	NA	0.035	102	--	207,367
3000	4000	NA	0.038	121	--	154,523
4000	4600	NA	0.023	139	--	235,214
4600	5900	0.445	0.017	150	6,334	272,684
5900	6054	0.379	0.008	175	6,419	224,664
6054	6058	0.348	0.006	177	6,942	174,709
6058	6624	0.39	0.008	178	6,122	227,702
6624	7000	0.809	0.013	188	2,726	277,041

SP results are meaningless (erroneous R_{mf}). Many of the clean intervals below 4600 calculate to be hydrocarbon bearing.

Mosley 1-10

A full suite of logs is available 1950-7000.

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
1950	3000	0.317	1.659	101	13,634	2,396
3000	4000	0.392	1.382	121	9,001	2,426
4000	5000	0.369	1.236	139	8,340	2,377
5000	5948	0.463	1.111	158	5,767	2,339
5948	6648	0.262	1.016	176	9,445	2,305
6648	7000	0.244	0.984	188	9,522	2,232

Most of the clean intervals calculate to be hydrocarbon bearing. There is a significant disconnect between R_w from Pickett Plots and R_w from the SP.

Needham-Medford 1

A full suite of logs exists from 2000 to 7000.

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
2000	3000	0.365	0.625	102	11,566	6,509
3000	3950	0.241	0.54	121	15,297	6,408
3950	4142	0.2	0.672	138	16,385	4,477
4142	4163	0.371	0.626	142	8,115	4,685
4163	5170	0.299	0.441	142	10,225	6,757
5170	5500	0.259	0.487	161	10,487	5,368
5500	6000	0.26	0.487	167	10,055	5,175
6000	6200	0.276	0.504	176	8,932	4,738
6200	7000	0.444	0.185	180	5,286	13,465

Hydrocarbon bearing intervals are calculated from 3100-3450, 4350-5100 (several intervals), and 6600-7000.

San Francisco Creek 1

A full log suite exists from 100 to 5890, except for SP (100-1000).

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
100	200	6.163	2.821	67	931	2,052
200	300	4.244	2.26	69	1,320	2,504
300	400	3.747	2.088	72	1,440	2,609
400	500	2.778	2.045	74	1,901	2,597
500	600	2.869	1.829	76	1,795	2,840
600	700	2.545	1.729	78	1,979	2,935
700	800	3.386	1.831	80	1,446	2,703
800	900	3.448	1.989	83	1,372	2,399
900	1000	2.593	2.161	85	1,791	2,156
1000	1100	2.876	2.177	87	1,578	2,093
1100	1200	1.673	1.581	89	2,680	2,839
1200	1300	1.777	1.507	91	2,467	2,920
1300	1400	2.727	1.55	94	1,548	2,750
1400	1500	2.475	1.634	96	1,674	2,554
1500	2000	0.742	1.854	98	5,655	2,202
2000	3000	0.597	1.336	109	6,397	2,778
3000	4000	0.455	1.269	131	7,090	2,451
4000	5000	0.291	1.051	153	9,749	2,554
5000	5500	0.145	1.038	175	18,213	2,268
5500	5890	0.287	0.897	186	8,094	2,479

South Fork Federal 23-17

A full log suite exists from 1400 to 7000

Interval		R_w Pickett (OHMM)	R_w SP (OHMM)	Temp (°F)	Salinity Pickett (ppm)	Salinity SP (ppm)
Top (ft.)	Bottom (ft.)					
1400	1500	1.353	85.3	91	3,261	50
1500	2000	1.371	0.669	93	3,151	6,636
2000	3000	1.303	0.555	102	3,038	7,378
3000	4000	0.863	0.796	121	3,933	4,276
4000	5000	0.964	0.536	139	3,065	5,625
5000	5900	0.446	0.642	158	5,998	4,105
5900	7000	0.321	0.702	175	7,649	3,384

Hydrocarbons are calculated in more of the clean intervals throughout.