APPENDIX A-2. Techlog layouts

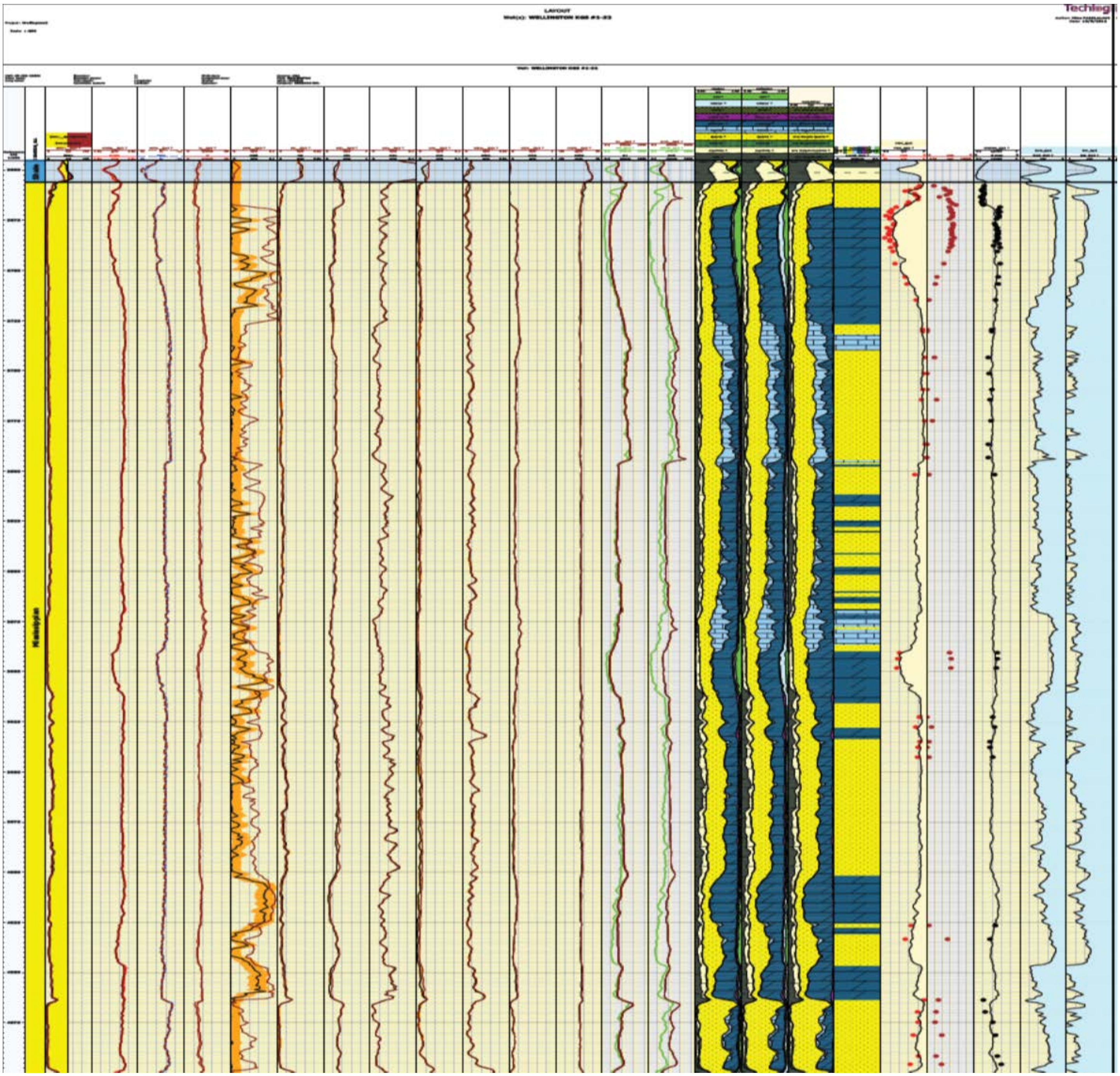

Figure A-1 : Well 1-32 layout—geochemical and conventional log analyzed by Techlog

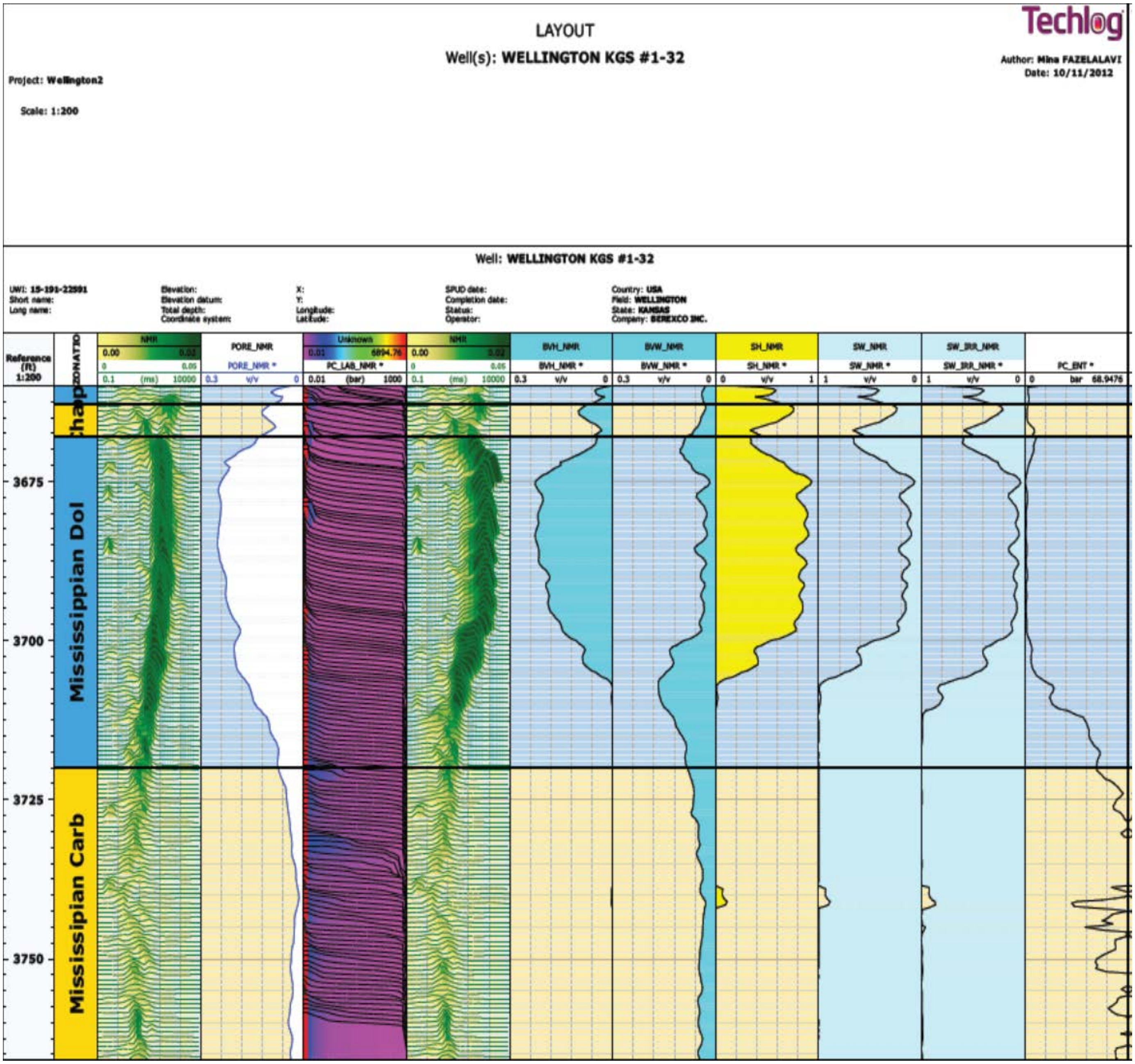

Figure A-2: Well 1-32 layout—Porosity, Pc, Swi and Swirr at Pc_irr equal 20 bar

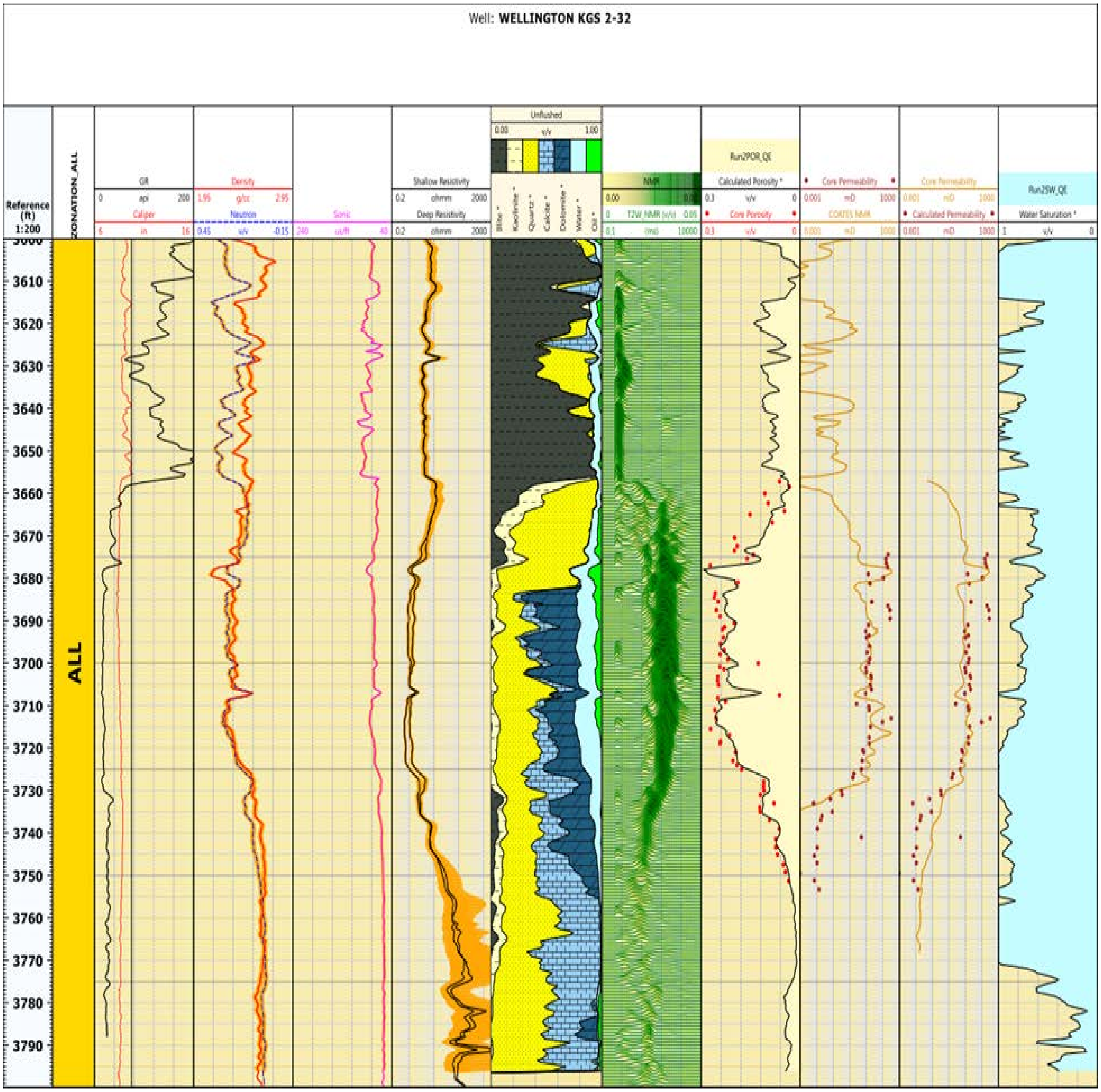

Figure A-3: Well 2-32 showing permeability by FZI-SWPHI and Coates compared to core. The second column on the right compares permeability by FZI-SWPHI and Coates permeability with core permeability on the third track from right

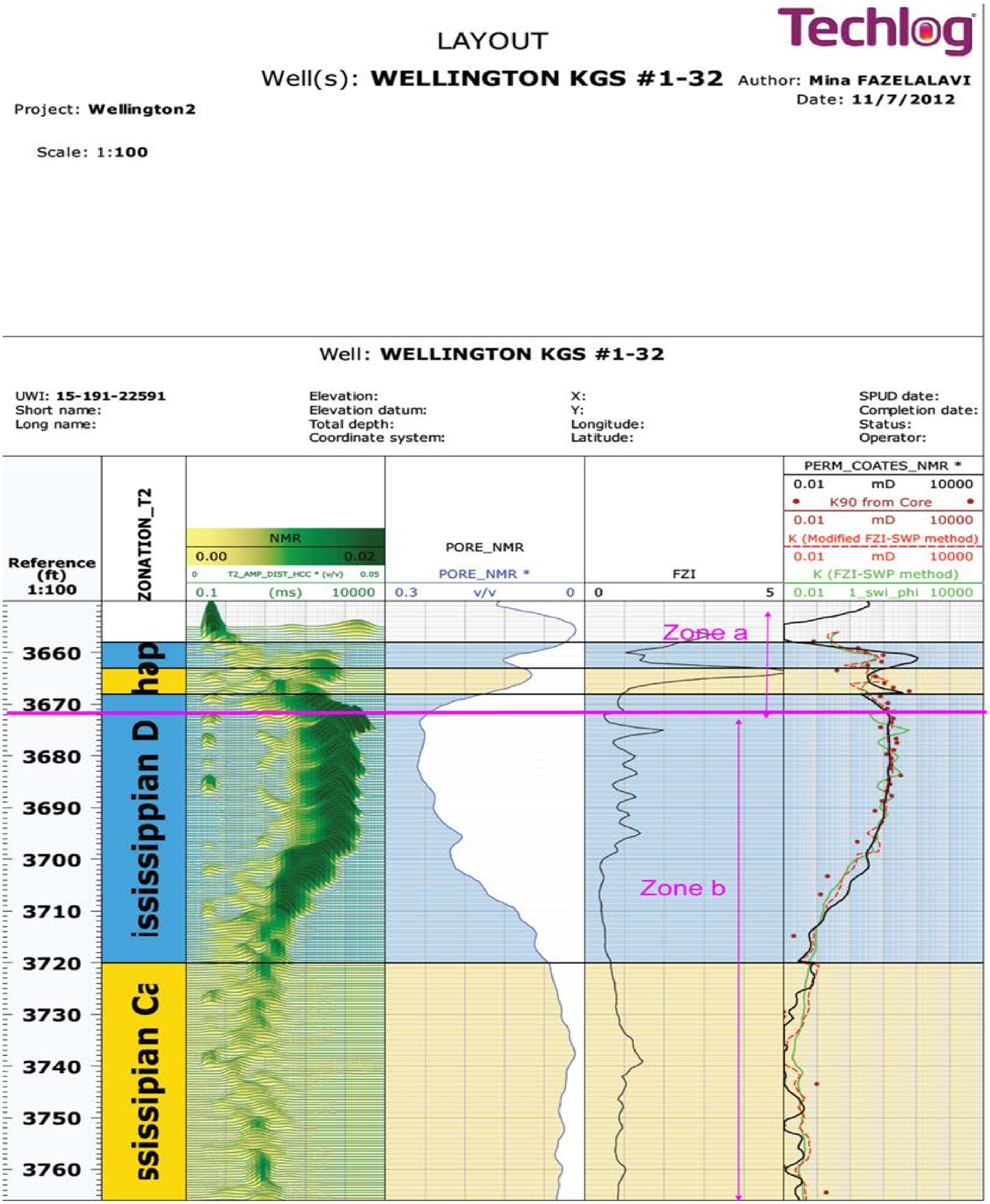

Figure A-4: Well 1-32 showing zone a and b. The first column on the right compares Coates permeability and permeability from FZI-SWP with core permeability

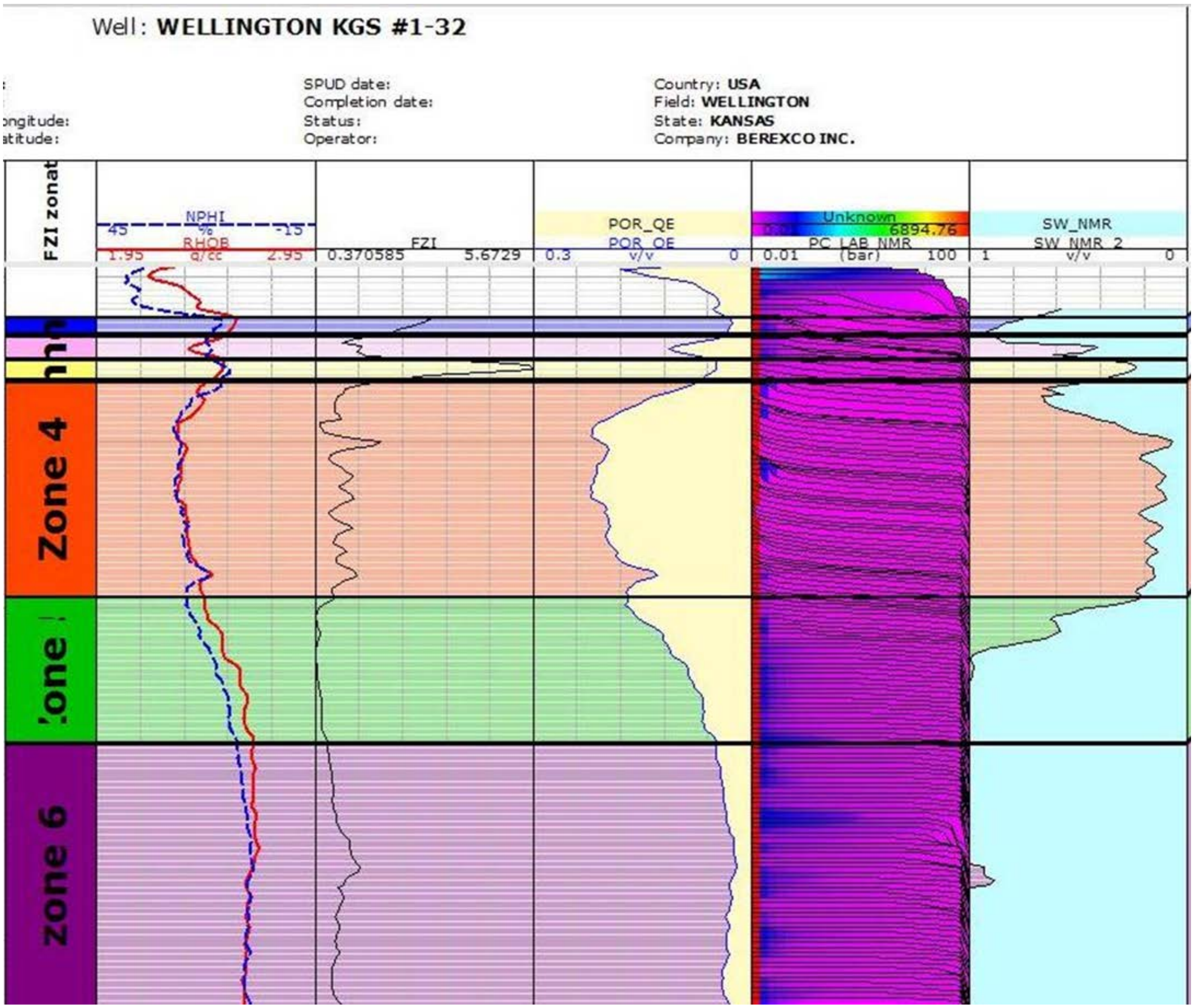

Figure A-5: Well 1-32 layout showing six zones based on similar FZI variation in each zone

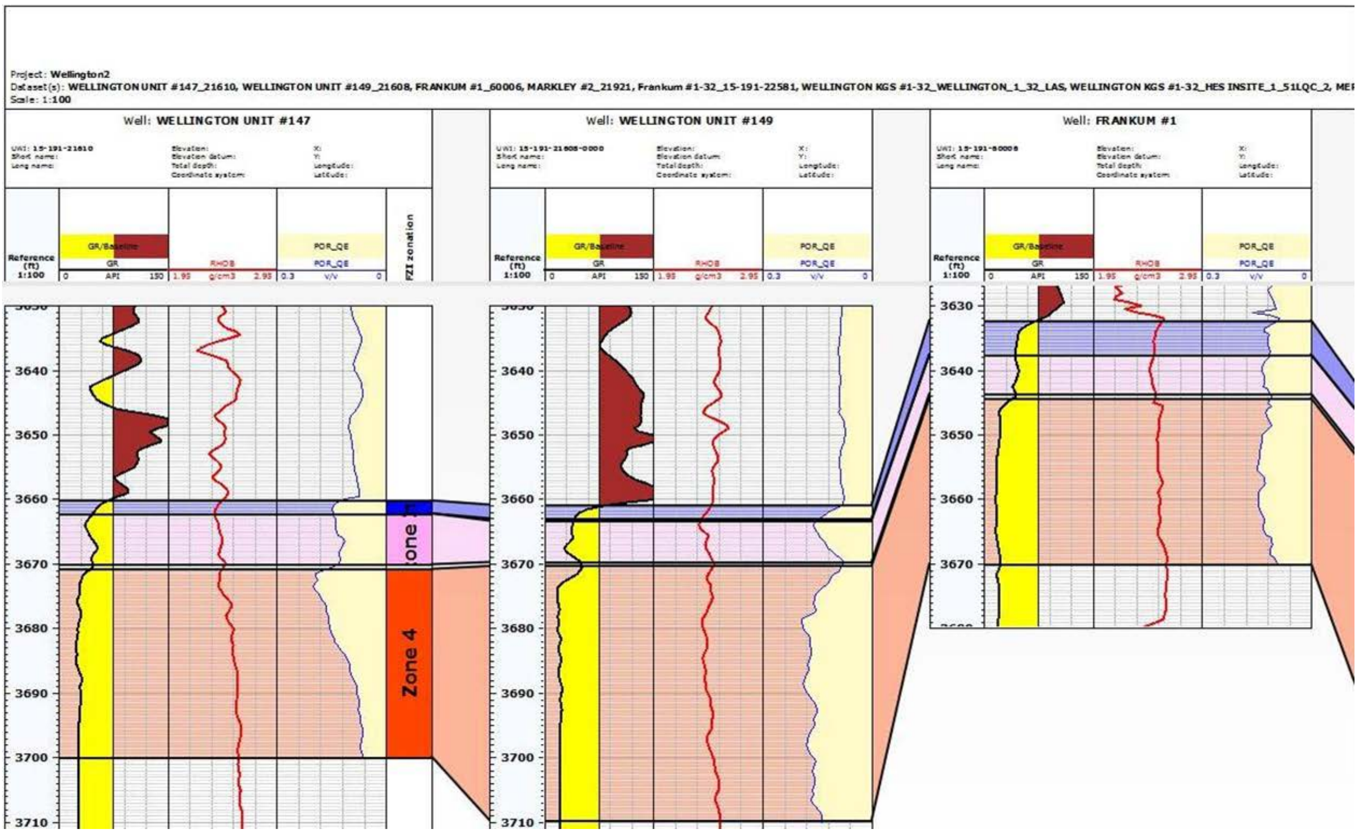

Figure A-6: **Equivalent zones in wells 147, 149, and Frankum#1 with equal FZI values corresponding to the six zones of Well 1-32**

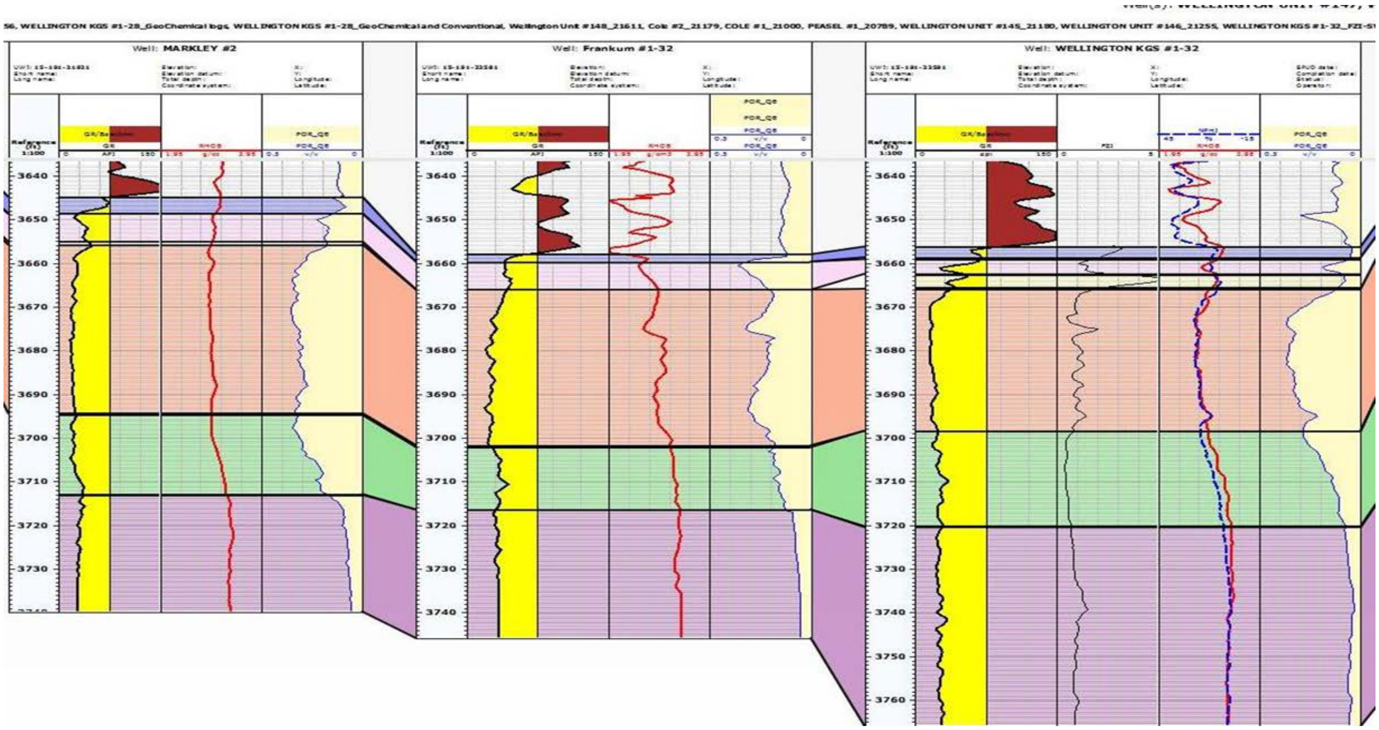

Figure A-7: Equivalent zones in wells Markley#2 and Frankum#1-32 with equal FZI values corresponding to the six zones of Well 1-32

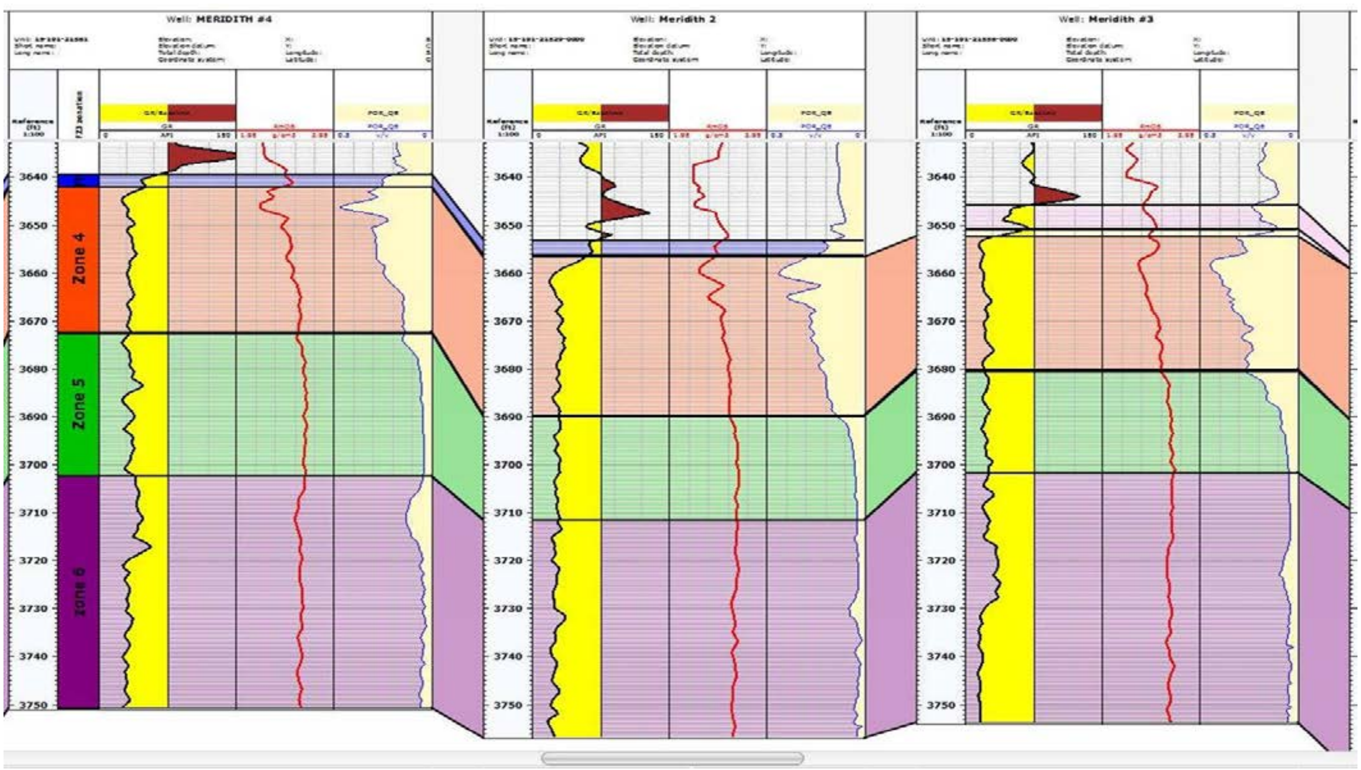

Figure A-8: Figure A 7: Equivalent zones in wells Meridith#4, Meredith2, and Meridith3 with equal FZI values corresponding to the six zones of Well 1-32

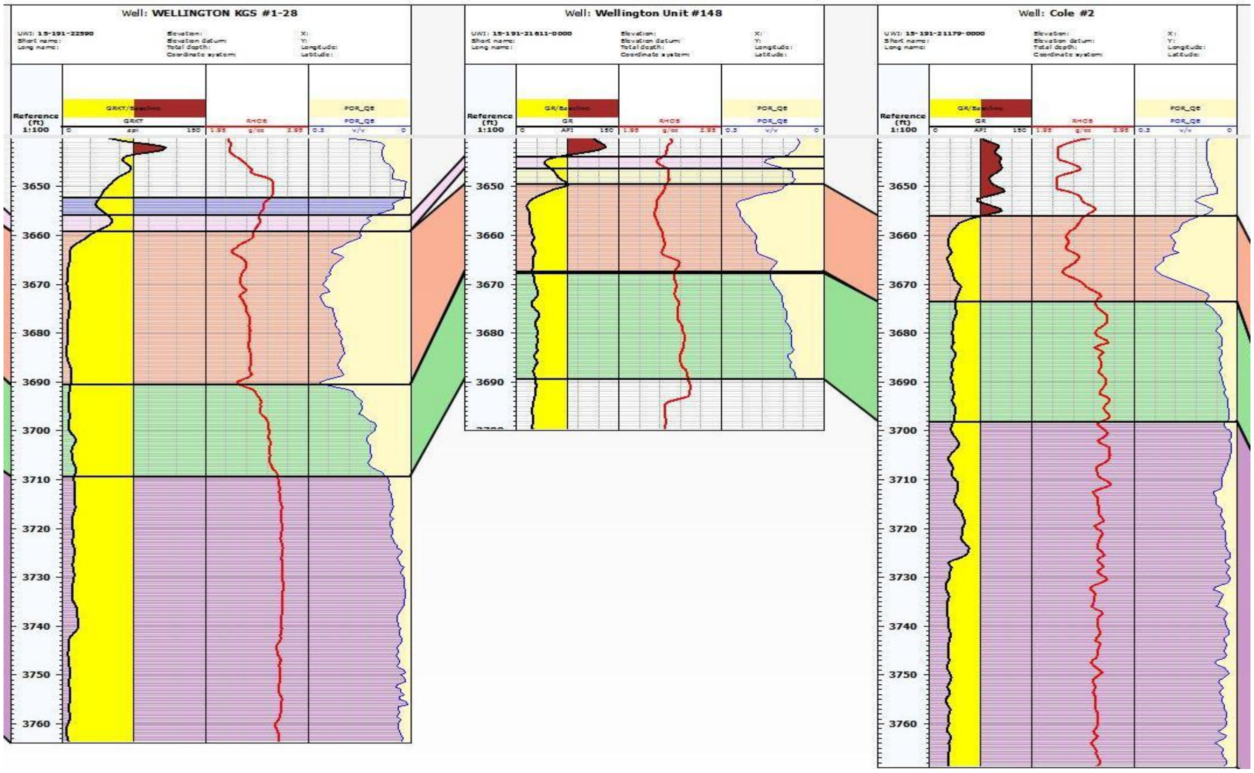

Figure A-9: Equivalent zones in wells 1-28, 148, and Cole #2 with equal FZI values corresponding to the six zones of Well 1-32

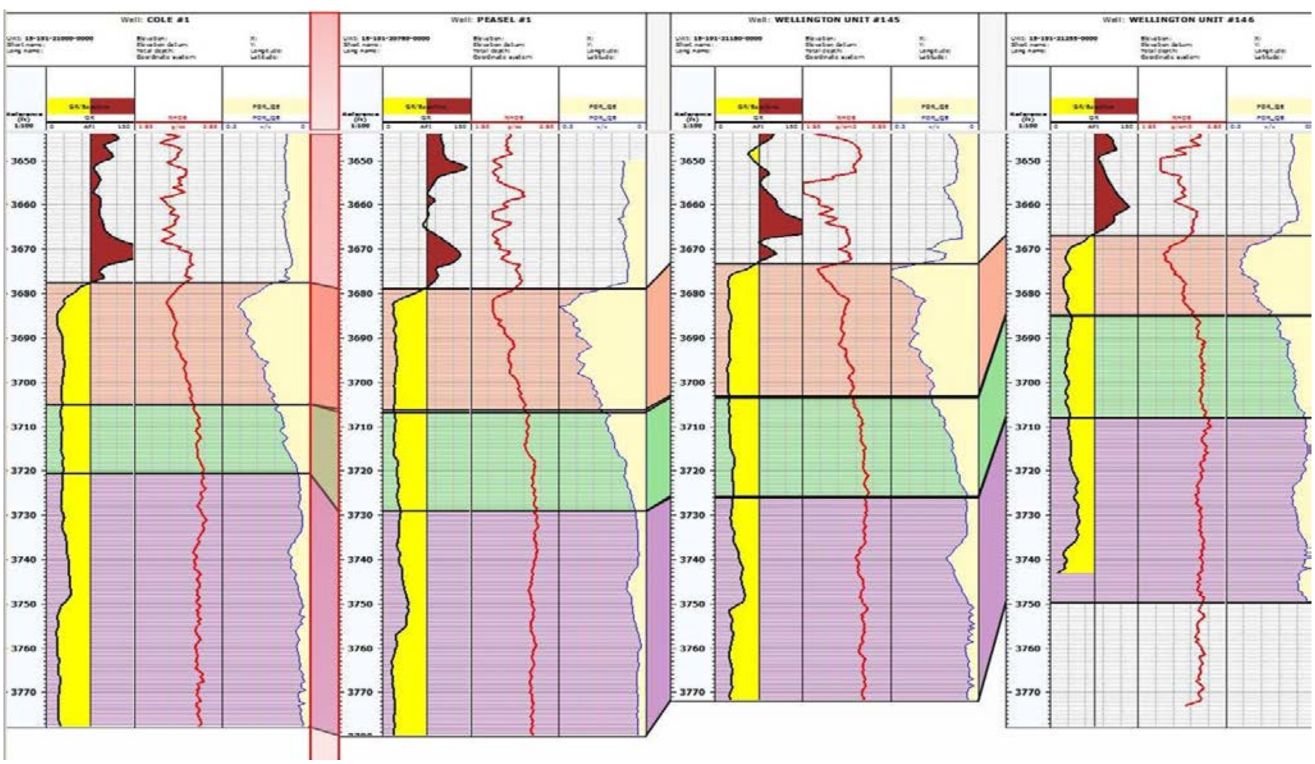

Figure A-10: Equivalent zones in wells Cole #1, Peasel #1, 145, and 146 with equal FZI values corresponding to the six zones of Well 1-32

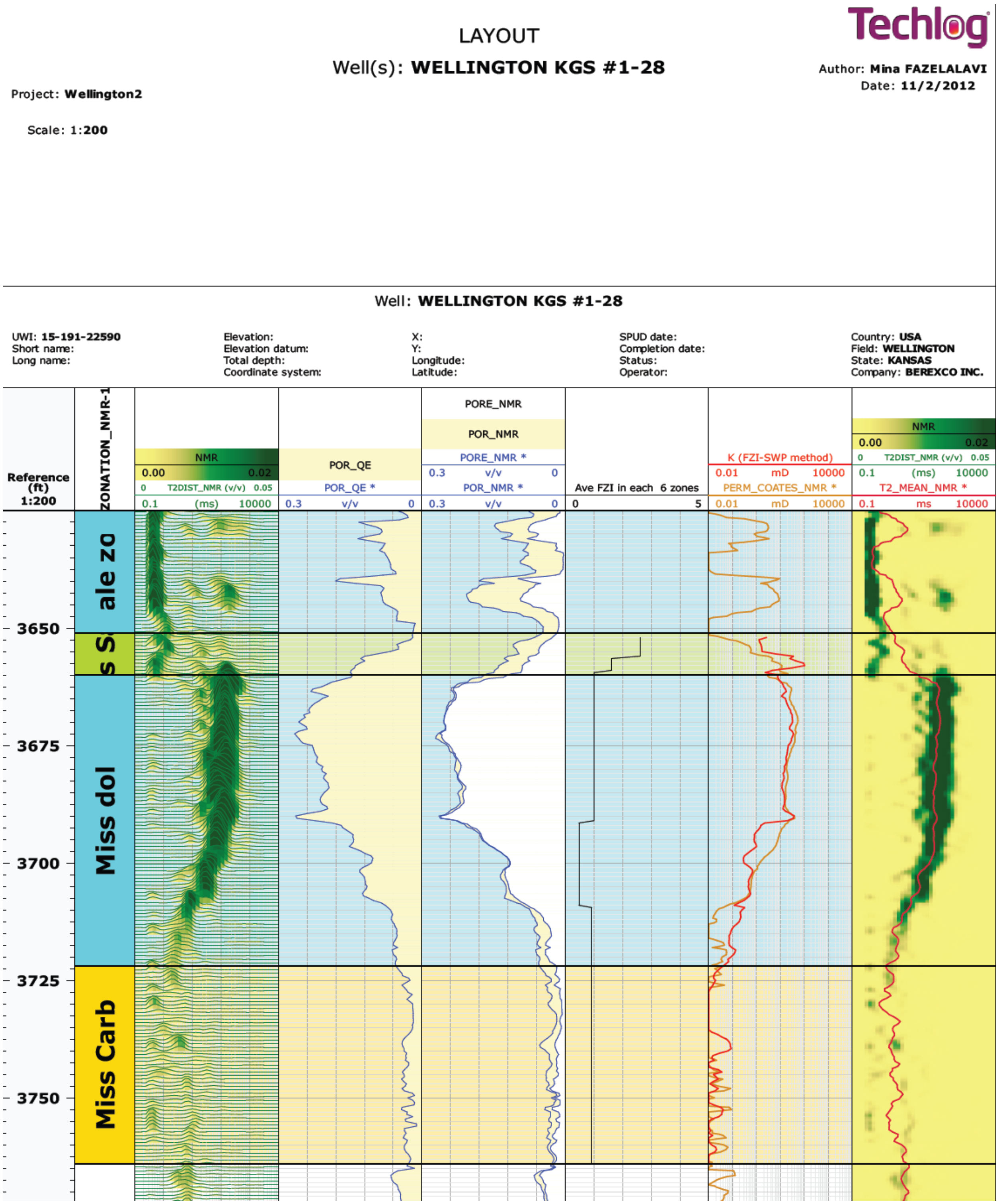

Figure A- 11: Well 1-28 showing average FZI in each of six zones in track 3 from right and comparing permeability from FZI-SWP method to Coates permeability

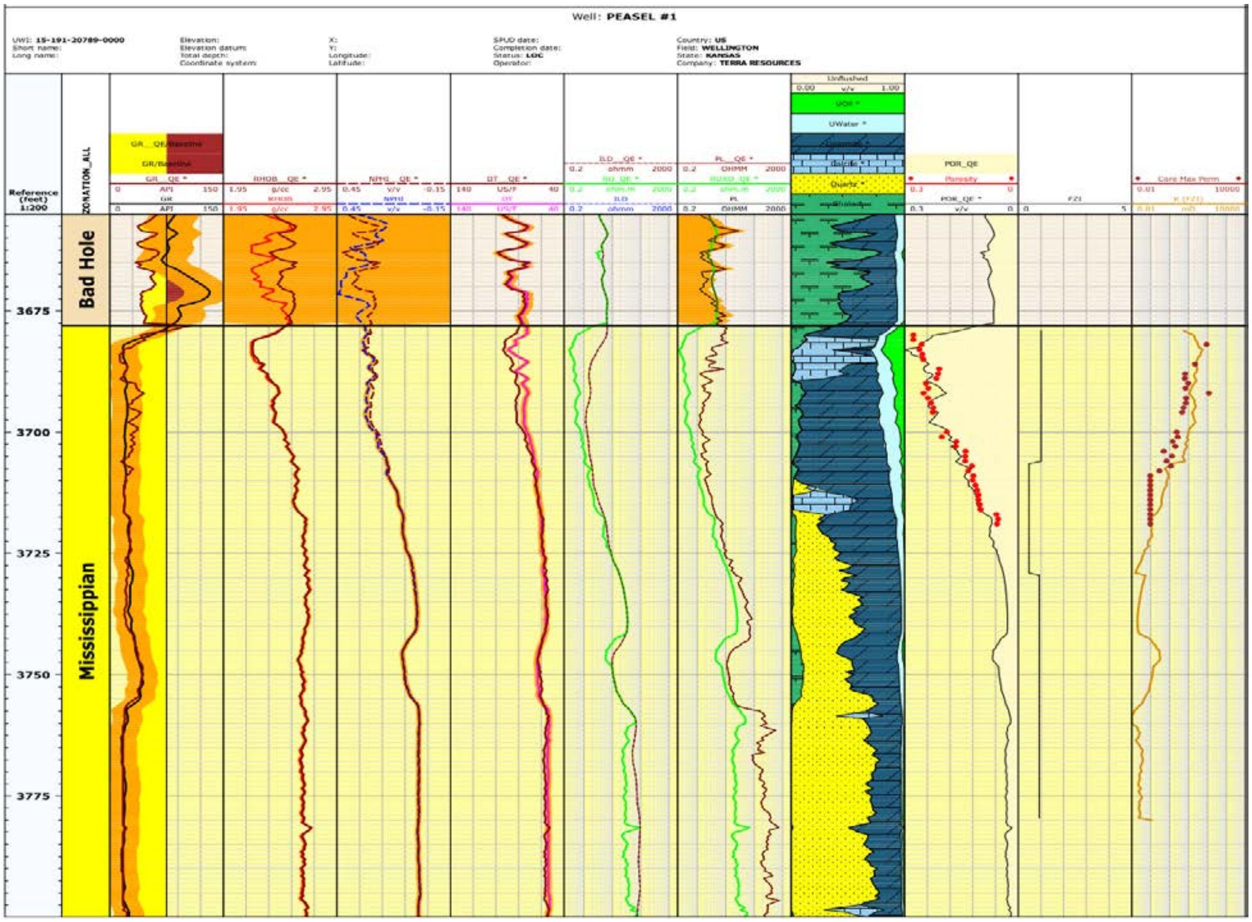

Figure A-12: Layout of Peasel #1 comparing permeability from the FZI-SWP method to Coates permeability and showing average FZI in each of the six zones

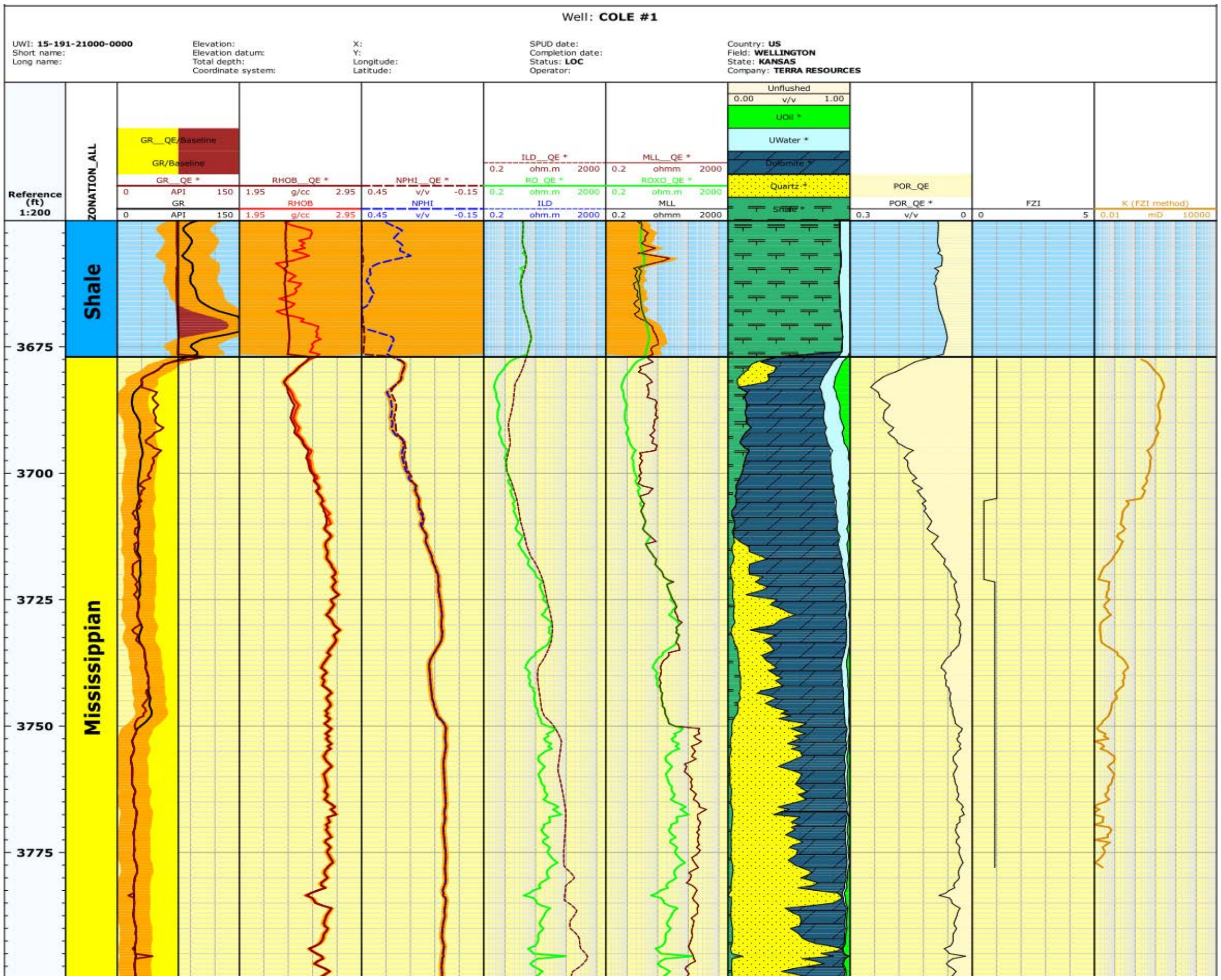

Figure A-13: Layout of Cole #1 showing average FZI in each of six zones and permeability from the FZI-SWP method

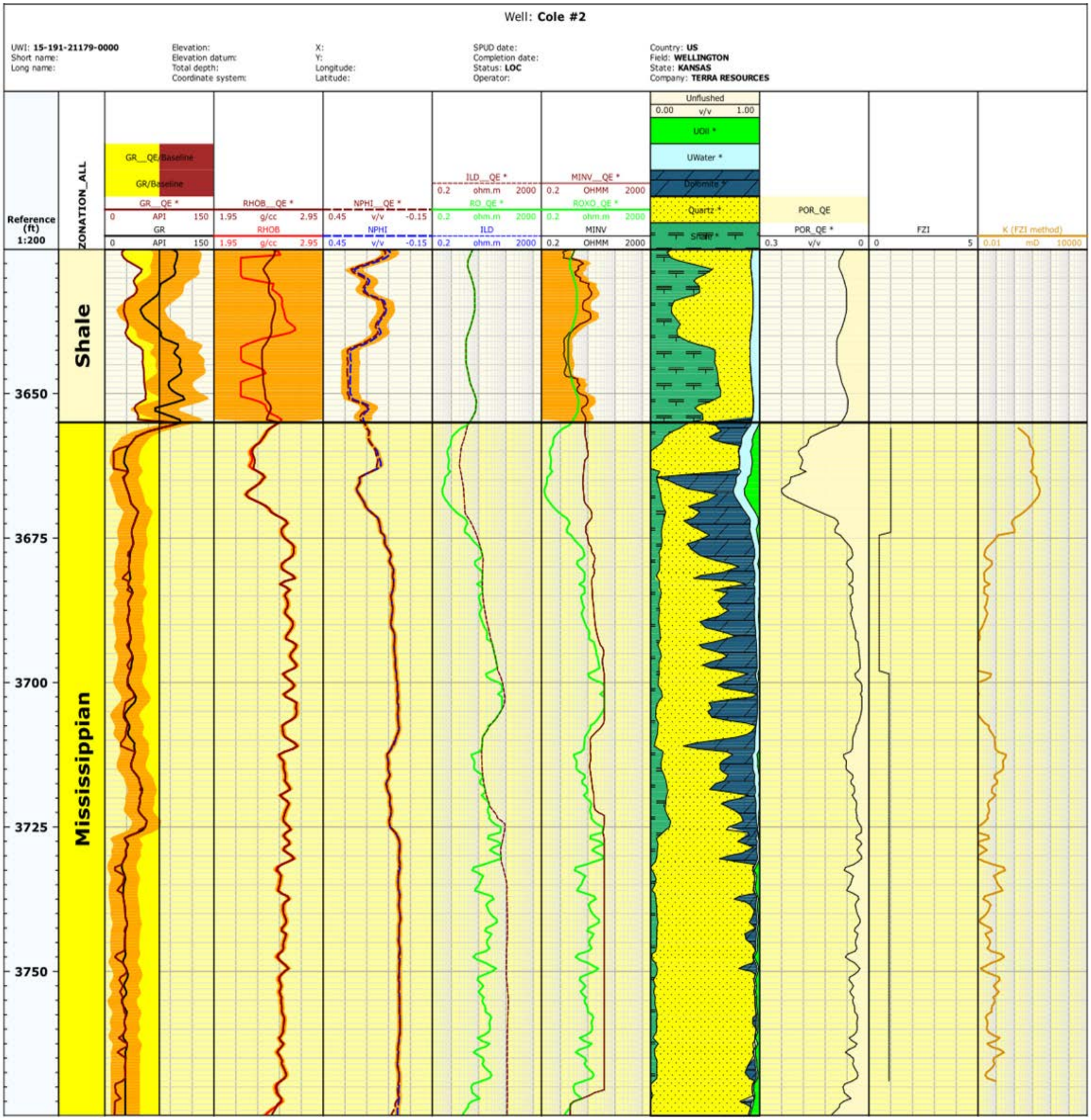

Figure A-14: Layout of Cole #2 showing average FZI in each of six zones and permeability from the FZI-SWP method

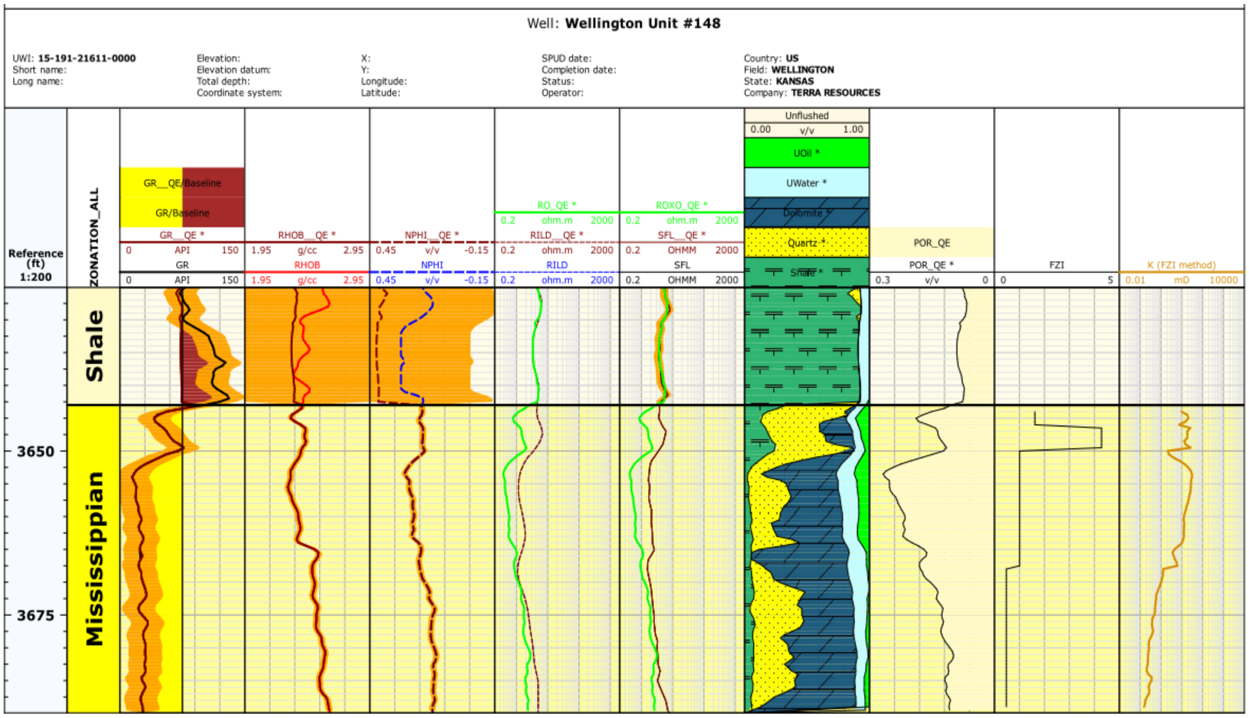

Figure A-15 : Layout of Well 148 showing average FZI in each of six zones and permeability from the FZI-SWP method

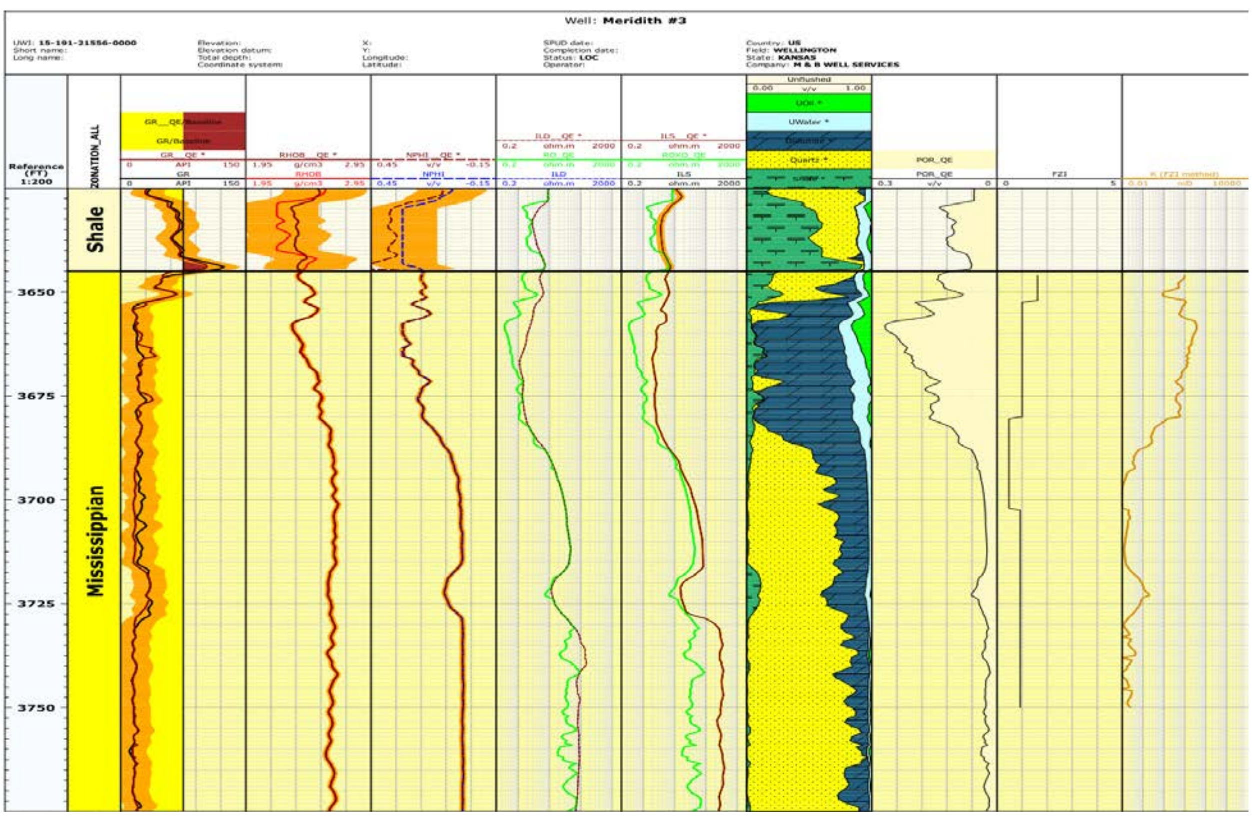

Figure A-1 6: Figure A-15: Layout of Meridith #3 showing average FZI in each of six zones and permeability from the FZI-SWP method

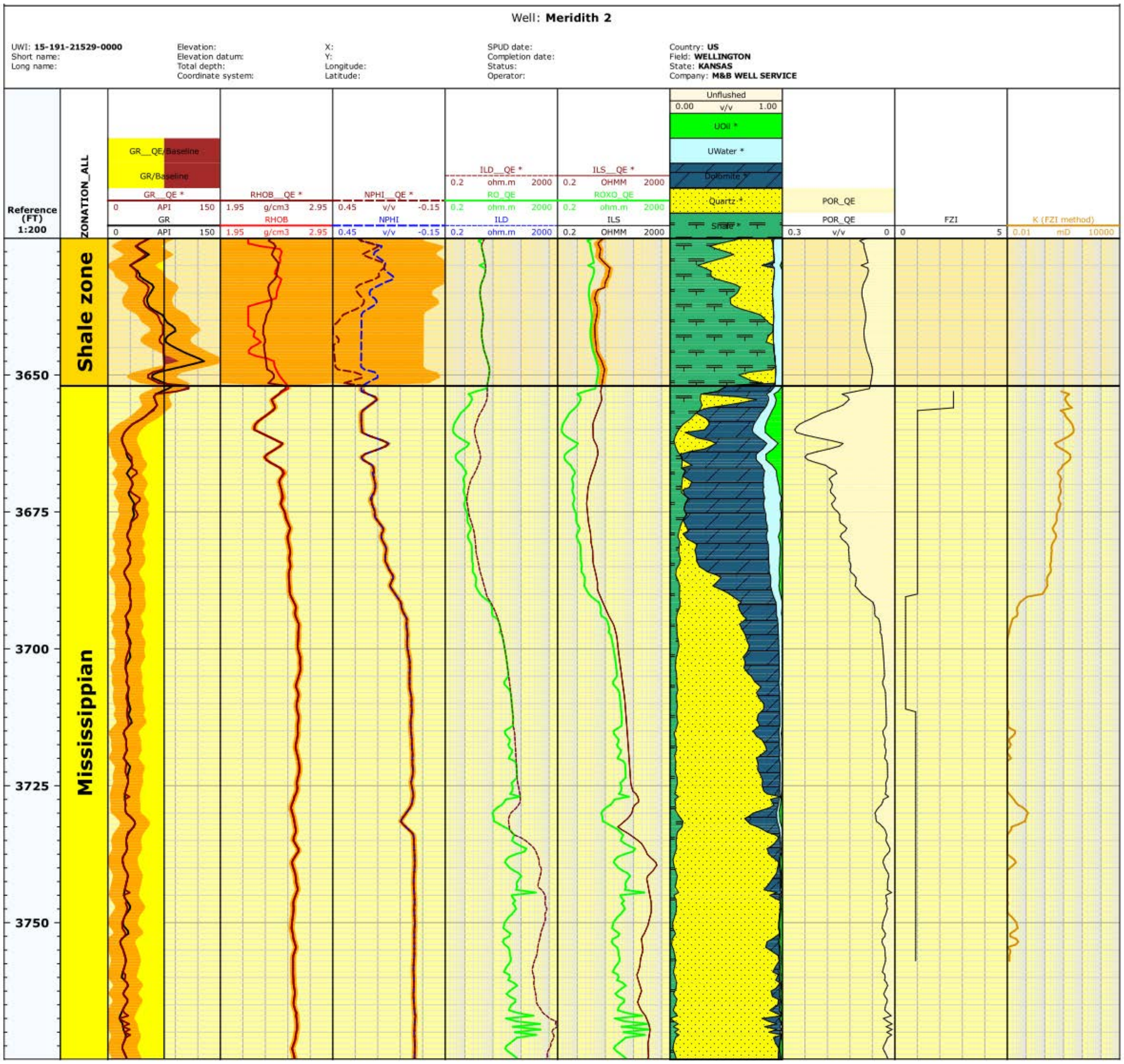

Figure A-17: Layout of Meridith #2 showing average FZI in each of six zones and permeability from the FZI-SWP method

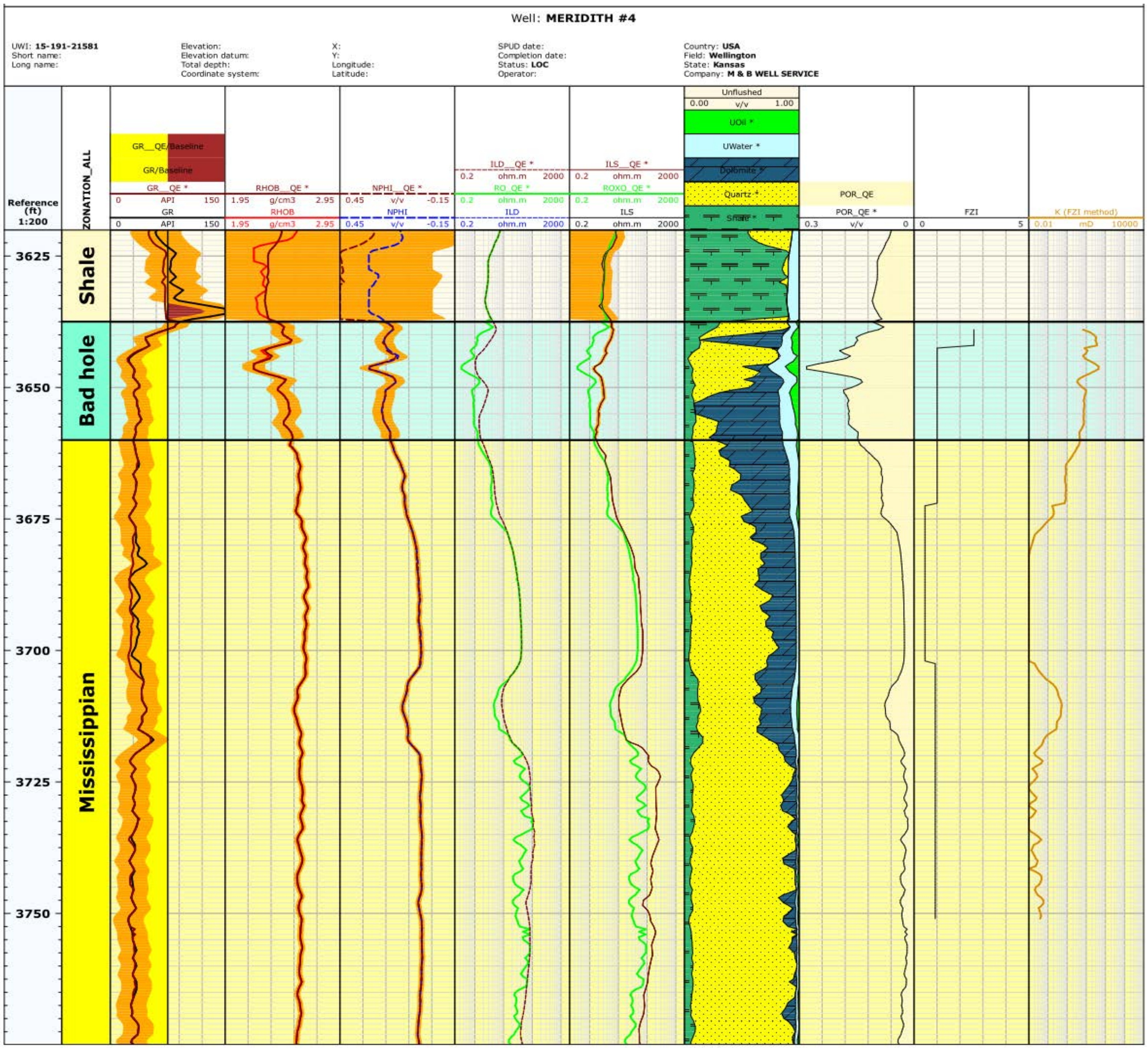

Figure A-18: Layout of Meridith #4 showing average FZI in each of six zones and permeability from the FZI-SWP method

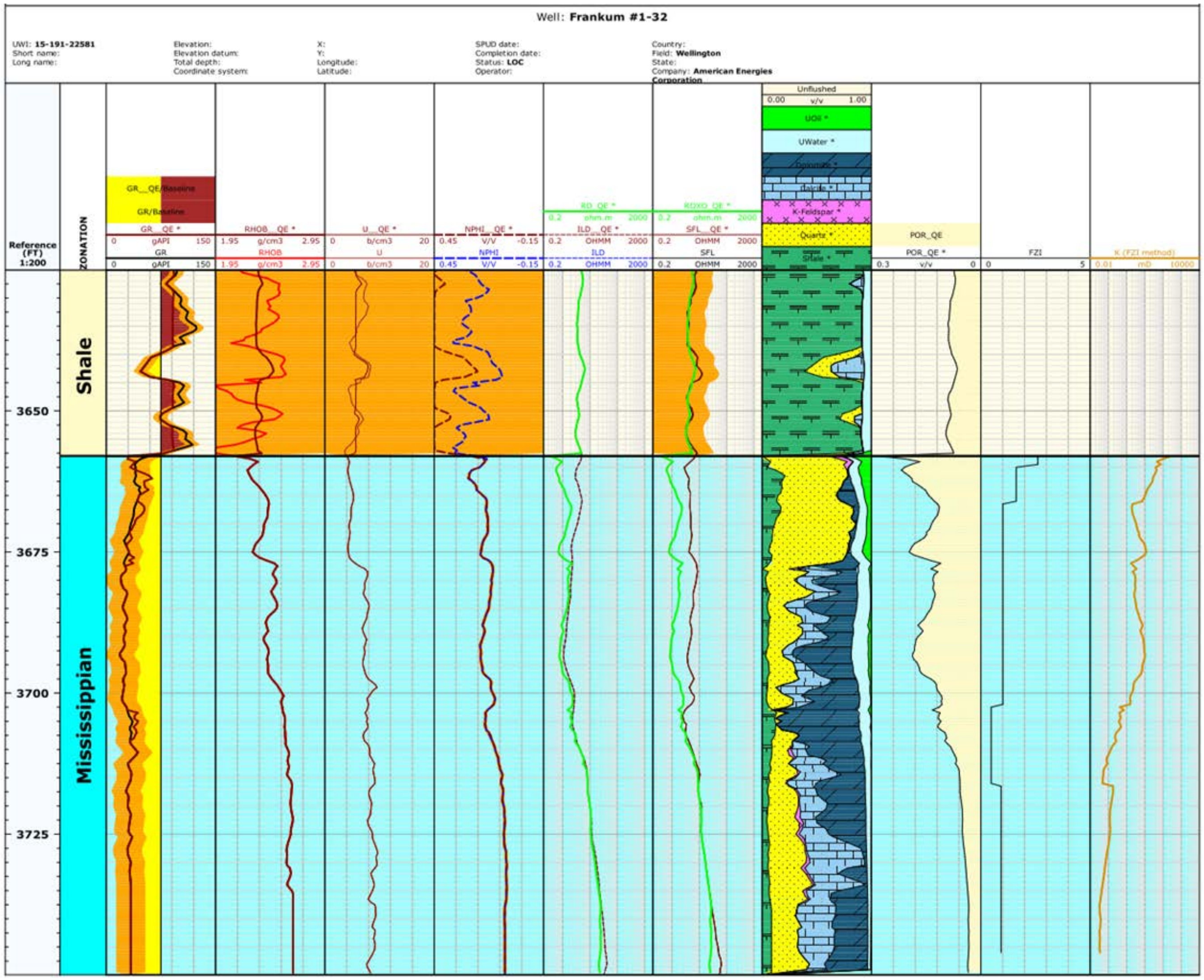

Figure A-19: Layout of Frankum # 1-32 showing average FZI in each of six zones and permeability from the FZI-SWP method

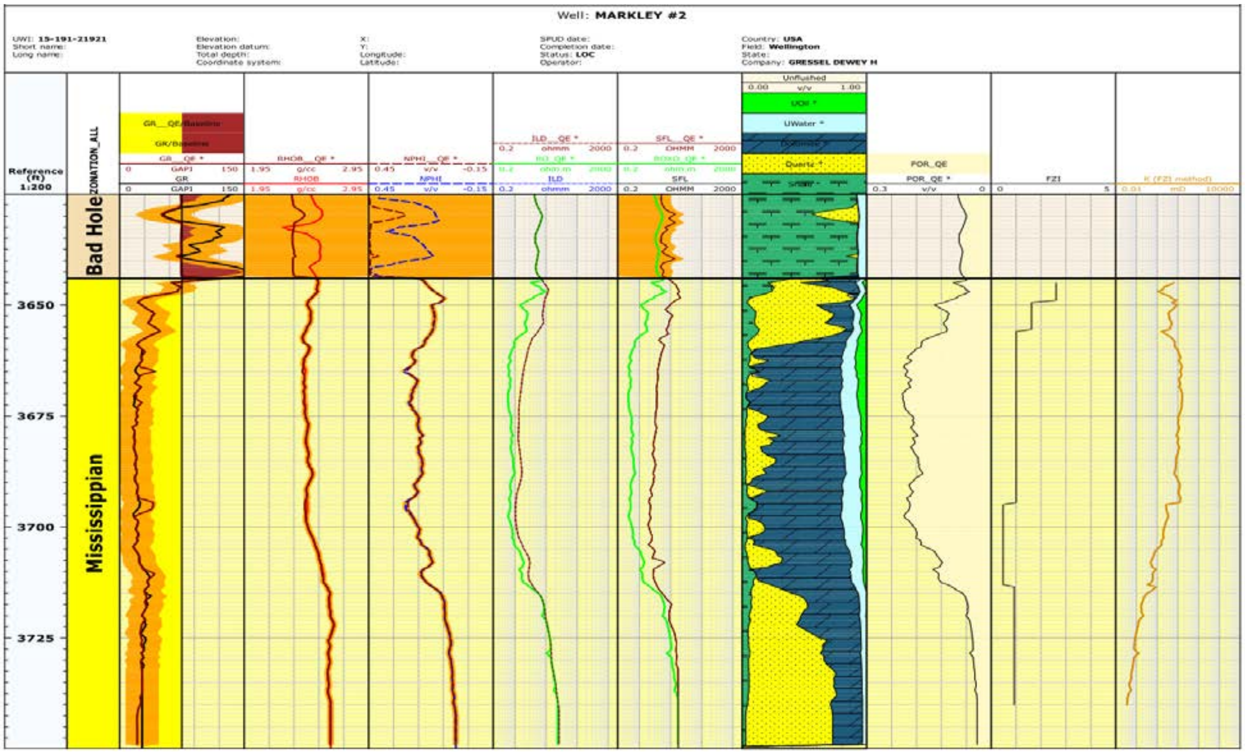

Figure A-20: **Layout of Markley #2 showing average FZI in each of six zones and permeability from the FZI-SWP method**

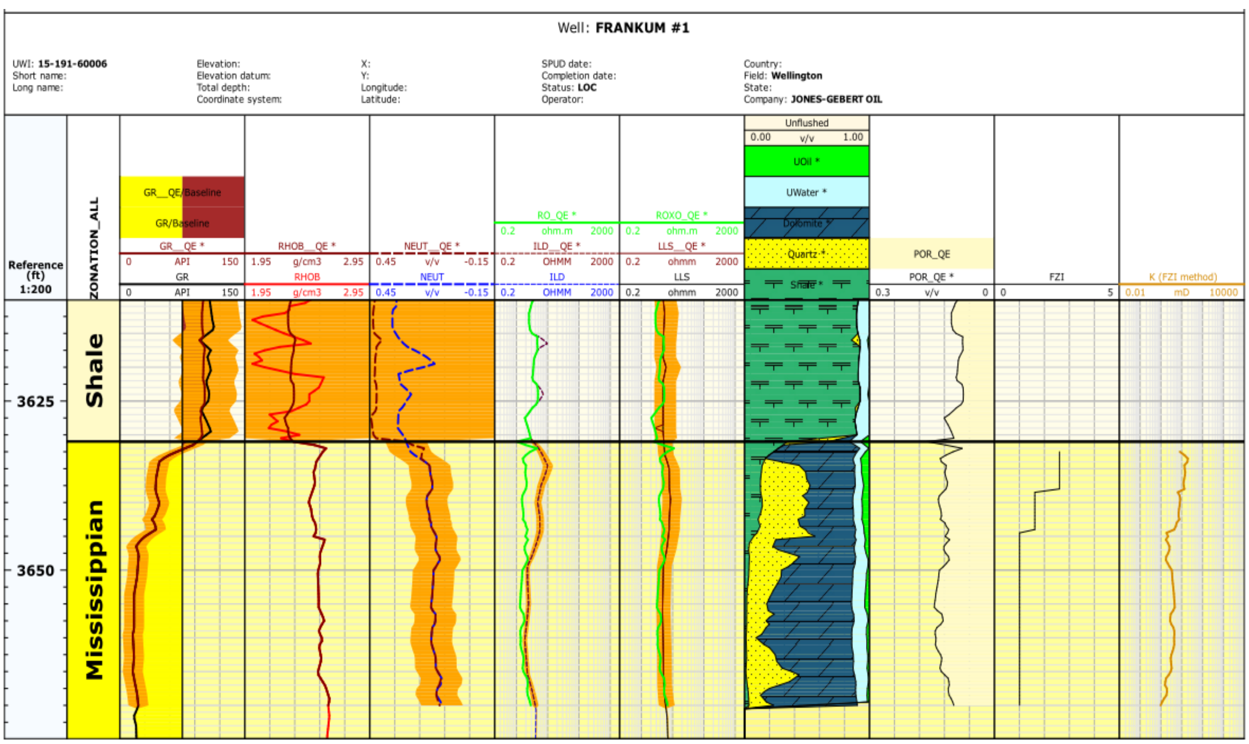

Figure A-21: Layout of Frankum #1 showing average FZI in each of six zones and permeability from the FZI-SWP method

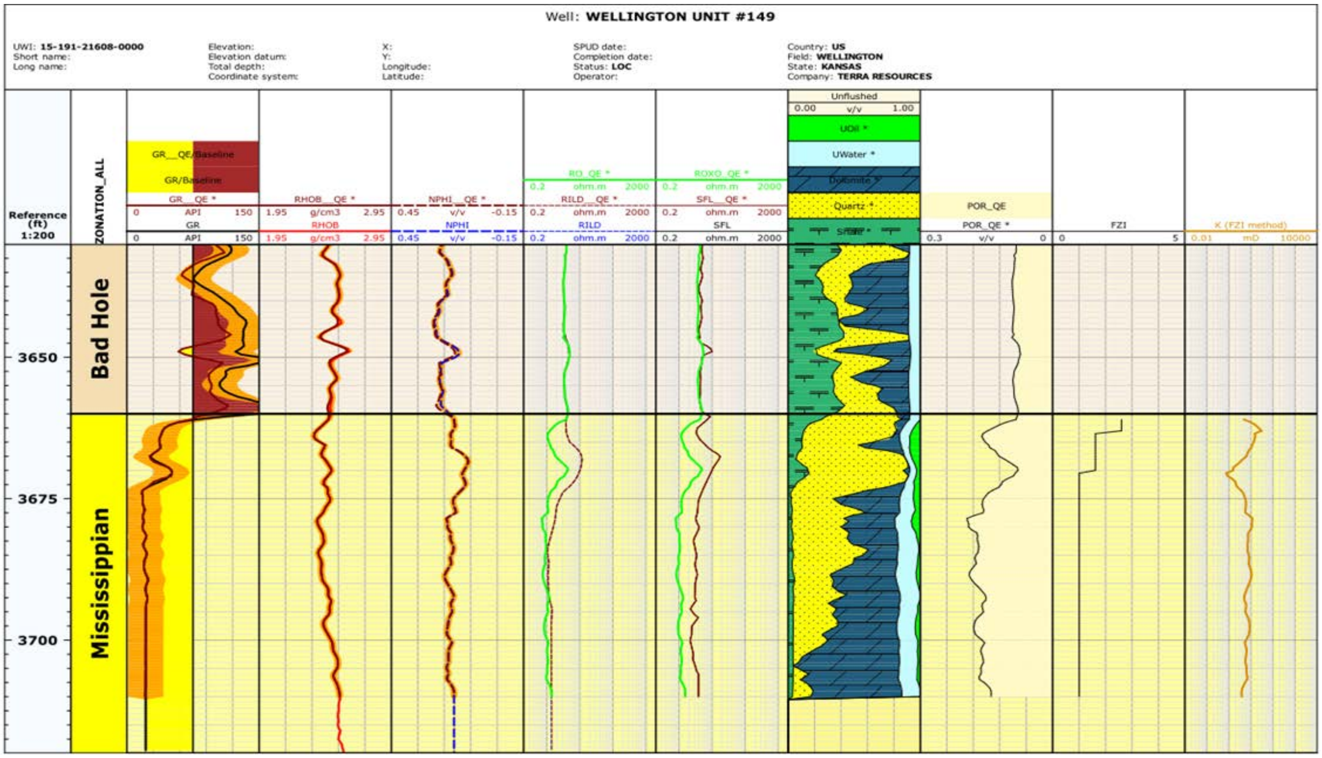

Figure A-22: Layout of Well #149 showing average FZI in each of six zones and permeability from the FZI-SWP method:

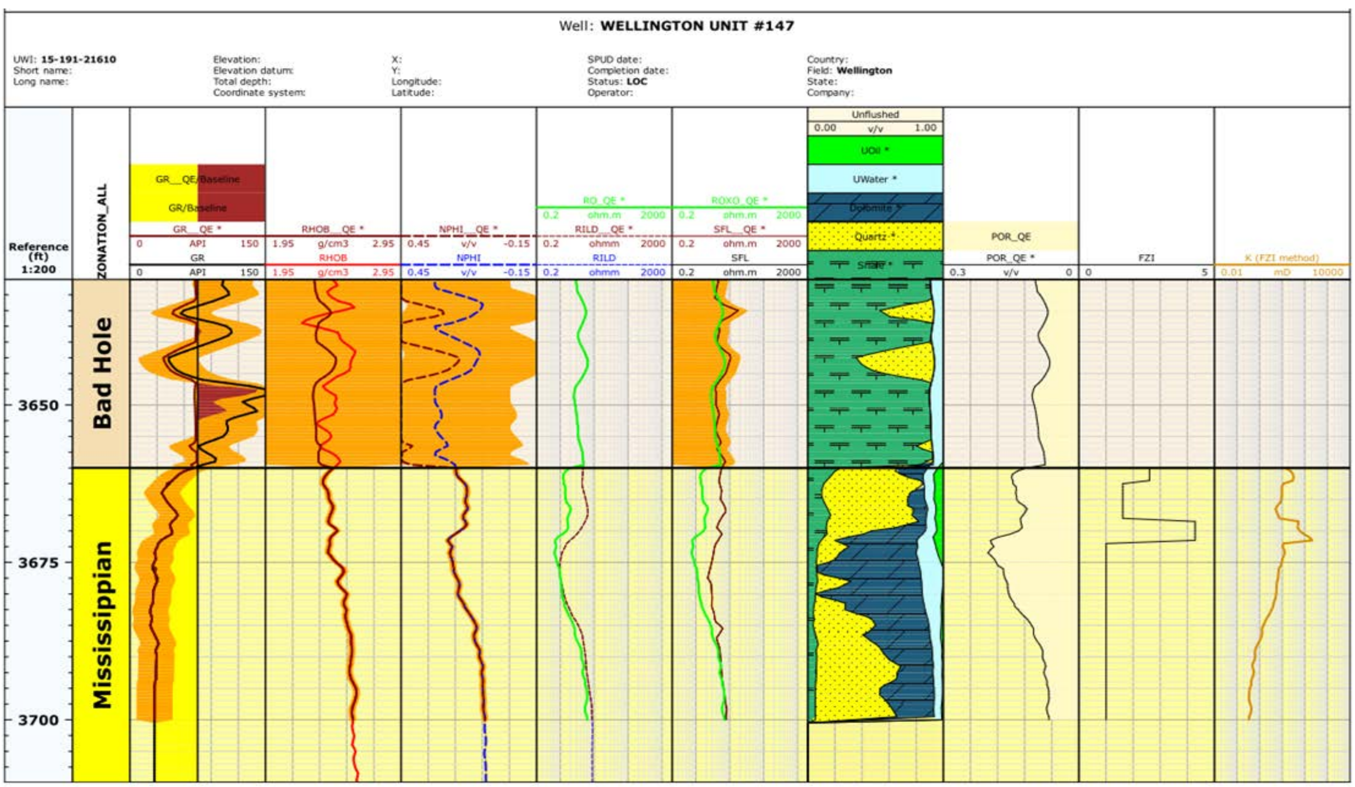

Figure A-23: Layout of Well #147 showing average FZI in each of six zones and permeability from the FZI-SWP method

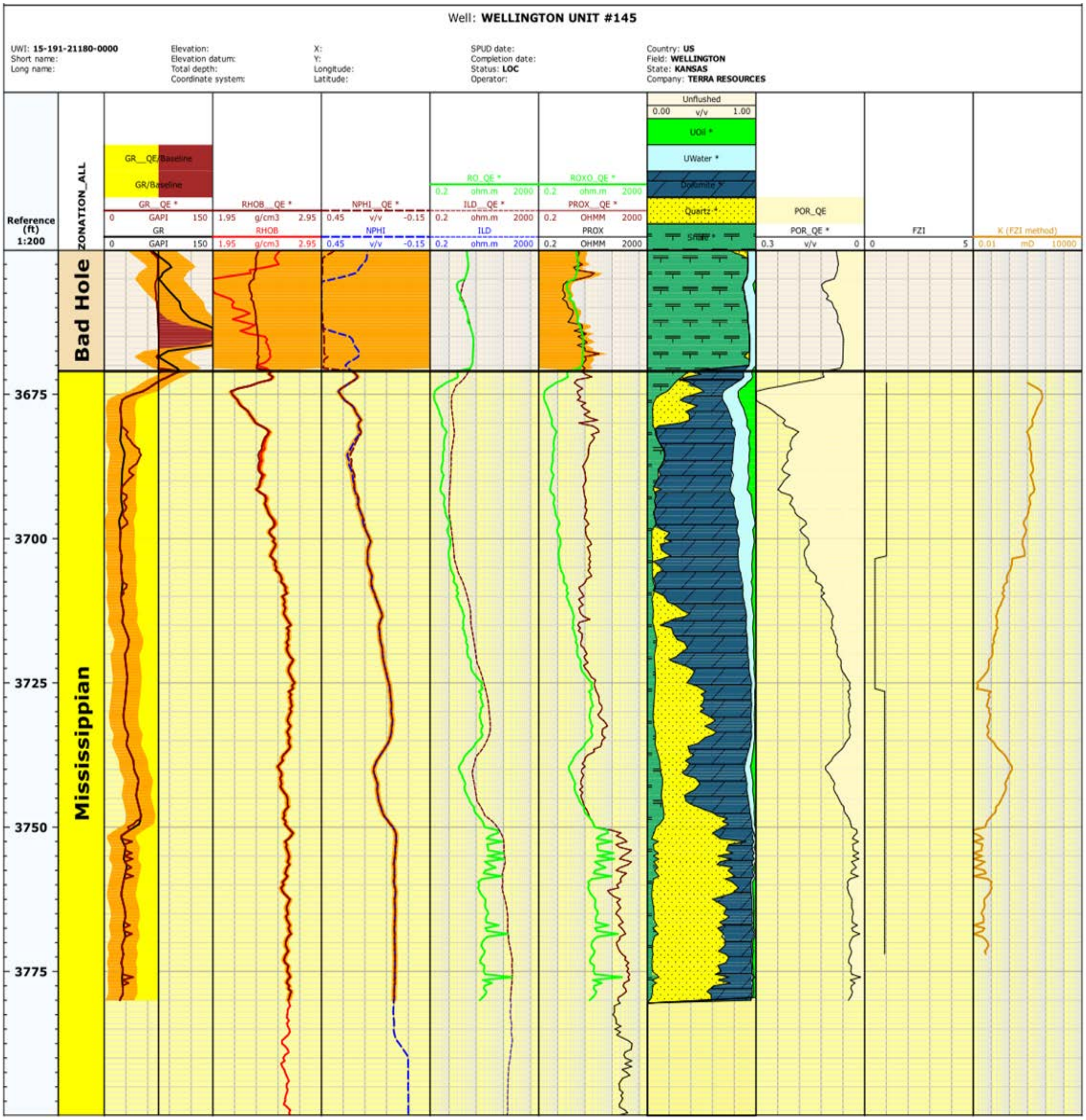

Figure A-24: Layout of Well #145 showing average FZI in each of six zones and permeability from the FZI-SWP method

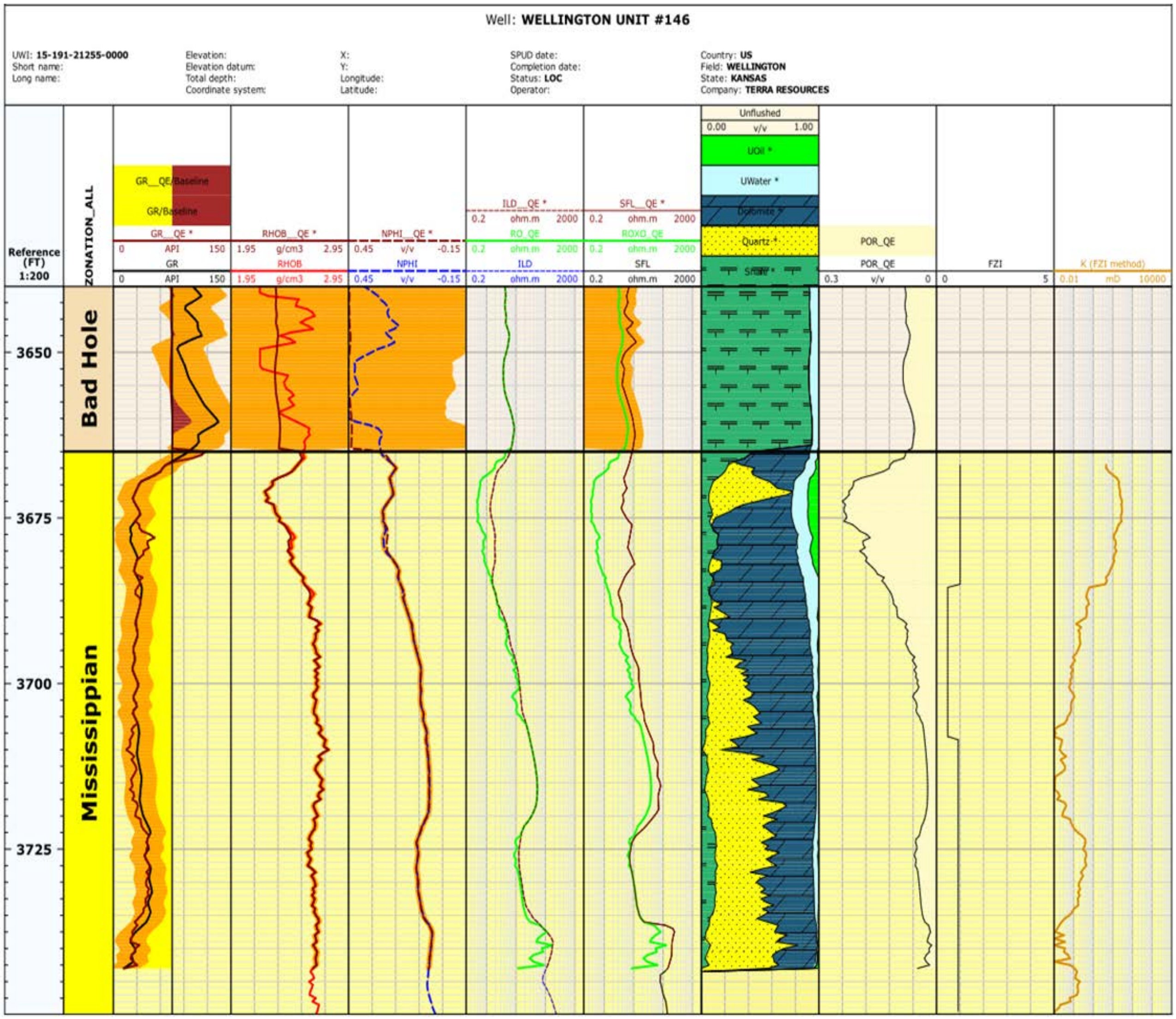

Figure A-25: Layout of Well #146 showing average FZI in each of six zones and permeability from the FZI-SWP method

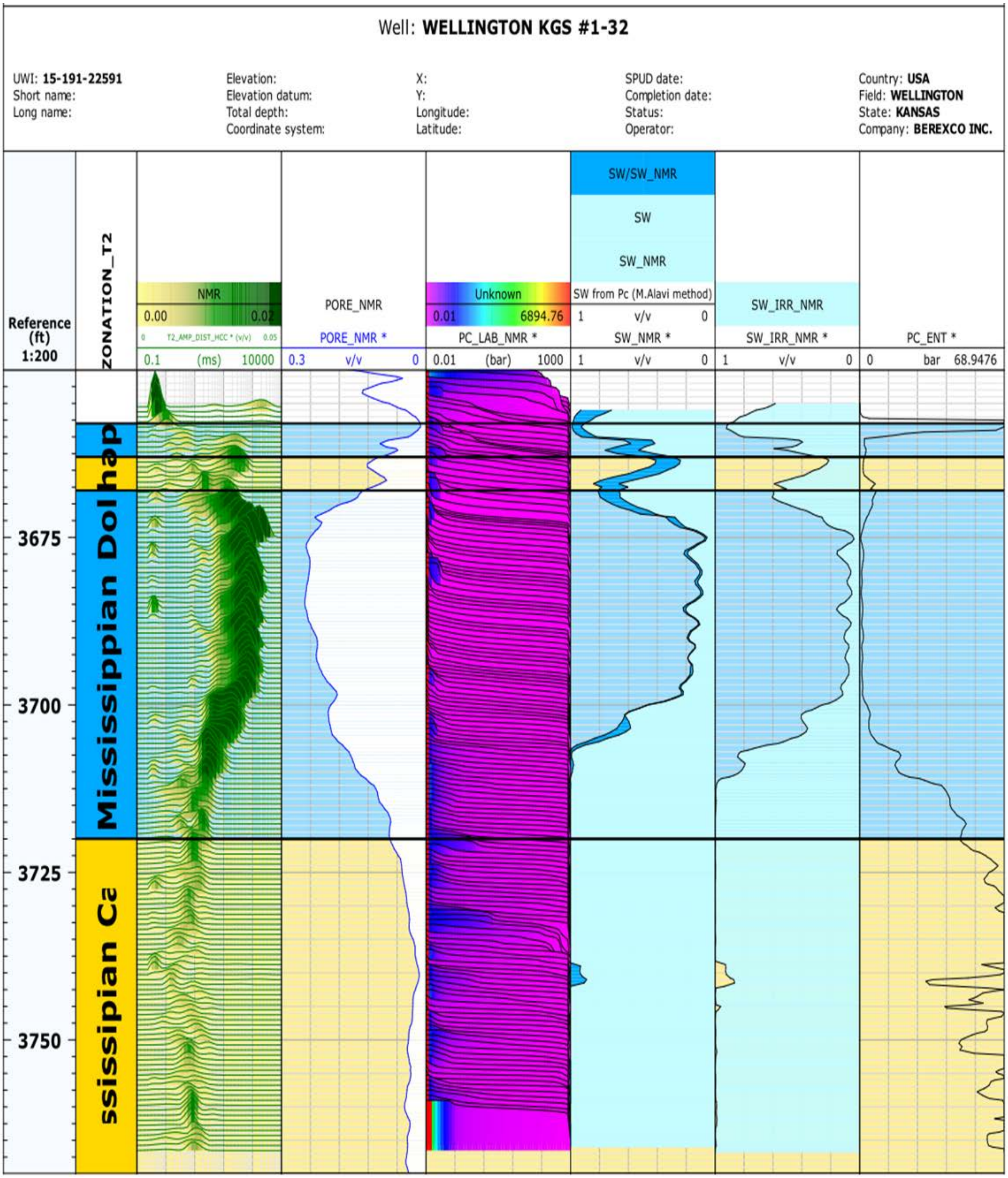

Figure A-26: Calculated initial water saturation using the Pc M.F.Alavi method compared with saturation from the NMR log

APPENDIX A-3. Relative Permeability Chat Section

RQI=			0.320	
Sor	Swc	Chat	Krw max	Kro max
0.321	0.45	**1**	0.204	0.871
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.450	0.550	0.000	0.000	0.871
0.470	0.530	0.087	0.005	0.694
0.490	0.510	0.174	0.015	0.540
0.510	0.490	0.262	0.027	0.408
0.530	0.470	0.349	0.042	0.298
0.550	0.450	0.436	0.059	0.208
0.570	0.430	0.523	0.077	0.137
0.590	0.410	0.610	0.097	0.083
0.610	0.390	0.698	0.119	0.044
0.630	0.370	0.785	0.142	0.019
0.650	0.350	0.872	0.166	0.005
0.670	0.330	0.959	0.191	0.000
0.679	0.321	1.000	0.204	0.000

Table B1: Relative permeability for the chat section at RQI=0.320

RQI=			0.280	
Sor	Swc	Chat	Krw max	Kro max
0.300	0.5	**2**	0.214	0.869
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.500	0.500	0	0	0.869
0.520	0.480	0.1	0.007	0.668
0.540	0.460	0.2	0.019	0.498
0.560	0.440	0.3	0.035	0.356
0.580	0.420	0.4	0.054	0.242
0.600	0.400	0.5	0.075	0.154
0.620	0.380	0.6	0.099	0.088
0.640	0.360	0.7	0.125	0.043
0.660	0.340	0.8	0.153	0.016
0.680	0.320	0.9	0.182	0.003
0.700	0.300	1.0	0.214	0.000

Table B2: Relative permeability for the chat section at RQI=0.280

RQI=			0.245	
Sor	Swc	Chat	Krw max	Kro max
0.270	0.56	**3**	0.224	0.867
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.560	0.440	0.000	0.000	0.867
0.580	0.420	0.118	0.009	0.634
0.600	0.400	0.235	0.026	0.443
0.620	0.380	0.353	0.047	0.292
0.640	0.360	0.471	0.072	0.177
0.660	0.340	0.588	0.101	0.094
0.680	0.320	0.706	0.133	0.041
0.700	0.300	0.824	0.167	0.011
0.720	0.280	0.941	0.204	0.001
0.730	0.270	1.000	0.224	0.000

Table B3: Relative permeability for the chat section at RQI=0.245

RQI=			0.220	
Sor	Swc	Chat	Krw max	Kro max
0.240	0.6	**4**	0.232	0.865
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.600	0.400	0.000	0	0.865
0.620	0.380	0.125	0.010262	0.620
0.640	0.360	0.250	0.029026	0.421
0.660	0.340	0.375	0.053324	0.267
0.680	0.320	0.500	0.082097	0.153
0.700	0.300	0.625	0.114735	0.074
0.720	0.280	0.750	0.150823	0.027
0.740	0.260	0.875	0.190058	0.005
0.760	0.240	1.000	0.232206	0.000

Table B4: Relative permeability for the chat section at RQI=0.220

RQI=			0.200	
Sor	Swc	Chat	Krw max	Kro max
0.210	0.66	**5**	0.240	0.864
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.660	0.340	0.000	0.000	0.864
0.680	0.320	0.154	0.014	0.569
0.700	0.300	0.308	0.041	0.344
0.720	0.280	0.462	0.075	0.184
0.740	0.260	0.615	0.116	0.079
0.760	0.240	0.769	0.162	0.022
0.780	0.220	0.923	0.213	0.001
0.790	0.210	1.000	0.240	0.000

Table B5: Relative permeability for the chat section at RQI=0.200

RQI=			0.175	
Sor	Swc	Chat	Krw max	Kro max
0.155	0.75	**6**	0.251	0.861
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.750	0.250	0	0	0.861
0.770	0.230	0.210526316	0.02429	0.477
0.790	0.210	0.421052632	0.068701	0.220
0.810	0.190	0.631578947	0.126212	0.071
0.830	0.170	0.842105263	0.194317	0.009
0.845	0.155	1	0.251455	0.000

Table B6: Relative permeability for the chat section at RQI=0.175

RQI=			0.145	
Sor	Swc	Chat	Krw max	Kro max
0.090	0.83	**7**	0.268	0.858
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.830	0.170	0	0.000	0.858
0.850	0.150	0.25	0.034	0.418
0.870	0.130	0.5	0.095	0.152
0.890	0.110	0.75	0.174	0.027
0.910	0.090	1	0.268	0.000

Table B7: Relative permeability for the chat section at RQI=0.145

RQI=			0.120	
Sor	Swc	Chat	Krw max	Kro max
0.030	0.930	**8**	0.287	0.855
q	1.5		p	2.5
Sw	**So**	**SwD**	**Krw**	**kro**
0.930	0.070	0	0.000	0.855
0.950	0.050	0.5	0.101	0.151
0.970	0.030	1	0.287	0.000

Table B8: Relative permeability for the Ccat section at RQI=0.120

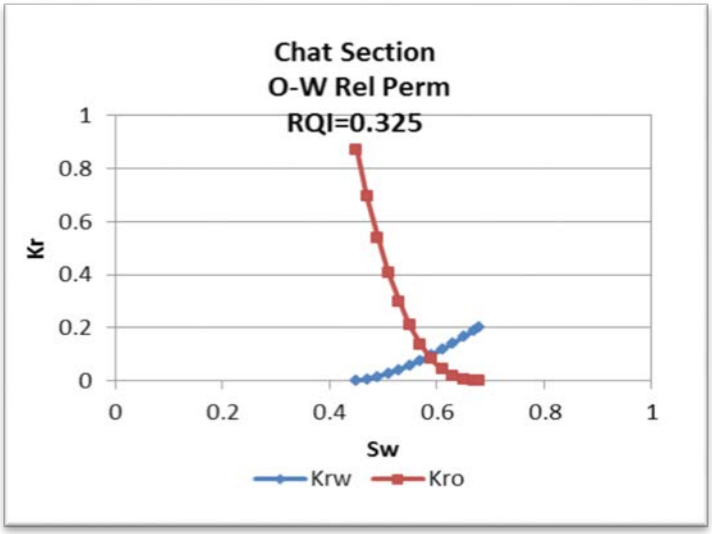

Figure B1: Relative permeability curve for the chat section at RQI=0.325

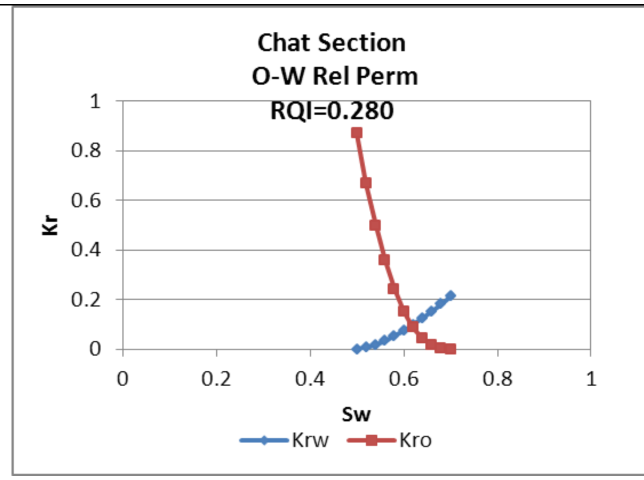

Figure B2: Relative permeability curve for the chat section at RQI=0.280

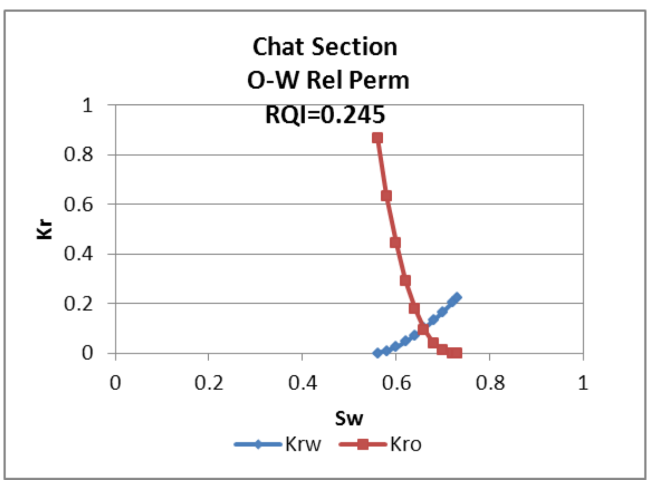

Figure B3: Relative permeability curve for the chat section at RQI=0.245

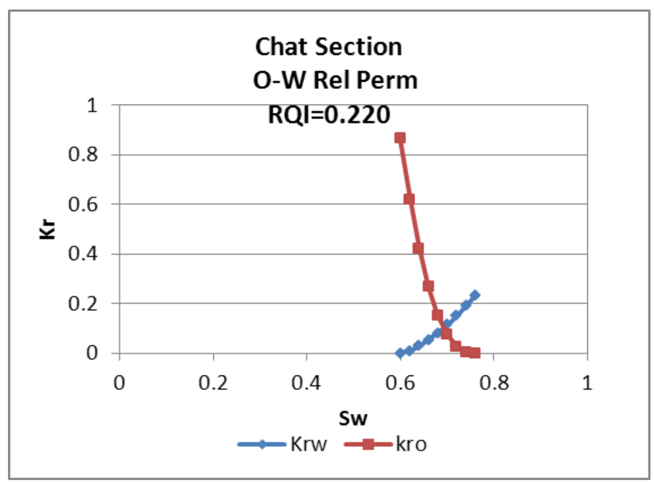

Figure B4: Relative permeability curve for the chat section at RQI=0.220

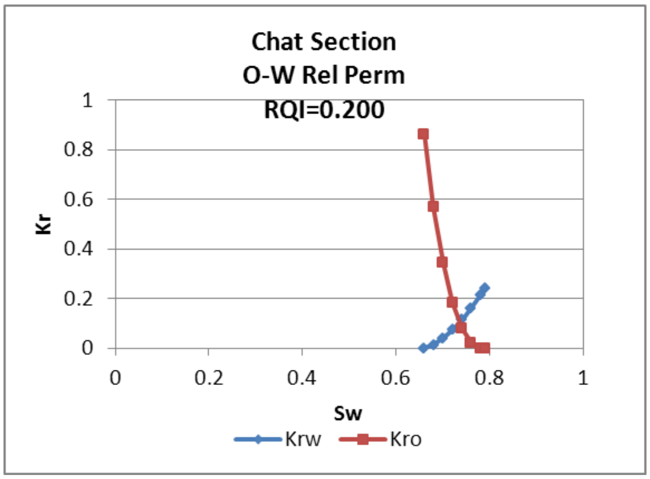

Figure B5: Relative permeability curve for the chat section at RQI=0.200

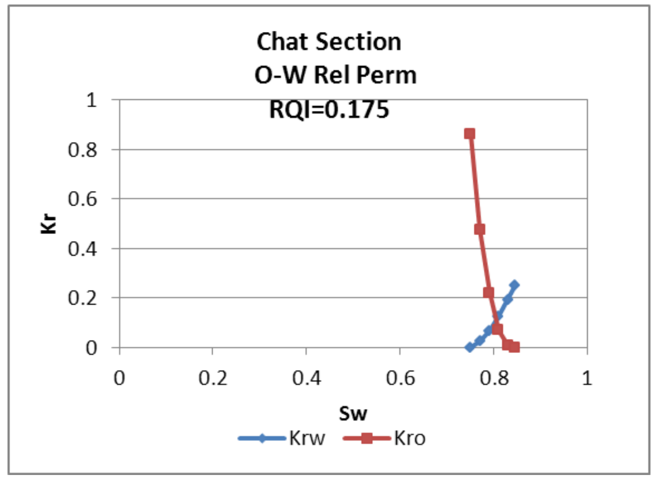

Figure B6: Relative permeability curve for the chat section at RQI=0.175

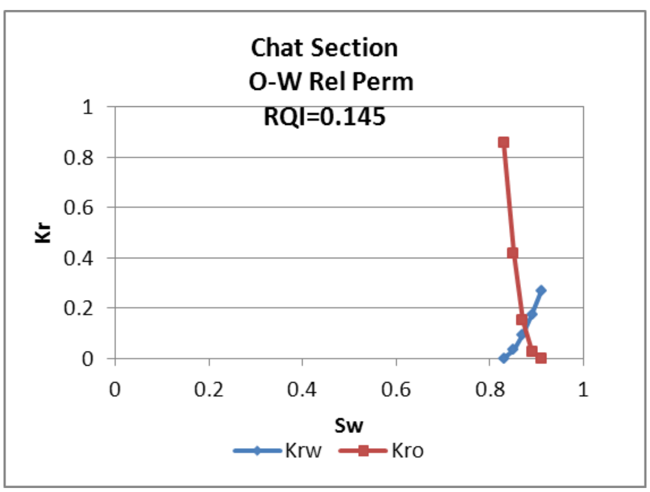

Figure B7: Relative permeability curve for the chat section at RQI=0.145

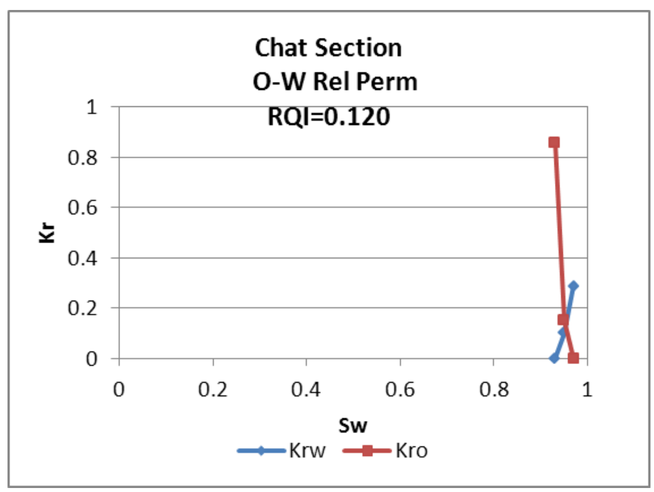

Figure B8: Relative permeability curve for the chat section at RQI=0.120

APPENDIX A-4. Relative Permeability Carbonate Section

Table C1: Relative permeability table for the carbonate section at RQI=0.520

RQI=			0.520	
Sor	Swc	Carbonate	Krw max	Kro max
0.364	0.08	1	0.172	0.880
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.080	0.920	0.000	0	0.880
0.100	0.900	0.036	0.001	0.803
0.120	0.880	0.072	0.003	0.730
0.140	0.860	0.108	0.006	0.661
0.160	0.840	0.144	0.009	0.597
0.180	0.820	0.180	0.013	0.536
0.200	0.800	0.216	0.017	0.479
0.220	0.780	0.252	0.022	0.426
0.240	0.760	0.288	0.027	0.377
0.260	0.740	0.324	0.032	0.331
0.280	0.720	0.359	0.037	0.289
0.300	0.700	0.395	0.043	0.250
0.320	0.680	0.431	0.049	0.215
0.340	0.660	0.467	0.055	0.182
0.360	0.640	0.503	0.061	0.153
0.380	0.620	0.539	0.068	0.127
0.400	0.600	0.575	0.075	0.104
0.420	0.580	0.611	0.082	0.083
0.440	0.560	0.647	0.090	0.065
0.460	0.540	0.683	0.097	0.050
0.480	0.520	0.72	0.105	0.037
0.500	0.500	0.755	0.113	0.026
0.520	0.480	0.791	0.121	0.018
0.540	0.460	0.827	0.129	0.011
0.560	0.440	0.863	0.138	0.006
0.580	0.420	0.899	0.147	0.003
0.600	0.400	0.935	0.156	0.001
0.620	0.380	0.971	0.165	0.0001

Table C2: Relative permeability table for the carbonate section at RQI=0.380

RQI=			0.380	
Sor	Swc	Carbonate	Krw max	Kro max
0.342	0.11	2	0.192	0.874
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.110	0.890	0.000	0	0.874
0.130	0.870	0.037	0.001	0.797
0.150	0.850	0.073	0.004	0.723
0.170	0.830	0.110	0.007	0.654
0.190	0.810	0.146	0.011	0.589
0.210	0.790	0.183	0.015	0.528
0.230	0.770	0.219	0.020	0.471
0.250	0.750	0.256	0.025	0.418
0.270	0.730	0.292	0.030	0.369
0.290	0.710	0.329	0.036	0.323
0.310	0.690	0.365	0.042	0.281
0.330	0.670	0.402	0.049	0.242
0.350	0.650	0.438	0.056	0.207
0.370	0.630	0.475	0.063	0.175
0.390	0.610	0.511	0.070	0.146
0.410	0.590	0.548	0.078	0.120
0.430	0.570	0.584	0.086	0.097
0.450	0.550	0.621	0.094	0.077
0.470	0.530	0.657	0.102	0.060
0.490	0.510	0.694	0.111	0.045
0.510	0.490	0.73	0.120	0.033
0.530	0.470	0.767	0.129	0.023
0.550	0.450	0.803	0.138	0.015
0.570	0.430	0.840	0.148	0.009
0.590	0.410	0.876	0.157	0.005
0.610	0.390	0.913	0.167	0.002
0.630	0.370	0.949	0.178	0.001
0.650	0.350	0.986	0.188	0.00002
0.658	0.342	1.000	0.192	0.000

Table C3: Relative permeability table for the carbonate section at RQI=0.250

RQI=			0.250	
Sor	Swc	Carbonate	Krw max	Kro max
0.315	0.15	3	0.222	0.867
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.150	0.850	0.000	0	0.867
0.170	0.830	0.037	0.002	0.789
0.190	0.810	0.075	0.005	0.714
0.210	0.790	0.112	0.008	0.644
0.230	0.770	0.149	0.013	0.579
0.250	0.750	0.187	0.018	0.517
0.270	0.730	0.224	0.024	0.460
0.290	0.710	0.261	0.030	0.406
0.310	0.690	0.299	0.036	0.357
0.330	0.670	0.336	0.043	0.311
0.350	0.650	0.374	0.051	0.269
0.370	0.630	0.411	0.059	0.231
0.390	0.610	0.448	0.067	0.196
0.410	0.590	0.486	0.075	0.165
0.430	0.570	0.523	0.084	0.136
0.450	0.550	0.560	0.093	0.111
0.470	0.530	0.598	0.103	0.089
0.490	0.510	0.635	0.112	0.070
0.510	0.490	0.672	0.122	0.053
0.530	0.470	0.710	0.133	0.039
0.550	0.450	0.75	0.143	0.028
0.570	0.430	0.784	0.154	0.019
0.590	0.410	0.822	0.165	0.012
0.610	0.390	0.859	0.177	0.006
0.630	0.370	0.897	0.189	0.003
0.650	0.350	0.934	0.200	0.001
0.670	0.330	0.971	0.213	0.0001
0.685	0.315	1.000	0.222	0.0000

Table C4: Relative permeability table for the carbonate section at RQI=0.160

RQI=			0.160	
Sor	Swc	Carbonate	Krw max	Kro max
0.278	0.22	4	0.259	0.860
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.220	0.780	0.000	0	0.860
0.240	0.760	0.040	0.002	0.777
0.260	0.740	0.080	0.006	0.699
0.280	0.720	0.120	0.011	0.625
0.300	0.700	0.159	0.017	0.557
0.320	0.680	0.199	0.023	0.493
0.340	0.660	0.239	0.030	0.434
0.360	0.640	0.279	0.038	0.380
0.380	0.620	0.319	0.047	0.329
0.400	0.600	0.359	0.056	0.283
0.420	0.580	0.399	0.065	0.241
0.440	0.560	0.438	0.075	0.203
0.460	0.540	0.478	0.086	0.169
0.480	0.520	0.518	0.097	0.139
0.500	0.500	0.558	0.108	0.112
0.520	0.480	0.598	0.120	0.088
0.540	0.460	0.638	0.132	0.068
0.560	0.440	0.677	0.145	0.051
0.580	0.420	0.717	0.158	0.037
0.600	0.400	0.757	0.171	0.025
0.620	0.380	0.80	0.185	0.016
0.640	0.360	0.837	0.199	0.009
0.660	0.340	0.877	0.213	0.005
0.680	0.320	0.917	0.228	0.002
0.700	0.300	0.956	0.243	0.00034
0.720	0.280	0.996	0.258	0.00000
0.722	0.278	1.000	0.259	0.000

Table C5: Relative permeability table for the carbonate section at RQI=0.100

RQI=			0.100	
Sor	Swc	Carbonate	Krw max	Kro max
0.250	0.315	5	0.306	0.852
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.315	0.685	0.000	0	0.852
0.335	0.665	0.046	0.003	0.757
0.355	0.645	0.092	0.009	0.669
0.375	0.625	0.138	0.016	0.588
0.395	0.605	0.184	0.024	0.512
0.415	0.585	0.230	0.034	0.443
0.435	0.565	0.276	0.044	0.380
0.455	0.545	0.322	0.056	0.322
0.475	0.525	0.368	0.068	0.270
0.495	0.505	0.414	0.081	0.224
0.515	0.485	0.460	0.095	0.182
0.535	0.465	0.506	0.110	0.146
0.555	0.445	0.552	0.125	0.114
0.575	0.425	0.598	0.141	0.087
0.595	0.405	0.644	0.158	0.064
0.615	0.385	0.690	0.175	0.046
0.635	0.365	0.736	0.193	0.030
0.655	0.345	0.782	0.211	0.019
0.675	0.325	0.828	0.230	0.010
0.695	0.305	0.874	0.250	0.005
0.715	0.285	0.92	0.270	0.002
0.735	0.265	0.966	0.290	0.000
0.750	0.250	1.000	0.306	0.000

Table C6: Relative permeability table for the carbonate section at RQI=0.080

RQI=			0.080	
Sor	Swc	Carbonate	Krw max	Kro max
0.220	0.43	6	0.330	0.848
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.430	0.570	0.000	0	0.848
0.450	0.550	0.057	0.005	0.732
0.470	0.530	0.114	0.013	0.626
0.490	0.510	0.171	0.023	0.530
0.510	0.490	0.228	0.036	0.444
0.530	0.470	0.285	0.050	0.366
0.550	0.450	0.343	0.066	0.297
0.570	0.430	0.400	0.083	0.237
0.590	0.410	0.457	0.102	0.184
0.610	0.390	0.514	0.122	0.140
0.630	0.370	0.571	0.142	0.102
0.650	0.350	0.628	0.164	0.072
0.670	0.330	0.685	0.187	0.047
0.690	0.310	0.742	0.211	0.029
0.710	0.290	0.799	0.236	0.015
0.730	0.270	0.856	0.262	0.007
0.750	0.250	0.914	0.288	0.002
0.770	0.230	0.971	0.316	0.0001
0.780	0.220	1.000	0.330	0.000

Table C7: Relative permeability table for the carbonate section at RQI=0.060

RQI=			0.060	
Sor	Swc	Carbonate	Krw max	Kro max
0.200	0.52	7	0.365	0.844
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.520	0.480	0.000	0	0.844
0.540	0.460	0.071	0.007	0.701
0.560	0.440	0.143	0.020	0.574
0.580	0.420	0.214	0.036	0.462
0.600	0.400	0.285	0.056	0.364
0.620	0.380	0.357	0.078	0.280
0.640	0.360	0.428	0.102	0.209
0.660	0.340	0.499	0.129	0.150
0.680	0.320	0.571	0.157	0.102
0.700	0.300	0.642	0.188	0.065
0.720	0.280	0.714	0.220	0.037
0.740	0.260	0.785	0.254	0.018
0.760	0.240	0.856	0.289	0.007
0.780	0.220	0.928	0.326	0.001
0.800	0.200	0.999	0.36438	0.000

Table C8: Relative permeability table for the carbonate section at RQI=0.050

RQI=			0.050	
Sor	Swc	Carbonate	Krw max	Kro max
0.174	0.660	8	0.389	0.841
q	1.5		p	2.5
Sw	So	SwD	Krw	kro
0.660	0.340	0.000	0	0.841
0.680	0.320	0.121	0.016	0.609
0.700	0.300	0.242	0.046	0.421
0.720	0.280	0.363	0.085	0.273
0.740	0.260	0.483	0.131	0.161
0.760	0.240	0.604	0.183	0.083
0.780	0.220	0.725	0.240	0.033
0.800	0.200	0.846	0.303	0.008
0.820	0.180	0.967	0.370	0.000
0.826	0.174	1.000	0.389	0.000

Figure C1: Relative permeability curve for the carbonate section at RQI=0.520

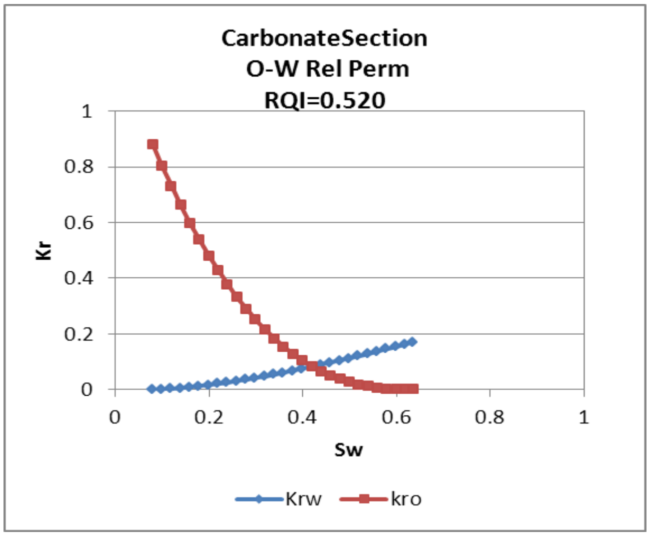

Figure C2: Relative permeability curve for the carbonate section at RQI=0.380

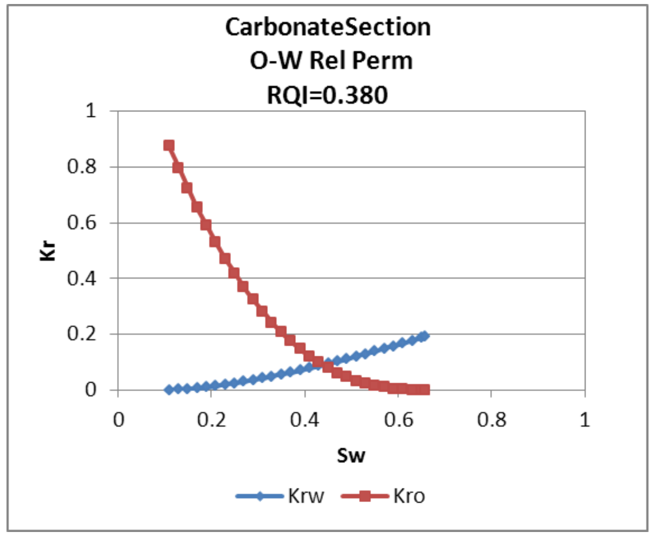

Figure C3: Relative permeability curve for the carbonate section at RQI=0.25

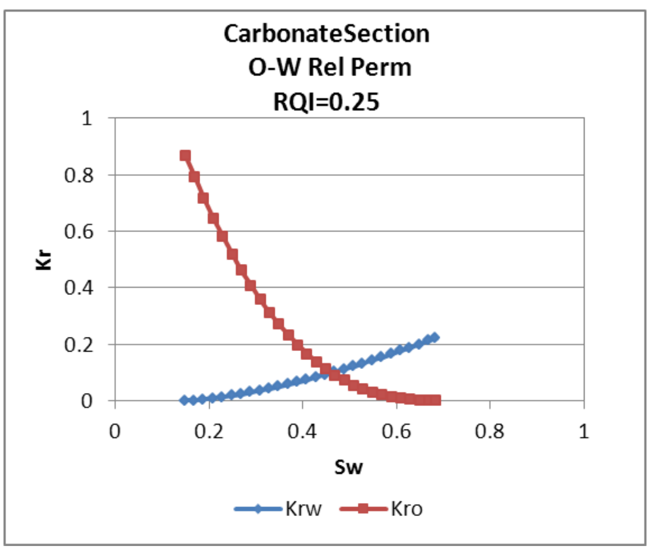

Figure C4: Relative permeability curve for the carbonate section at RQI=0.16

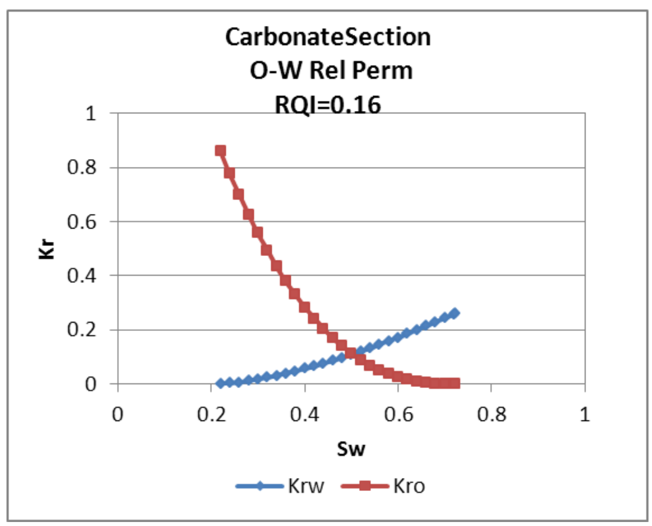

Figure C5:Relative permeability curve for the carbonate section at RQI=0.100

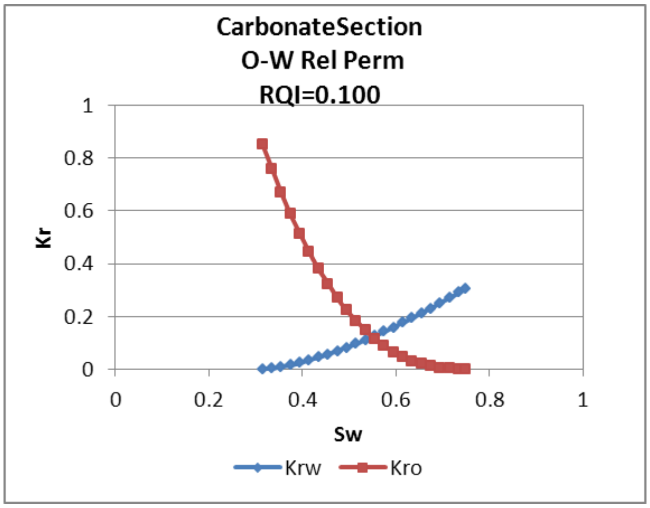

Figure C6: Relative permeability curve for the carbonate section at RQI=0.08

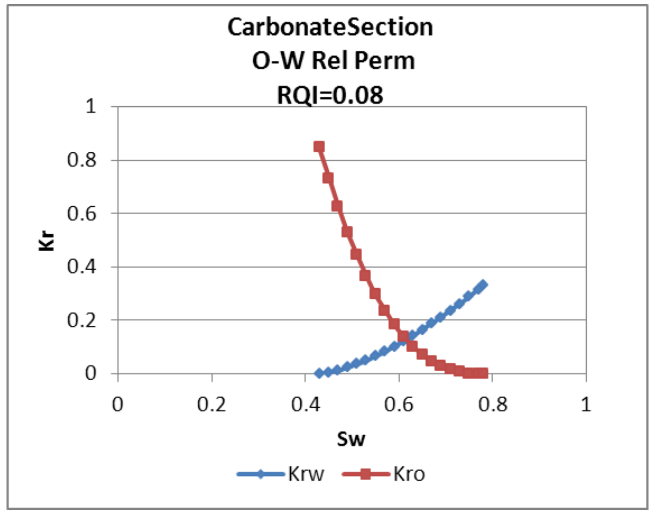

Figure C7: Relative permeability curve for the carbonate section at RQI=0.06

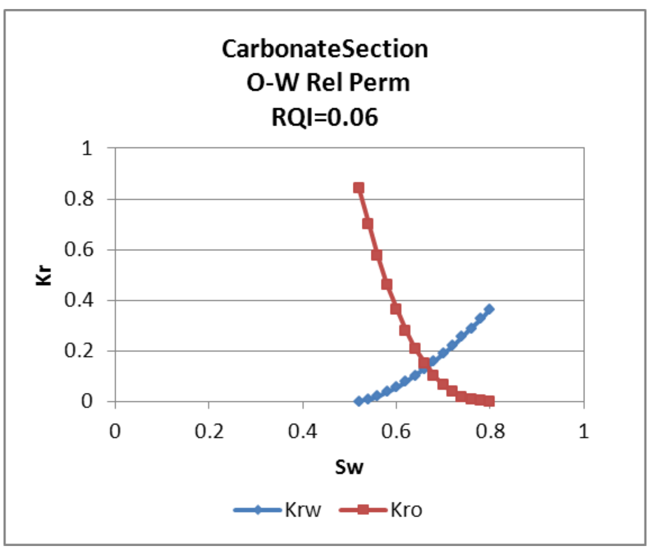

Figure C8: Relative permeability curve for the carbonate section at RQI=0.05