

HDD™ Simultaneous Formation Tester (SFT)

CASE HISTORY: \$100,000 + in Reduced Drilling and Completion Costs using RECON's HDD™ Simultaneous Formation Tester Data

Challenge:

In this case history; the client, **RAINBOW SEVEN OIL & GAS**, requested RECON's assistance with the evaluation of multiple potential gas zones on one of its new-drills in North-Texas.

This particular area is characterized by prolific-looking gas zones, when identified on Open Hole logs. However, due to the intensity of historical production in the area, many of these zones are near depletion.

The need for accurate reservoir pressure measurements is essential to make correct completion decisions.

Solution:

RECON deployed a suite of Open Hole logs (Dual Induction-LL3, Compensated Neutron-Lithology Density (PE), Microlog, Gamma Ray) utilizing its "**Industry Only**" STANDARD High Resolution sampling rate of **10 samples/ft** to provide the client with accurate and precise Open Hole Log data, along with RECON's caliper type HDD™ Simultaneous Formation Tester (SFT), which allows for "no-limit" sampling of multiple pressure points at multiple depths.

The SFT tool has the ability to collect highly accurate formation pressures, along with a single (selectable volume) fluid sample per run, in order to accurately characterize downhole pressures and producible fluids.

By using an extendable caliper-type arm, which provides positive contact with the borehole wall, while the tool is stationary, a user defined amount of fluid can be withdrawn from the mini-sample snorkel chamber to create a differential pressure at the borehole contact point.

The "equalized" pressure recorded by the tool is referred to as the Formation Pressure.

Results:

The Open Hole Log data identified multiple potential gas zones. Specifically, the data from the microlog tool, in conjunction with the formation pressure data obtained with the SFT, assisted in determining the permeability potential of each of these gas zones, along with potential depletion from existing production.

Reduced future drilling costs for offset wells by **\$50,000 to \$60,000 per well**, by eliminating the need to drill deeper, beyond target intervals.

Minimized rig time that would have been used for Drill-stem testing (DST) alternative, resulting in costs savings of \$10,000 to \$15,000 per zone. **Overall cost savings upwards of \$50,000.**

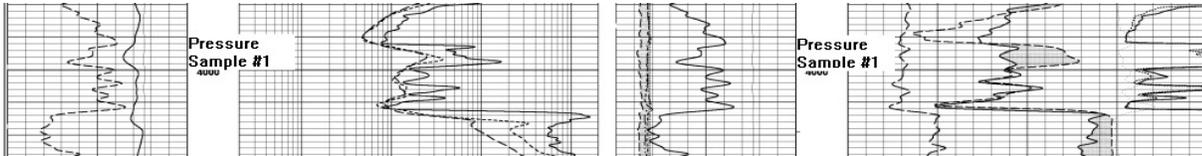
Eliminated the need to spend + \$20,000 per stage to complete an test and additional 4 stages of unproductive or alternatively produced zones. **Overall cost savings of over \$80,000.**

Case History Data:

Based upon “picks” from the Open Hole Logs, the client made the decision to test five (5) sand / conglomerate targets. The well depth tests ranged between 4,000 and 1,700 feet measured depth (MD). The client chose not to capture any fluid samples during the operation.

Sample Point #1:

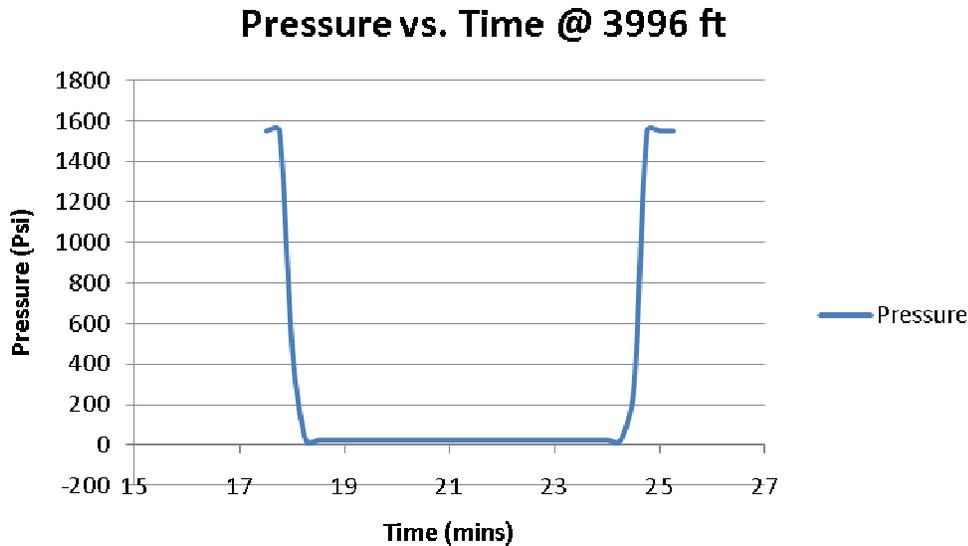
Open Hole Log Data:



Description:

Conglomerate zone approximately 6 ft in thickness. Average Rt value of 20 ohms. Average density porosity of 10%. Indication of gas present by the suppression of the Neutron porosity and crossover of the Density porosity. Poor microlog indications can be interpreted as a low permeability zone.

Formation Tester Pressure Data:

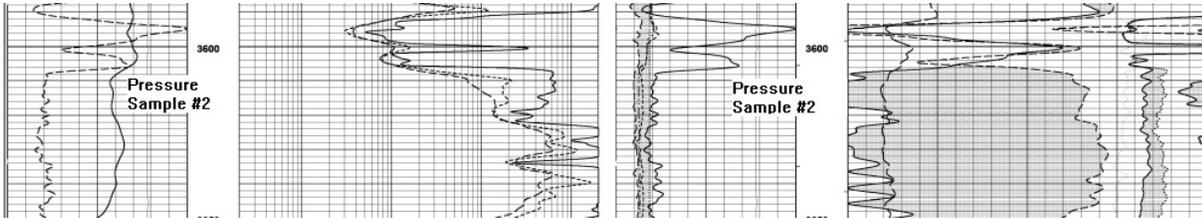


Analysis:

The pressure test is indicative of a tight formation. The drawdown was 20.88 psi and remained at that pressure for approximately 6 minutes. This zone was of particular interest, because it was not present in the direct offset wells. The rock was determined to be non-productive. The decision was not to complete.

Sample Point #2:

Open Hole Log Data:

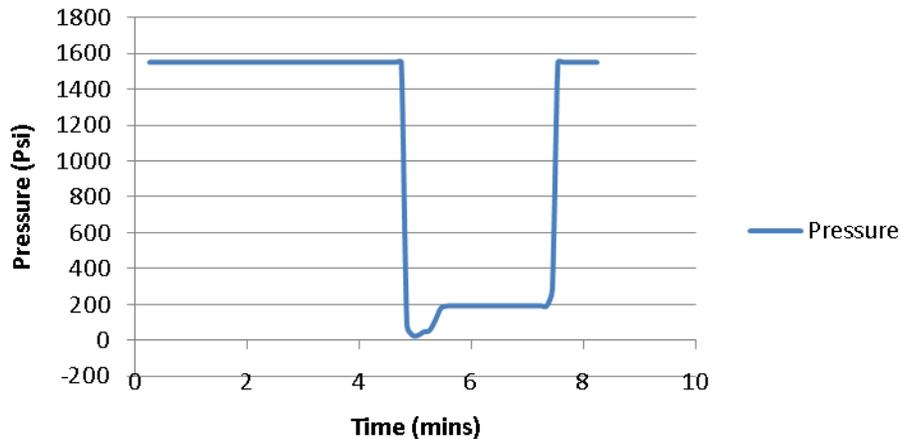


Description:

Porous gas bearing sand formation greater than 40ft in thickness. Extremely well developed, with an average Rt value of 170 ohms. Average density porosity of 20%. Somewhat indicative of a depleted reservoir within the area. Excellent permeability, as seen from the microlog.

Formation Tester Pressure Data:

Pressure vs. Time @ 3612 ft

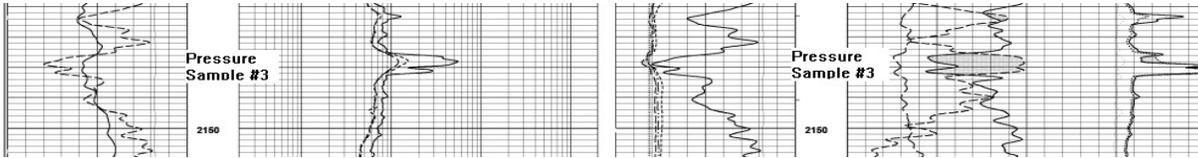


Analysis:

The resulting test is deemed a good test. The results show a final formation pressure of 196 psi. The time from drawdown to buildup of formation pressure was less than one minute. The well developed sand, along with the high permeability, contributed to the quick build up. Pressures of 196 psi may appear to be on the verge of depletion. However, through good production and completion methods, the client determined that completion of this zone would still be possible. A final decision to bring this zone on-line was made.

Sample Point #3:

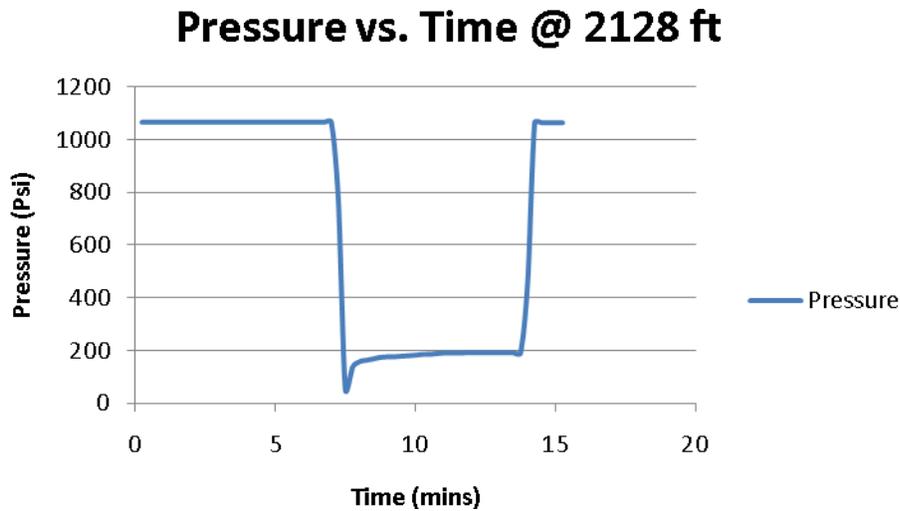
Open Hole Log Data:



Description:

Conglomerate/sand zone approximately 6 ft in thickness. Average Rt value of 10 ohms. Average density porosity of 17%. Indication of gas present by the suppression of the Neutron porosity and crossover of the Density porosity. Evidence of permeability from microlog indications.

Formation Tester Pressure Data:

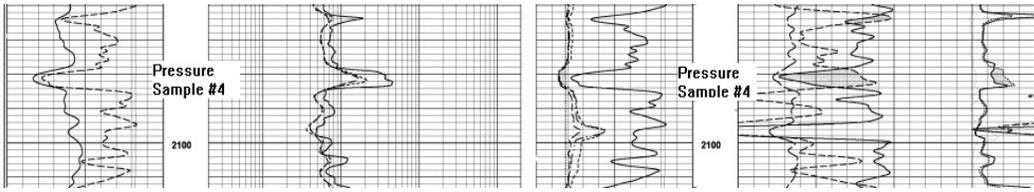


Analysis:

The resulting test is deemed a good test. The formation pressure eventually stabilized at approx 193 psi. The formation pressure took approximately 7 minutes to stabilize. Due to the thickness being only 6 ft, the decision was made at the time, to by-pass this zone. However, it could be a zone of interest for future development.

Sample Point #4:

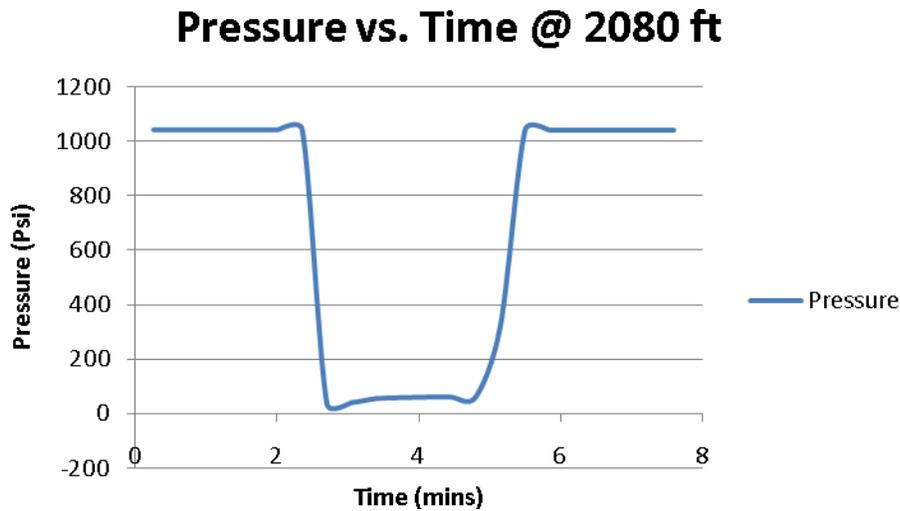
Open Hole Log Data:



Description:

Thin 4 ft sand. Average Rt value of 26 ohms. Average density porosity of 20%. Indication of gas present by the suppression of the Neutron porosity and crossover of the Density porosity. Evidence of permeability from microlog indications.

Formation Tester Pressure Data:

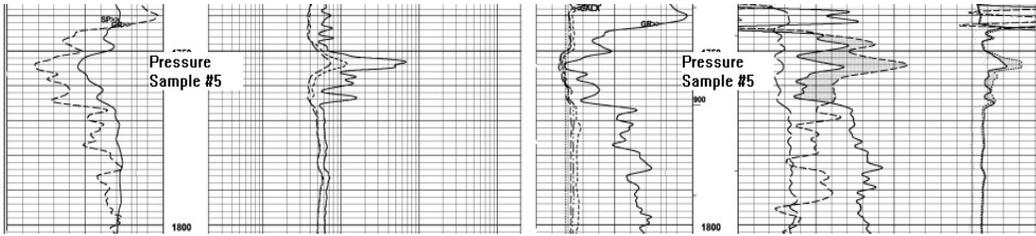


Analysis:

The resulting test is deemed a good test. The formation pressure was approximately 61 psi. This is low for productive sands in the region. The Open Hole log data indicated favorable development of the sand. However, there is a lack of pressure in the formation. The decision was that this zone is depleted.

Sample Point #5:

Open Hole Log Data:

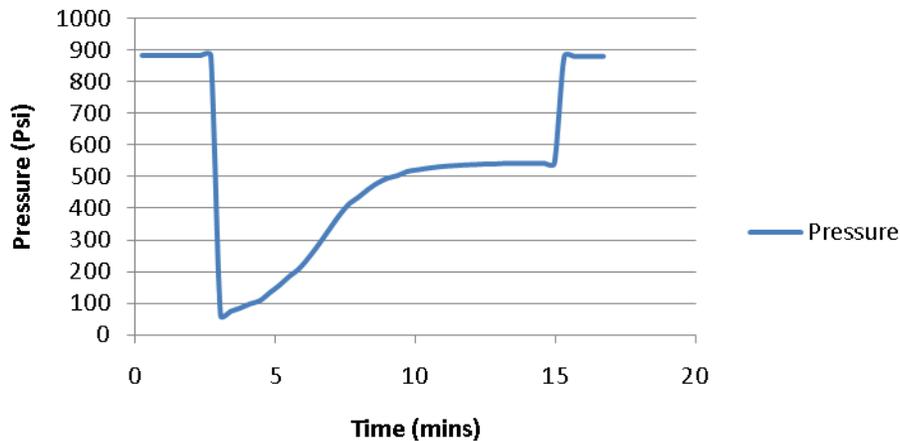


Description:

Moderately developed sand, approximately 19ft thick. Average Rt value of 5 ohms with evidence of bottom water. Average density porosity of 18%. Indication of gas present by the suppression of the Neutron porosity and crossover of the Density porosity. Evidence of permeability from microlog indications.

Formation Tester Pressure Data:

Pressure vs. Time @ 1751 ft



Analysis:

The resulting test is deemed a good test. The stabilized formation pressure was 543 psi, exceptional for this area. The test results confirmed the production potential of this gas-bearing sand. Due to the zone being below 4000 ft, the client did not want to risk cementing this high within the wellbore. For future development, the client felt that drilling an offset shallow well to exploit this sand would be the proper course of action.

Summary:

In total, five formation tests were conducted all with good operational results. Three of the five zones tested proved to have production potential, with satisfactory pressures to warrant development. Of the remaining two zones, one showed signs of depletion and the other to be a tight formation, as determined from the Formation Tester results and corroborating microlog information. The client decided to initially perforate zone #2 (as tested), while leaving the other two productive zones for future production consideration. Zone #2 was brought online with a production rate of 150 mmcf/day up production tubing, while holding 150 psi on the backside. Associated saltwater production of less than 1 bpd is being reported. This is certainly impressive for a 200 psi zone.

Conclusions:

Utilizing RECON's High Resolution STANDARD Open Hole Log data, complimented by the HDD™ Simultaneous Formation Tester (SFT), RECON was able to reduce future drilling cost for the client by approximately \$50,000 to \$60,000. As a result of the success of the data and production of this well, Rainbow Seven Oil & Gas modified its drilling plans for offsetting wells, and a decision was made to drill two (2) shallower-than-anticipated wells in order to delineate and exploit the shallow, high pressure zone, identified by Sample Point #5.

Conventional Drill-stem Tests (DST) cost between \$10,000 to \$15,000 per interval, with the majority of the cost resulting from additional rig time usage. A financial and operational advantage of deploying the RECON HDD™ Simultaneous Formation Tester is the ability to perform multiple tests on one Wireline trip into the wellbore, eliminating the need for multiple deployments into an Open Hole environment.

Additional savings were also realized with the elimination of two (2) completions. Open Hole Logs showed evidence of gas / potential zones of interest that, without the information gathered via the SFT would be considered targets for completion. These being Sample Point #2 (tight) and Sample Point #4 (depleted). Feedback from the client indicated that, to have performed cased hole completions, for zone evaluation, it would have cost an additional \$20,000 to \$30,000 per zone.

As a result, the Simultaneous Formation Tester (SFT) will be run on both of the new drills, in order to qualify and quantify the productivity of future developments.

Acknowledgment:

Thank you to RAINBOW SEVEN OIL & GAS for allowing RECON the opportunity to publish the data and results of the operation for this case history.

Presenter:

This Case History was both researched and published through the efforts of Andrew Nguyen, a Professional Petroleum Engineer with RECON's Mansfield Texas Open Hole Logging base of operations.

Editorial contributions by Jarett Gough, P.Geol. – Corporate Development Manager, RECON