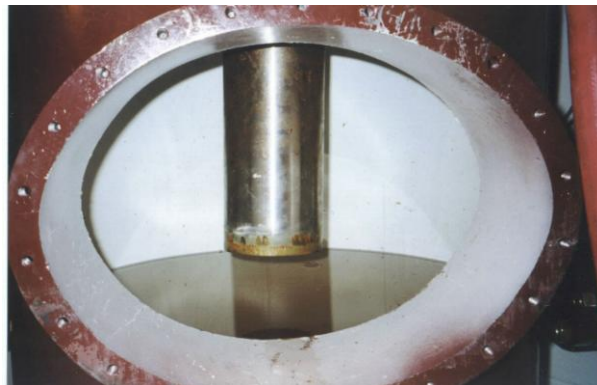


## Vortex Downhole Tools Case Study



**Texas A&M Lab Testing – Coal Bed Well – Downhole VX Removes More Water from Wellbore with Same Gas Rate** – 130’ vertical flow loop. The downhole VX was able to enhance the ability of the flow regime to lift water up the tubing by up to 12.5%. The downhole VX also reduced the pressure drop due to friction by up to 15%.



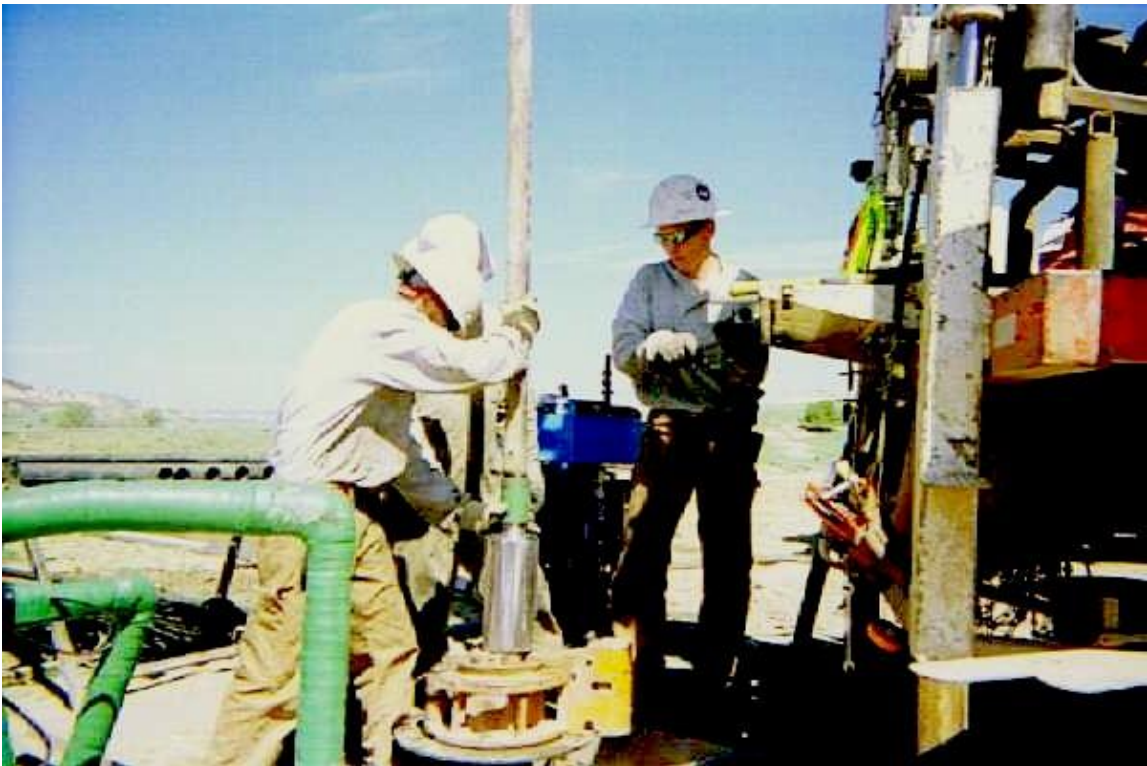
**Texas A&M Field Testing – Downhole VX Removes Water from Wellbore** – 1,200’ wellbore. The downhole VX was able to lift the water with only 56% of the gas-volume/critical-velocity up the 2 3/8 tubing...

Accepted industry liquid lifting theory shows that for a wellhead pressure of 20 psig (34.7 psia), and 2 3/8 tubing, the Turner equation gives a minimum lift velocity of 49 ft/sec which corresponds to a flow rate of 0.201 MMSCFD which is equal to 0.162 lb/sec mass rate.

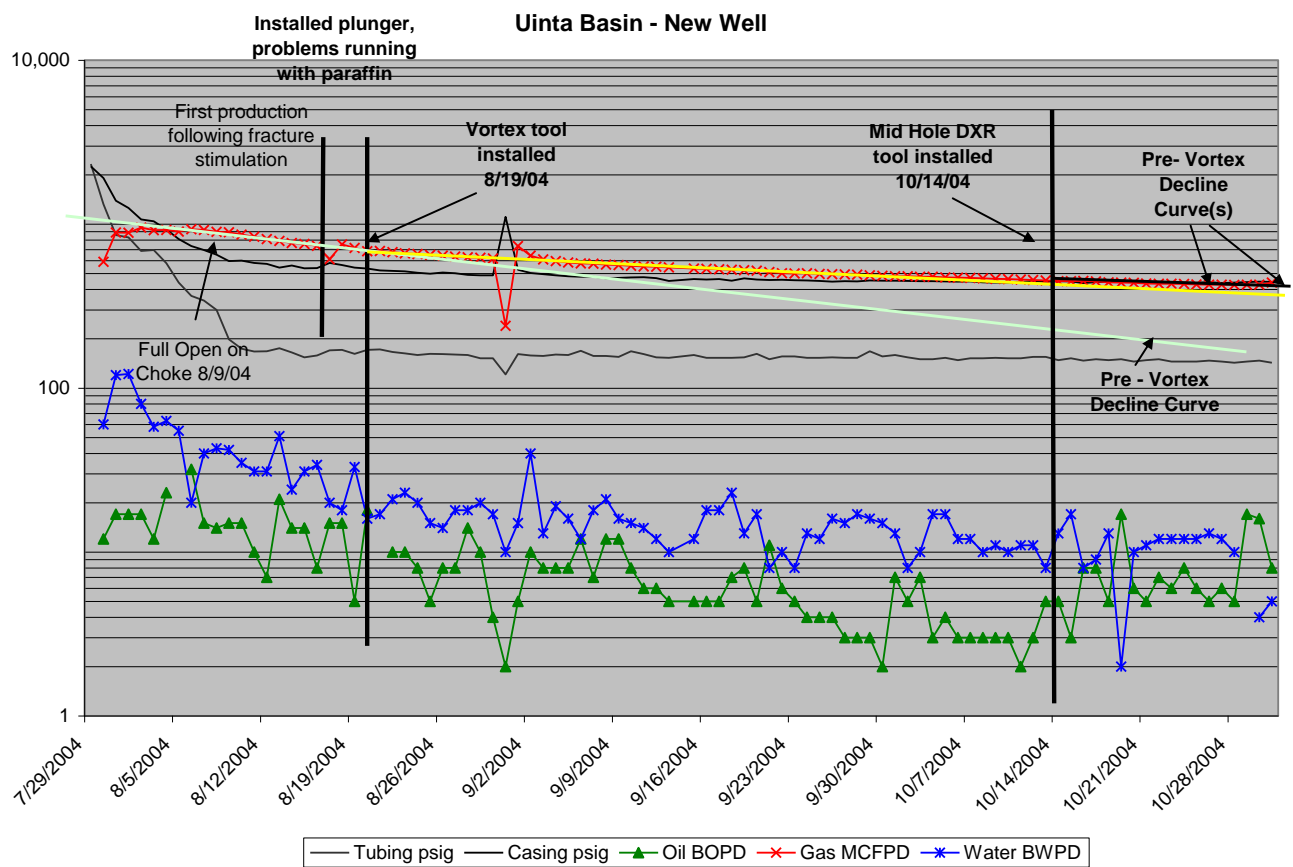
During Texas A&M testing, 10 gallons of water was injected and .09 lb/sec was the minimum mass flow rate with which the well would unload. This mass flow rate corresponds to approximately 0.11 MMSCFD and a minimum lift velocity of 26.72 ft/sec.

## Field installations overview:

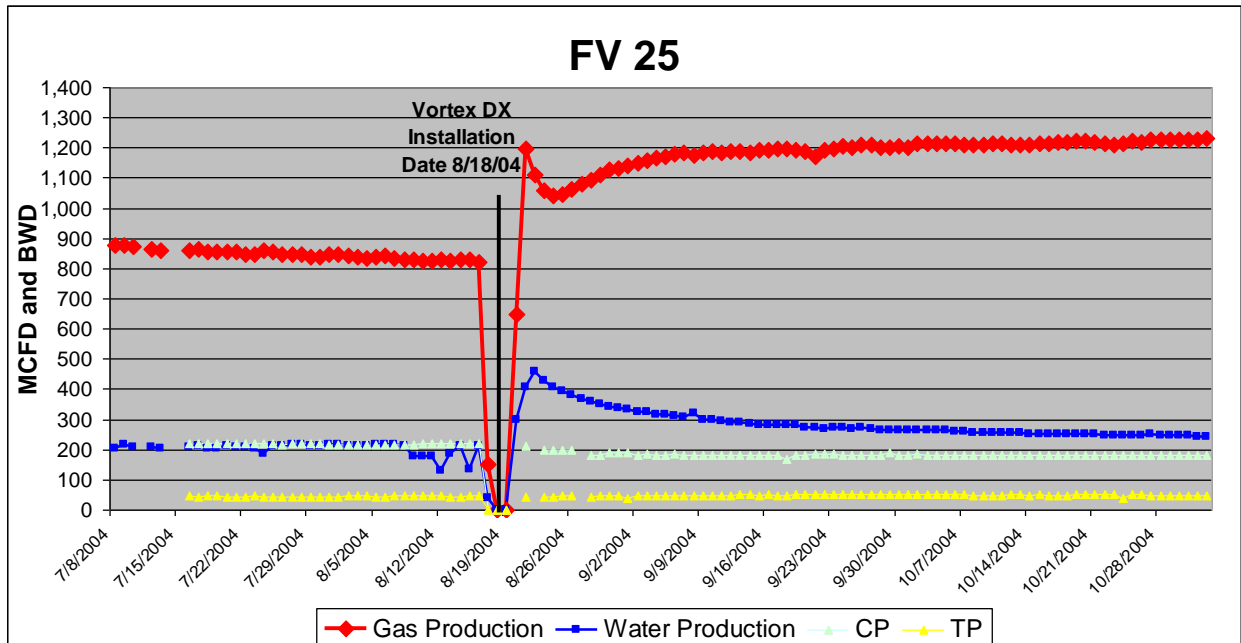
The downhole VX tools have been successfully applied in a wide range of installations ranging from shallow high permeable coal-bed wells to deep tight gas wells. Wells ranging from high water rates to very low water rates. Vertical wells and also wells with horizontal laterals. Please let us know your production characteristics by completing a 'Downhole Input Form' so that we can determine if a Downhole VX tool is right for you. This form can be found on our website at [www.vortexflowllc.com](http://www.vortexflowllc.com) under the Forms section.



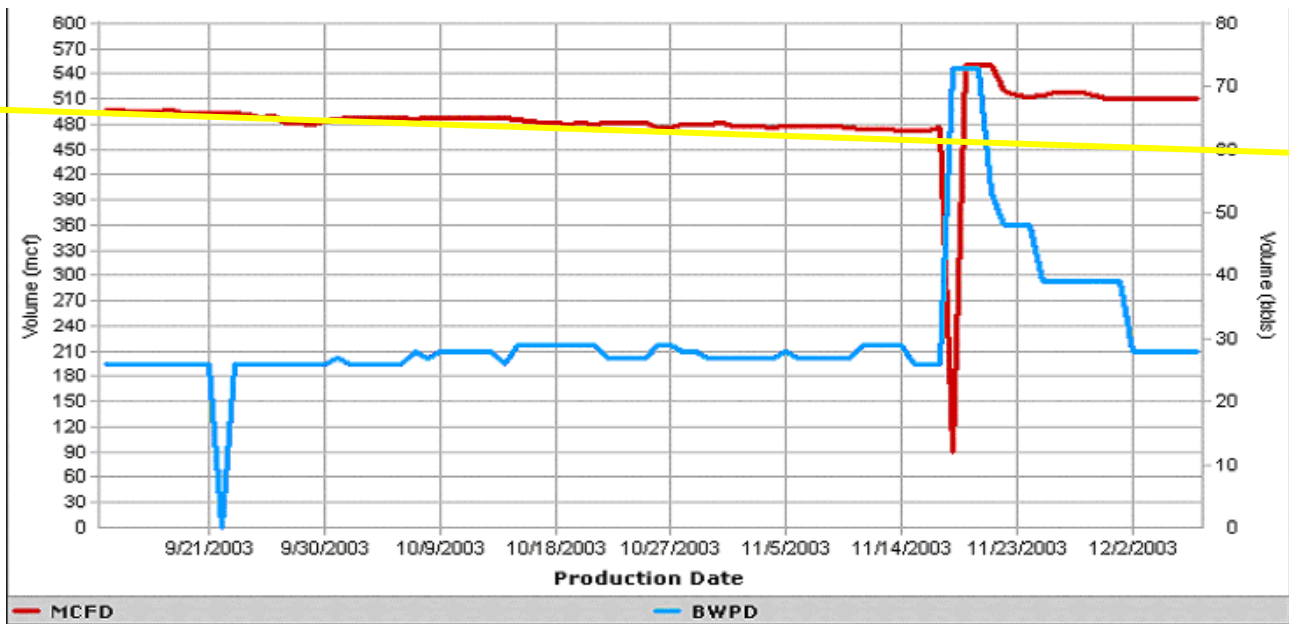
**“Moderate Depth New Well and Stacked Tools”...Uinta Basin – Downhole DXR and mid-hole DXR lowers bottom-hole pressure and flattens decline curve on a well that is flowing steadily – 7,000’ producing well. This installation shows how the DXR tools can benefit even a newly completed and steadily flowing well. This well has been producing gas at well above the critical gas rate. This DXR tool installation was done to see if a DX tool could enhance tubing throughput and well production even in a well without a liquid loading problem by lowering the flowing bottom-hole pressure and flattening the decline curve. After installation of the first DXR tool, the well decline curve was significantly flattened. After installation of a second mid-hole DXR, the oil production improved from 3 BOD to 6 BOD...indicating a further reduction of the flowing bottom-hole pressure. The results illustrate how one DXR tool can enhance a well’s production from day one of its life and how a second tool can further enhance well performance!**



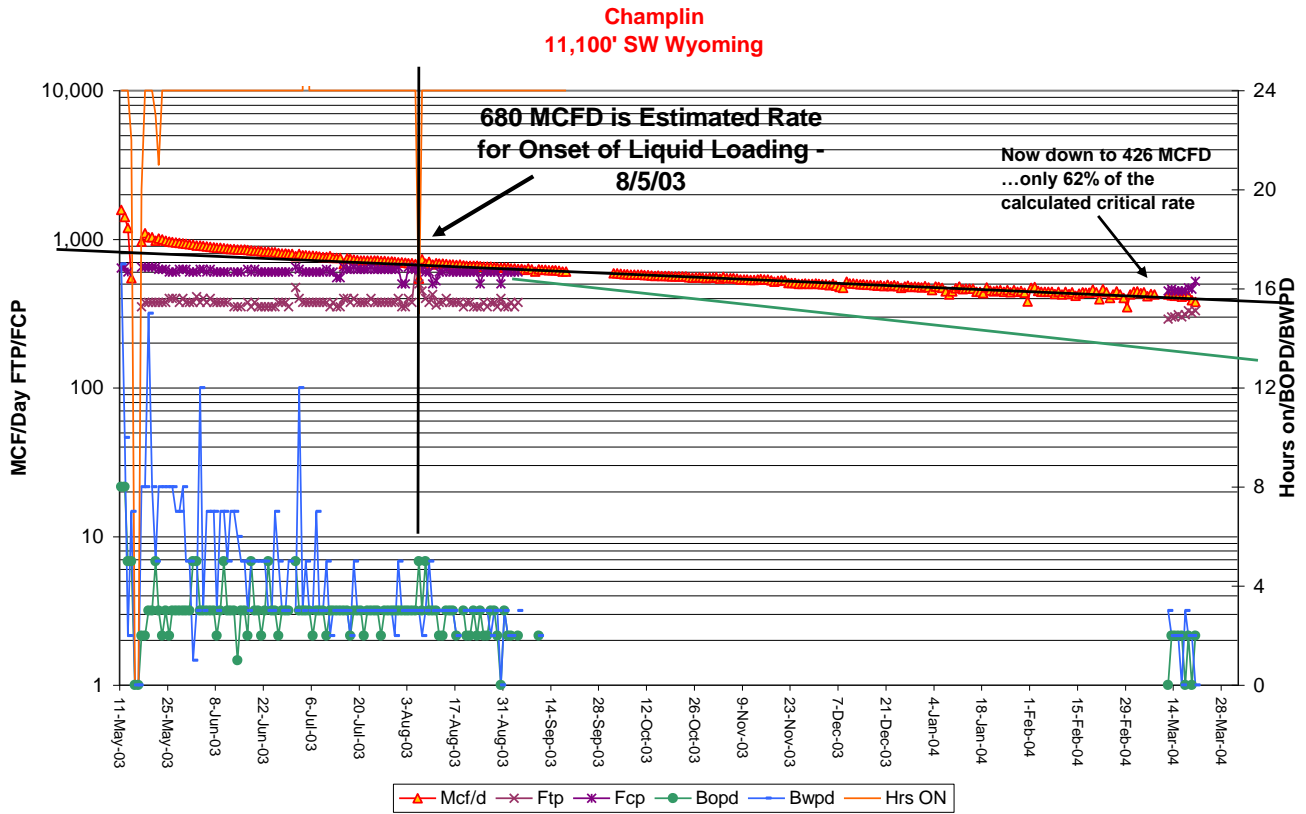
**“Moderate Depth, High Perm, Moderate Water and Low Pressure”...Australia – Coal Well – Downhole DX Reduces Multi-Phase Friction, Lowers Flowing Bottom Hole Pressure on a Well that is flowing steadily – Increases Rate significantly – 3,000’ producing well. This installation shows how the DX tools can benefit even a steadily flowing well. This well has been producing gas at well above the critical gas rate. This DX tool installation was done to see if a DX tool could enhance tubing throughput and well production even in a well without a liquid loading problem. Based on nodal analysis, the flowing bottom-hole pressure for this well was reduced 40 PSI. The results illustrate how a DX tool can enhance a well’s production from day one of its life!**



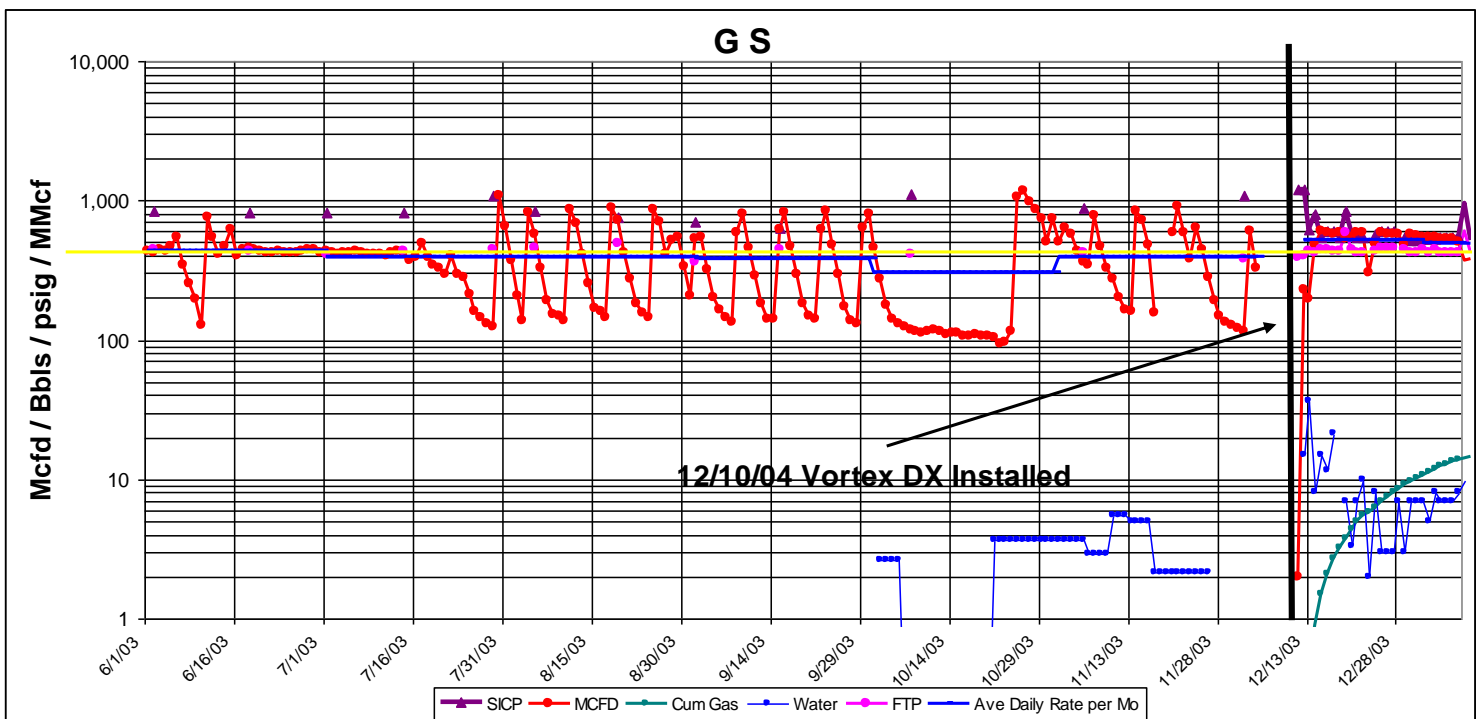
**“Moderate Depth, High Perm, Moderate Water and Low Pressure”...Price, UT – Coal Well – Downhole DX Reduces Multi-Phase Friction, Lowers Flowing Bottom Hole Pressure on a Well that is flowing steadily – Increases Rate 10% – 3,000’ producing well. This installation shows how the DX tools can benefit even a steadily flowing well. This well has been producing gas at well above the critical gas rate. This DX tool installation was done to see if a DX tool could enhance well production even in a well without a liquid loading problem. Based on nodal analysis, the flowing bottom-hole pressure for this well was reduced by 13 PSI. The results illustrate how a DX tool can enhance a well’s production from day one of its life!**



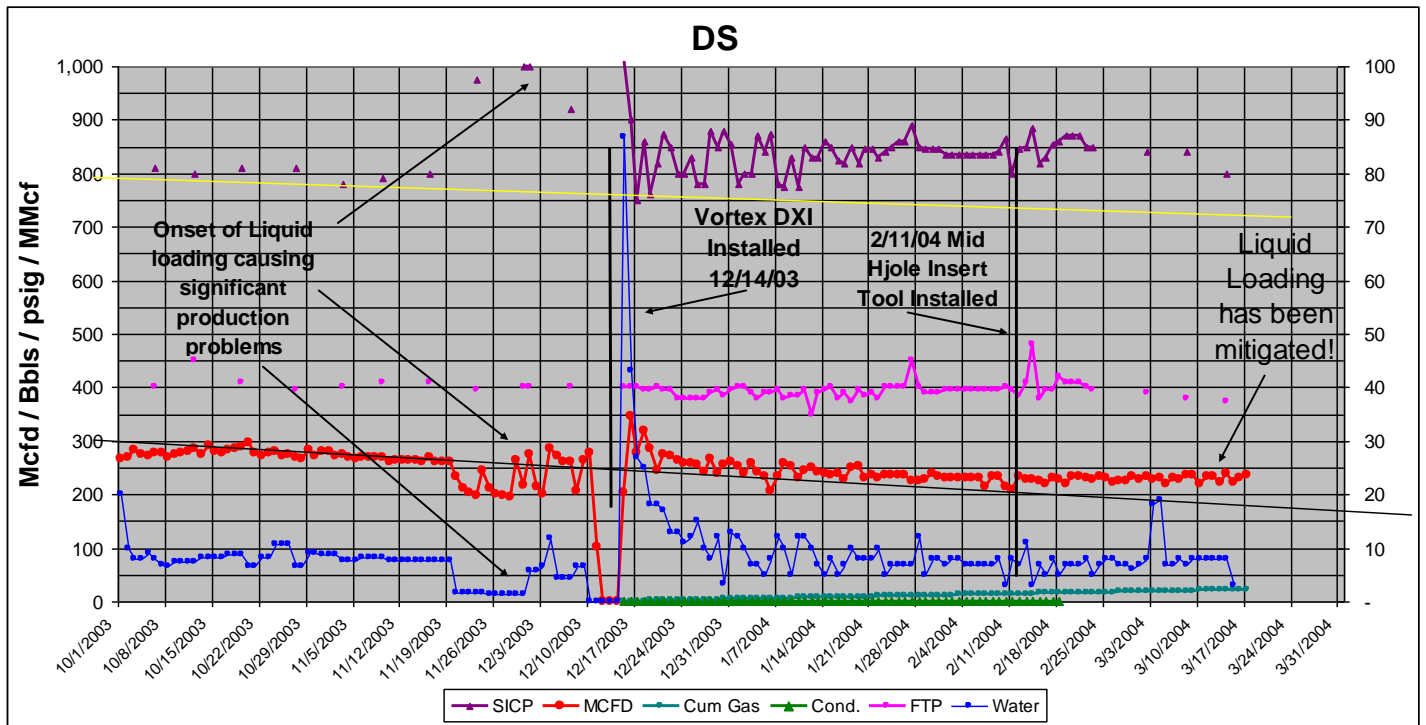
**“Deep, Tight, Low Water and High Pressure”...Green River Basin – WY – Frontier Formation – Downhole DX Provides Stable Production on Newly Completed Well – Shows No Signs of Liquid Holdup in Wellbore – 11,000’ producing well. Through 38 weeks, the well is producing without any signs of liquid loading as it bucks 350 – 400 PSIG at surface. Based on nodal analysis, this well is producing steadily with only 70% of the calculated critical gas rate.**



**“Deep, Tight, Low Water and High Pressure”...Ft. Worth Basin – TX – Barnett Shale Well – Downhole DXI Removes Water from Wellbore – Stabilizes Production – 8,000’ deep producing well. Prior to the installation of the downhole DXI, the well would operate with casing pressure in excess of 1,000 PSI. This well would then load up severely once per week. Since installation of the DXI tool, the casing pressure is consistent and averages only 575 PSI – indicating no liquid loading. The flowing bottom-hole pressure has been reduced by approximately 400 PSI. This well is able to consistently produce without loading with only 75% of the calculated critical gas rate necessary to continually lift liquid.**

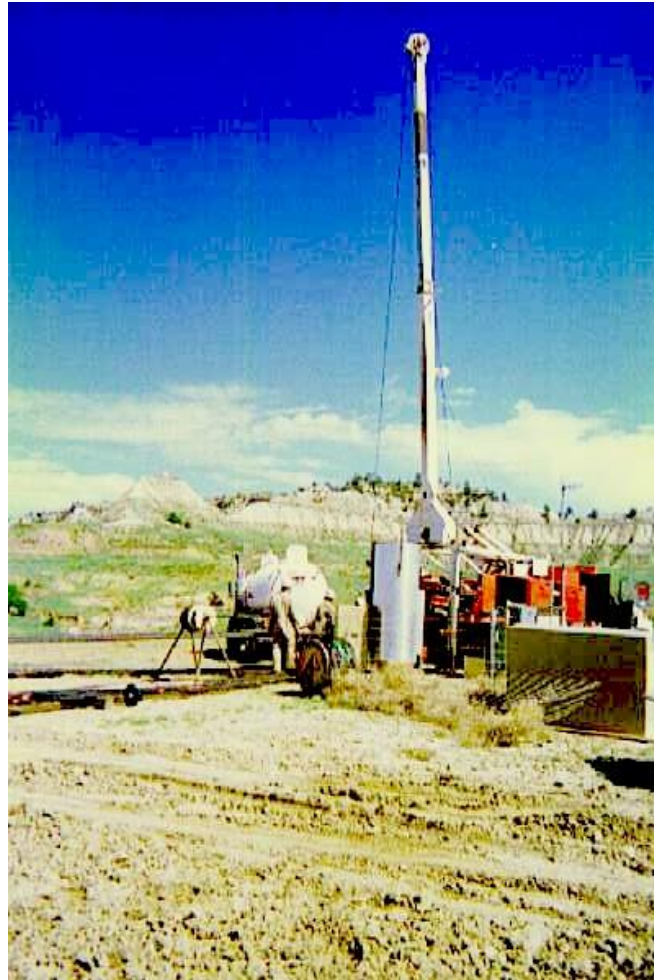


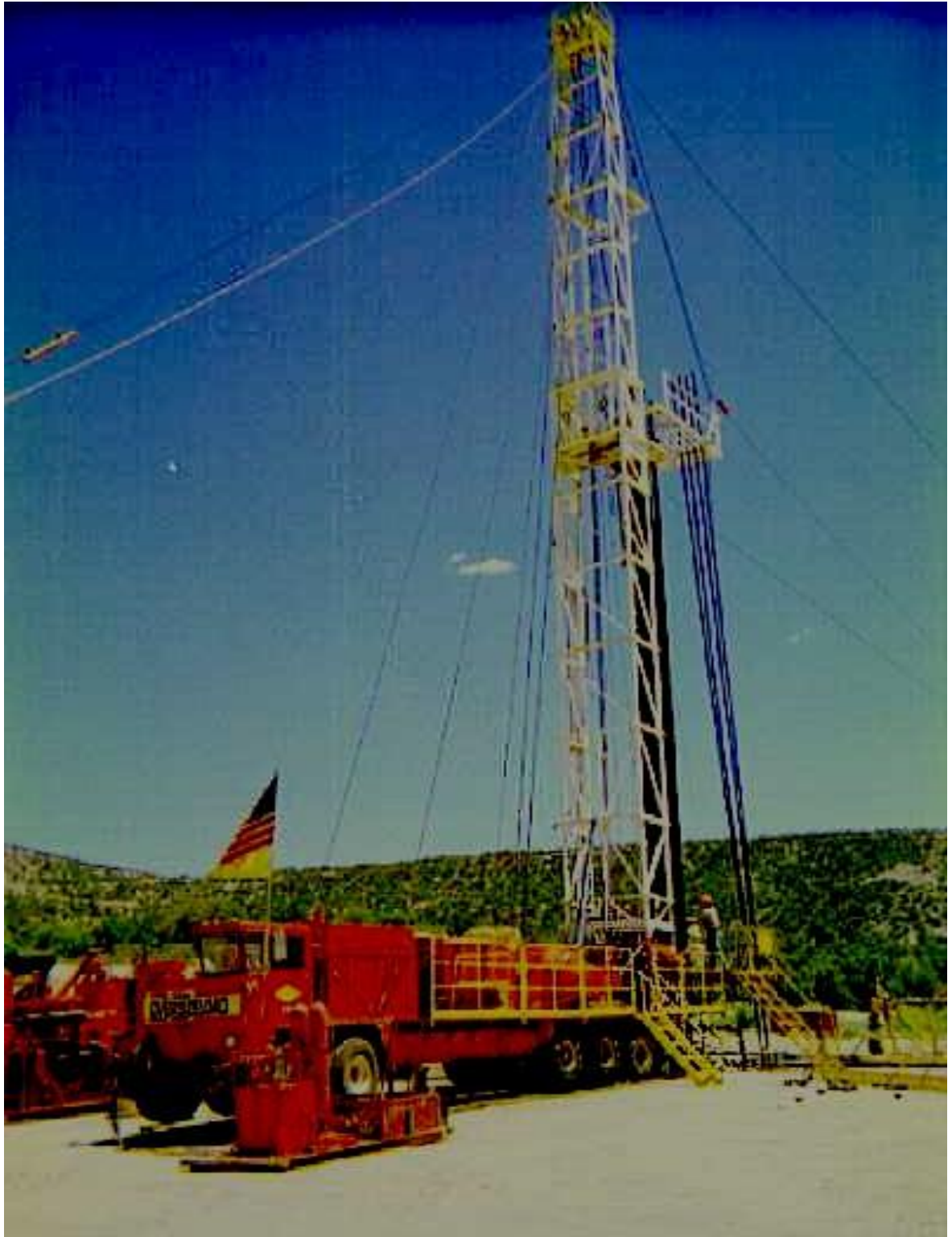
**“Deep, Tight, Low Water and High Pressure”...Ft. Worth Basin – TX – Barnett Shale Well – Downhole DXI Removes Water from Wellbore – Stabilizes Production – 8,000’ deep producing well.** Prior to the installation of the downhole DXI, the well would operate with casing pressure in excess of 1,000 PSI and had recently shown classic signs of liquid loading – erratic gas production, reduced water production and increased casing pressure. Since installation of the DXI tool gas production has been stabilized and the decline rate flattened. Water production has also been more consistent – indicating less liquid loading. Upon installation of a second DXR tool that was set in middle of the tubing, the decline rate further flattened and became more stable.





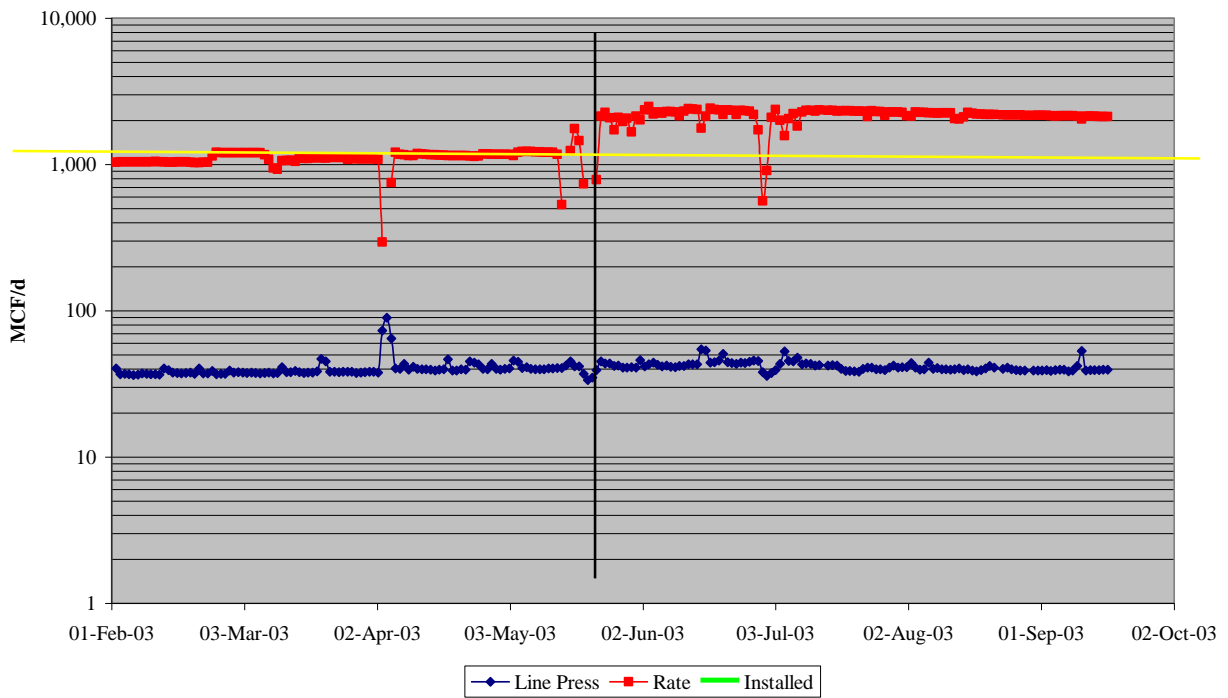
**“Shallow, High Perm, Low Water and Low Pressure”...Powder River Basin – WY – Coal Bed Well – Downhole DX Removes Water from Wellbore – 750’ producing well. Within five weeks (the first time the fluid level was taken), the water level had been reduced from 16’ above the bottom of the tubing to 0’. This well has been able to continue to lift water from the wellbore through the 2 3/8 tubing with only 65 – 70 MCFD.**



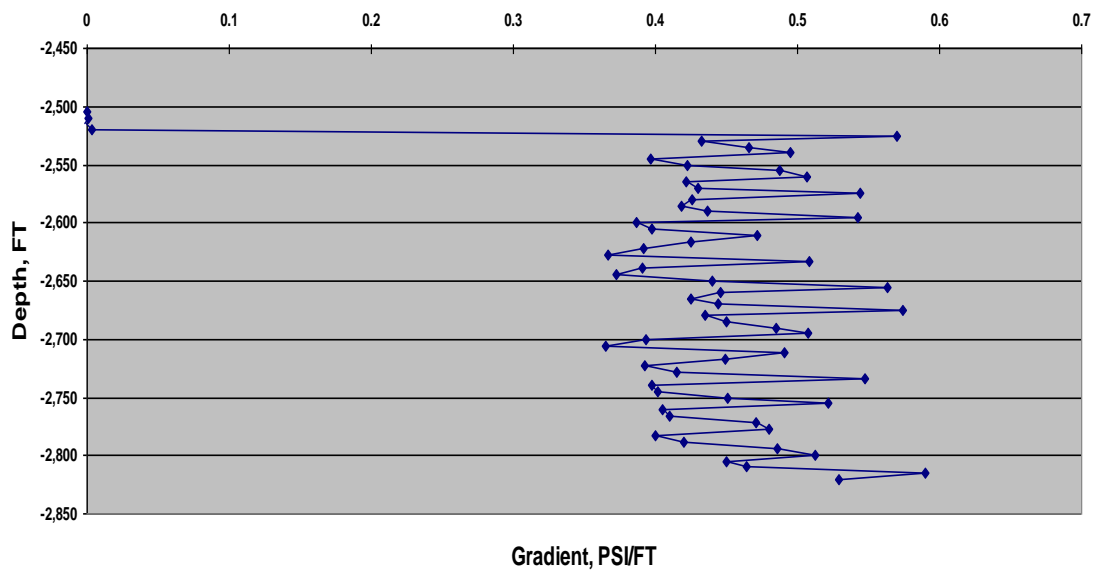


**“Moderate Depth, High Perm, Low Water and Low Pressure”...San Juan Basin – CO – Coal Bed Well – Downhole DX Removes Water from Wellbore – Increases Production –** 2,827’ deep producing well. Prior to the 5/03 installation of the downhole DX, the well had approx 302’ of fluid at the bottom of the wellbore (see pressure survey below) or about 129 PSI of extra pressure on the reservoir. This well was producing gas up the backside and utilized an educator to bring 250 MCFD up the tubing. The tubing was being used for fluid control. The well typically produced 1,200 MCFD. After installation the well has been producing up to 2,400 MCFD. The fluid level is now only 0’ and the gradient of the fluid column indicates that it is now mostly vapor and less water. The new production level was maintained for an extended period of time after the DX tool installation.

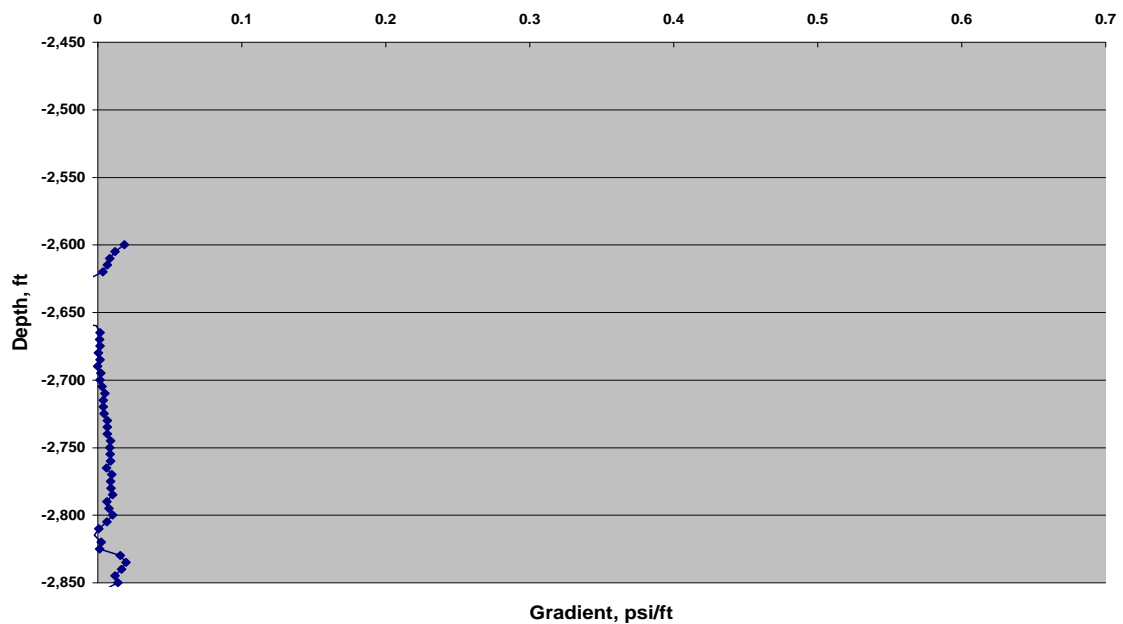
**JB G**



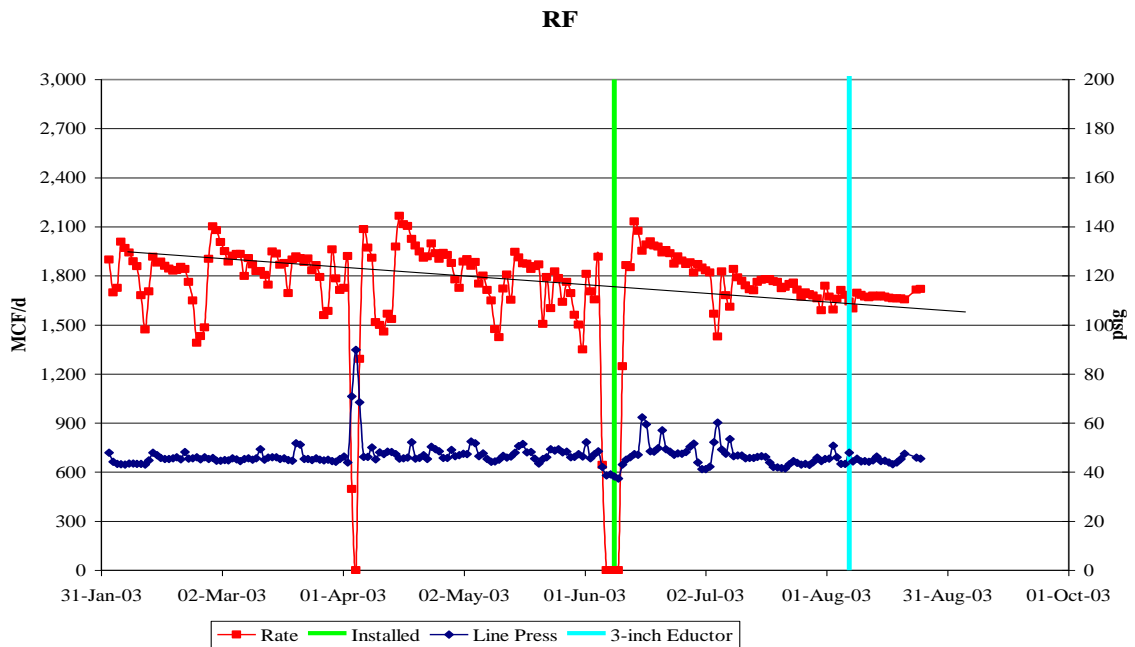
### JB G - Pressure Survey - 04/03



### JB G - Pressure Survey - 08/03



**“Moderate Depth, High Perm, Low Water and Low Pressure”...San Juan Basin – CO – Coal Bed Well – Downhole DX Removes Water from Wellbore – Increases Production –** 3,014’ deep producing well. Prior to the installation of the downhole DX, the well had approx 100’ of fluid at the bottom of the wellbore. This water placed an additional 43 psi on the reservoir. This well was producing gas up the backside and utilized an eductor to bring 170 MCFD up the tubing. The tubing was being used for fluid control. The well typically produced 1,700 MCFD. After installation the well has been producing more consistently and at an estimated 150 MCFD above the prior decline curve.



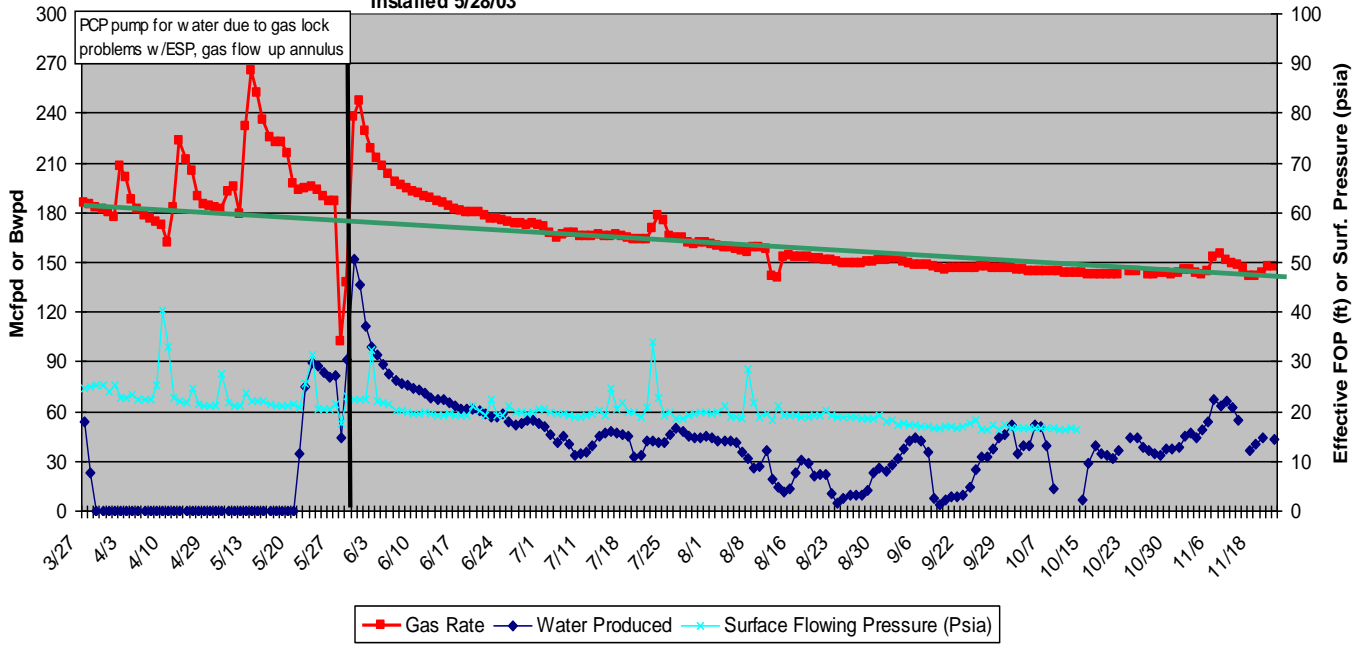
**“Shallow Depth, High Perm, High Water and Low Pressure”...Powder River Basin – WY – Coal Bed Well – Downhole DX Replaces PCP Pump and Increases Gas and Water Production** – 568’ deep installation. Total depth of the well is 623’. Prior to the installation of the downhole DX, the well produced 180 MCFD and 60 BWD. 14 weeks after installation, this well continues to flow effectively without using any additional LOE (electricity, maintenance and repair) costs.

PCP Pump used prior to downhole DX.



# 5-23-56-76 CO

VX Downhole Tool  
Installed 5/28/03

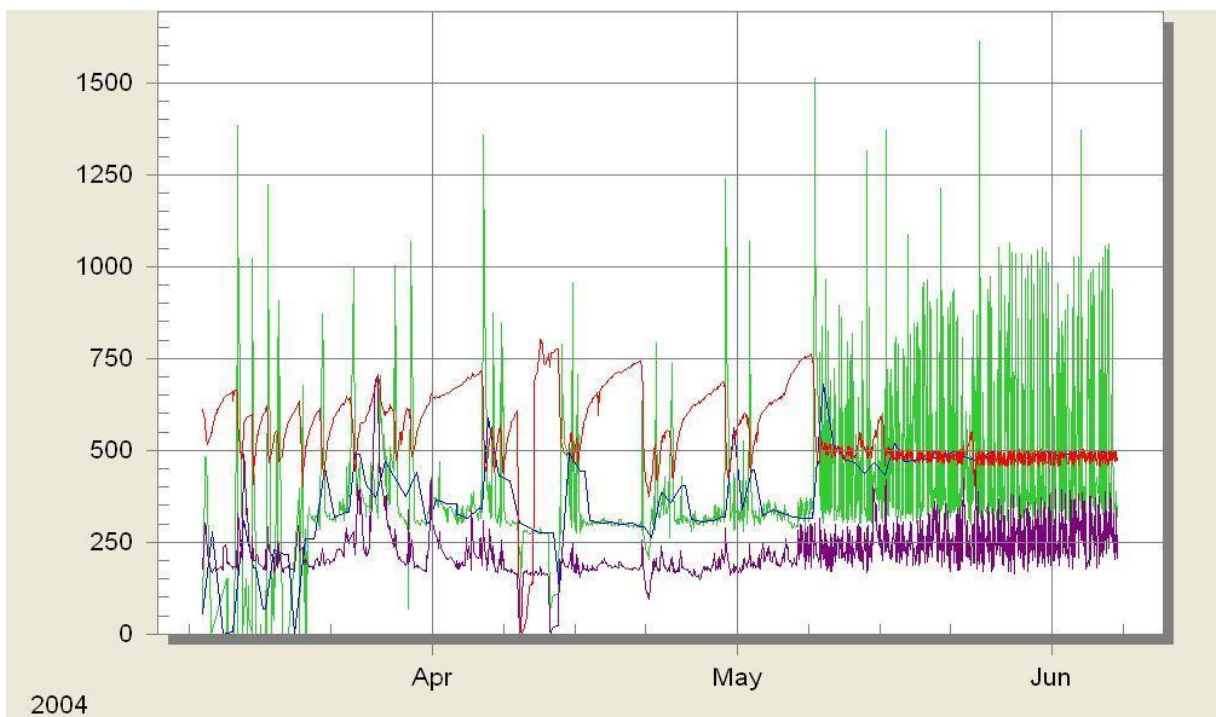


## Intermittent Well Flow Case Study

**“Deep, Tight, Low Water and Moderate Pressure”...Piceance Basin – Tight Gas Well – Downhole DXR enhances the effectiveness of an automated intermitter, Lowers Flowing Bottom Hole Pressure and increases rate 150 MCFD – 8,000’ producing well.** This installation shows how the DXR tools can benefit even a well that is producing at a rate below the minimum rate to continually flow 24/7 with a DXR tool in place. In this case, the DXR enhanced a well that was produced with an automated intermitter. The automated intermitter starts the ‘on’ cycle given a casing/tubing differential and then shuts-in upon the gas rate reaching a predetermined minimum gas rate of about 275 MCFD. In this manner a well is able to maximize its production time.

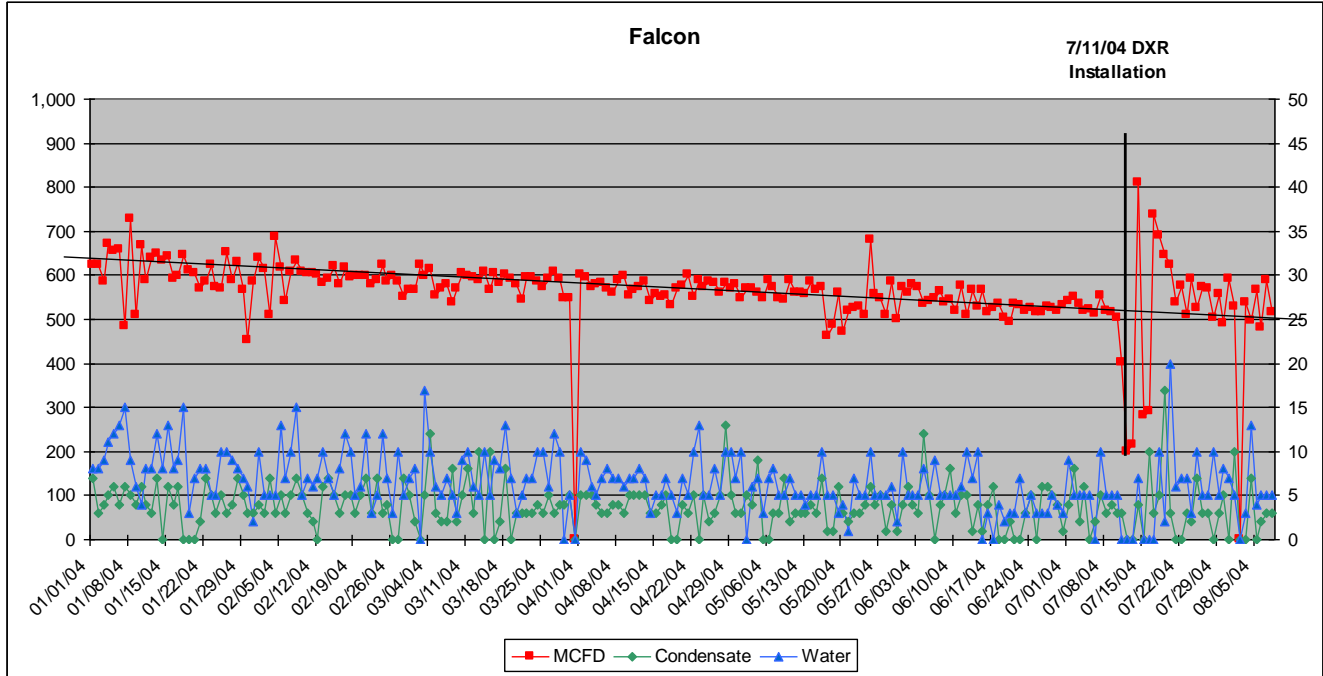
Based on the chart shown below, the bottom-hole pressure for this well was reduced by 200-250 PSI to a stable 500 PSI. Gas rate appears to have been improved by 150 MCFD.

The red line represents the casing pressure, the purple line the tubing pressure, the green line the instantaneous gas rates (measured 3x per hour) and the blue line represents daily gas production.

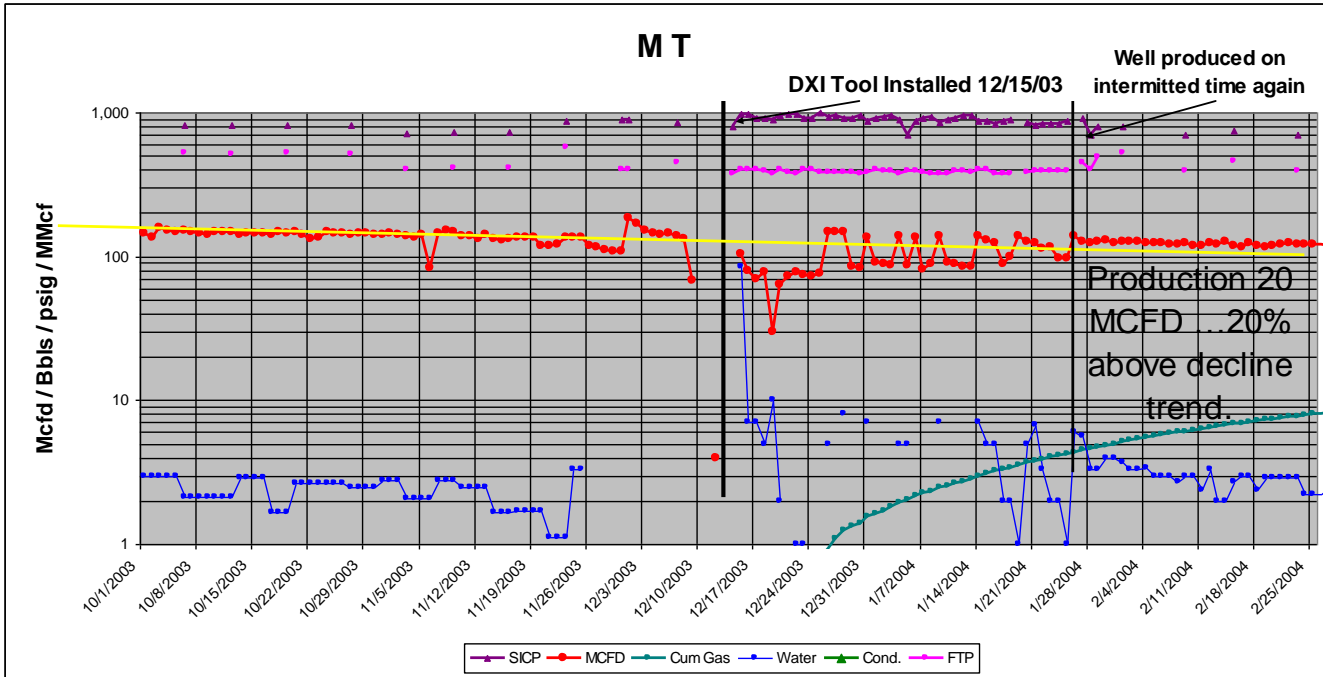




**“Deep, Tight, Low Water and High Pressure”...Green River Basin – WY – Downhole DXI Removes Water from Wellbore – Stabilizes Production – 12,000’ deep producing well.** Prior to the installation of the downhole DXR, the well was operating on a timer and was produced in three cycles per day and ‘on’ for about 18 hrs per day. A DXR tool was installed and the cycles were kept the same. Production has been increased by 10 -15% from the pre DXR trend line. This production would likely improve to a greater degree with an automated intermitter in place (as is discussed in the Piceance Basin well). Additionally, as this well is significantly greater than 7,500’ deep, a second tool stacked mid-hole would also likely improve the results seen to date.



**“Deep, Tight, Low Water and High Pressure”...Ft. Worth Basin – TX – Barnett Shale Well – Downhole DXI Removes Water from Wellbore – Stabilizes Production – 8,000’ deep producing well.** Prior to the installation of the downhole DXI, the well was operating on a timer and was produced for about 12 hrs per day. A DXI tool was installed and the well was taken off of the timer. However, the gas production was less than 40% of the critical gas rate and the well was not able to flow effectively 24/7. But, when the well was put back on the same timer schedule with the DXI tool in place, production came up above the pre-installation decline trend nicely. Production now appears to be 20% above the trend line.



**To find out how Vortex Flow can help you increase production or reduce your LOE costs, call us on 303.761.7570 or visit us online at [vortextools.com](http://vortextools.com) and go to the “Forms” section.**