Case study: Marshall County, West Virginia

Baker Hughes Integrated Services empowered customer to drill more than 1 mile of lateral in 24 hours

An operator petitioned Baker Hughes to drill a lateral footage section of more than 1 mile in a single day. To achieve this, Baker Hughes needed to present the operator with solutions to improve drilling performance by reducing days on well and cost per foot.

The operator had several challenges, including maximizing on-bottom rates of penetration (ROP) and improving cuttings removal and flow rates while maintaining good wellbore placement and hole stability.

The need for high flow rate also had to be balanced with the need to control pressures and maintain a high level of environmental compliance.

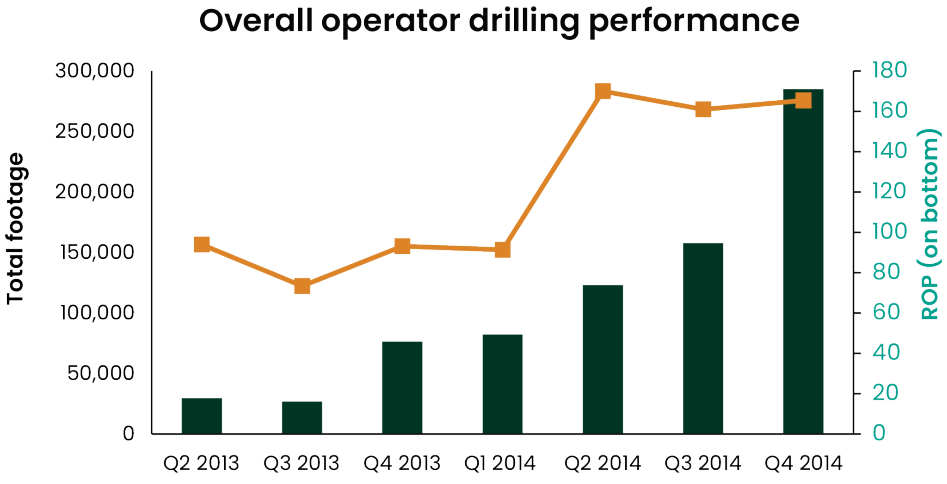
Baker Hughes was able to address the operator's challenges by combining its NEXT-DRILL™ invert emulsion drilling fluid system, its **AutoTrak™ Curve high build-up rate rotary steerable system** (RSS), and the **Talon™ polycrystalline diamond compact (PDC) drill bit**, which is designed specifically for use with the AutoTrak Curve RSS.

One of the keys to the performance Baker Hughes provided is the NEXT-DRILL fluid's design, which enabled it to optimize pressure management by converting wasted pressure back to flow rate.

The fluid complimented the drill bit's **StaySharp™ cutter technology** and optimized the bit's hydraulic and mechanical efficiencies.

By using the AutoTrak Curve RSS' on-bottom downlink capability, as well as expertise from Baker Hughes Reservoir Navigation Services (RNS), high ROP and optimized wellbore placement were achieved without compromising directional control.

The compact, single-piece design of the AutoTrak Curve RSS enabled better directional control through real-time monitoring of near bit inclination (5.9 ft [1.8 m] behind the bit) and bulk



Challenges

- Increase lateral footage and ROP
- Improve flow rates and boost bit and tool performance
- Enhance hole cleaning
- Increase flow rate and controlled pressures without inducing downhole losses
- Maintain fluid properties with increasing ROP

Results

- Increased drilling performance while maintaining wellbore stability
- Delivered high ROP (up to 224 ft/hr [68.3 m/hr] in lateral section)
- Maintained high environmental compliance standards
- Reduced drilling time and drilling fluid costs
- Doubled foot per day average when compared to similar field wells
- Maximized operator's return on investment

gamma ray (11.5 ft [3.5 m] behind the bit).

This impressive level of control resulted in 100% placement of the wells in the target zone.

The integrated technologies from Baker Hughes worked together to surpass competitor performance while also maximizing wellbore stability and extending bit life.

This high-performance Baker Hughes package saved the operator more than one drilling day in the lateral sections of the wells and delivered cost savings of approximately $100,000 USD per lateral section. Baker Hughes and the operator's drilling and rig crews also worked together to provide the highest standards of safety, resulting in no health, safety, or environmental incidents.

This project is a great example of how Baker Hughes' development efforts and integrated performance have kept the focus on safety while improving drilling performance for operators.

Baker Hughes