

# Lime Rock Resources Prevents Frac Hits and Increases Parent and Infill Well Production

BroadBand Shield, BroadBand Sequence, and WellWatcher Stim services boost parent well production by 150% and infill well average by 66% over the parent, North Dakota

## CHALLENGE

Perform multistage stimulation treatments in two infill wells without sanding up or significantly reducing oil production in the primary well between them.

## SOLUTION

- Design stimulation treatments using BroadBand Sequence\* fracturing service, which facilitates sequential stimulation of perforated clusters to maximize wellbore coverage and reservoir contact.
- Design some treatments to include BroadBand Shield\* fracture-geometry control service to minimize the risk of frac hits.
- Monitor pressure communication between wells using WellWatcher Stim\* stimulation monitoring service.

## RESULTS

- Eliminated pressure communication between one infill well and the parent well in stages using the BroadBand Sequence and BroadBand Shield services, as compared with pressure communication observed in up to 61% of stages fractured without BroadBand Shield service.
- Boosted oil production in the parent well by 150% and avoided sanding up, saving an estimated USD 400,000 and more than two weeks of deferred production if a cleanout had been required.
- Produced 66% more oil equivalent from infill wells as compared with parent well production in the 11 months after stimulation.



## Stimulate infill wells without harming a parent oil producer

Infill drilling accounts for more than 60% of the new wells drilled in North America, where operators have learned through experience that stimulating infill wells sometimes causes fluid and proppant communication into older wells due to pressure depletion—also known as frac hits. This communication can be beneficial or detrimental to production. In the most severe cases, the older wells can be sanded up, requiring expensive and time-consuming cleanout operations to restore production.

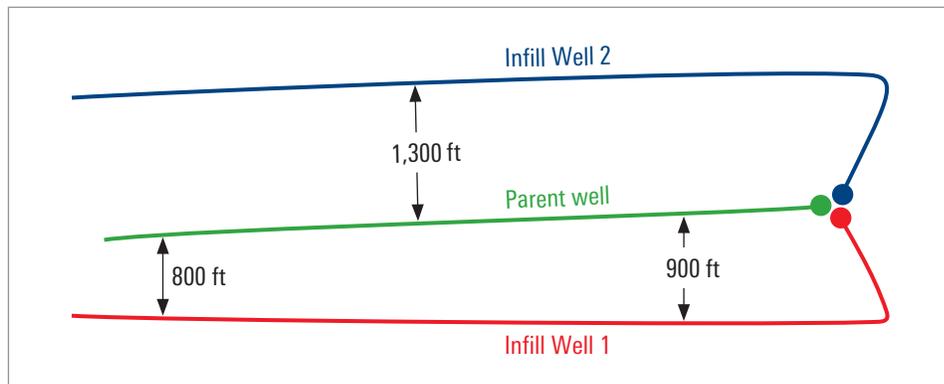
For Lime Rock Resources in North Dakota, detrimental frac hits occurred in about half of the operator's new completions. To avoid the problem, the operator engineers tried pumping fluid into older wells while stimulating the infill wells. The technique reduced the risk of sand flow and cleanouts in the older wells but cost up to USD 300,000 per well.

Lime Rock Resources wanted a more efficient solution for multistage stimulation of two infill wells near a well that had been on production for 7 years. The parent well had a damaged liner and a fish behind the liner, so any frac hit requiring a sand cleanout would be extremely costly in terms of deferred production and intervention expenses to restore production.

## Limit fracture growth and monitor pressure response

Schlumberger recommended the BroadBand Sequence and BroadBand Shield services for the two infill wells on either side of the parent well. BroadBand Sequence service temporarily isolates existing fractures and unlocks new fractures in virgin rock by diverting fluid from lower- to higher-stress regions. BroadBand Shield service delivers far-field diversion pills to limit frac hits or fracture propagation into existing producing wells.

Rather than commit to using BroadBand Shield service in both wells, Lime Rock Resources engineers agreed to test the service's efficacy in several stages of infill Well 1. For infill Well 2, all of the stages would be stimulated with BroadBand Sequence service designs optimized for the area. In infill Well 1, five stages were stimulated with BroadBand Sequence and BroadBand Shield services and the next five stages with only BroadBand Sequence service. This pattern was repeated until the last stage.



*Damage in the parent well precluded easy sand cleanout, so Lime Rock Resources was eager to avoid any detrimental frac hits while stimulating production from the two new infill wells.*

## CASE STUDY: Lime Rock Resources prevents frac hits, eliminating risks for damaged parent well, North Dakota

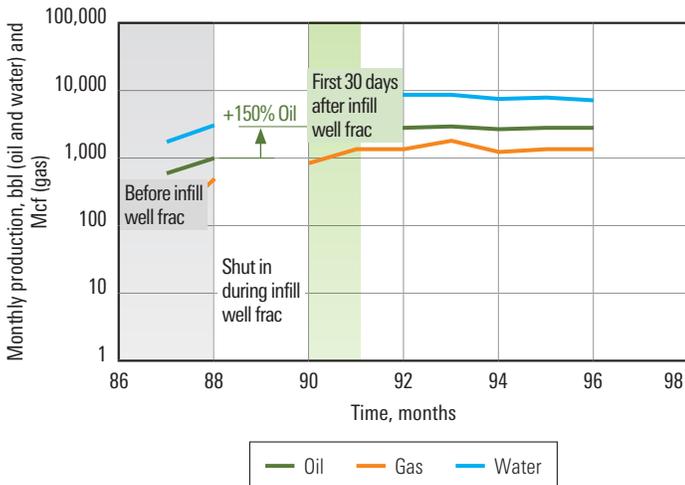
To analyze fluid and proppant communication during the operations, the WellWatcher Stim service was used to monitor pressure response at high frequency in both infill wells and the parent well during all stages. Proprietary algorithms were used to clearly confirm pressure communication or lack of communication.

### Protect the parent well while stimulating the infill wells

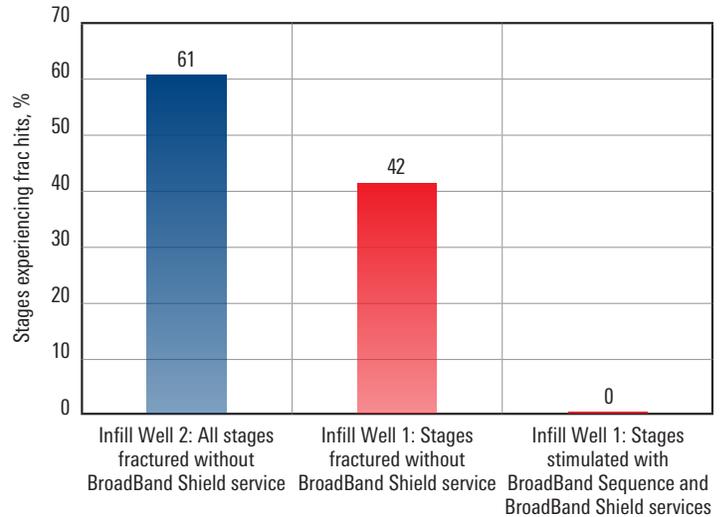
The fracturing operations were completed in both infill wells as designed. For infill Well 2, stimulated without BroadBand Shield service, the WellWatcher Stim service recorded evidence of pressure communication with the parent well in 61% of the stages. For infill Well 1, the service recorded evidence of pressure communication in 42% of the stages without BroadBand Shield service and no pressure communication in the stages stimulated using the combined BroadBand Sequence and BroadBand Shield services.

Despite the evidence of pressure communication, no sand cleanout was required in the parent well, and Lime Rock Resources was able to resume its production at the same rate experienced before the infill well stimulation treatments. Production then increased significantly, adding a 150% production increment after the infill well stimulation.

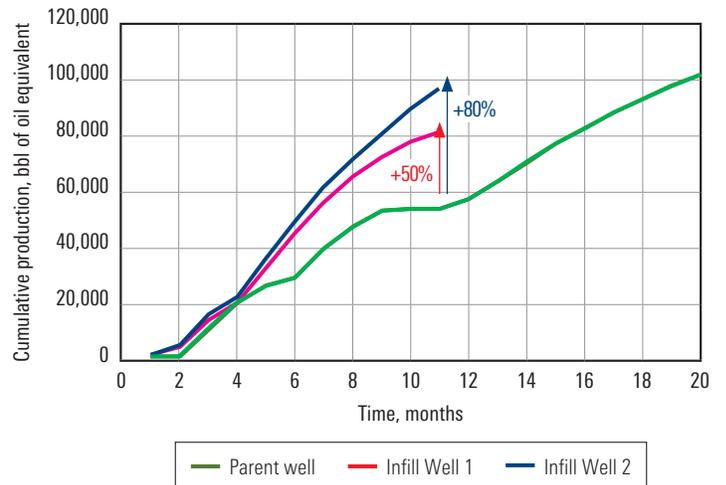
In addition, the infill wells outperformed the parent, delivering 66% more cumulative barrels of oil equivalent over the first 11 months after stimulation.



The infill well treatments stimulated a 150% boost in the parent well oil production.



In both infill wells, WellWatcher Stim service indicated some stages treated without BroadBand Shield service experienced frac hits with the parent well. In the stages of Infill Well 1 stimulated with the combined BroadBand Sequence and BroadBand Shield services, WellWatcher Stim service indicated no frac hits.



The infill wells outperformed the boosted parent well by 66% on average in cumulative production over the first 11 months after stimulation.

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