Stretching Dollars: Bakken Township Development

Bryan George
2/19/2014
“How....”
“What if....”
8 3/4" Intermediate hole.
9 5/8" Surface casing set.

7" Intermediate casing set to target formation.

Liner Top / Hanger set at KOP (Kick Off Point)

4 1/2" Production Liner
(Typical 30 stage frac/swell packer isolation.)

TYPICAL WELLBORE SCHEMATIC

BAKKEN SHALE
3 Mile Lateral Wells - Cost and Performance

<table>
<thead>
<tr>
<th>Wells Location</th>
<th>Spud Date</th>
<th>Days – Spud to TD</th>
<th>DRL $/FT</th>
<th>Avg $/Lat FT</th>
<th># of Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mott 1-16H</td>
<td>6/30/2012</td>
<td>35.1</td>
<td>$237.34</td>
<td></td>
<td></td>
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<tr>
<td>Louisville 2-9H</td>
<td>10/27/2012</td>
<td>25.3</td>
<td>$177.65</td>
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<td></td>
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<tr>
<td>Memphis 2-4H</td>
<td>12/3/2012</td>
<td>28.8</td>
<td>$180.78</td>
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<td></td>
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<tr>
<td>Patch 1-11H</td>
<td>5/2/2013</td>
<td>21.6</td>
<td>$152.89</td>
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<tr>
<td>Haffner 1-31H</td>
<td>11/23/2013</td>
<td>27.9</td>
<td>$171.66</td>
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<tr>
<td>Lannister 1-23H1</td>
<td>12/30/2013</td>
<td>19.0</td>
<td>$155.11</td>
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</tbody>
</table>

- **35% Improvement**
- **46% Improvement**

**Table:**

<table>
<thead>
<tr>
<th></th>
<th>Avg $/Lat FT</th>
<th># of Wells</th>
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<tbody>
<tr>
<td>2 Mile Lateral</td>
<td>$322.76</td>
<td>250 Wells</td>
</tr>
<tr>
<td>3 Mile Lateral</td>
<td>$302.13</td>
<td>6 Wells</td>
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</table>
Lessons Learned

- Loaded for Bear
  - XT39 Drill Pipe
  - RS on the Hook
  - Hydril 563 Liner

IT CAN BE DONE
Louisville 2-9H

Lessons Learned
- DS38 Drill Pipe
- Drilled Well E/W vs N/S
- Knowledge Sharing
Memphis 2-4H

Lessons Learned
- Torque & Drag Issues
- >8% Lube Does Not Work
- Hole Cleaning Issues

Western Hemisphere Land Record for Deepest Horizontal Well
Lessons Learned
- Drilled with Compound Mechanical Rig
- 1st Well to Run TXP Connections
- No Hole Cleaning Issues and Smoother Wellbore
- Single Lateral BHA from DO to TD

World Record for Consecutive Lateral Footage Drilled
Lessons Learned

- Shallow TVD Can Be Done
- Complex Wellbore Geometry
- Turn in Lateral
- Successful Liner Run Despite Tq & Drag Models
Lessons Learned

- Confidence is building that we can successfully drill and case.
Energy Corridor
Remember This?

Crude Line
Gas Line

INDEPENDENT MEANS
## Stretching Dollars

<table>
<thead>
<tr>
<th>Development Pattern</th>
<th>Wells</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 2 Mile</td>
<td>141</td>
<td>$1,105.4</td>
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<tr>
<td>3 Mile Lateral</td>
<td>109</td>
<td>$998.9</td>
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<tr>
<td>Potential Savings</td>
<td>32</td>
<td>$107 Million</td>
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</table>

<table>
<thead>
<tr>
<th>Development Pattern</th>
<th>Locations</th>
<th>Acres</th>
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<tbody>
<tr>
<td>Standard 2 Mile</td>
<td>64</td>
<td>280.3</td>
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<tr>
<td>3 Mile Lateral</td>
<td>46</td>
<td>179.1</td>
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<tr>
<td>Potential Savings</td>
<td>18</td>
<td>101.2</td>
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</table>

**36% reduction in footprint**

Additional Benefits

- Additional Lateral Footage
- Mobilization
- Waste Reduction
- Permits
- Completions
- Gathering Line / Battery Design
Future Challenges

Drilling
- Pad Drilling
- Stacked Laterals
- Casing Design

Completions
- Cleanout
- Friction Pressure
- Toe Stim Concerns
- Tracer in Frac

Reservoir
- Lower Performance Areas
Questions?