Complex Multi-Well Pad Planning

2/11/15
Agenda

• Typical pad planning process
• Deficiencies in planning complex units/pads
• Anti-collision
• Solutions to help our planning process on complex units
• Examples of units planning using new solutions
• Complex unit/pad planning process
Typical Pad Planning Process

1. Reservoir Engineer
2. Operations Land Coordinator
3. Drilling Engineer
4. Regulatory Engineer
Typical Unit Layout
Complex Unit A
Complex Unit A
Anti-collision Separation Factor

\[ SF = \frac{(C \text{ to } C)}{(UR_a + UR_b)} \]

\[ SF = 1 \]
North Drilling Anti-Collision Policy

• While drilling vertical and curve, anti-collision monitoring/calculations at the rig after every survey when Separation Factor < 2.0 (2 Sigma)

• If Separation Factor < 1.5, contact CLR Drilling Engineer immediately. Discuss trends, trajectory, plan forward for separation.

• If Separation Factor < 1.0, stop drilling immediately. Contact CLR Drilling Engineer and Area Drilling Manager. Discuss risk options, trends, plan forward. Direct approval necessary before drilling resumes.
Complex Unit A
Complex Unit A
Solutions for Better Planning

• Brought in an in-house well planner
  – Makes well planning process more efficient when working face to face and drawing out ideas

• Trial with Landmark’s Decision Space Software
  – Essentially automates the well planning process
  – Enter constraints:
    • lateral spacing and length
    • well trajectory constraints
    • unit boundaries, etc.
  – Program will pick pad locations and create plans
Complex Unit B
Complex Unit B
Complex Units C, D, E, F, and G
Complex Units C, D, E, F, and G
Complex Units C, D, E, F, and G

Laterals Tied to Pads

Manual/Auto Optimization
Complex Units C, D, E, F, and G

Laterals Tied
Planning Process for Complex Pads

- Reservoir Engineer
- Operations Land Coordinator
- Drilling Engineer
- Regulatory Engineer

Decision Space
- Technical Team
- Compass
Questions?