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SLIDES: Encana

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Directional Possibilities

- S-Shaped Well
- Slant Well
- Horizontal Well
- Short Radius
- Production Zone
- Re-entry
Extended Reach Drilling

1 Mile Deep

6.3 Miles (33,184 ft) Displacement
Continuous Sand Bodies with Vertical Wells

WELL # 1

“Shaley” Zone

“Sand” Zone

WELL # 2

WELL # 3

Non-Jonah Reservoir
Continuous Sand Bodies with Horizontal Wells

“Shaley” Zone

“Sand” Zone

Non-Jonah Reservoir
Mesa Verde Stacked Sands Model
Well Log Presentation
10 – Acre Spacing
Reservoir Characterization

Datum: top Paludal Coal C
Well log from a portion of a pay zone in a Jonah well.
Discontinuous Sand Bodies with Vertical Wells

Remaining Pay Sands on 40 Acre Spacing
Discontinuous Sand Bodies with Vertical Wells

Remaining Pay Sands on 20 Acre Spacing
Discontinuous Sand Bodies with Vertical Wells

40 Acre  20 Acre  10 Acre  40 Acre

Remaining Pay Sands on 10 Acre Spacing

Sand body completely missed even with 10 acre spacing.

Sands as seen on logs may appear too small and be passed by.

Discontinuous Sand Bodies with Vertical Wells
Horizontal wells will never work well with thick accumulations of discontinuous sands.
Surface casing cemented across entire aquifer interval.

Water Aquifer

Fort Union Interval
Non-Gas / Normal Pressure Sands

Top of Lance Formation
Gas Productive / Over Pressured Sands
Reservoir Considerations

*The Economic Drivers*

*As it applies to Horizontal or Extended Reach Drilling*

Reservoir characteristics must support the additional costs of horizontal drilling.

In certain applications, horizontal or extended reach drilling becomes the most *economic alternative* for reaching and developing a given reservoir.

Horizontal drilling has proven to be a viable, economic technology for developing specific reservoir types (fractured, and/or low permeability).
Reservoir Considerations

The Economic Drivers

As it applies to Mesa Verde Stacked Sands

As well density increases, so then does total reservoir resource recovery increase….(waste is minimized)

But, as well density increases, resource recovery on a per well basis decreases

So, as well density increases, there is a diminishing return on investment….

The additional costs of directional drilling continue to adversely impact these economics
Putting It All Together…
Where does the technology usually work?

- **Offshore**
  - When cost of infrastructure is very high

- **Unique Reservoir Types**
  - Austin Chalk or Balken Shales or excellent examples

- **Mountainous Areas (ie, Mamm Creek)**
  - When cost of access is very high

- **Urban Areas (ie, DJ Basin – Denver, and Mamm Creek)**
  - When urban development coexists with oil/gas development
Putting It All Together…
Where does the technology typically not work?

- **Reservoir Type…**
  - If the unique reservoir type does not support horizontal drilling, the vertical drilling is usually always the most economic development method

- **Difficult Drilling Areas…**
  - Where the additional costs do not economically support the effort
Back Up Slides / Pictures
Mamm Creek Field
Garfield County, Colorado
Multi-Well Pad