

# **NMOGA**

## **EXHIBIT D**

# Roderick C. Milligan

1400 Smith St 43<sup>rd</sup> Floor · 281.413.9794 · [RoderickMilligan@chevron.com](mailto:RoderickMilligan@chevron.com)

## EDUCATION

### TUSKEGEE UNIVERSITY

*B.S., Electrical Engineering, Power Concentration*

- Kappa Alpha Psi Fraternity President - 2010-2011

## PROFESSIONAL EXPERIENCE

### CHEVRON NORTH AMERICA

#### *Characterize and Define Drilling & Completions Engineer*

- Provide the asset team with design concepts, (directional design, cement design, and casing design).
- Create standards on the bit design and bottom hole assembly (BHA) to reduce the tendency of the well to deviate from the target plan.
- Work with supply chain and directional companies to create contracts that reflect feasible drilling days.

#### *Project Execution Drilling & Completions Engineer*

- Collaborated with a multifunctional project team to deliver a Saltwater Disposal (15,000' TVD) well while staying within the drilling tolerance.
- Executed 90% of the wells within 1st Quartile performance, based on offset operator benchmarking, analyzing major gaps in the process and improving the execution of those gaps through personnel training of best practices.
- Decreased the dogleg severity in wells by collaborating with geologist to stay within the geological target.
- Collaborate with bit manufacturing companies to design a well to reduce the deviation from the designed target line.

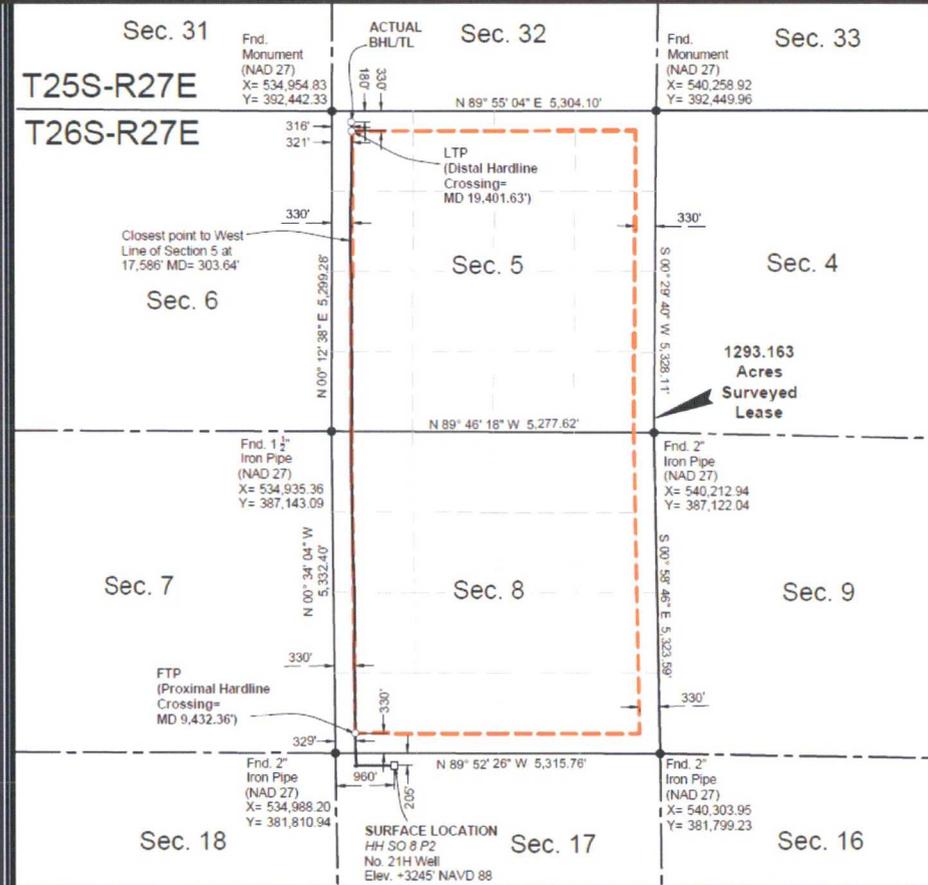
#### *Lead Design and Planning Drilling Engineer (Texas, New Mexico)*

- Planned and designed the development the directional plan of multiple reservoir benches.
- Developed the standard for New Mexico six well pad directional plan.
- Developed a Master Development Plan for Bureau of Land Management (BLM) regulatory group to reduce the turnaround time for permits from 6-8 months to two weeks.
- Ran well analysis for the torque and drag of a well design.
- Created time estimates based on the well design and directional work

#### *Drill Site Manager (East Texas, Oklahoma, New Mexico, West Texas)*

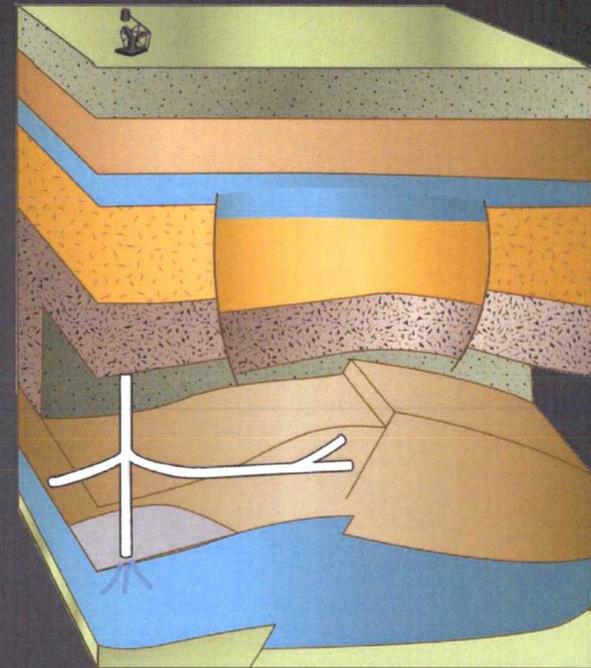
- Spearheaded the implementation of Schlumberger rotatory steerable technology on a well for the control of the directional work from an original cycle of 58 days (1st Quartile metrics).
- Held direct accountability for regulatory compliance, on-site contractor safety, and productivity for over 100 field operations.
- Managed the execution of the directional drill plan.

# Plat



# WHAT IS COVERED

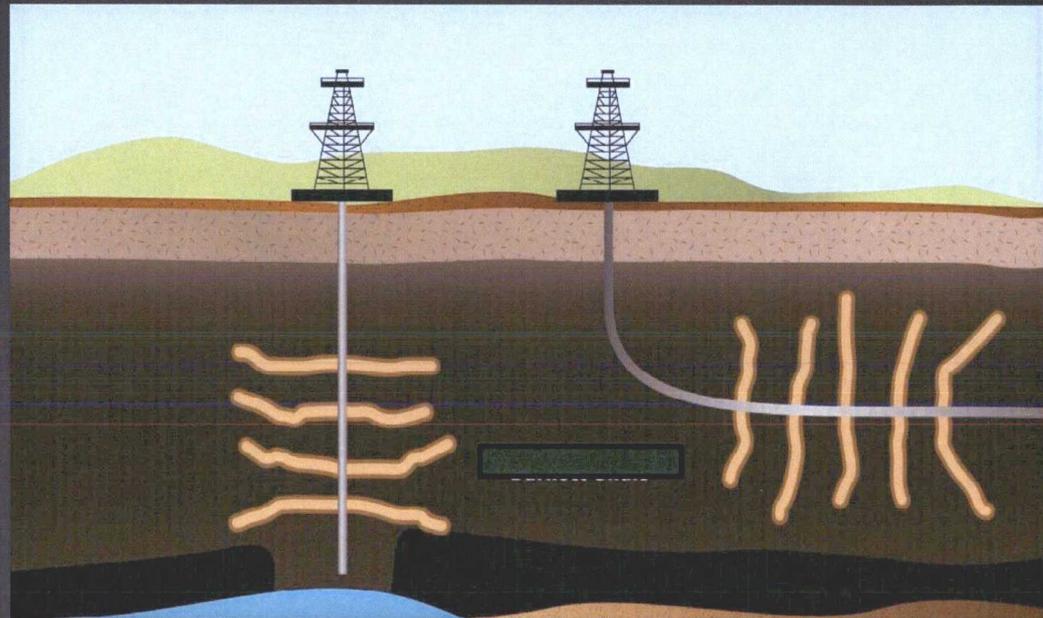
- Directional Drilling Methods
- BHA Design
- Drillstring Components: Stabilizers, Motors
- Problems associated with Directional Drilling



© WIPAC 2011

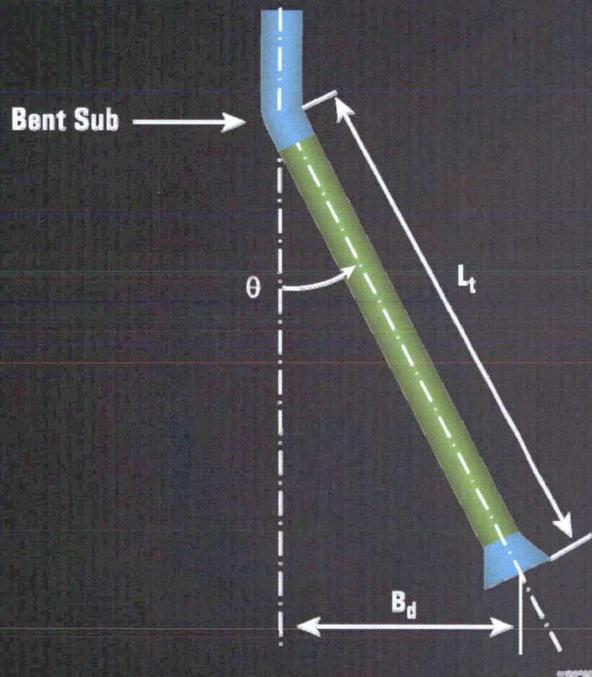
## DEFLECTION DEVICES AND METHODS

- Rotary Assemblies
  - Bent Motors
  - Rotary Steerable System



## BENT MOTORS

### BENT SUB



Lateral distance from the BHA centerline to the bit center.

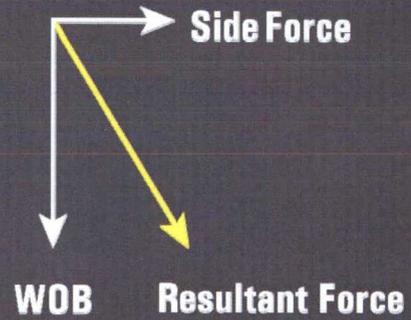
$$B_d = L_t \times \sin \theta \quad [\text{in}]$$

where:  $L_t$  (in) length from bend to bit  
 $\theta$  ( $^\circ$ ) bend angle

## KICKOFF IN OPEN HOLE



- The bit, motor and stabilizers form 3 contact points for a defined circular path.
- 3-point geometry applies.

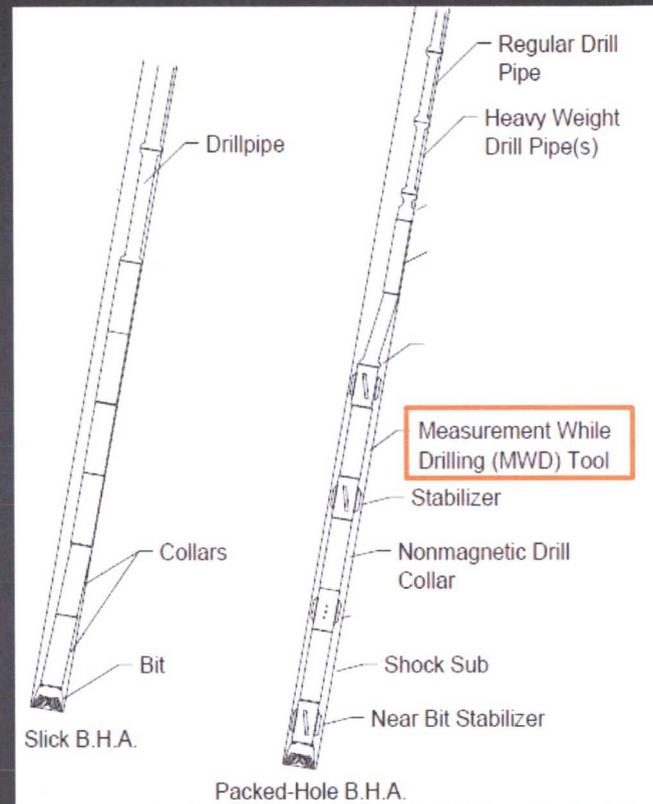


© WIPRODD 215

5

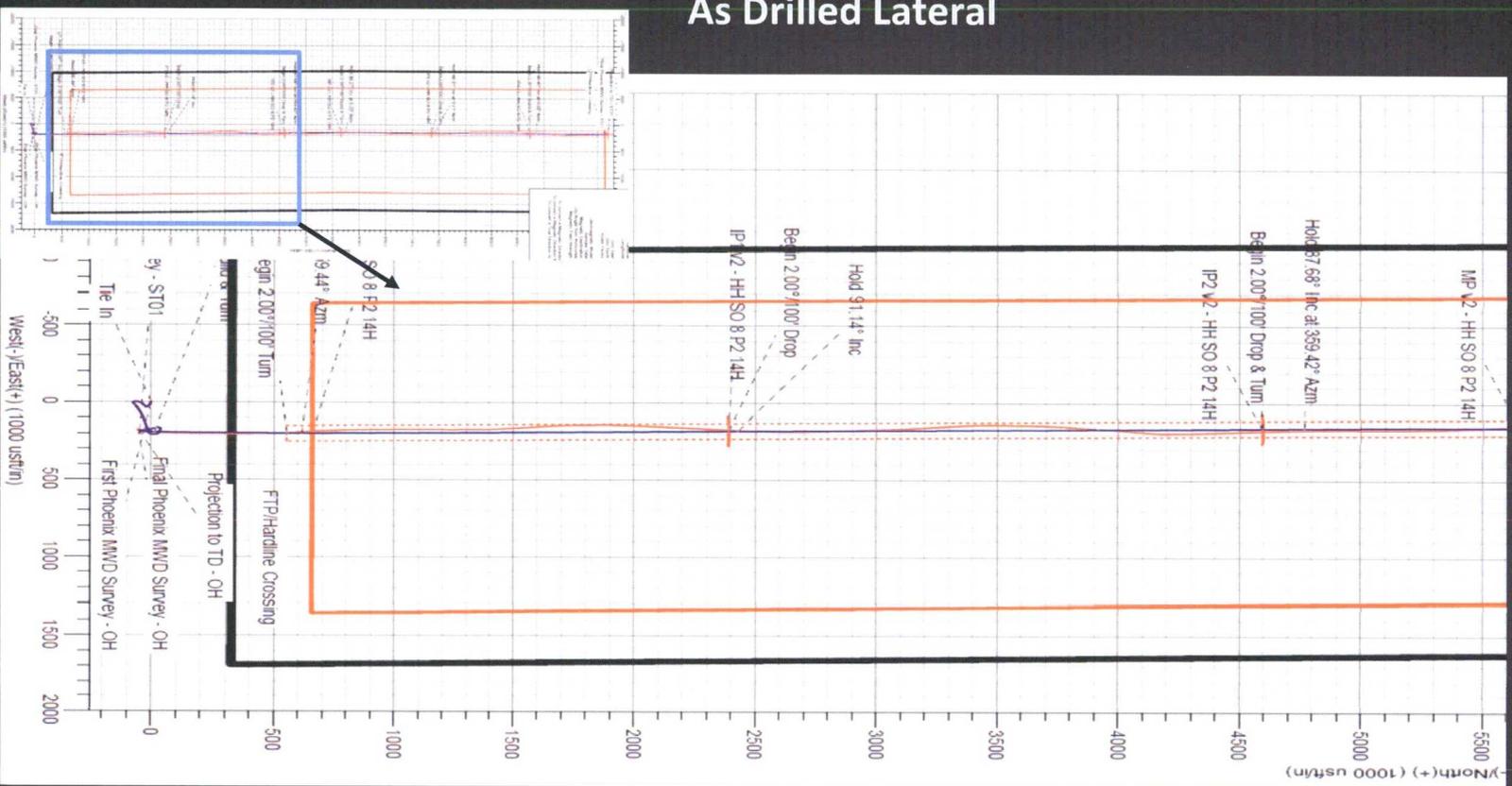
## Common BHA Problems to Control Directional

- Formation Effects
  - soft formation
  - hard formation
  - natural fractures
  - thin laminated formations
- Worn Stabilizers/Bits
  - undergauge Stabs/bits
- Measure While Drilling (MWD) Tool
  - Normally 40 ft. - 60 ft. behind the bit





### As Drilled Lateral



# Summary

## Ideal Situation

- Zero Tool Tolerance
- Zero Geological Anomalies
- Perfect Execution of Deflections
- Continuous Location Awareness at the Bit

## Actual Situation

- Tools Manufactured with tolerances
- Geological Anomalies Occur
- Operations Adjust Drilling Parameter to Meet Undesired Deflections
- Location Measurements Lag 40-60' Behind the Bit

## Conclusion

Operators Need a 50 Feet tolerance to Manage Latent Hole Conditions