



HDD Advancements Combat Challenges of Hard Rock Drilling

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Agenda

- History
- Product
- Tooling
- Drilling Fluids

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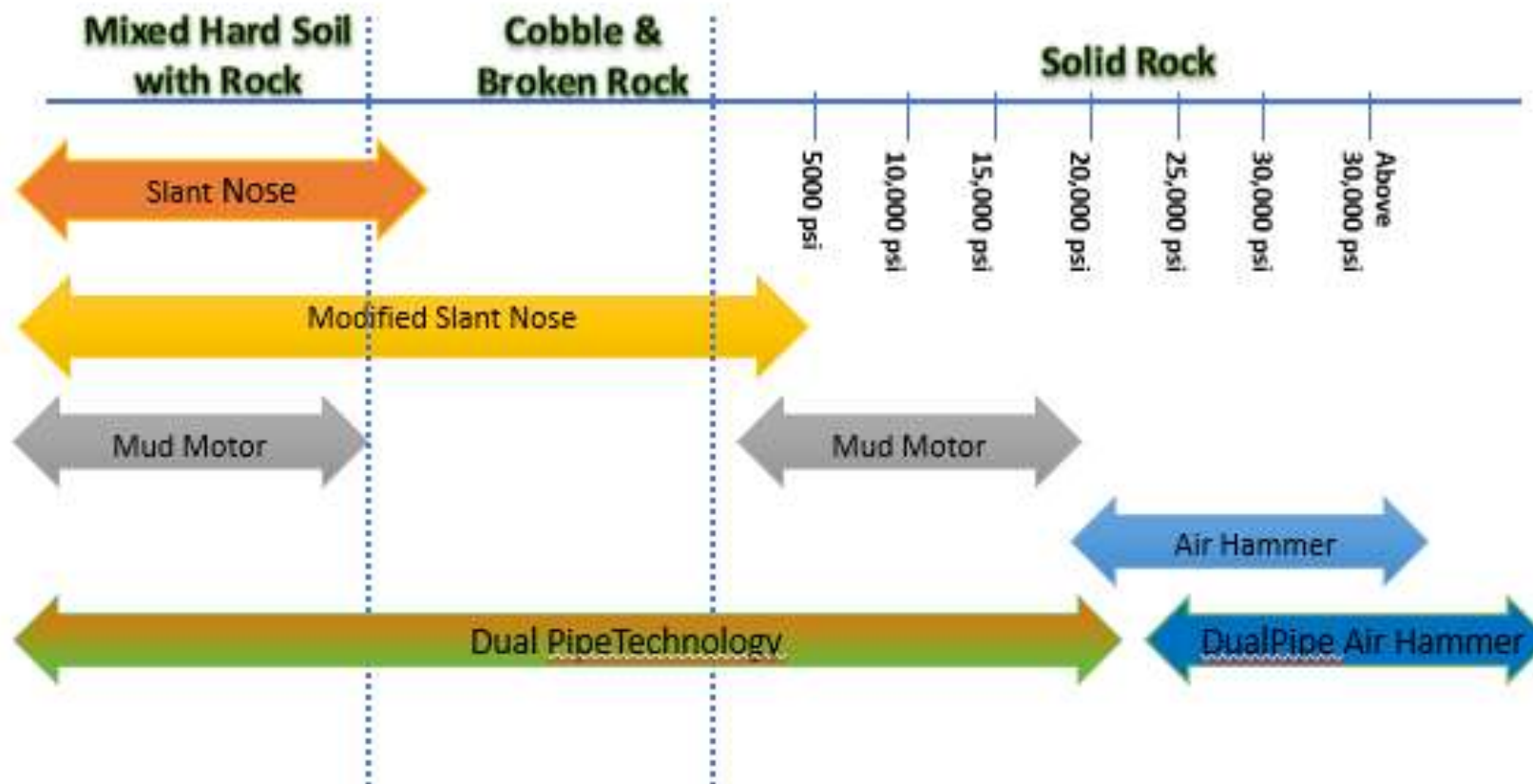
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Drilling Technology Effectiveness



Drill Pipe Rock Tooling

- Mechanical motors with rotary bits and drag bits
 - Effective for use in cobble, layered or solid rock
 - Mechanical bit drive (inner rod)
 - Low drill fluid requirement (+/- 30 lpm)
 - Outer body rotation locked for steering
 - Outer body rotating to go straight



Switchback

- Speed
- Efficiency
- Productivity



Dual Pipe Rock Tooling

- Dual Pipe Mechanical Motor with air Hammer System
 - Effective for use in solid rock



Drilling Fluids

- Drilling fluids are essential in any HDD installation
- Disposing of used fluid can be time consuming and costly
- Recycling drilling fluids can:
 - Reduce the overall volume of fluid on a jobsite
 - Reduce fluid disposal costs
 - Conserve water
 - Improve drilling productivity
 - Impacts carbon footprint
 - Limit disturbance to the environment



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Fluid Recycling Savings

	3,000 gallons		1,000 gallons
	Cost Per Day		Cost Per Day
Mixing system	\$134.76	Micro recycling system	\$277.63
Water	\$15.00	Water	\$5.00
Fuel used on vac/truck for mud recovery	\$84.50		
Drilling additive cost for the day	\$99.00	Drilling additive cost for the day	\$33.00
Fuel used on mixing system	\$50.00	Fuel used on micro recycling system	\$66.60
Cost of dumping mud (determined from volume pumped/day)	\$249.75	Cost of dumping mud (determined from volume pumped/day)	\$64.80
Fuel used hauling mud off	\$133.20	Fuel used hauling mud off	\$44.40
Hourly charge of vacs being pulled (wear and tear)	\$300.00	Cost of screens	\$55.00
Hourly charge on trucks hauling mud off (wear and tear)	\$150.00		
Total cost for the day of drilling	\$1,216.21	Total cost for the day of drilling	\$546.43

TOTAL SAVINGS IN ONE DAY

\$669.78

TOTAL SAVINGS FOR MONTH OF EQUAL USAGE

\$13,395.60

Inadvertent Returns

- Dual Pipe Technology
- Low fluid volume tooling is key
 - Equals out to low downhole pressures
 - Helps prevent inadvertent returns



Questions