

Drilling and Completions Changes from Conventional to Unconventional Developments – Part Two

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Drilling and Completions Changes from Conventional to Unconventional Developments – Part Two

Part One – Conventional Well Design

- Targets permeable reservoirs with technologies of the day
- Within a traditional mineral leasing structure
- To develop a conventional field, vertically or directionally

Part Two – Unconventional Well Design

- Targets very low permeability rock with new technologies
- Within a relatively new mineral leasing structure
- To develop an unconventional field, horizontally

Part Three – Regulatory Response to Unconventionals

- Increased focus on protection of workers, public health, the environment
- Maintain protection of mineral ownership and prevents waste
- Adapting or replacing older paradigms to embrace new technology

Unconventional Rock



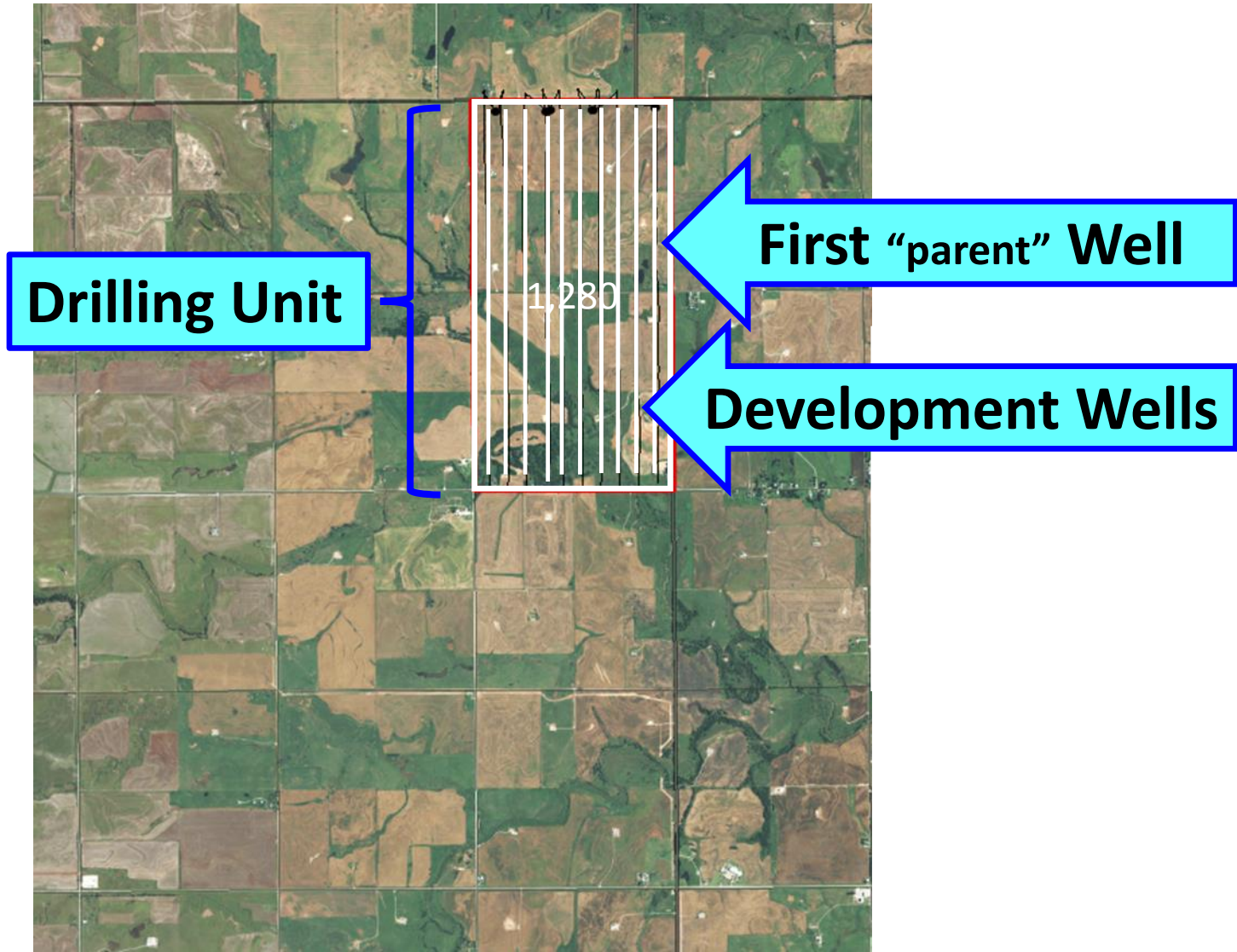
Unconventional Thinking



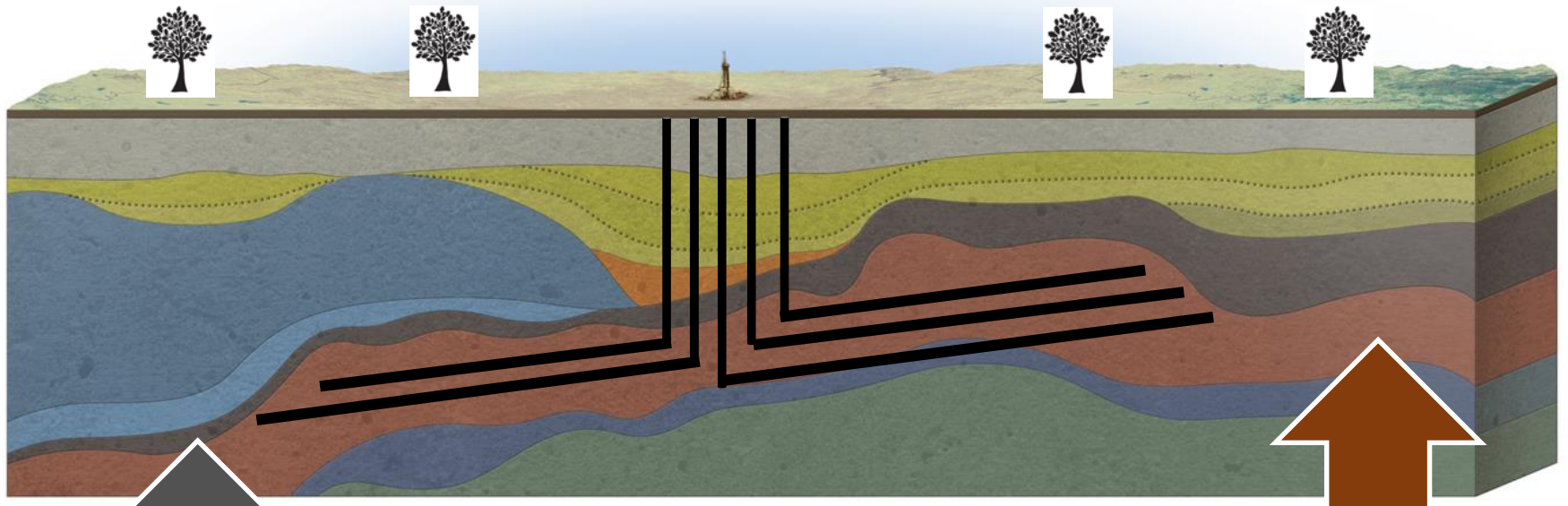
George P. Mitchell

<https://energyfactor.exxonmobil.com/news/george-mitchell/>

Unconventional Leasing Framework



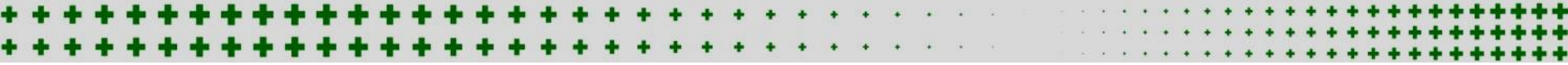
Unconventional Horizontal Development



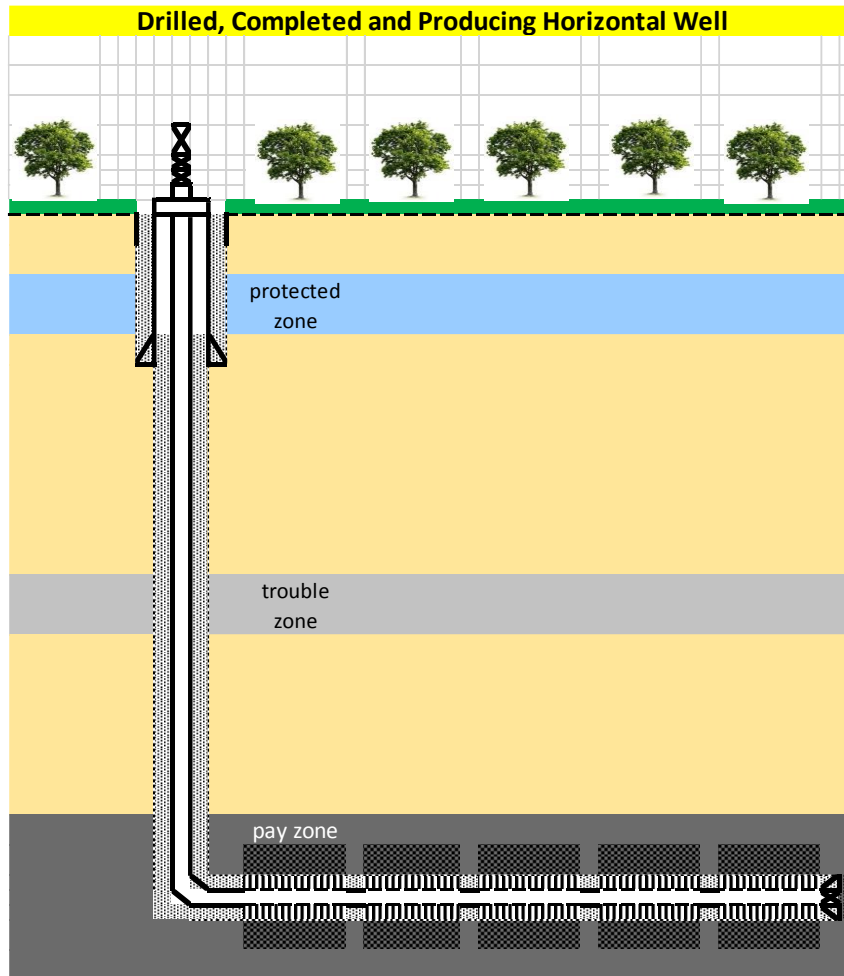
Trapping Formation
Has
Relatively High
Permeability

Source Formation
Has
Relatively Low
Permeability

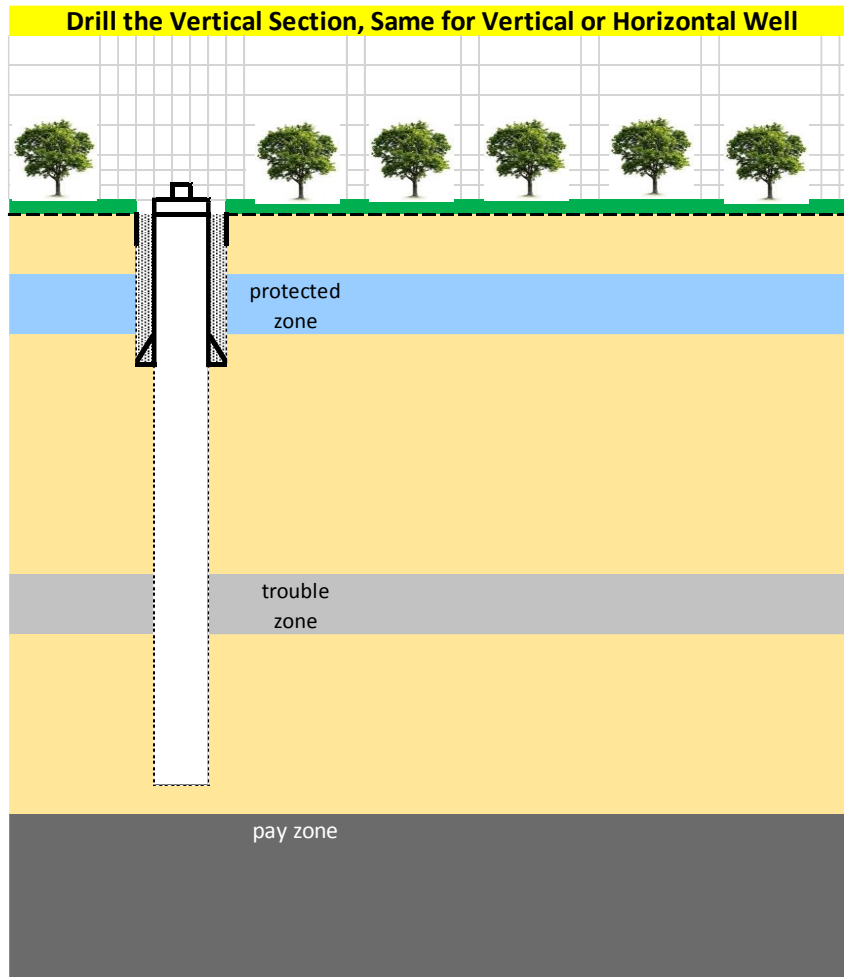
Unconventional Horizontal Development



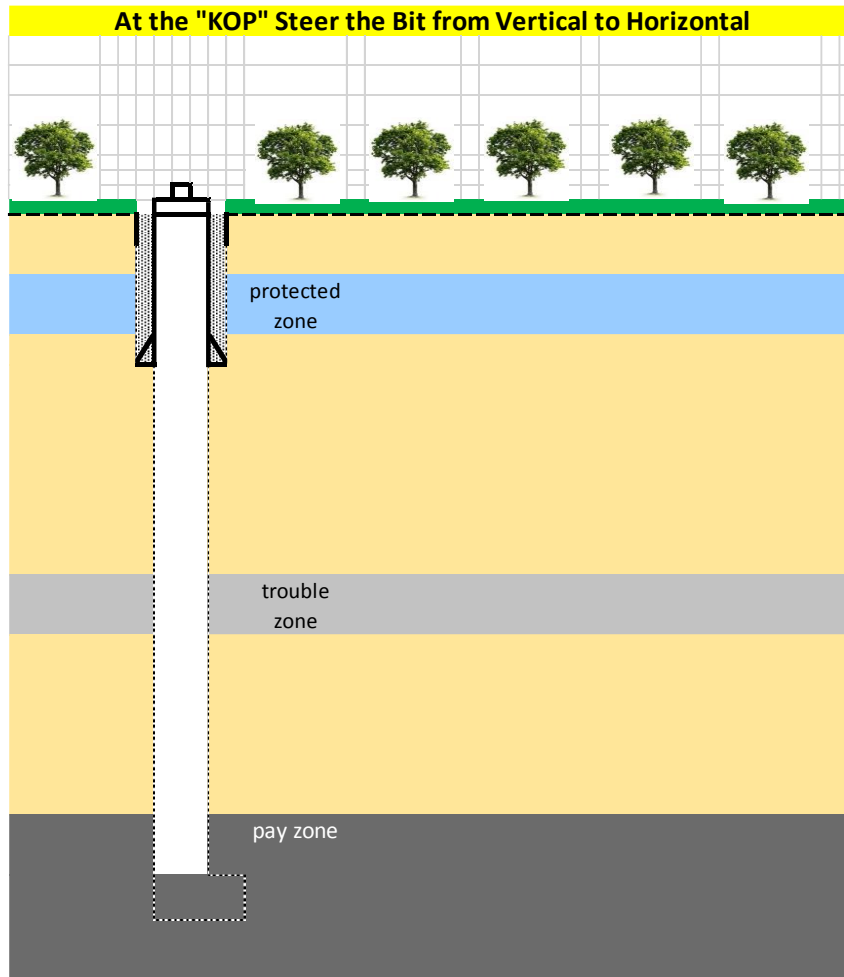
Unconventional Drilling



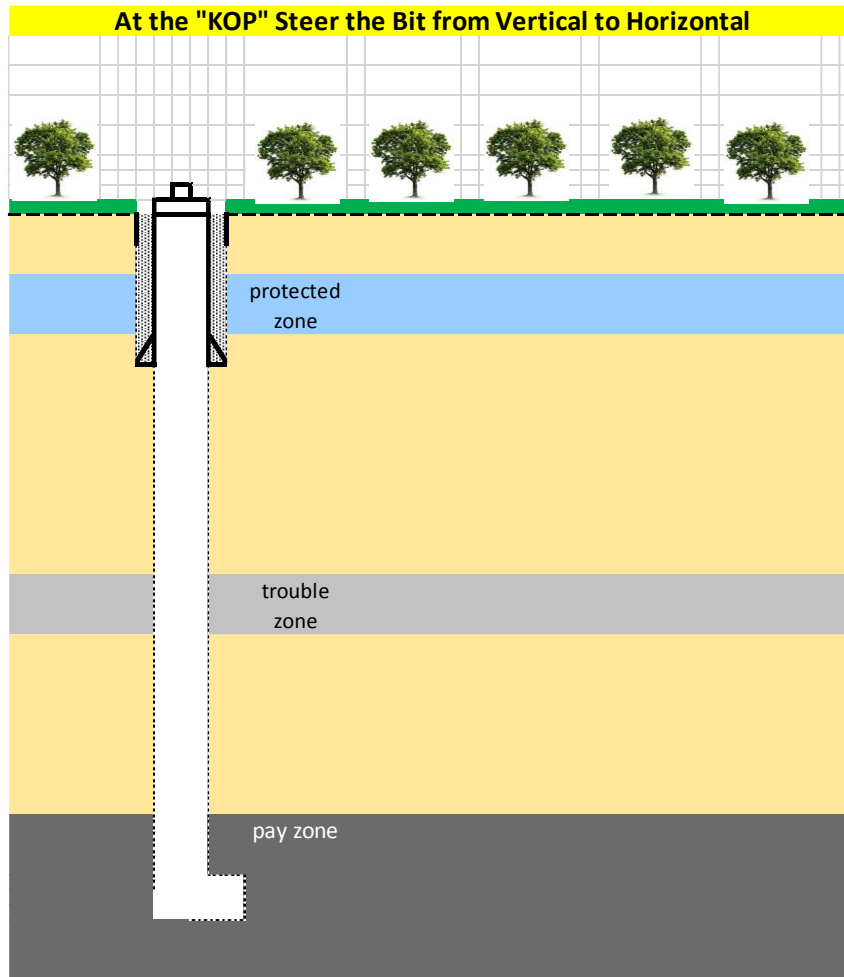
Unconventional Drilling



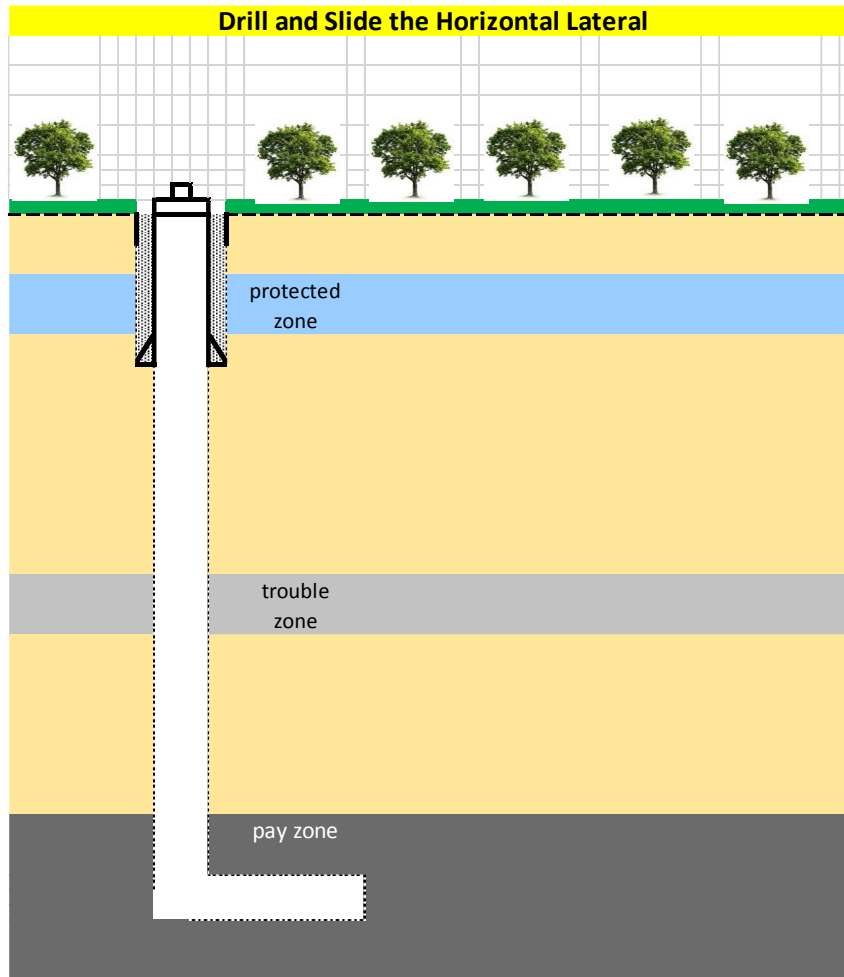
Unconventional Drilling



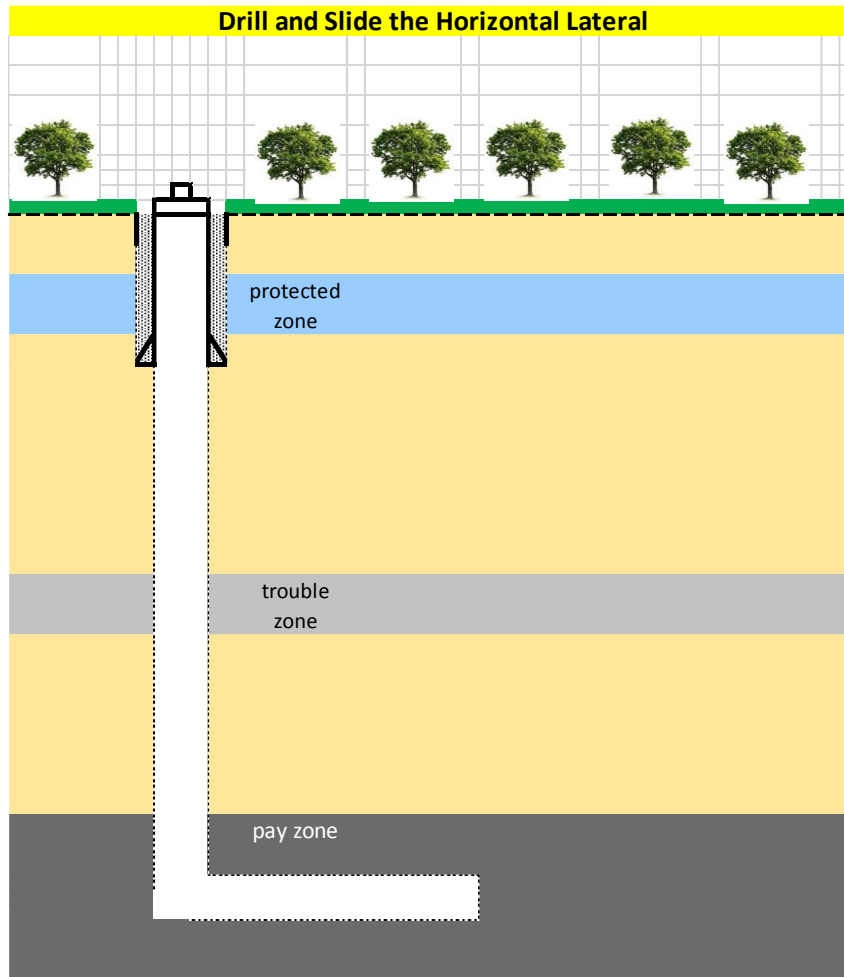
Unconventional Drilling



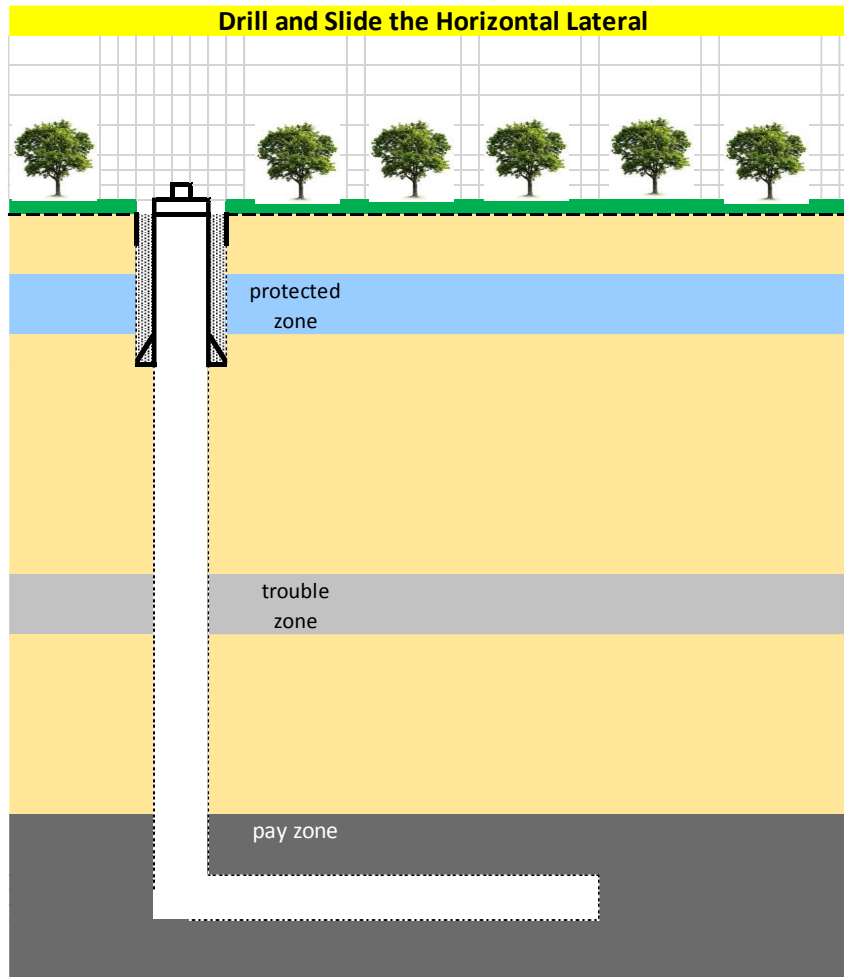
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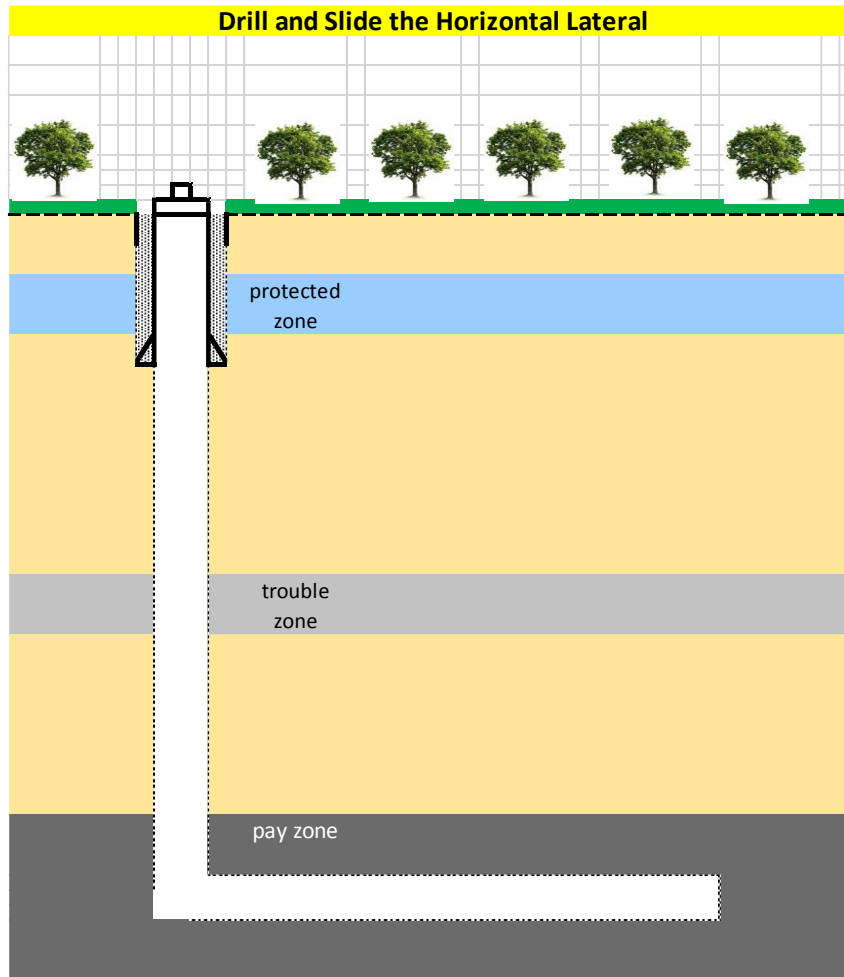
Unconventional Drilling



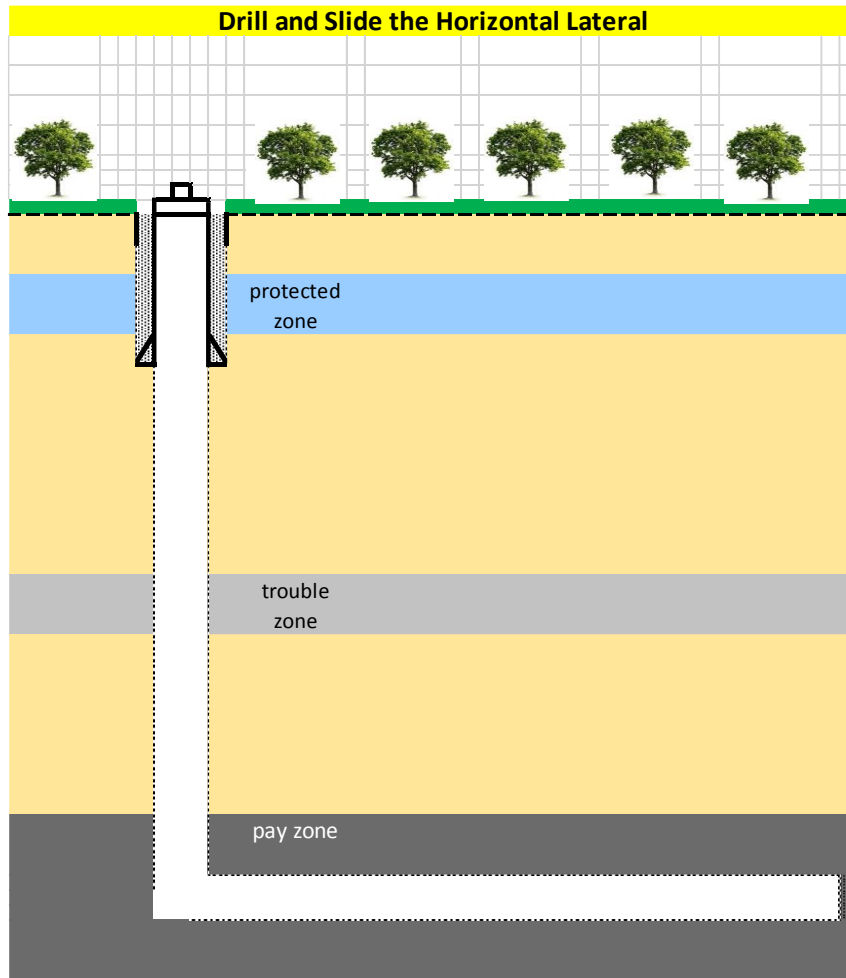
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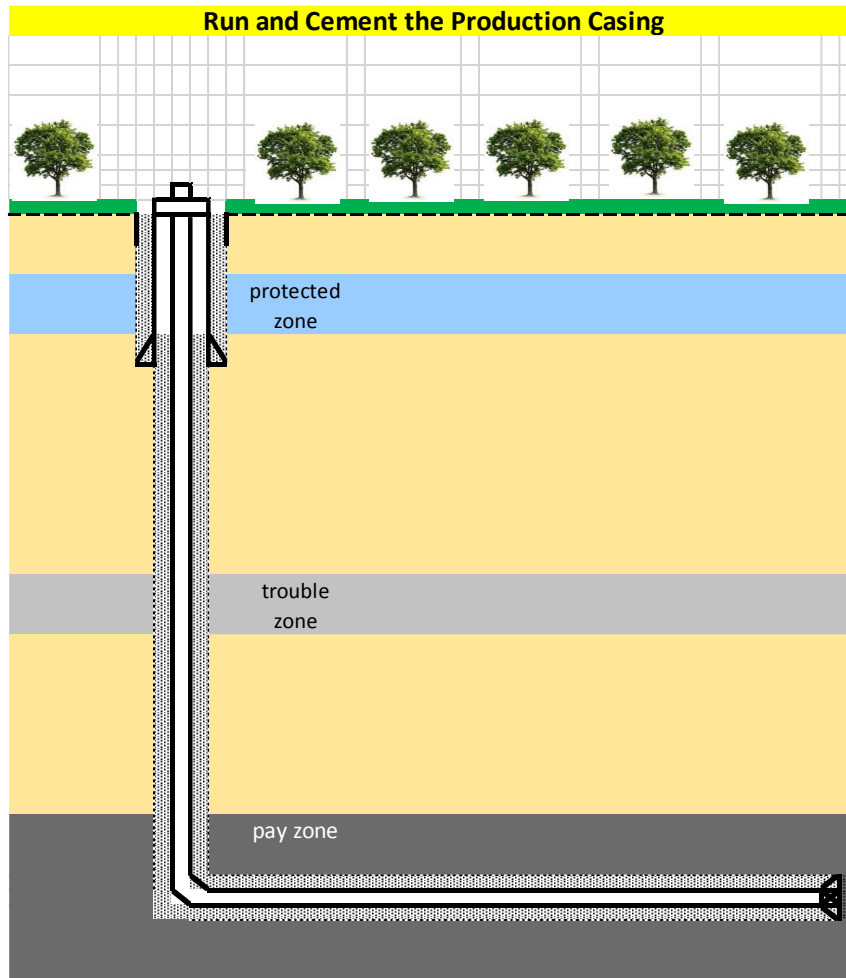
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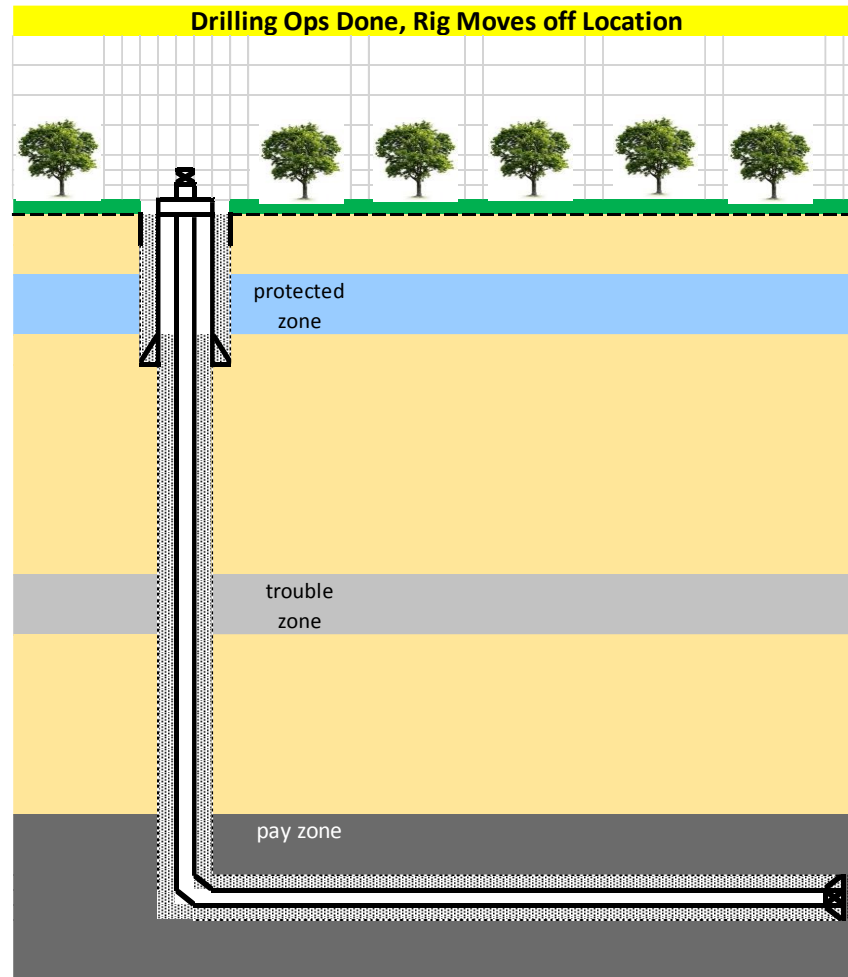
Unconventional Drilling



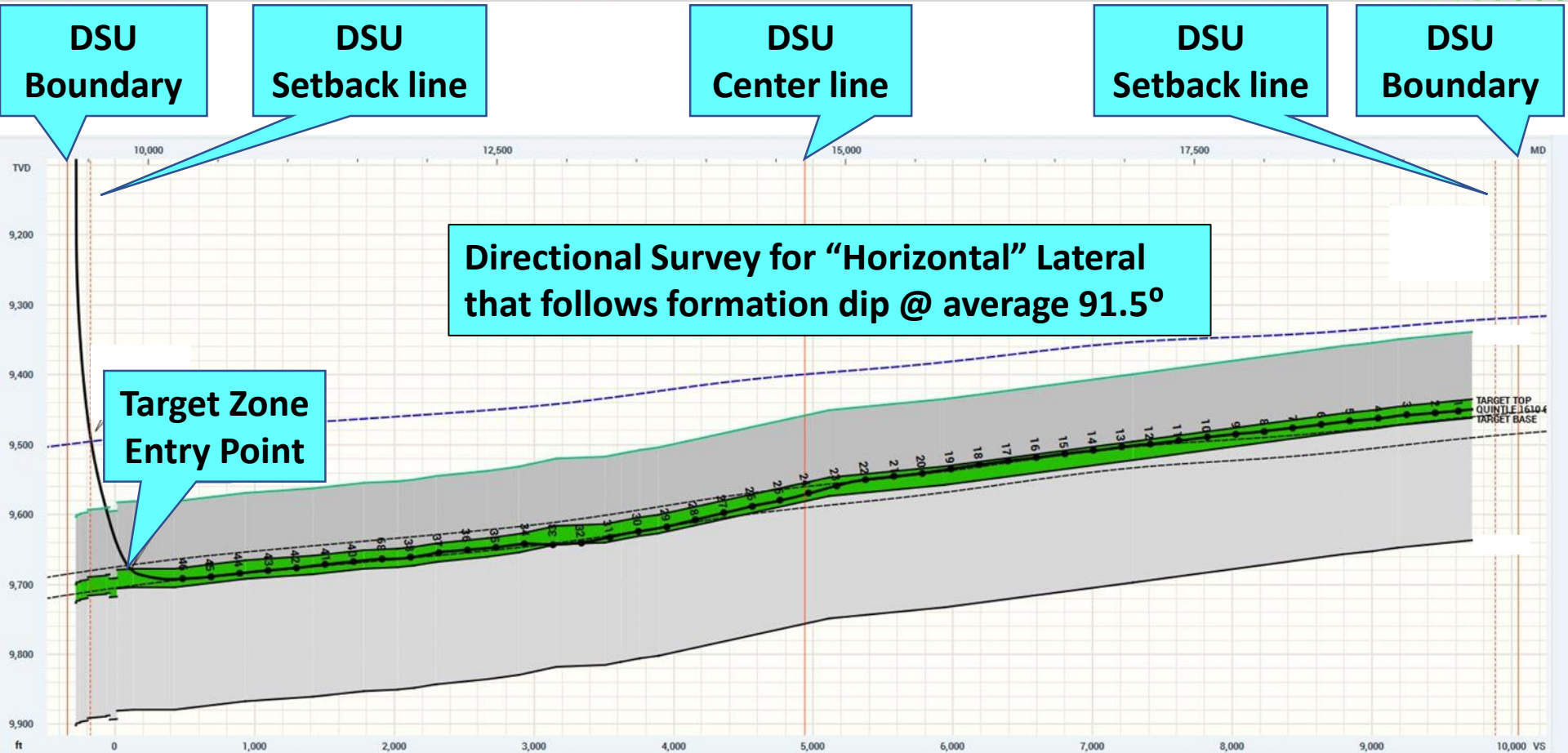
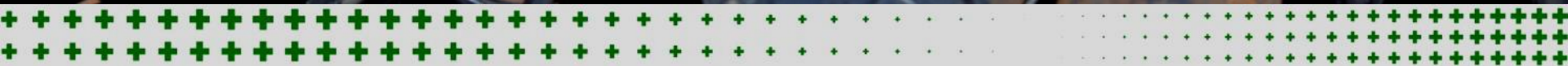
Unconventional Drilling



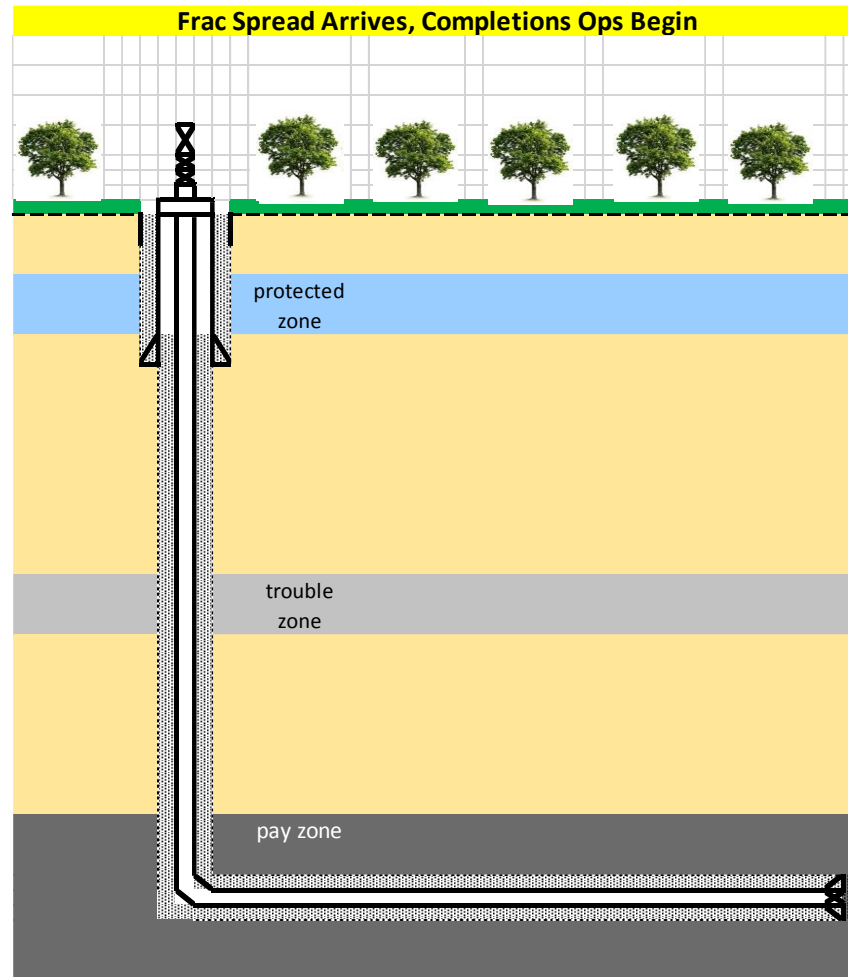
Unconventional Drilling



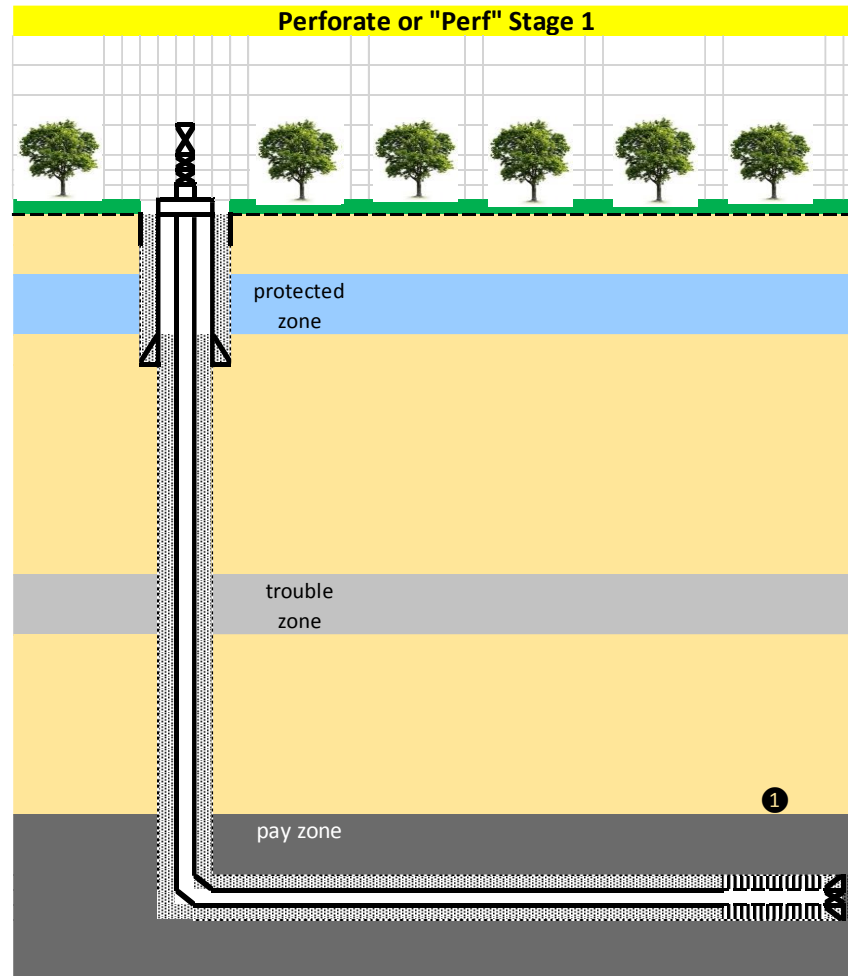
Unconventional Drilling Strategies



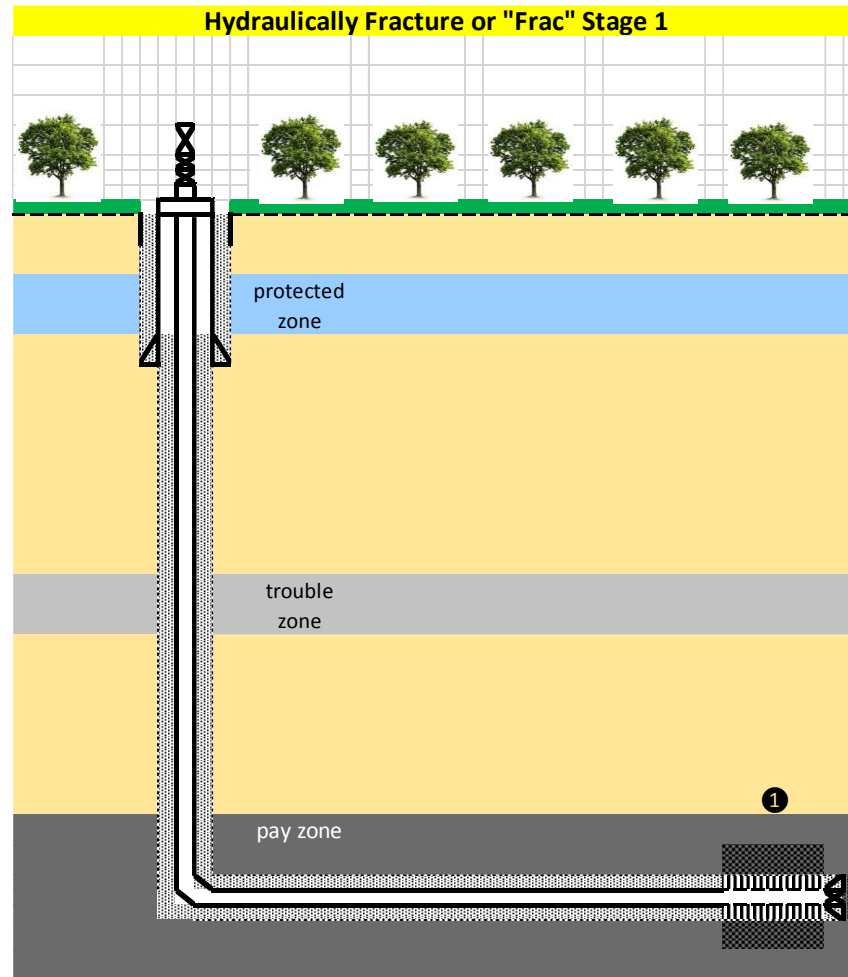
Unconventional Completions



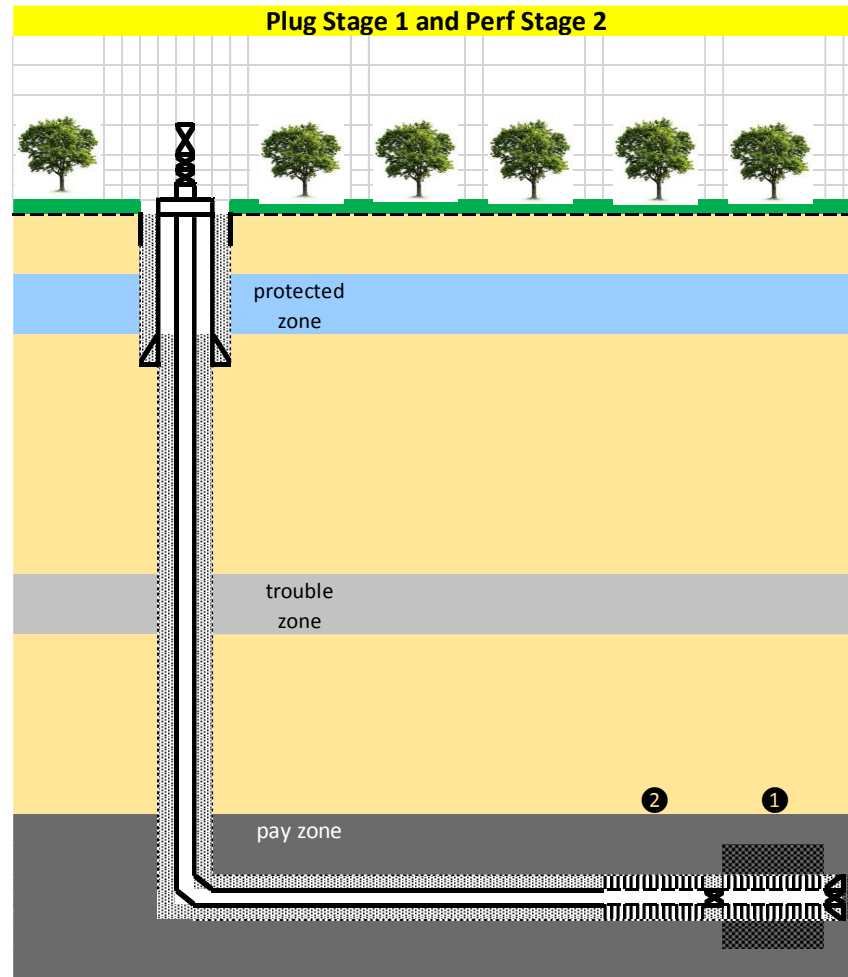
Unconventional Completions



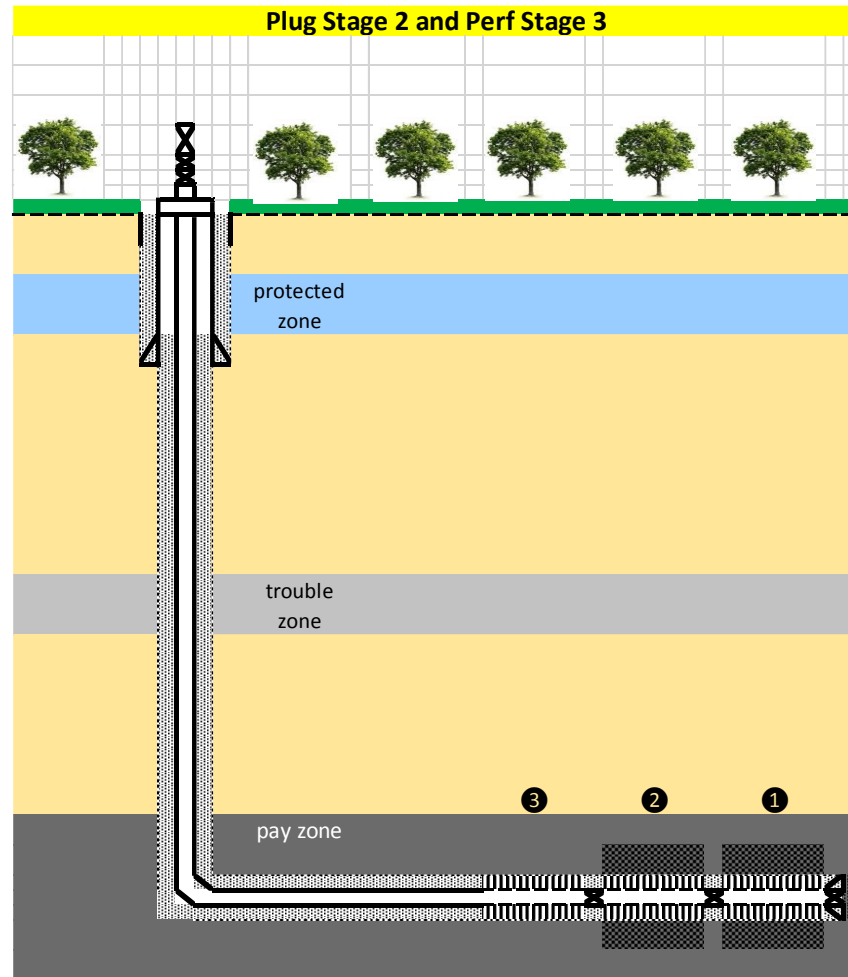
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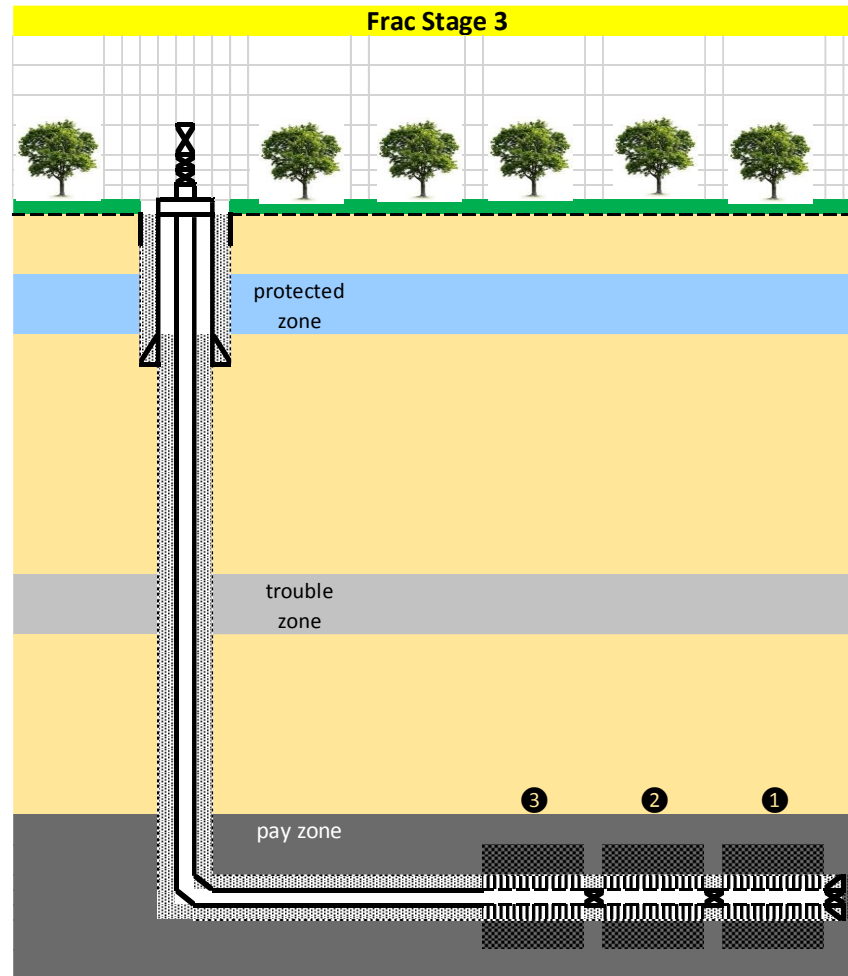
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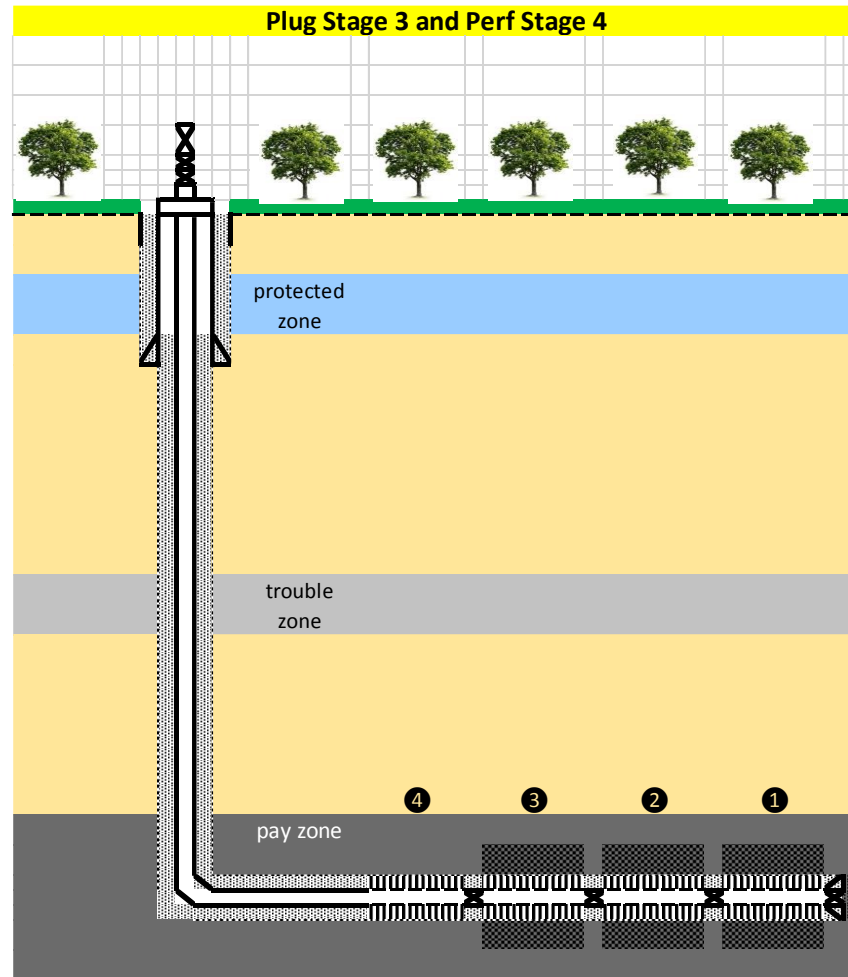
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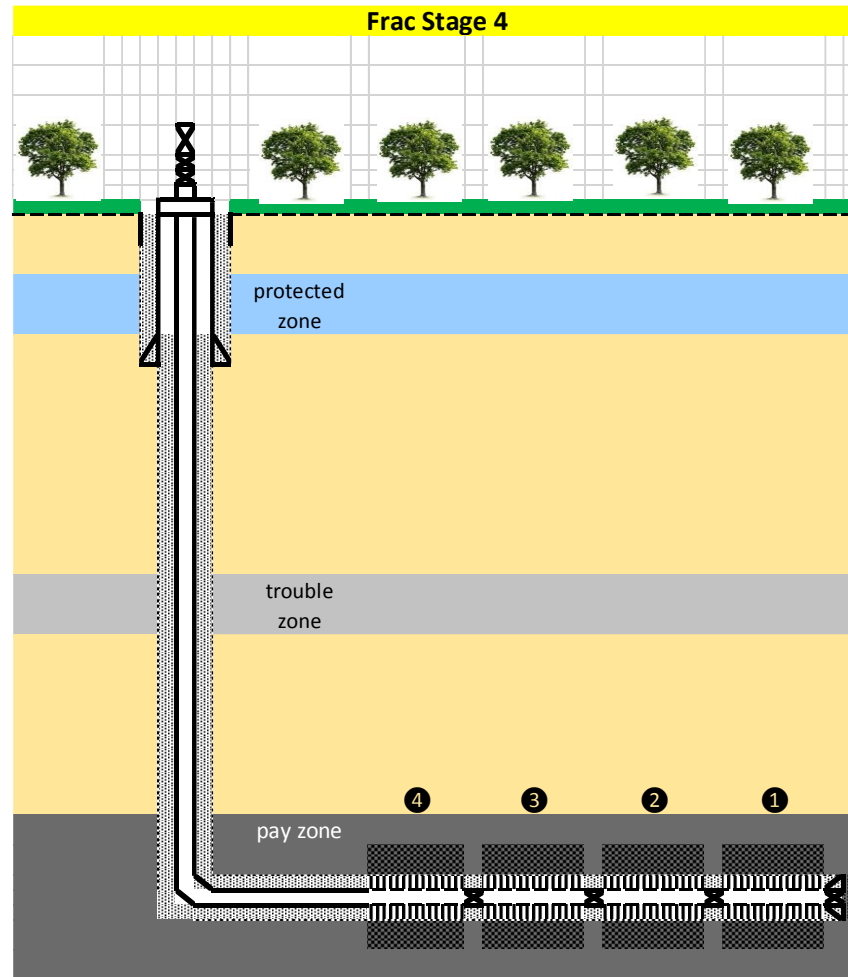
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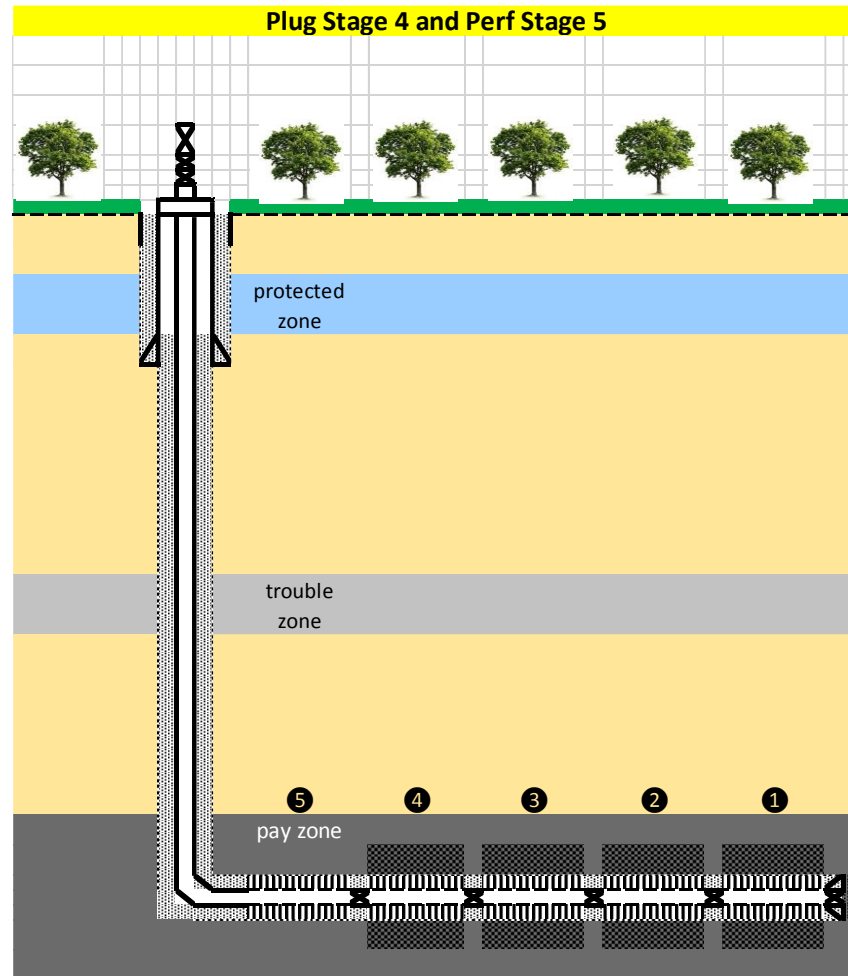
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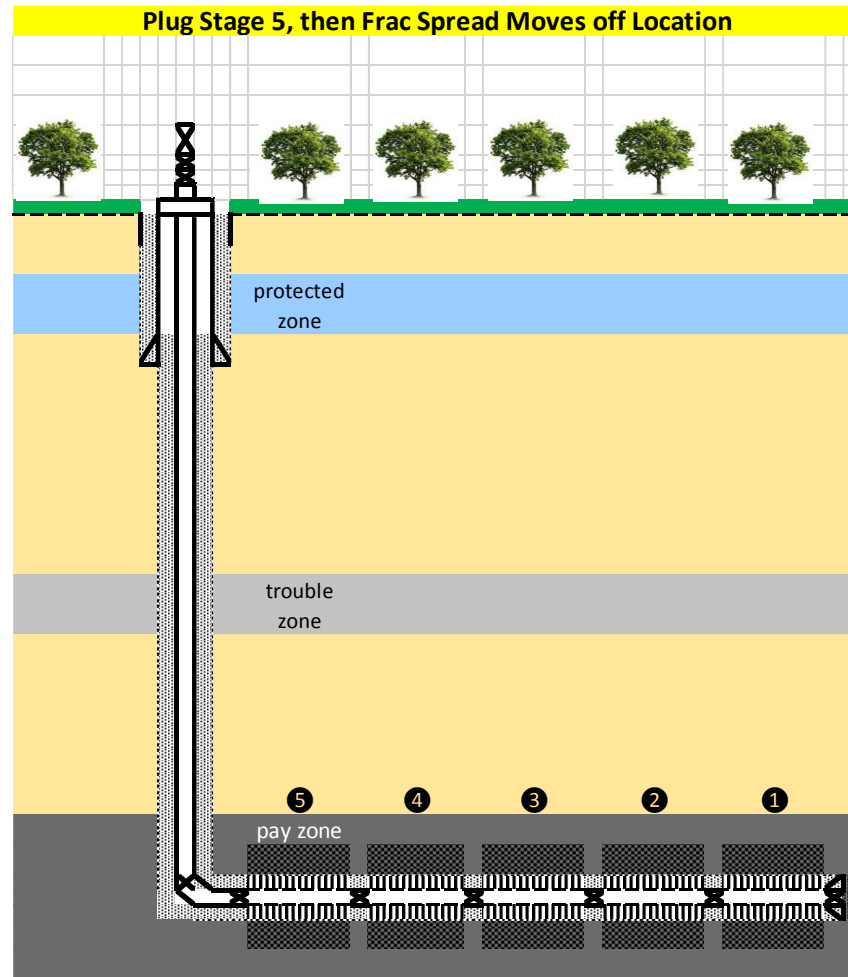
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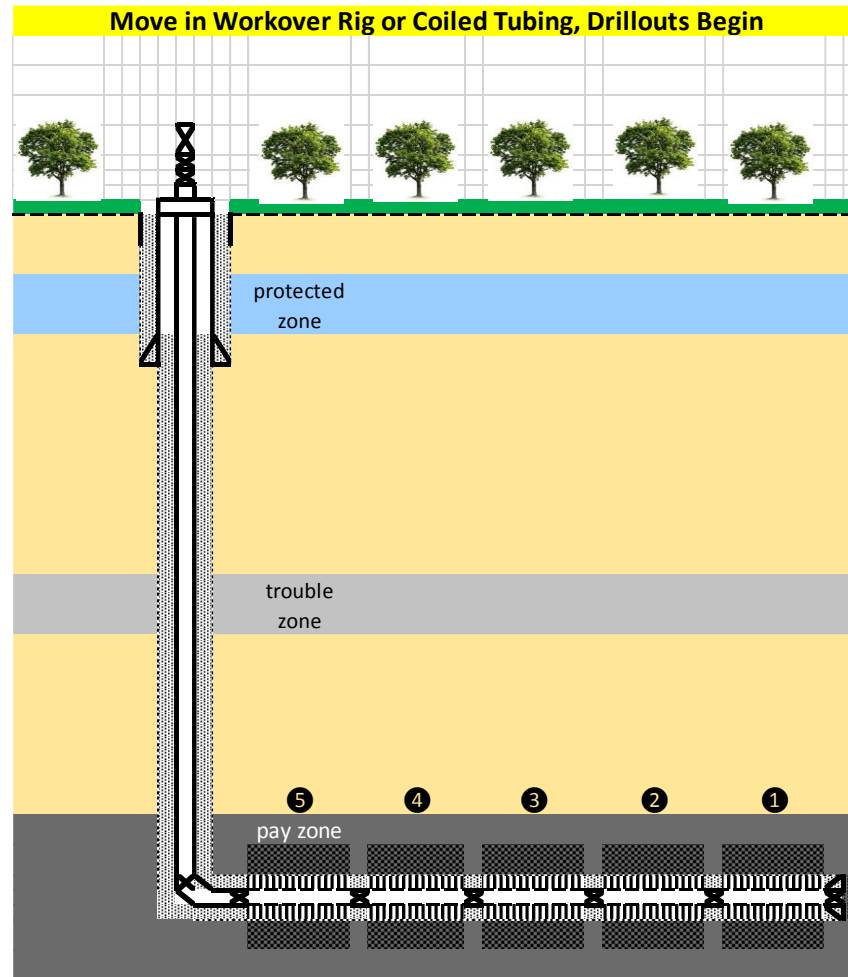
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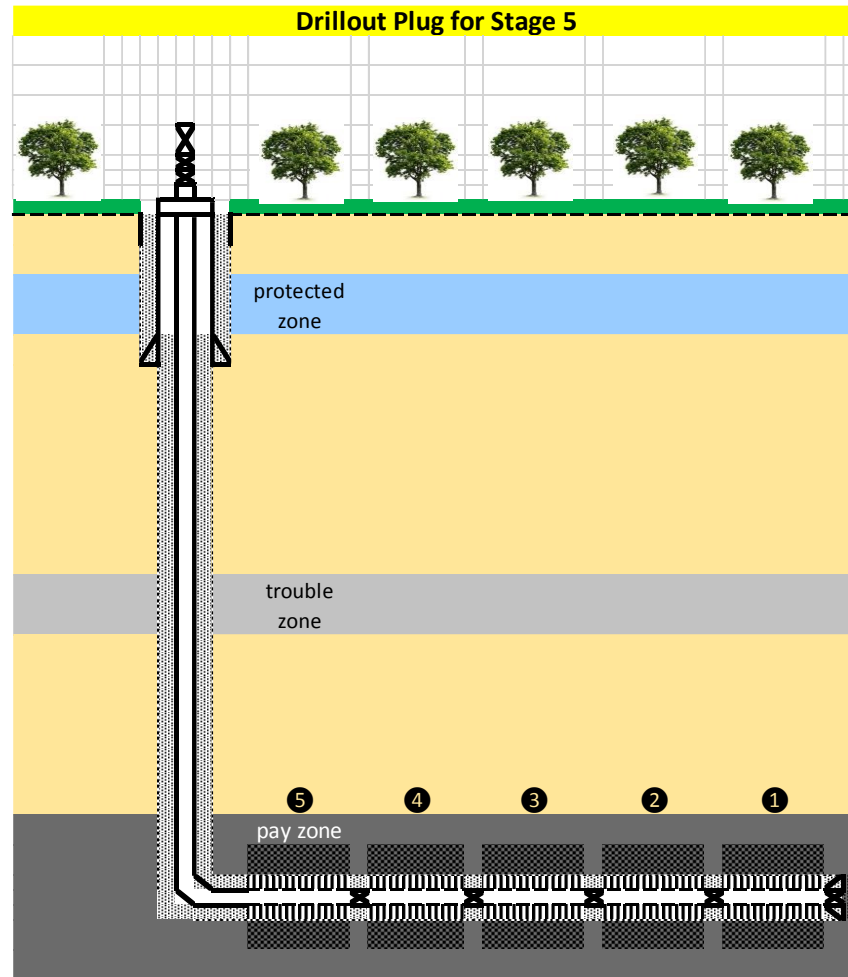
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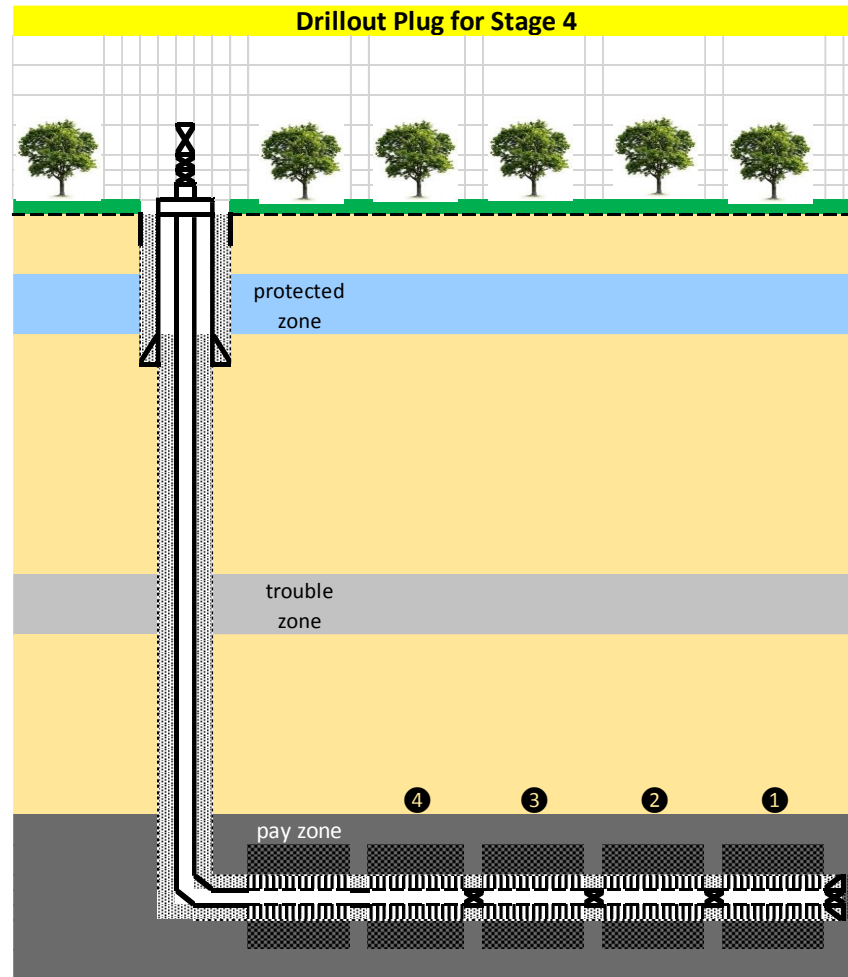
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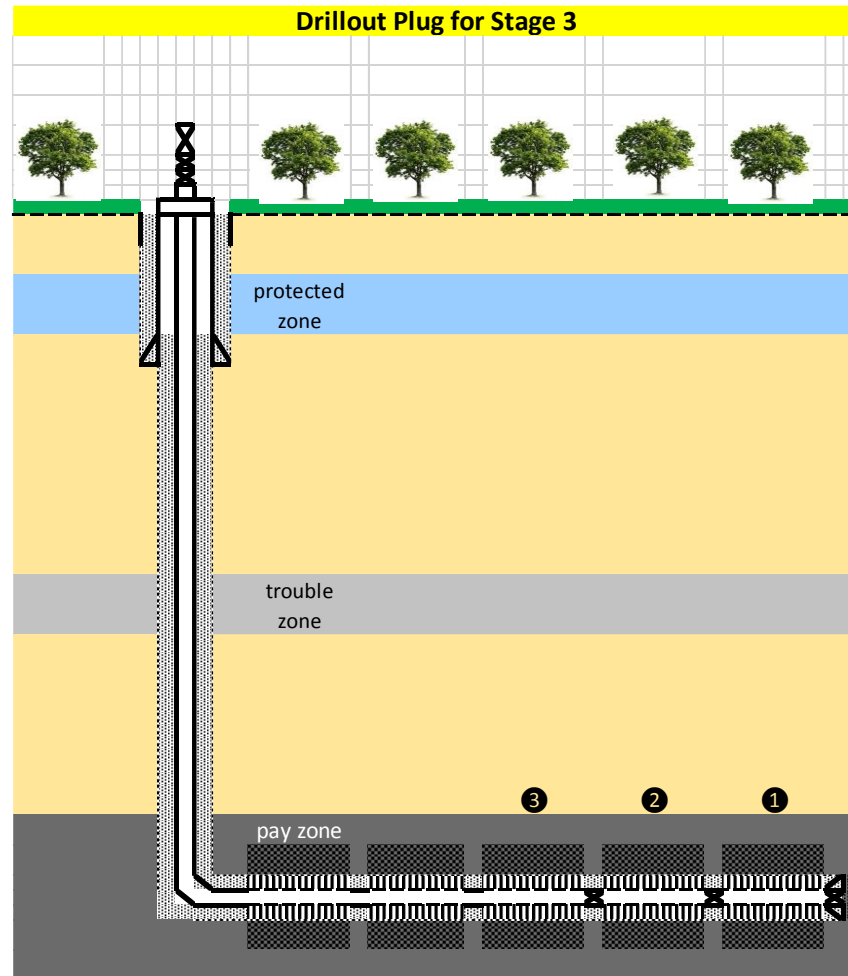
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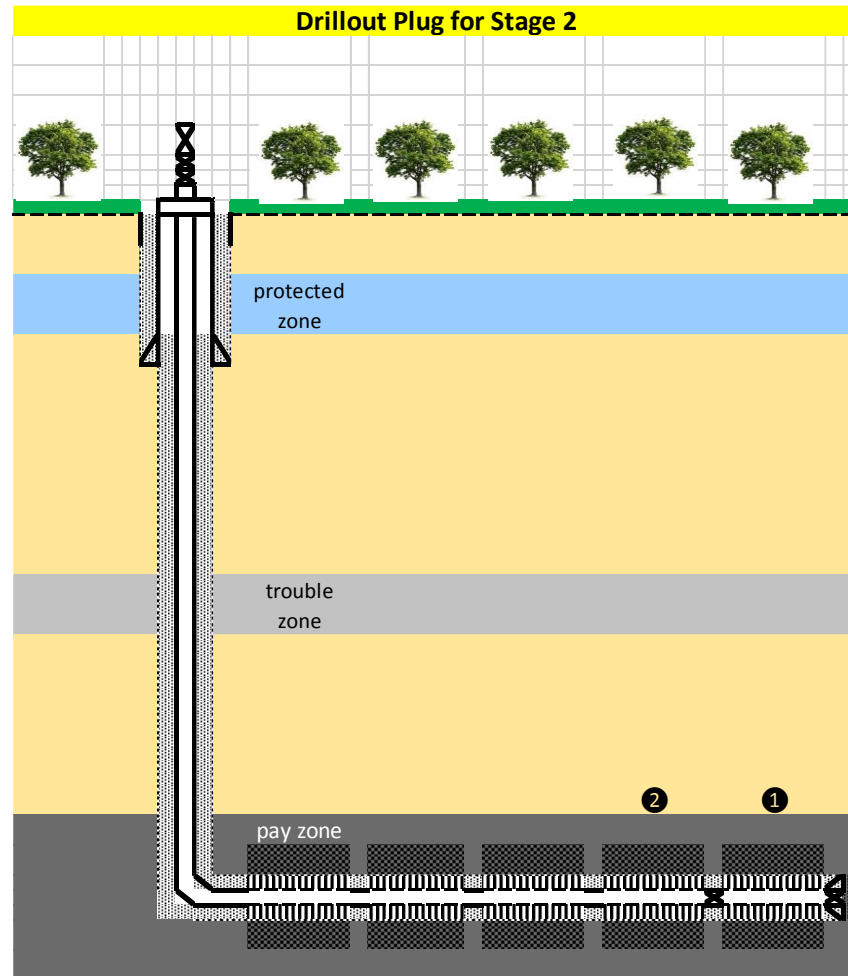
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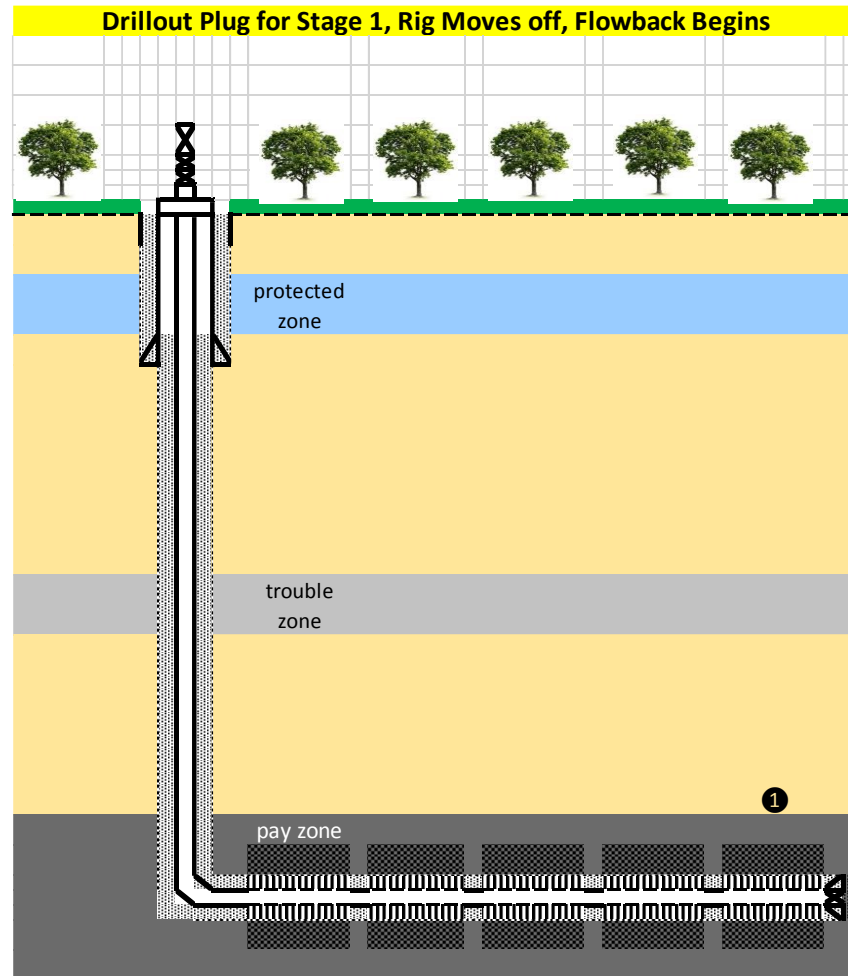
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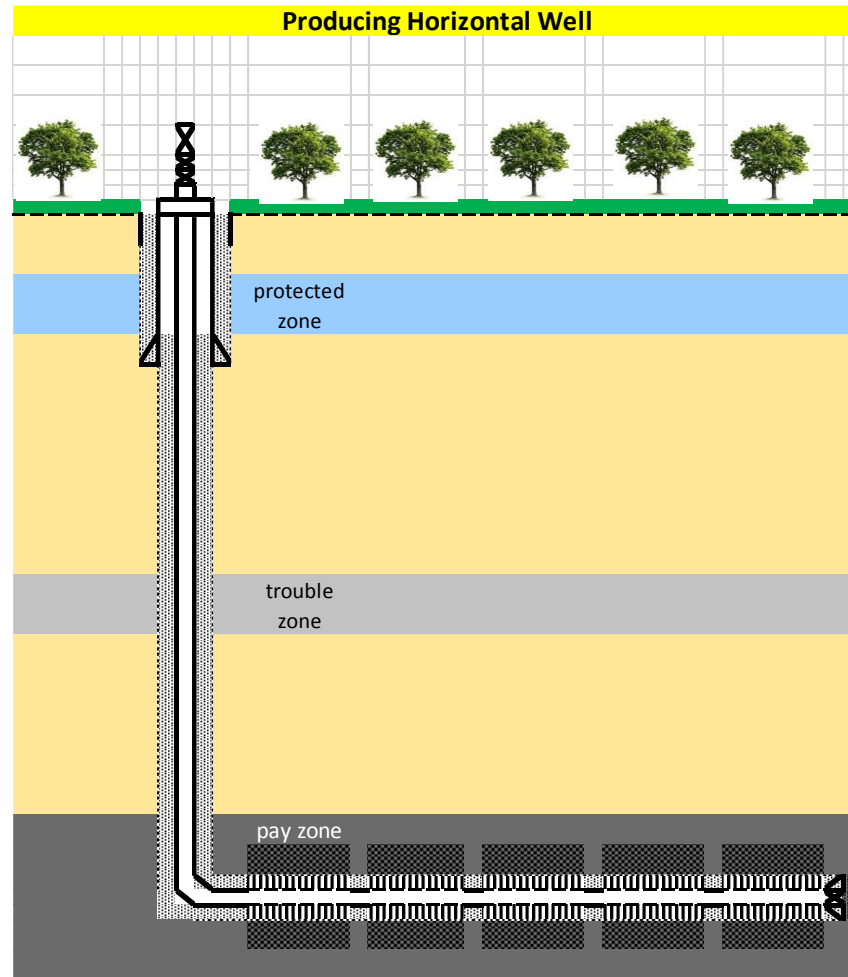
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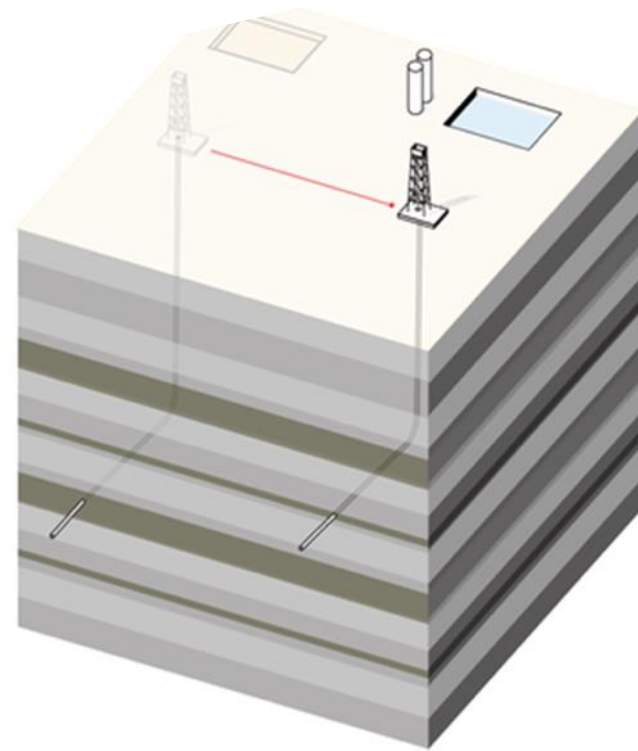
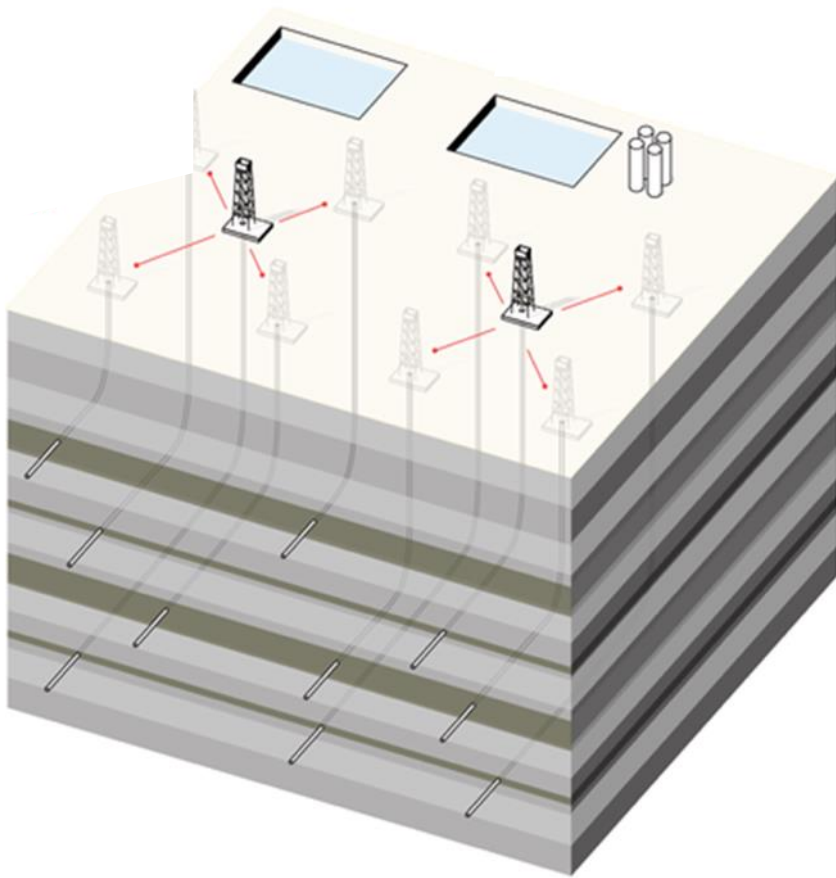
Unconventional Completions



Unconventional Completions



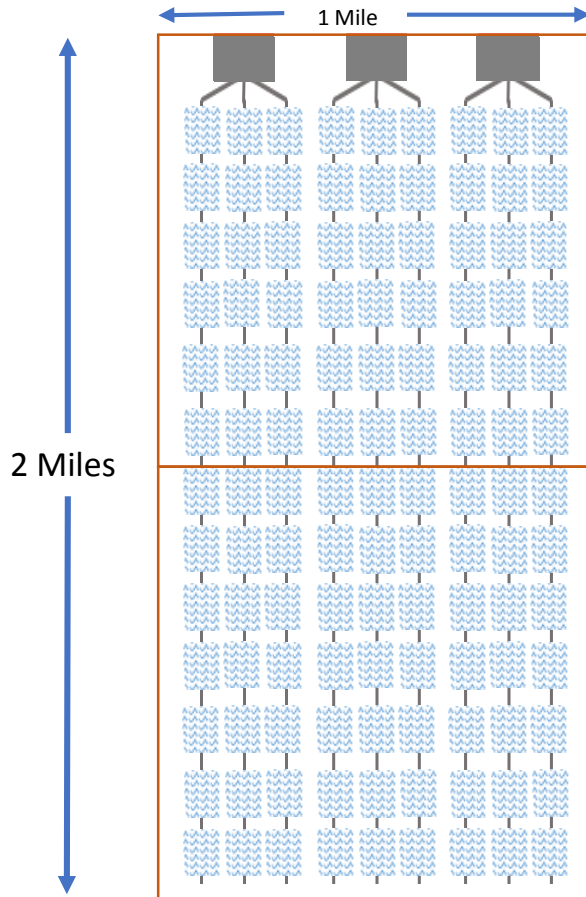
Unconventional Completion Strategies



Sources: Encana, Bloomberg research

Bloomberg

Unconventional Completion Strategy: 1 spread

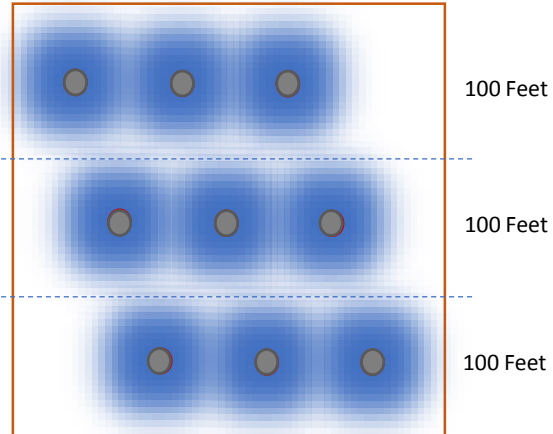


Water per 10,000' lateral		
given	calc'ed	calc'ed
gal / ft	bbl / ft	bbls/10,000'
1,900	45.24	452,381

Water per 3 well drilling pad		
given	calc'ed	calc'ed
laterals/pad	bbl / ft	bbls
3	45.24	1,357,143

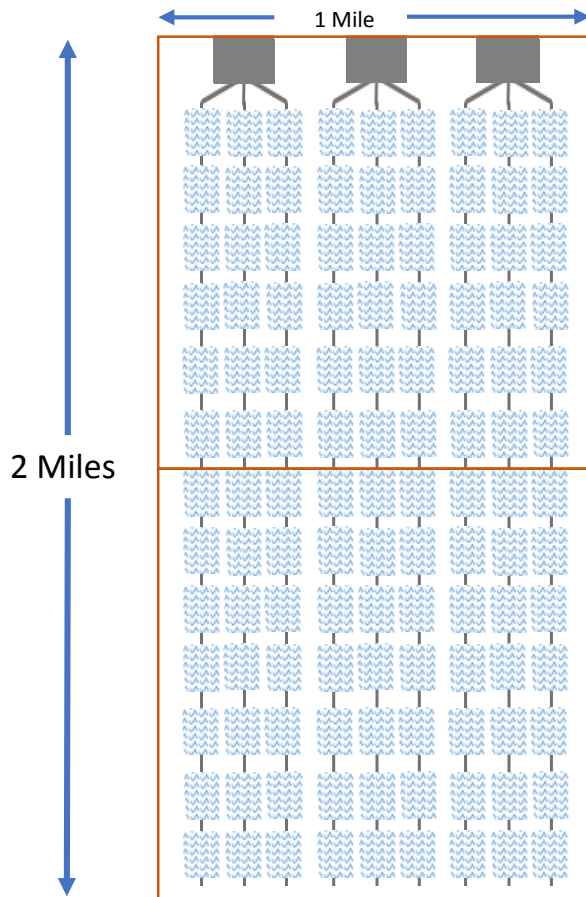
Water per 3 pad DSU		
given	calc'ed	calc'ed
pads/DSU	bbl / ft	bbls
3	45.24	4,071,429

1 Mile



4 mm bbls needed over an ~ 9-week period

Unconventional Completion Strategy: 2 spreads

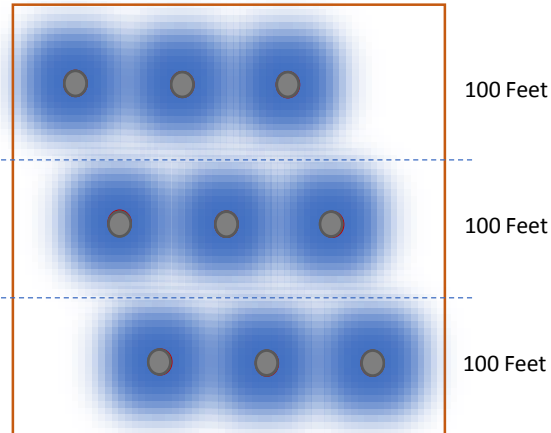


Water per 10,000' lateral		
given	calc'ed	calc'ed
gal / ft	bbl / ft	bbls/10,000'
1,900	45.24	452,381

Water per 3 well drilling pad		
given	calc'ed	calc'ed
laterals/pad	bbl / ft	bbls
3	45.24	1,357,143

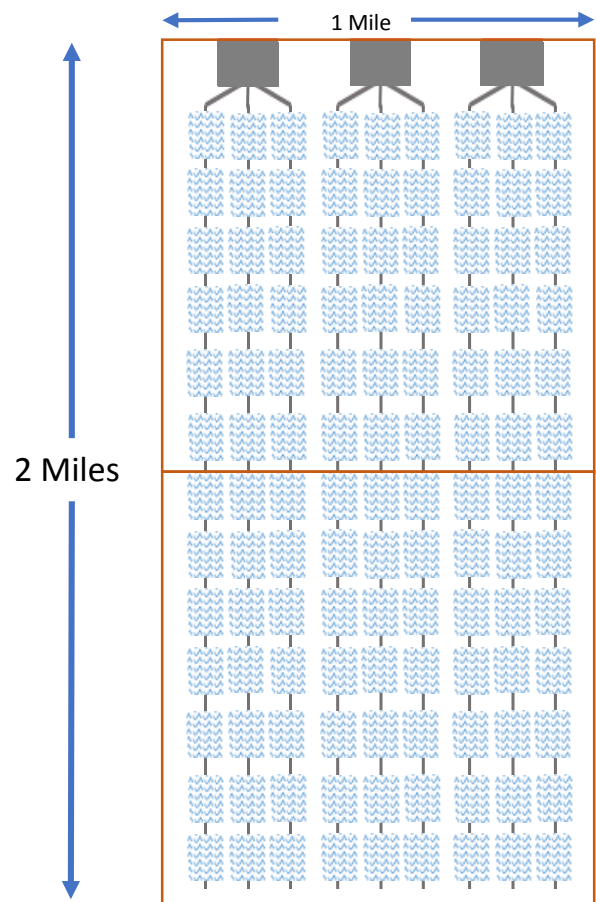
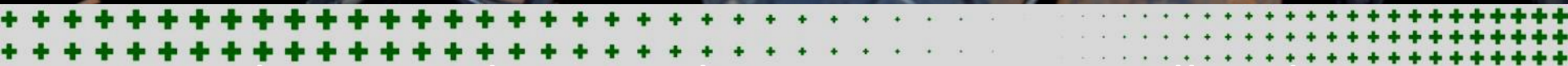
Water per 3 pad DSU		
given	calc'ed	calc'ed
pads/DSU	bbl / ft	bbls
3	45.24	4,071,429

1 Mile



4 mm bbls
needed over
an ~ 6 week
period

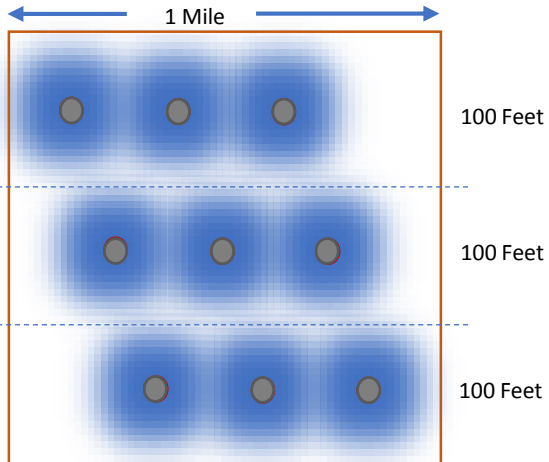
Unconventional Completion Strategy: 3 spreads



Water per 10,000' lateral		
given	calc'ed	calc'ed
gal / ft	bbbl / ft	bbbls/10,000'
1,900	45.24	452,381

Water per 3 well drilling pad		
given	calc'ed	calc'ed
laterals/pad	bbbl / ft	bbbls
3	45.24	1,357,143

Water per 3 pad DSU		
given	calc'ed	calc'ed
pads/DSU	bbbl / ft	bbbls
3	45.24	4,071,429



4 mm bbbls needed over an ~ 3-week period

Drilling and Completions Changes from Conventional to Unconventional Developments – Part One

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