




Castle Pines North Metropolitan District Directional Water Well

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Discussion Topics

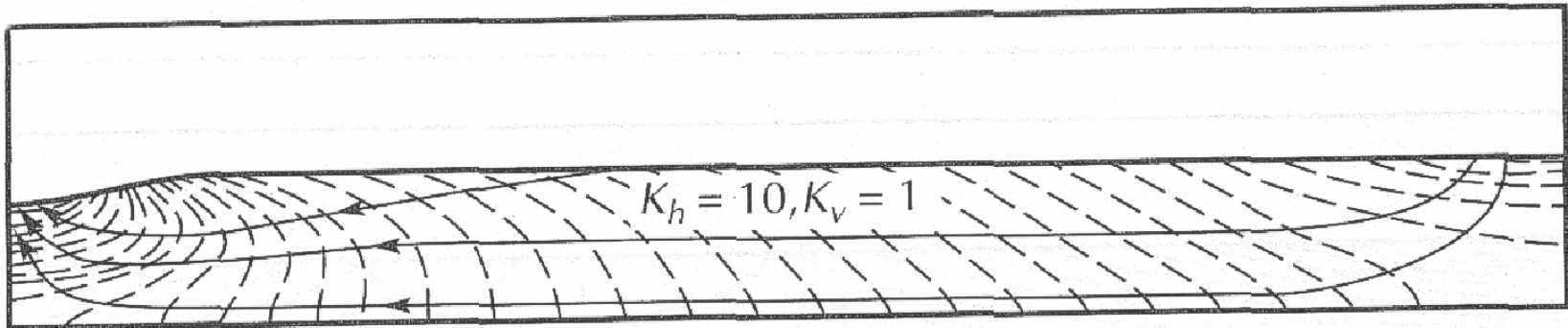
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- Why directional wells
 - Hydrogeology
 - Previous directional well work
 - Well Design
 - Permitting
 - Methodology
 - Drilling
 - Completion



Why Directional Well?

- Proven oil field technology
- Initial analysis indicates up to 4 times the production capability
- Sustainability
- Takes advantage of more of the available saturated thickness

Flow in an Anisotropic Aquifer



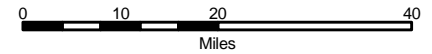
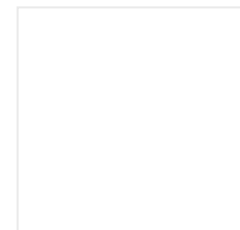
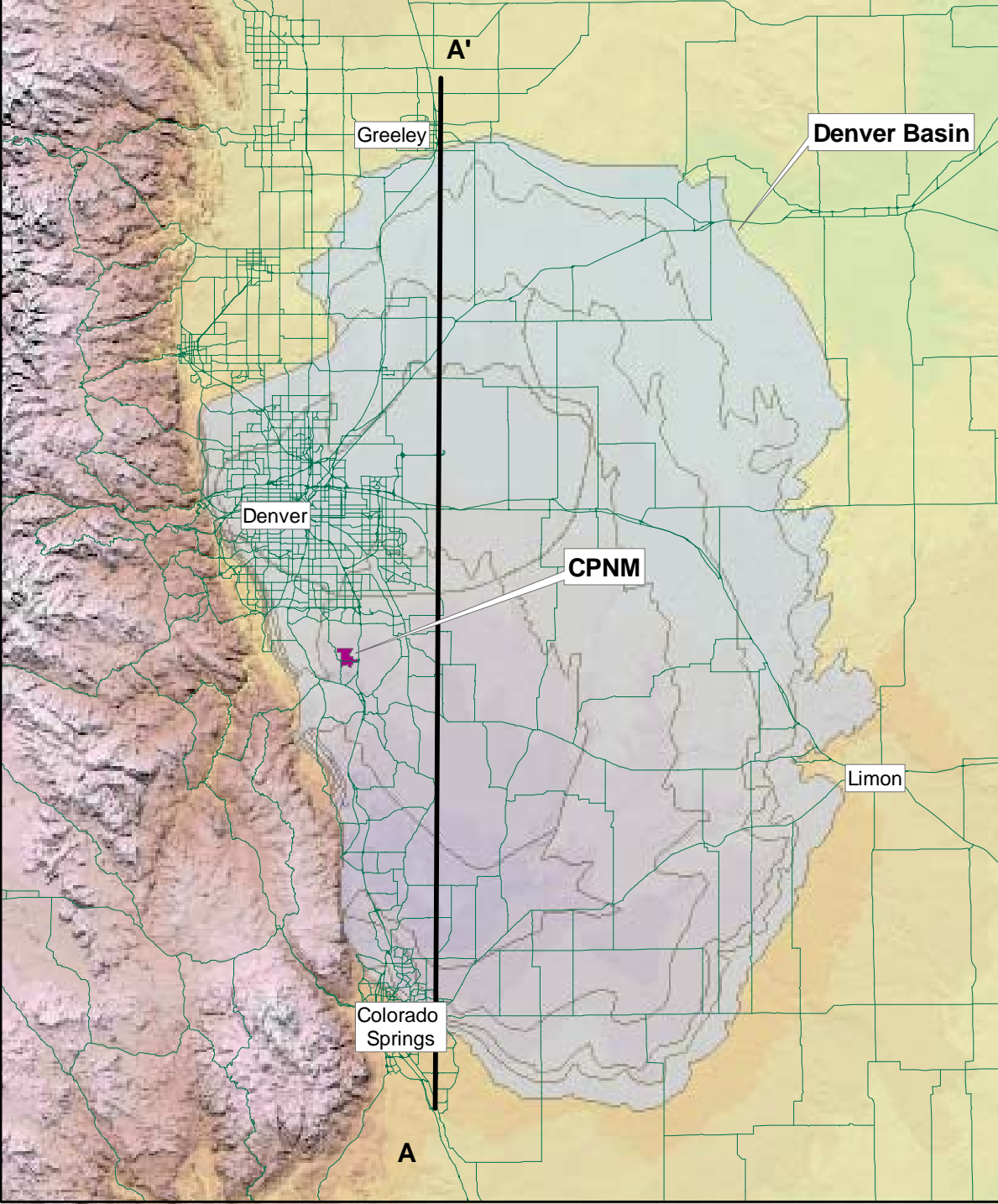
- Flow lines do not cross equipotential lines at right angles
- Estimated that the horizontal conductivity can be up to 10 times that of vertical
- May also be related to depositional direction



Hydrogeology

- Sand occurs in horizontal lenses and usually not continuous
- Depositional Environment

Castle Pines North Metro District Location Within the Denver Basin

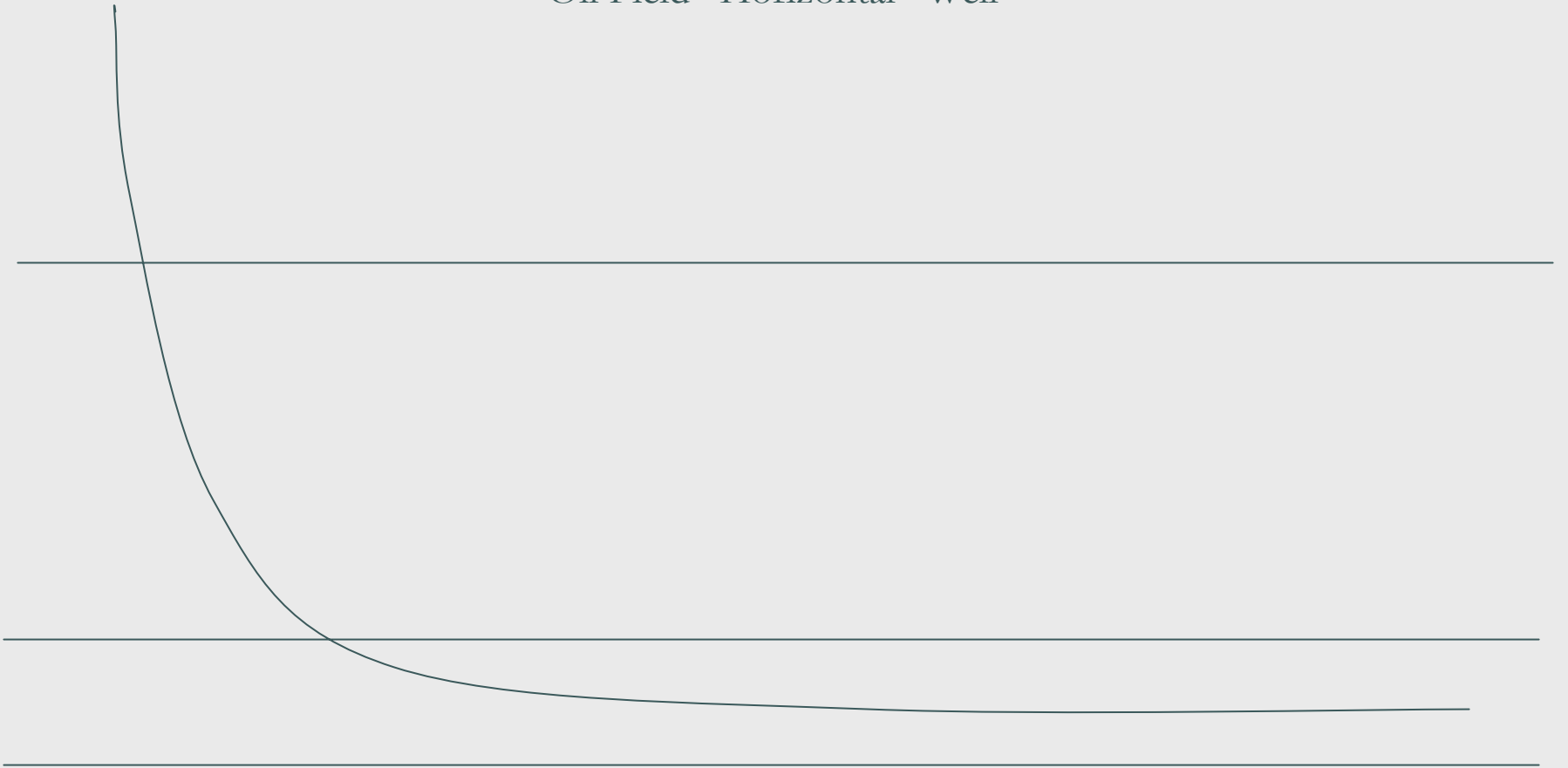


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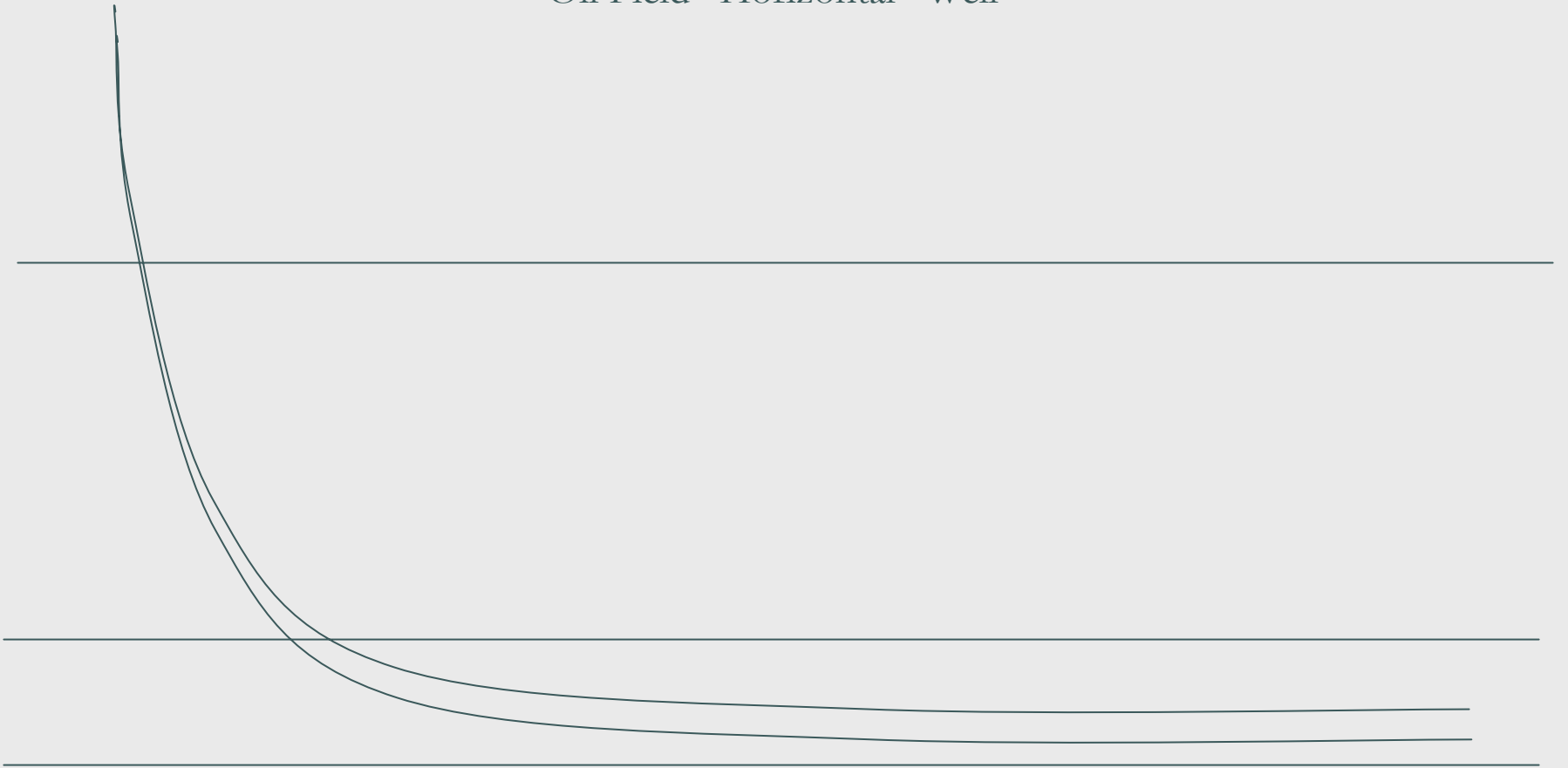


Project No. 125.1
Date: December 15, 2003

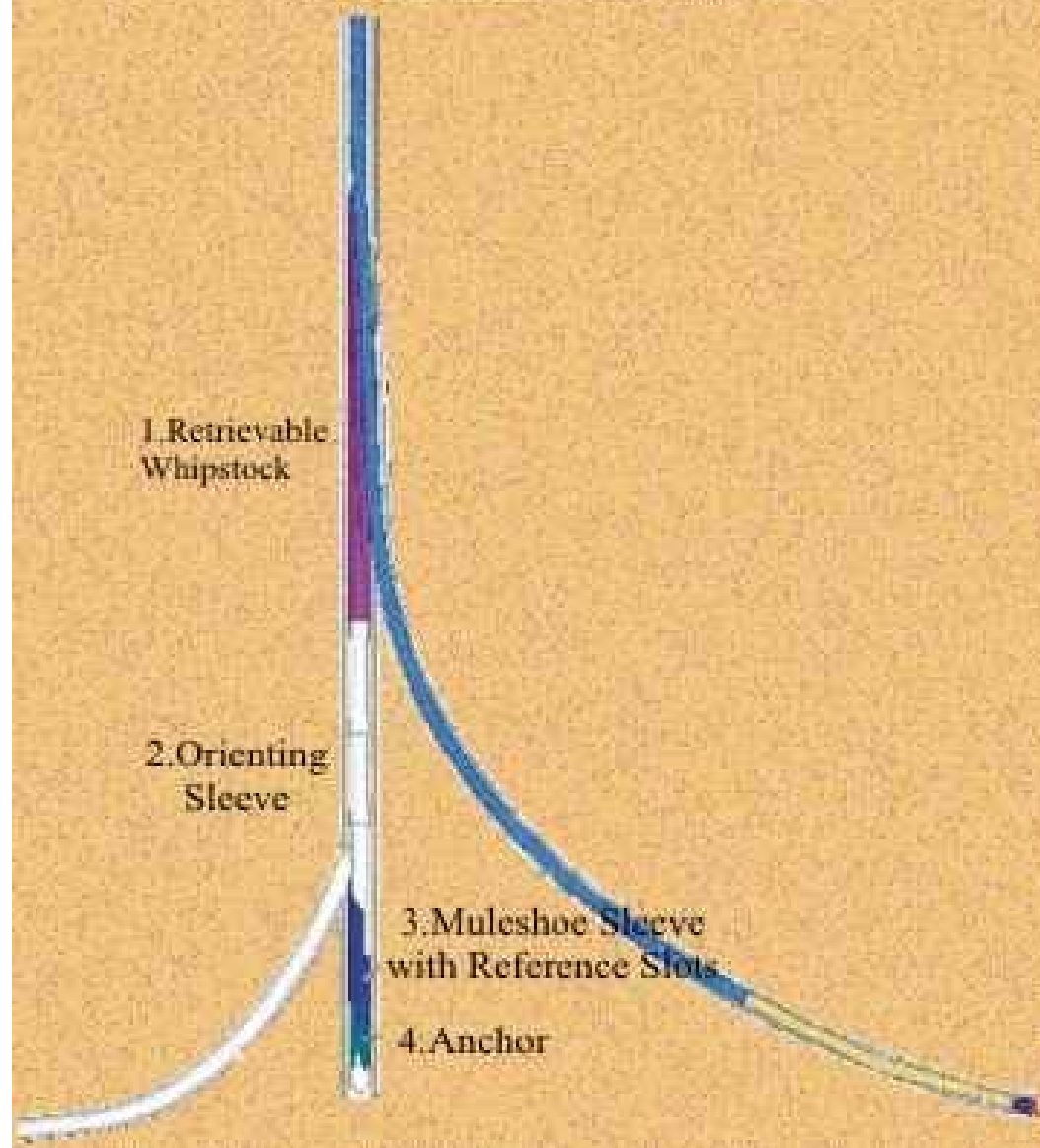
Oil Field “Horizontal” Well



Oil Field “Horizontal” Well



Multilateral Well





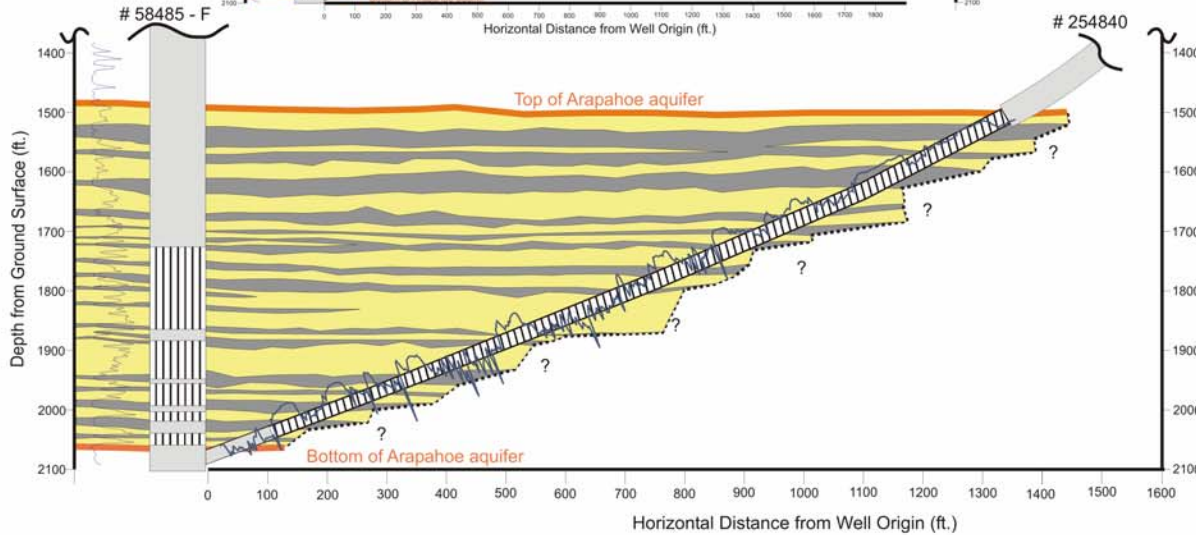
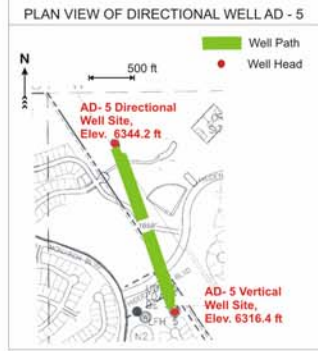
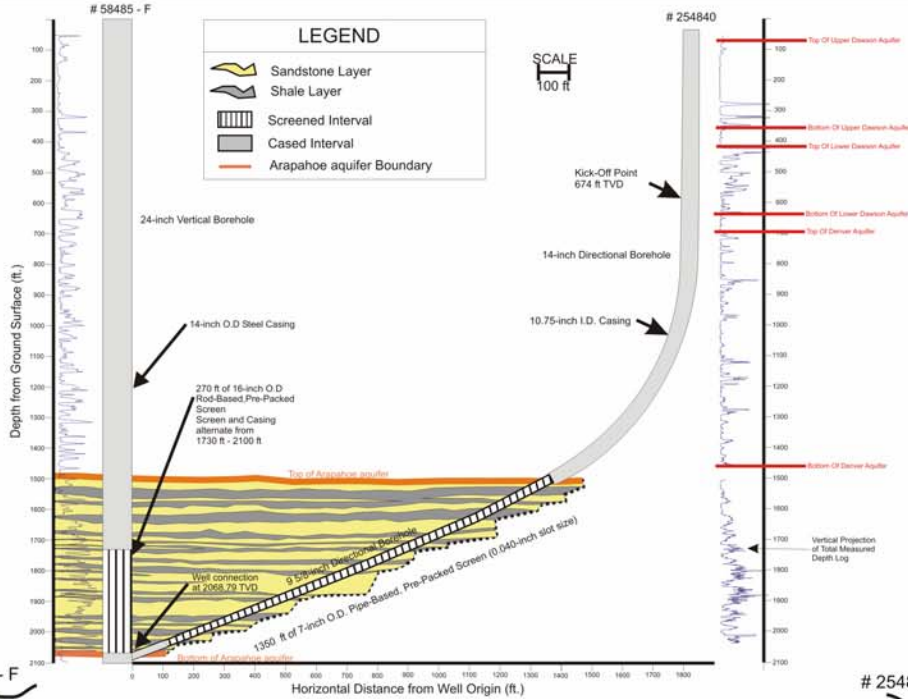
sperry-sun
DRILLING SERVICES

HALLIBURTON

JH₂O



Note: Well Diameters Not to Scale



Castle Pines North Metro District Directional Well - AD-5
Lithologic Cross-section showing well path and screen placement

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Job No. 125.116

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Previous Directional Water Wells

- Environmental Industry
- Shallow Gallery Type Wells
- Antelope Hills – Town of Bennett