

# TARGET DRILLING

**TODAY'S DIRECTIONAL DRILLING**

PRECISION DRILLING FOR YOUR SUCCESS

# Core Capabilities

Underground  
Directional  
Drilling

Surface  
Directional  
Drilling

Precision  
Utility  
Boring

**Target Drilling**

Equipment  
Design &  
Development

Technology  
And  
Innovation

International  
Operations

# Core Capabilities

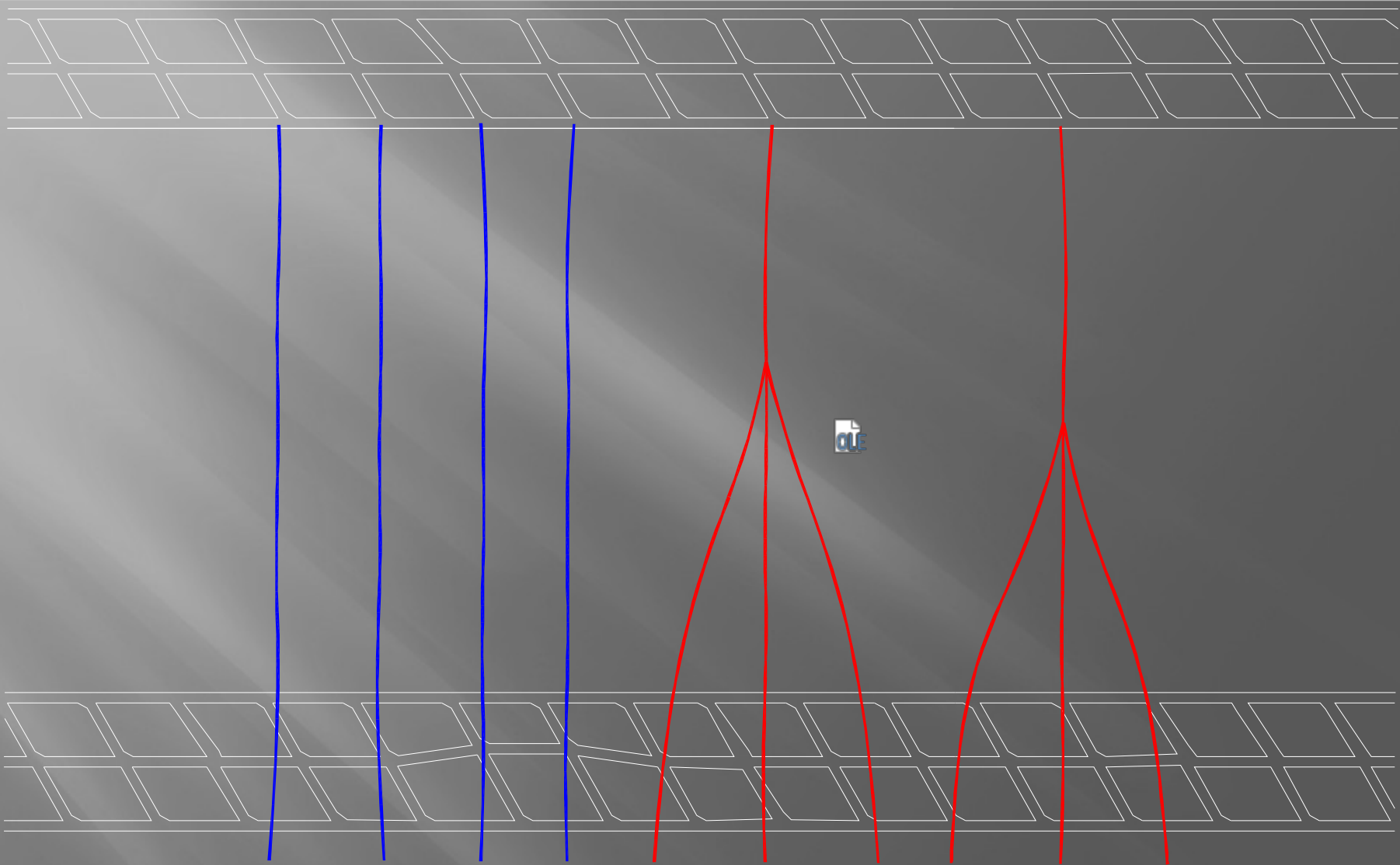
- ▶ Target Drilling originally started over 20 years.
- ▶ Only service company to provide ***both underground and surface directional drilling capabilities***
- ▶ To date we have drilled over ***6.5 million feet of precision underground boreholes***
- ▶ ***204 underground boreholes drilled with lengths over 4,000 feet (more than the rest of the world combined)***
- ▶ ***Longest underground precision borehole in the US – 5,560 feet***
- ▶ ***Design and fabricate underground and surface rigs; and borehole navigation equipment***
- ▶ Surface directional drilling capable of horizontal Marcellus Shale wells (10,000 feet vertical with 5,000 foot laterals)
- ▶ Most experienced and efficient directional driller in the industry

# “Today’s Directional Drilling”

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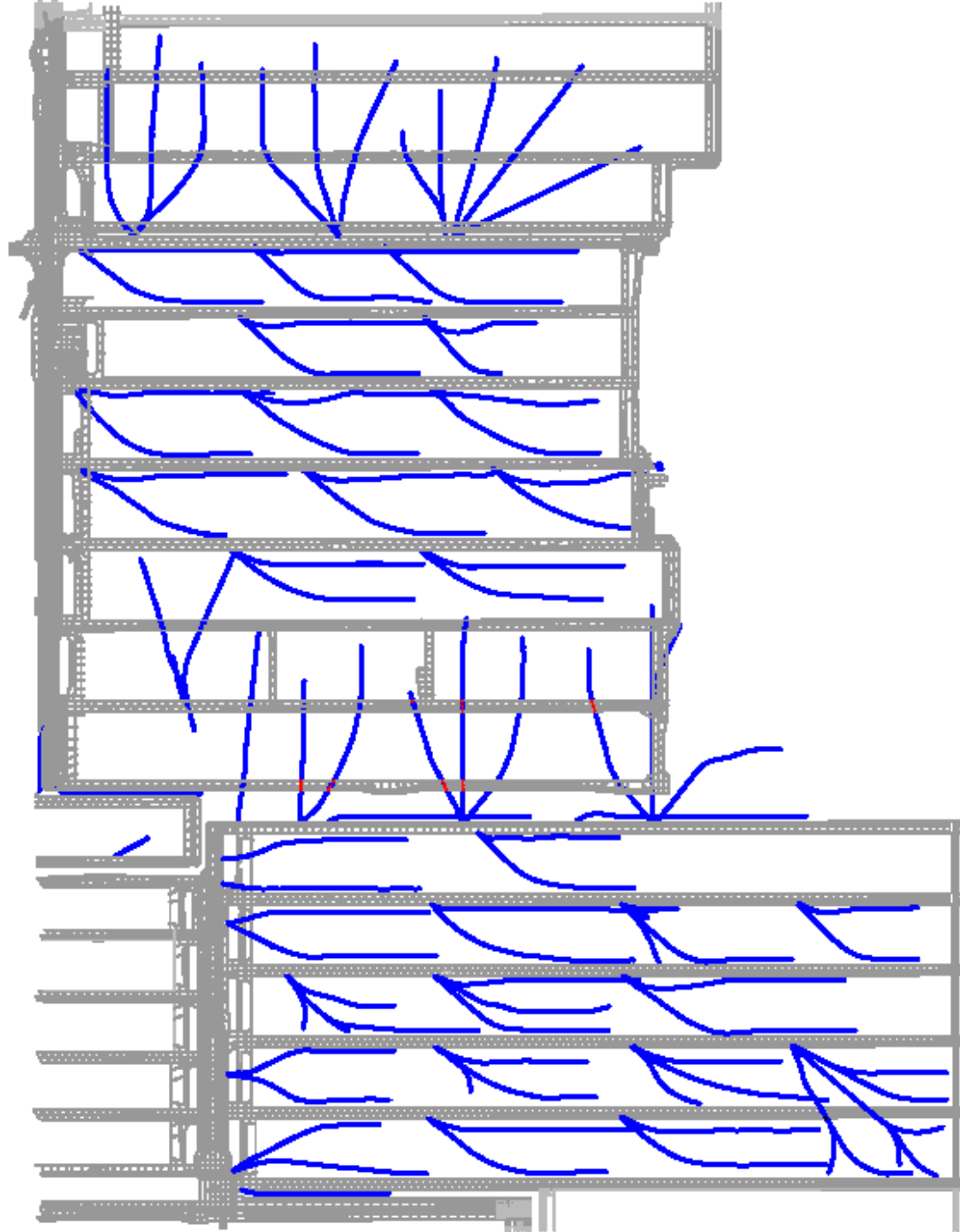
- ***Comprehensive Longwall Degasification*** – degassing coal being longwall mined and adjacent coalbeds via surface and in-mine horizontal drainage
- Advanced applications of taking directional drilling to ***“NEW EXTREMES”***
- ***Evolving Directional Drilling Equipment to Enhance Longwall Mining Safety and Efficiency***





**Comprehensive  
Longwall  
Degasification  
– Coal Being  
Longwall Min**

**IN-MINE CM  
SHIELDING  
BOREHOLE**



**DIETER  
REHOLES  
"GER" LIFE**

**HORIZONTAL  
SIFICATION**

**DIETER  
REHOLES**

**Advantages – Reduces CH<sub>4</sub> Concentration at Face to < 1%; Eliminates CH<sub>4</sub> Caused Mining Delays**

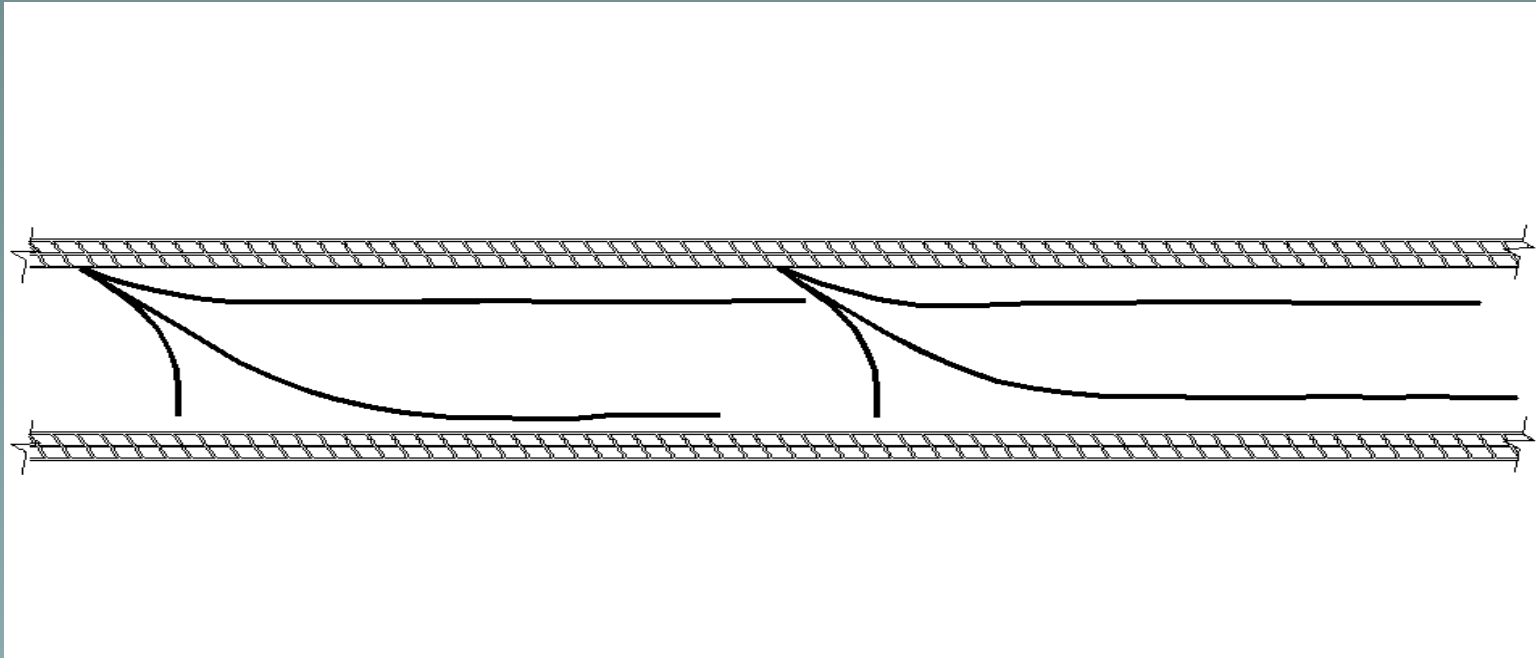
### **In-Mine Borehole Shields LW CM Development**



***TD's IN-MINE LONG BOREHOLES WERE CRITICAL IN INCREASING LW PANEL DIMENSIONS > 1,000' FACE WIDTH AND > 10,000' LENGTH; USING 3-ENTRY GATEROAD DEVELOPMENT.***

**NORTH AMERICAN RECORD  
IN-MINE BOREHOLE AT CUMBERLAND MINE**

# *Longholes Parallel to Return and Belt Entries*



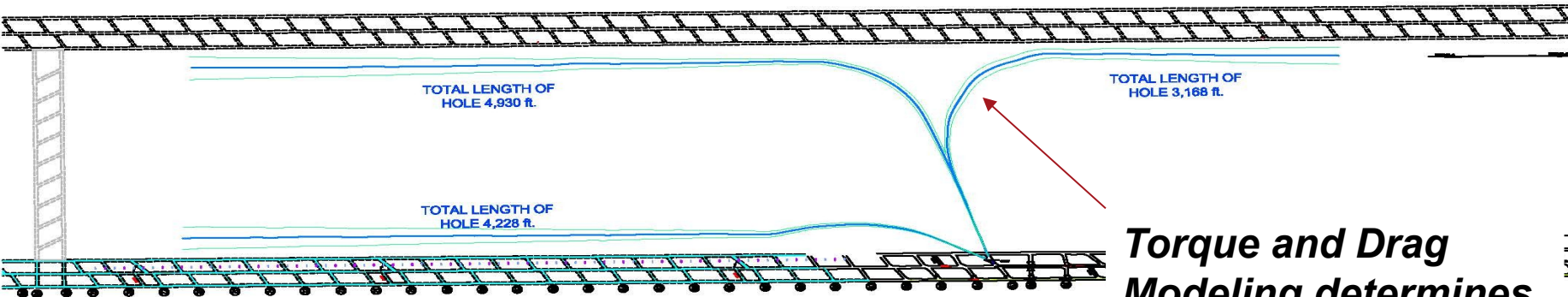
**Drill Across Longwall Panel Increases Degas Time**

**Release Free Gas for Up to 18 Months**

**Drill Branches for Continuous Coverage**

# In-Mine Horizontal Degasification “Extreme Curvature”

Three in-mine horizontal degasification boreholes drilled from the same location to decrease cost applying extreme borehole curvature



*Torque and Drag Modeling determines feasibility of (117°) wellbore curvature before drilling begins*

14111

# In-Mine Horizontal Degas Boreholes



## Benefits

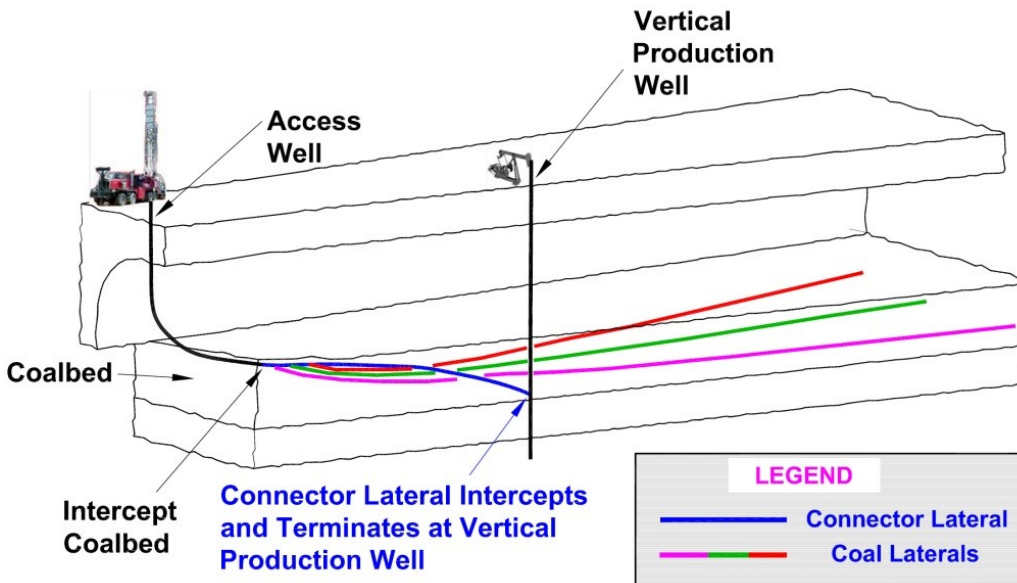
- ▶ Mine specific, patterns can be developed to fit any mine plan to minimize mining impact
- ▶ “Shielding Boreholes” Provide Immediate Degas Benefit
- ▶ Needs little to no surface rights to implement

## Disadvantages

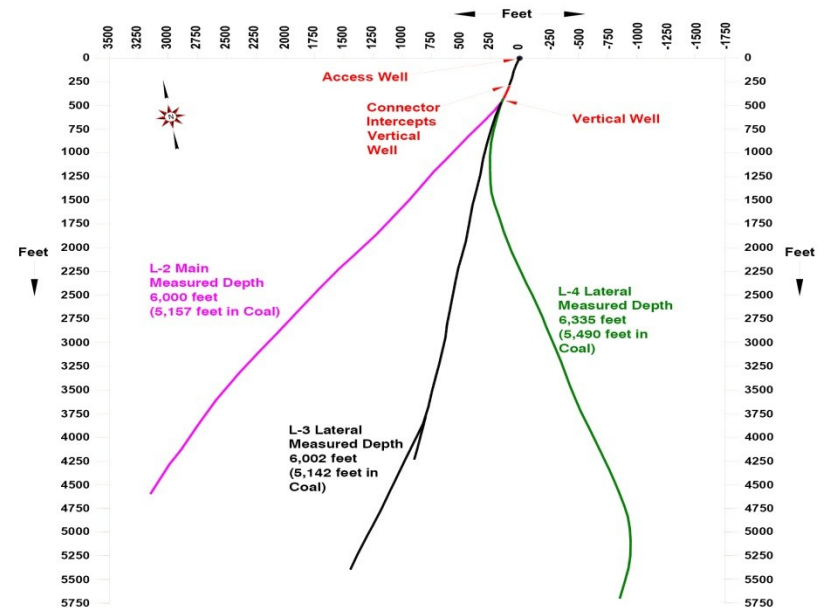
- ▶ Short well expectancy life if Shielding Boreholes
- ▶ Minimal degasification area per well
- ▶ Interference to Mining Operations

# TD's Surface CBM Wells Degasify Longwall

- Cased curve isolates water From other formations
- Reduces Torque and Drag To Drill Laterals >5,000'
- Only Connector Intercepts Vertical Well – Enhanced UBD

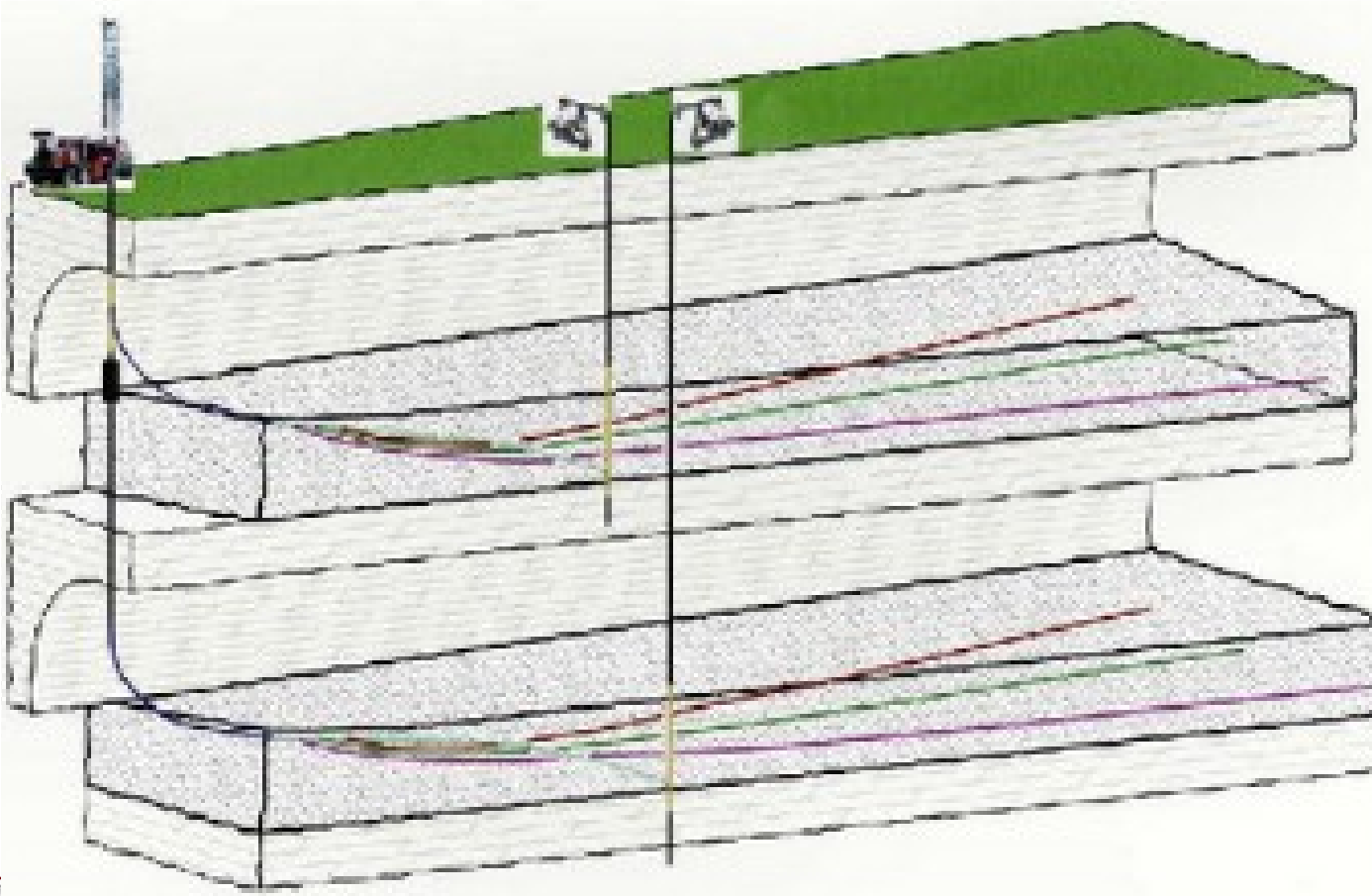


TD Patented CBM Dual Well UBD Technique



# TD's CBM Wells Comprehensively Degas LW

*2 Distinctly Different TD CBM Wells But Drilled from Same Pad*



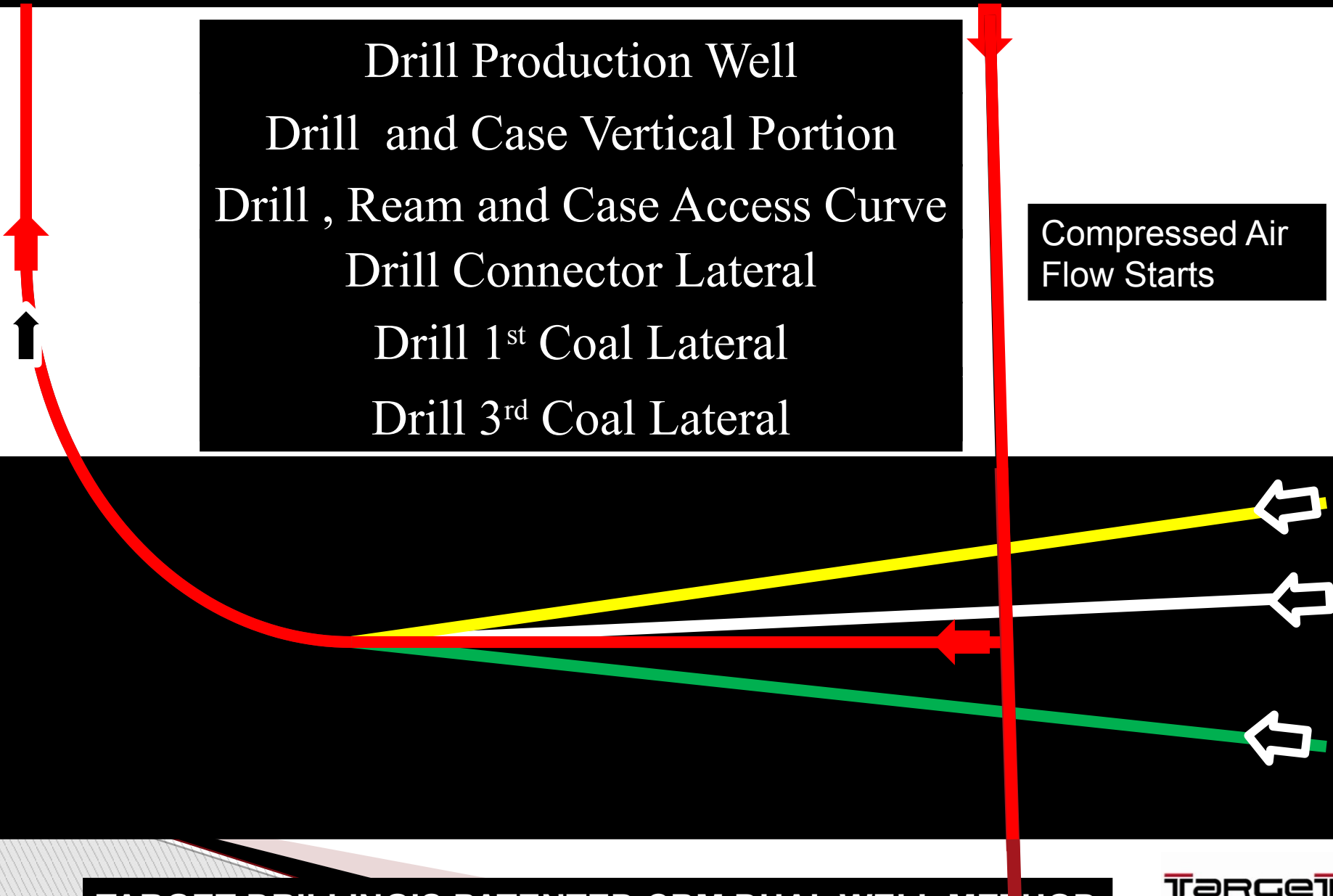
**“Upper” Coalbed -  
Primary Source of  
Longwall Gob Gas**

***Coalbed Being  
Mined By Longwall***



Drill Production Well  
Drill and Case Vertical Portion  
Drill, Ream and Case Access Curve  
Drill Connector Lateral  
Drill 1<sup>st</sup> Coal Lateral  
Drill 3<sup>rd</sup> Coal Lateral

Compressed Air  
Flow Starts



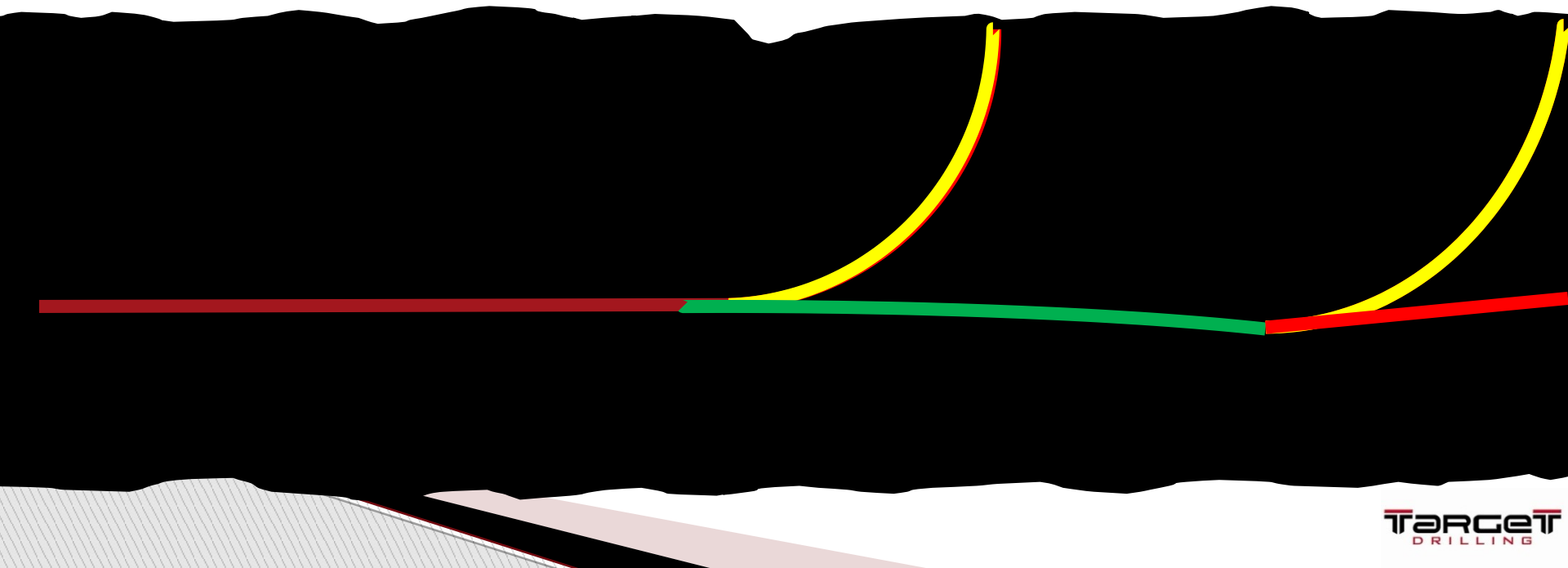
Drill Coal Laterals Entirely In Coal

Steer to Intercept Roof Every 300ft

Pull Drill String Back Into Coal to Sidetrack

Sidetrack and Continue Drilling In Coal

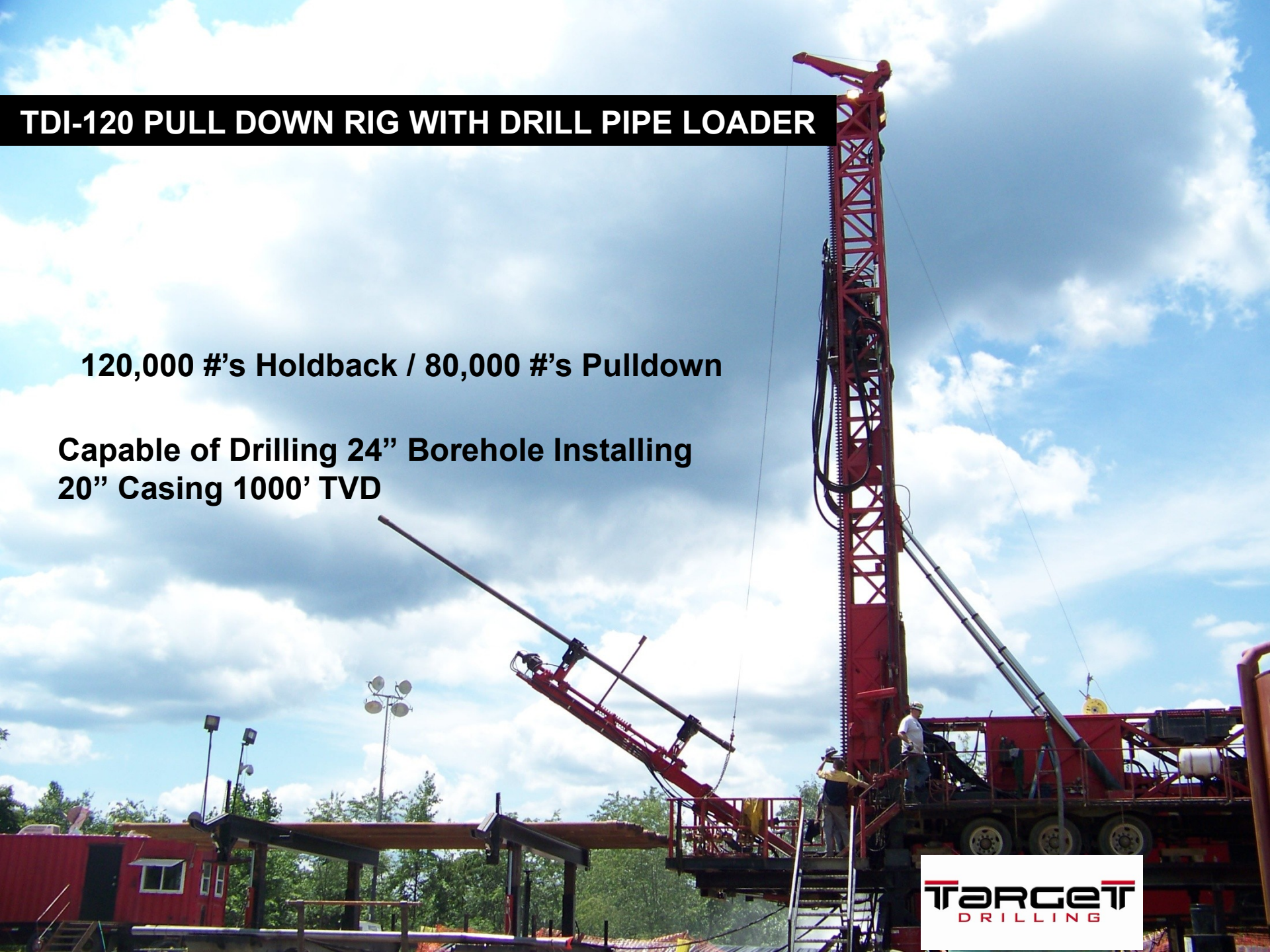
Drill Coal and Steer to Intercept Roof in ~300ft and Sidetrack



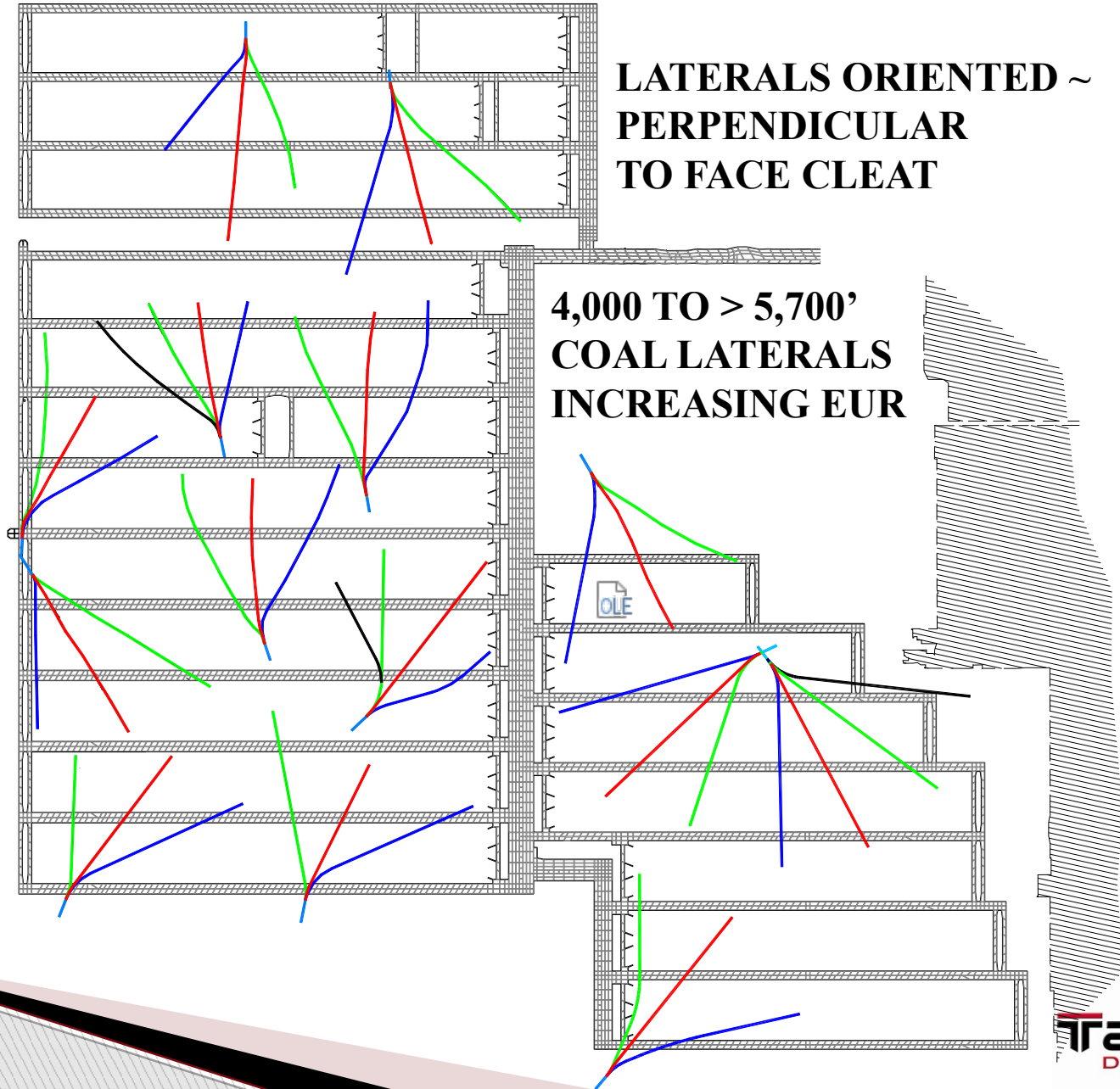
# TDI-120 PULL DOWN RIG WITH DRILL PIPE LOADER

**120,000 #'s Holdback / 80,000 #'s Pulldown**

**Capable of Drilling 24" Borehole Installing  
20" Casing 1000' TVD**

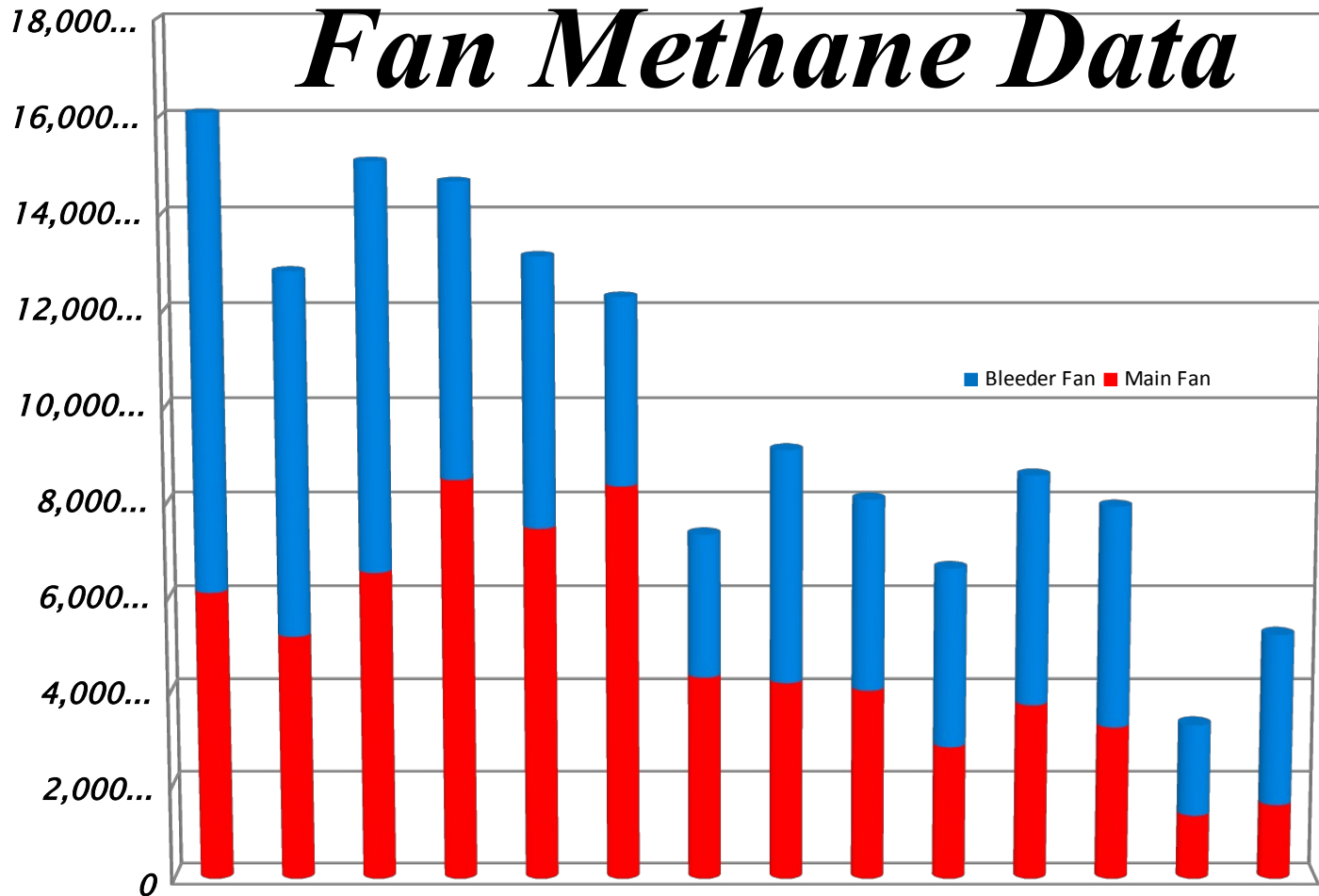


# TD CBM WELLS DRILLED WITH AVERAGE 587 ACRES / WELL





# *Fan Methane Data*



# Surface CBM Horizontal Wells



## Advantages

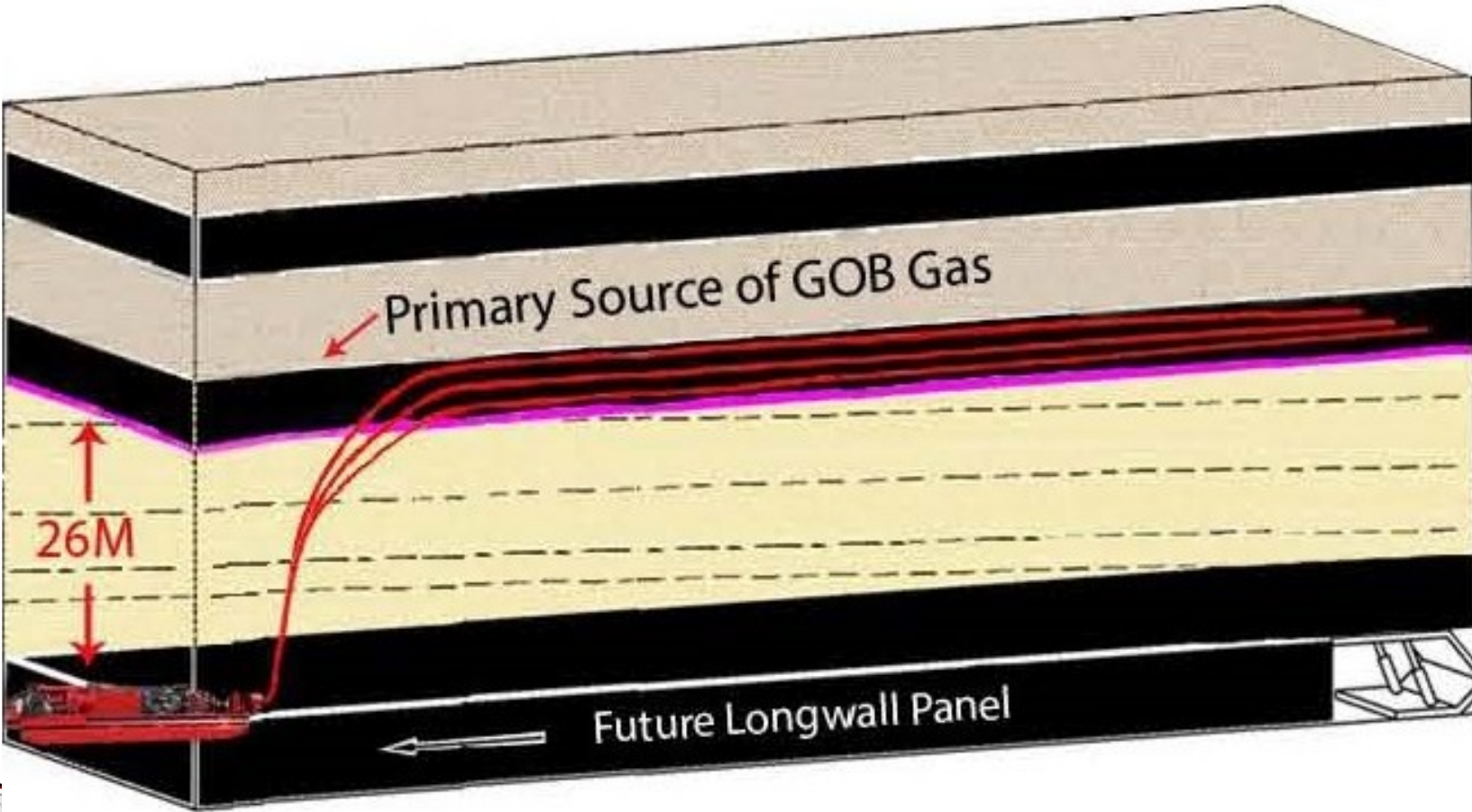
- ▶ Long-Term Degasification Potential Years in Advance of Mining
- ▶ Drilling Horizontal CBM Wells DOES NOT Interfere With Daily Mining Operations
- ▶ Return on Investment if Selling the CBM

## Disadvantages

- ▶ Need to Obtain CBM Lease
- ▶ Need to Obtain Surface Access from Surface Owners
- ▶ Surface Topography and Environment Not Always Feasible
- ▶ Costs of CBM Wells and Infrastructure Require A Greater Upfront Investment

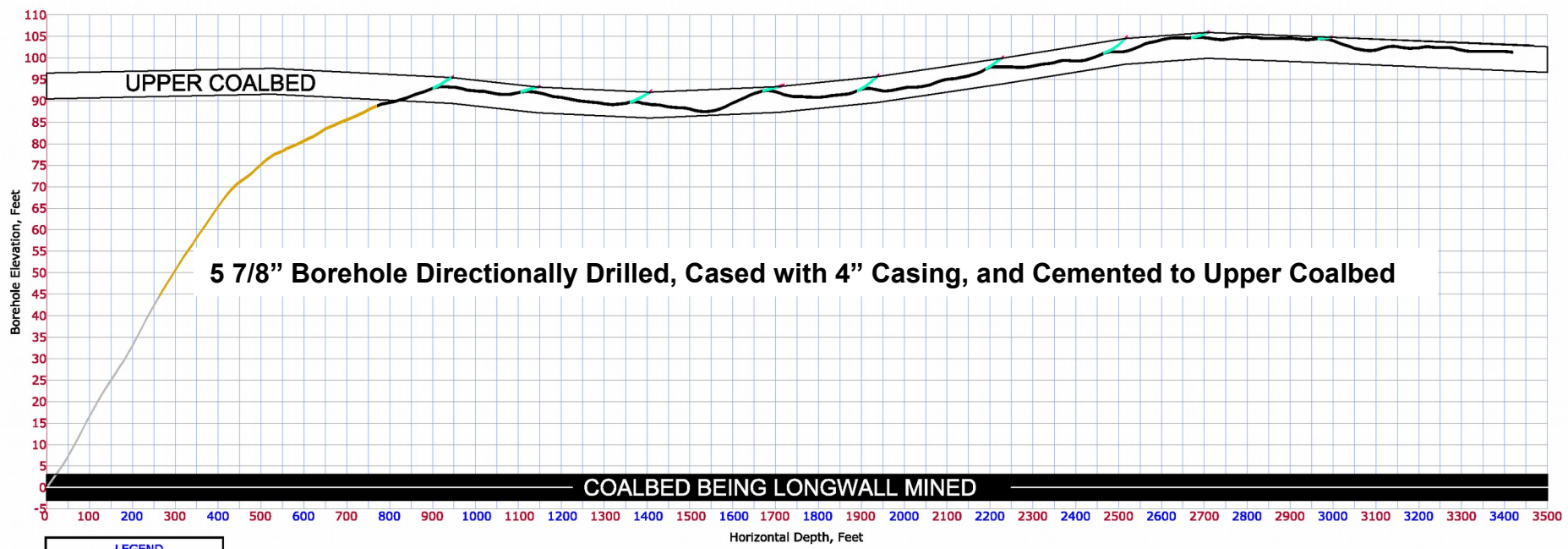
# Degasifying “Upper Coal” When Can’t From Surface

Advance In-Mine Degasification of Coal Seam Above Future Longwall



# In-Mine Degasification of Upper Coal In Advance of Longwall

## In-Mine Horizontal Degasification of Upper Coalbed



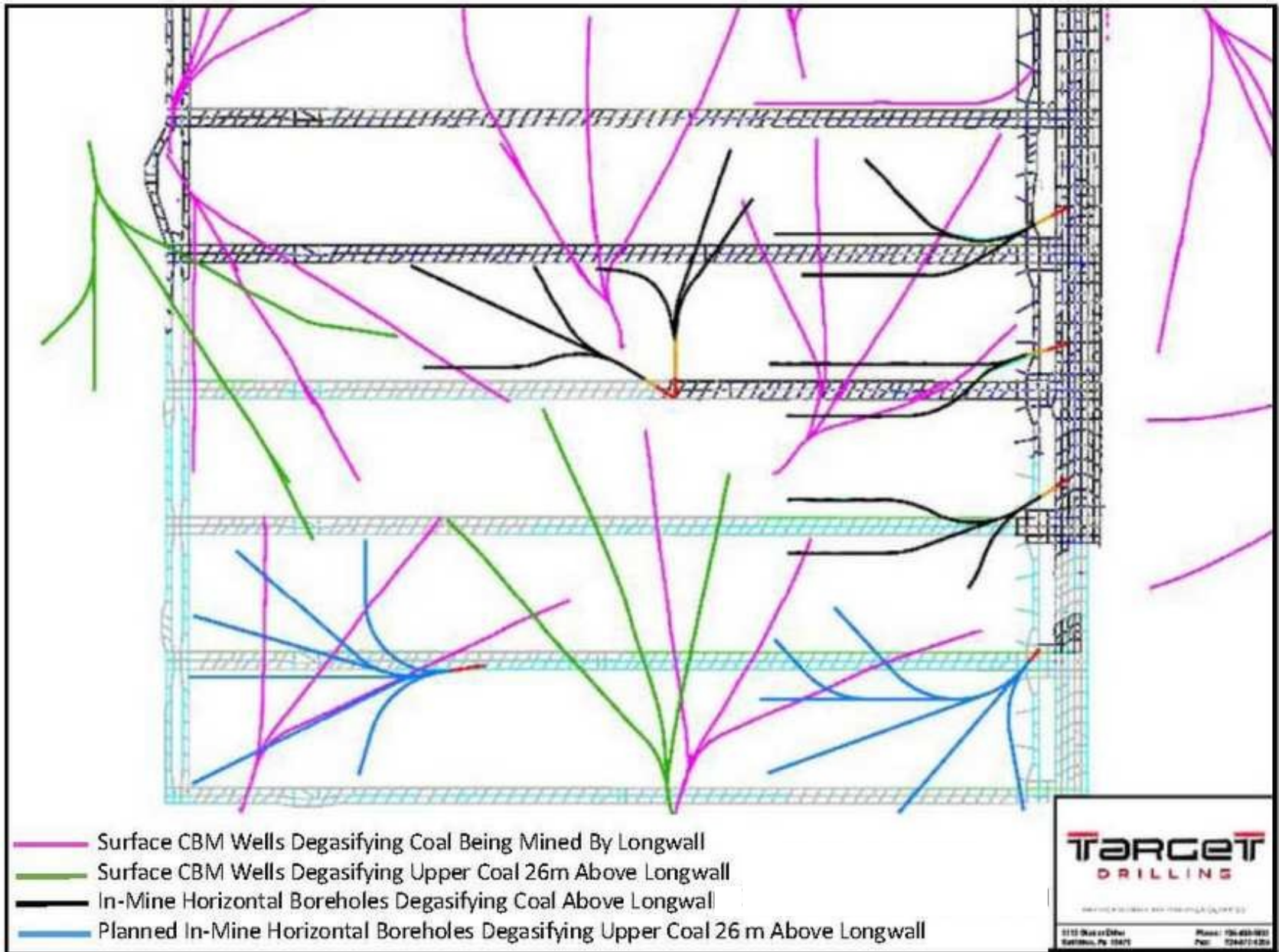
**5 7/8" Borehole Directionally Drilled, Cased with 4" Casing, and Cemented to Upper Coalbed**

- LEGEND**
- Casing
  - Borehole In Rock
  - Borehole In Coal
  - Sidetrack In Coal
  - Rock Intercept

## Sideview of In-Mine Borehole Targeting "Upper Coalbed"



# COMPREHENSIVE LONGWALL DEGASIFICATION – IN-MINE AND SURFACE



# ***TD Taking Drilling Technology to “New Extremes”***

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- ▶ **Highly deviated horizontal boreholes calculating TAD**
- ▶ **Planned Interception of Abandoned Mines – to Maximize Identification of Proven Coal Reserves SAFELY to Mine**
- ▶ **Outcrop Directional Drilling – Larger Pilot Borehole Using Oil Field Rotary Drill Pipe Equipped with TD’s Coax Integrated Wireline AND *MAGNESTAR MWD™ Survey System for Navigation***
- ▶ **Polymer Gel Plugging Continues to be Effective**

# Continually Improving Drilling Equipment

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Replaced OEM Components with Leading Manufacturer Off-the-Shelf Components

Increased Electric Motors to 60 Hp

Redesigned Drill Head

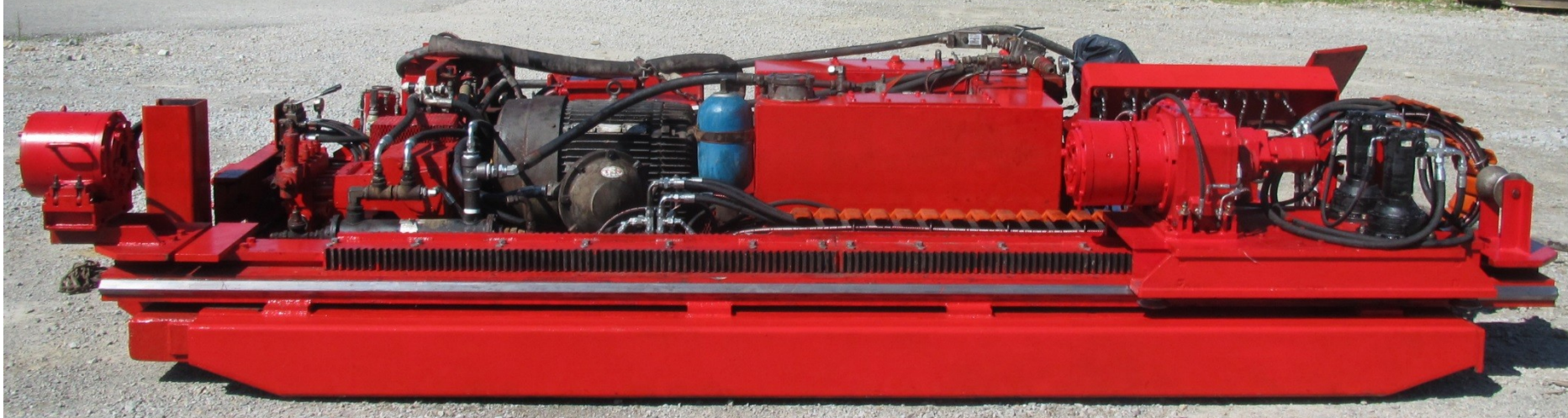


Increased Capacity of Major Hydraulic Pumps and Motors.  
Added Oversize Heat Exchanger to Maintain Oil Temperature

**TD 40,000 Pound Push/Pull Underground Permissible Rig**

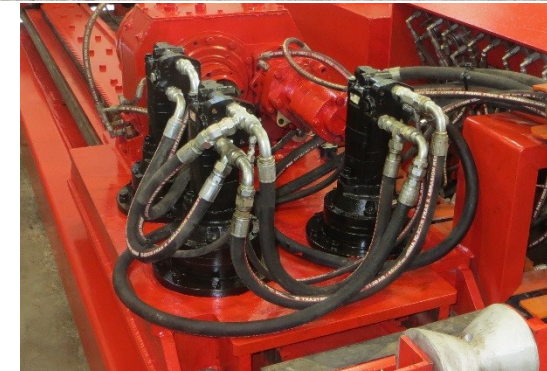


# UDR130 Rig – More Horsepower to Drill Upper Coalbed



## TD UDR130 High Capacity Rig Improvements:

- MSHA 2G Permissible Rig with 150 Hp Electric Motor
- Redesigned 11' Feed System 57,000#'s Thrust/Pullback
- Equipped with Two Triplex Pumps (120 gpm, 1500 psi)
- On Demand Pilot Controlled Hydraulic System



**EQUIPPED WITH  
3 PLANETARIES**

# TD's NEW UDR600 HIGH POWER >6,000' (2Km) RIG

## UDR600 - SPECIFICATIONS (HGB RIG)

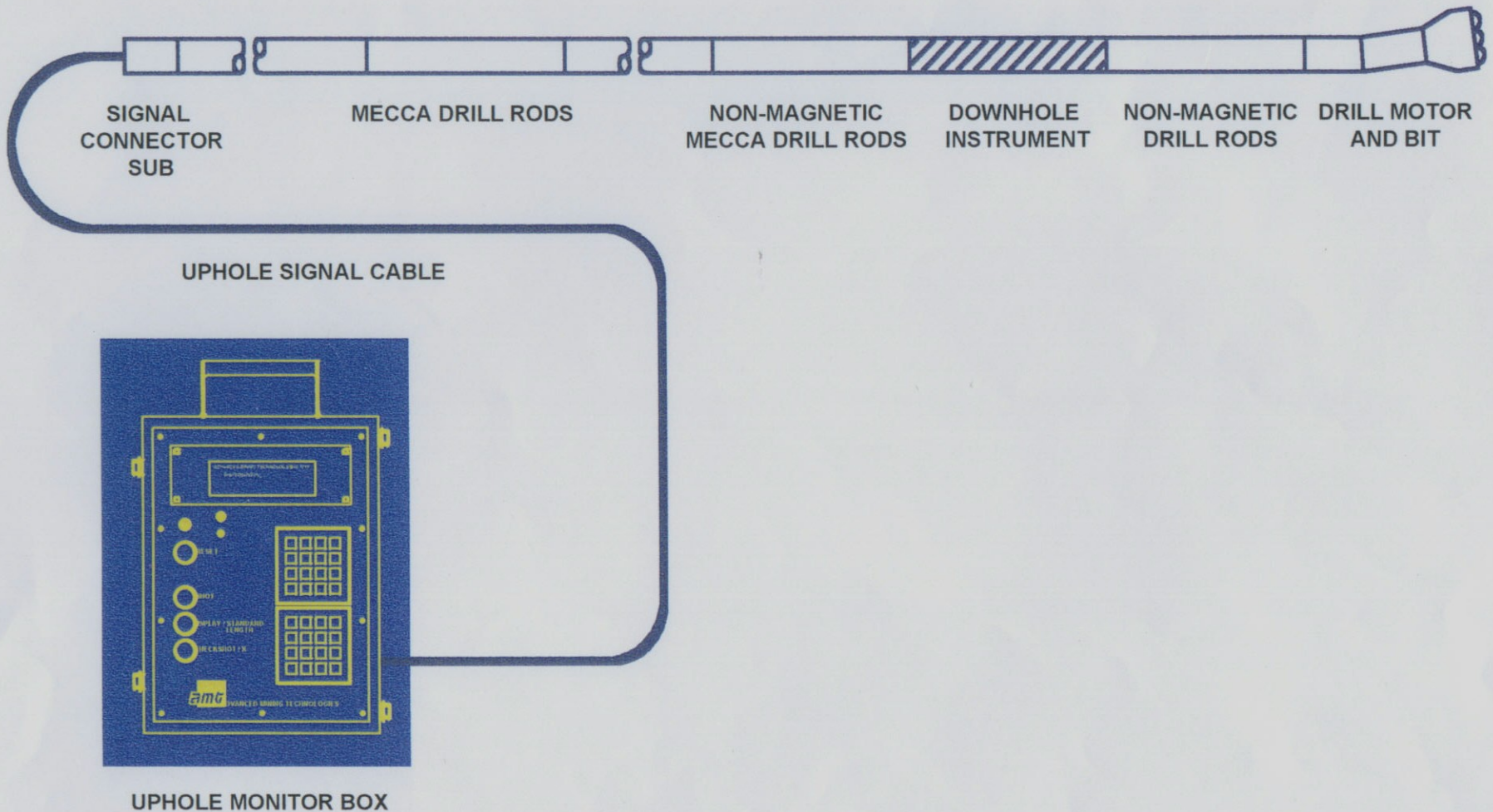
Thrust/Pullback: 350kN/78klb  
Power Torque: 8kN/M; 5900ftlb  
Water Maximum Flow: 905lpm;  
340Gpm  
Water Maximum Pressure: 88  
bar; 1,294 psi

Power - 1,000 Volts AC;  
600 HP (3-200 HP Motors)

Rig Power Unit and 2-Triplex Pump Units not shown

**DESIGNED WITH COMPUTERIZED "DRILLER'S ASSIST AND REAL-TIME DIAGNOSTICS"**

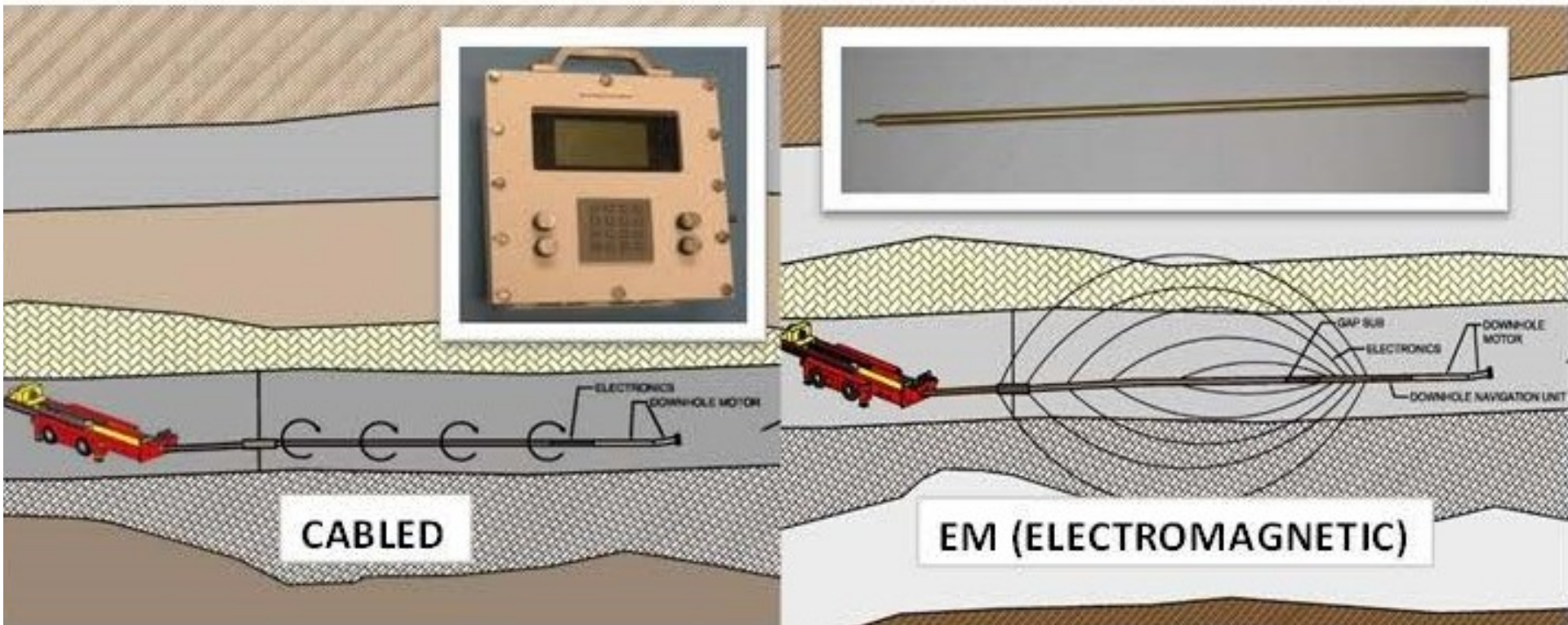




## DDM-MECCA SYSTEM DIAGRAM

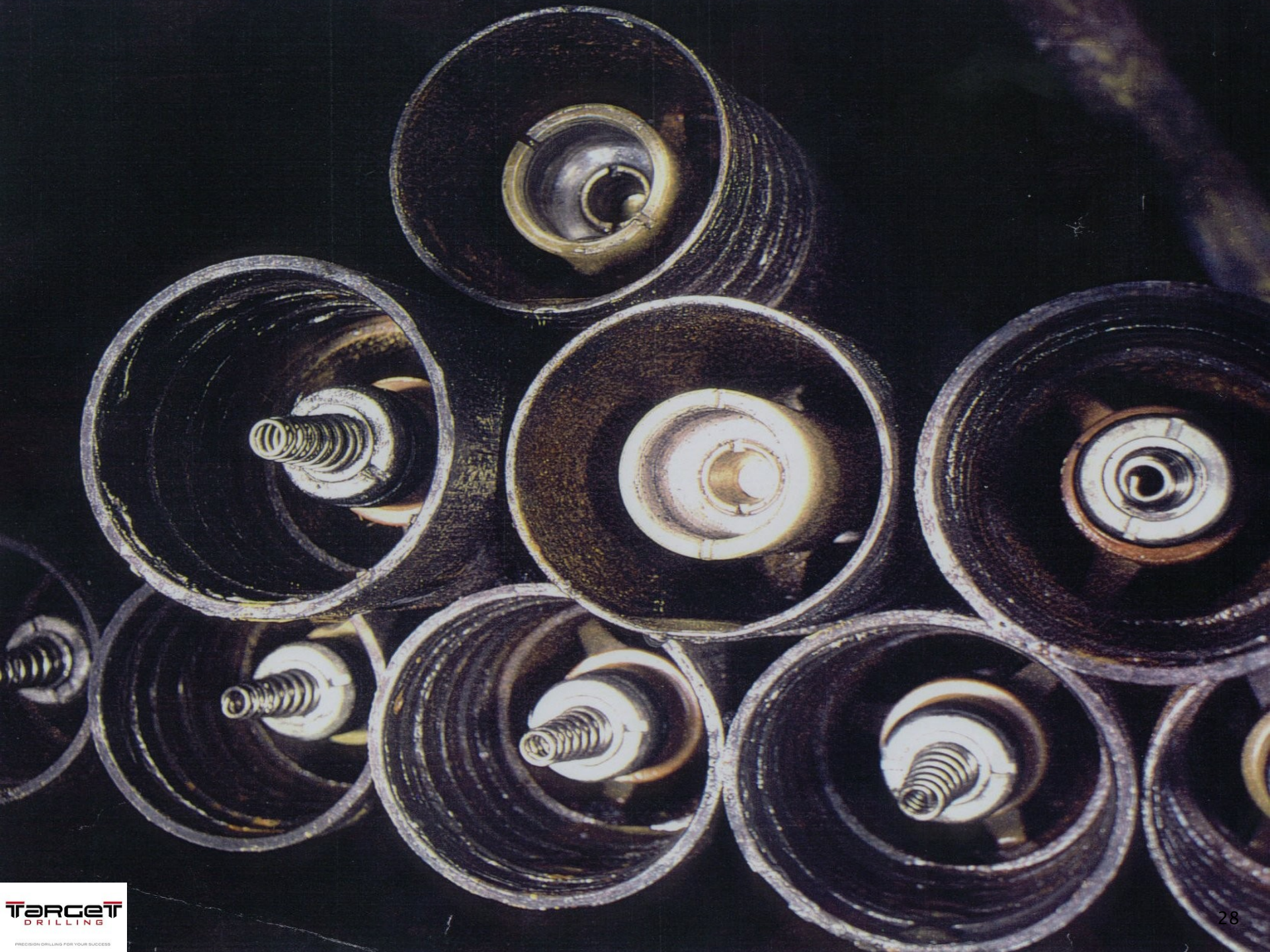
# TD's NEW In-Mine Permissible Borehole Navigation System

**MAGNE★STAR MWD™**



**MagneStar MWD™ Cabled and EM Equipped with Oil Field Gamma Module**

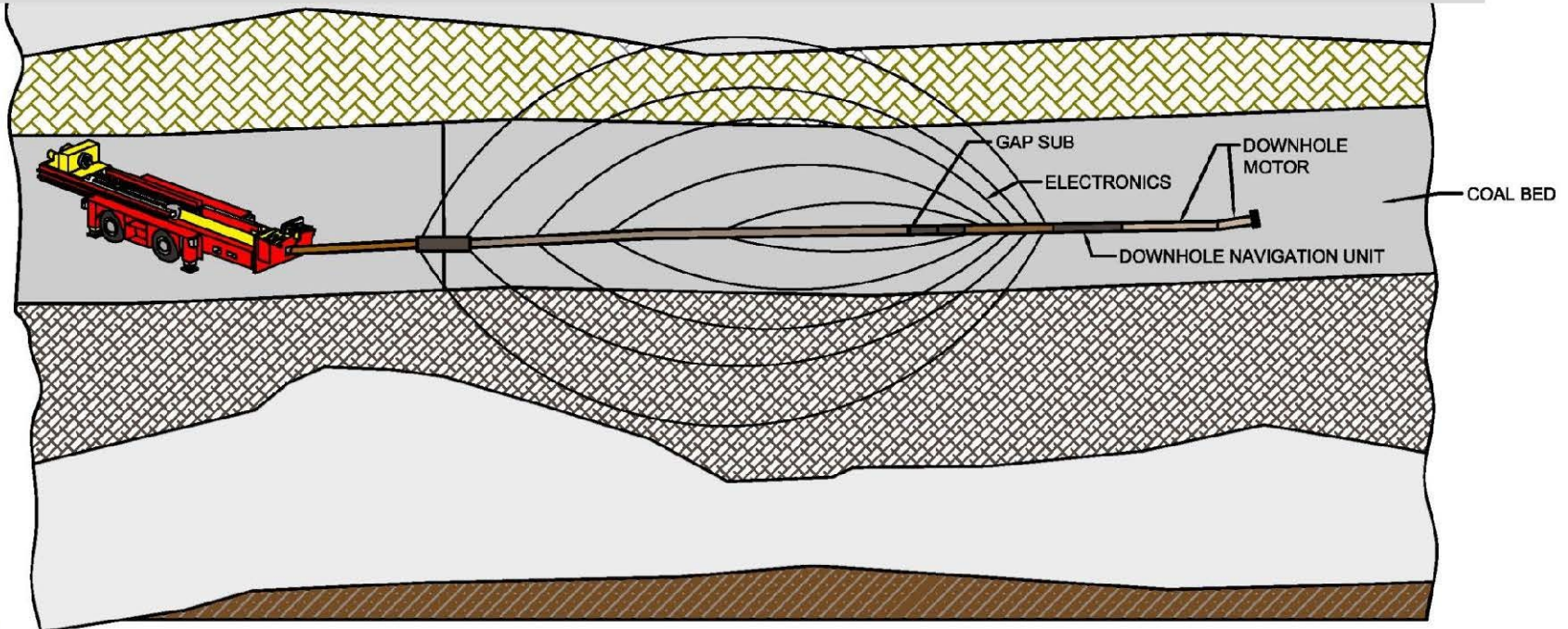






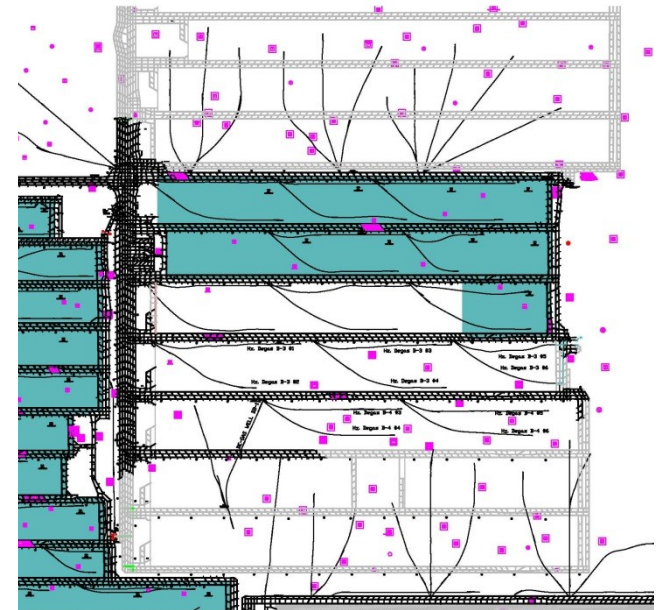
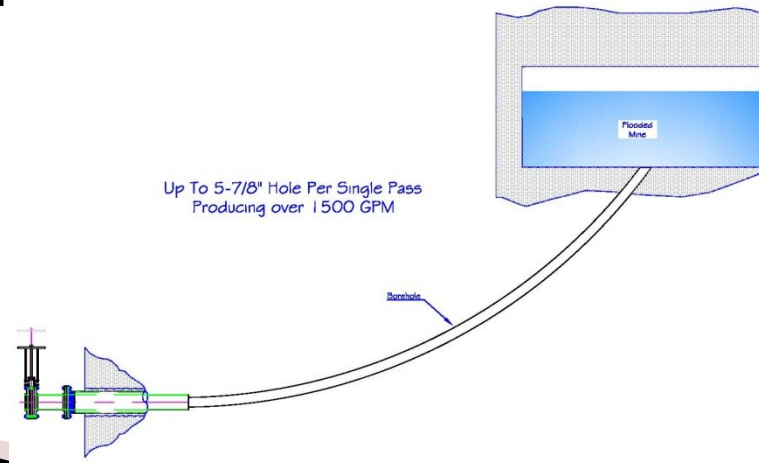
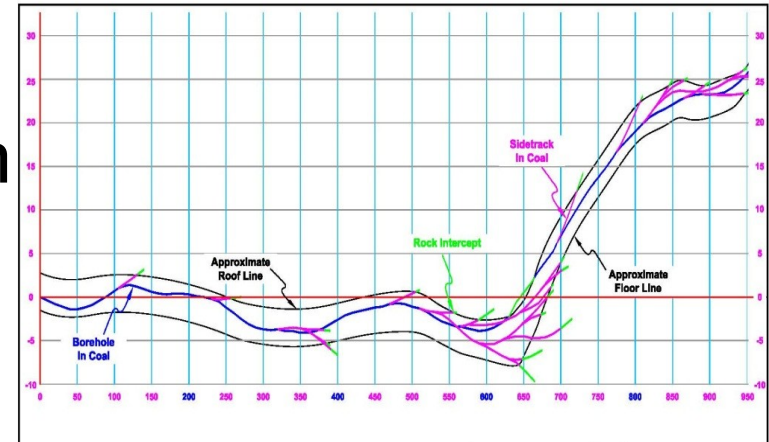
# MagneStar Wireless MWD with Gamma

No cable or conductor inside Drill Pipe Provides Numerous Benefits During Directional Drilling and If Fishing Required

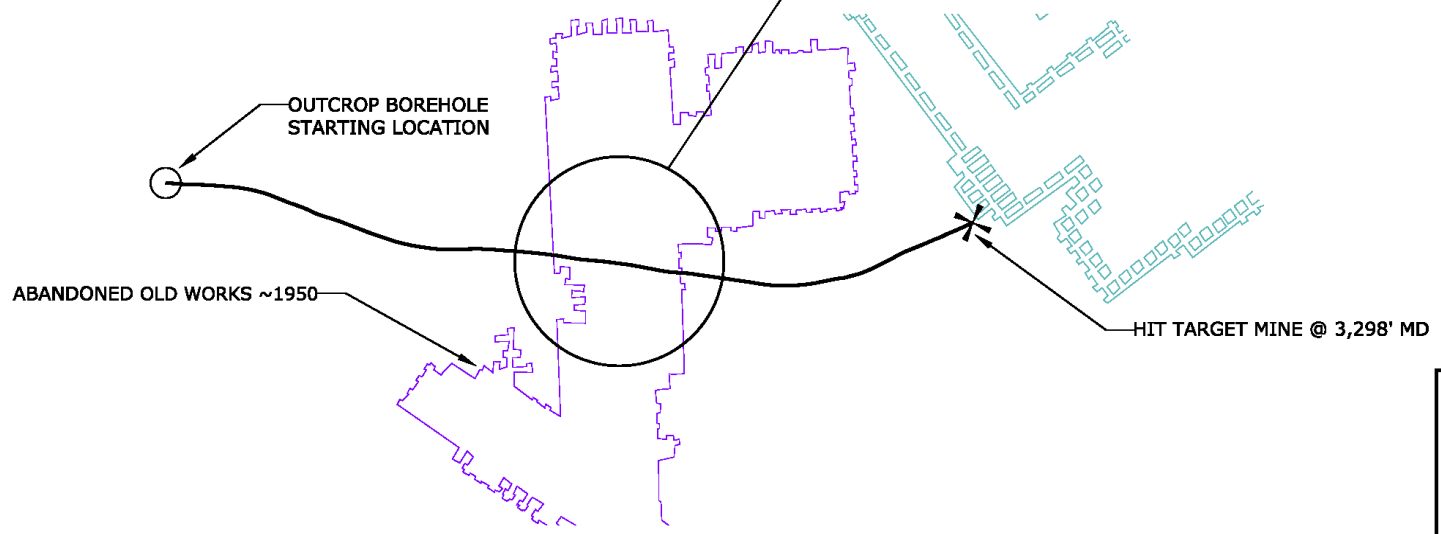
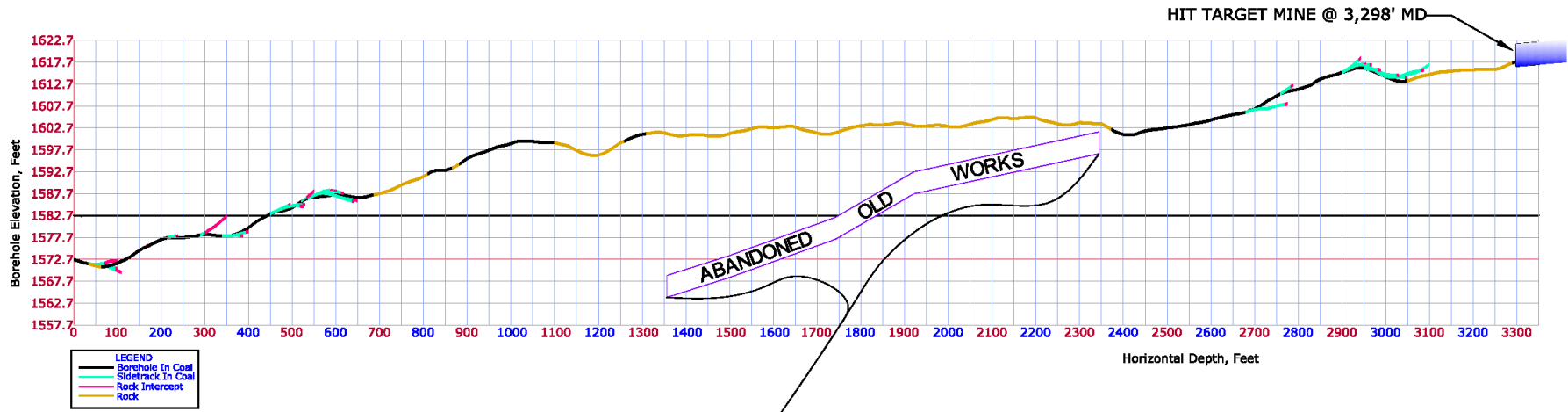


# Underground Directional Drilling

- ▶ Abandon Mine Verification
- ▶ In-Mine Degas
- ▶ Water Drainage
- ▶ Coalbed Exploration
- ▶ Borehole Plugging with Polymer Gel



# Outcrop Abandoned Mine Water Drainhole - Rock & Coal



**TARGET DRILLING**

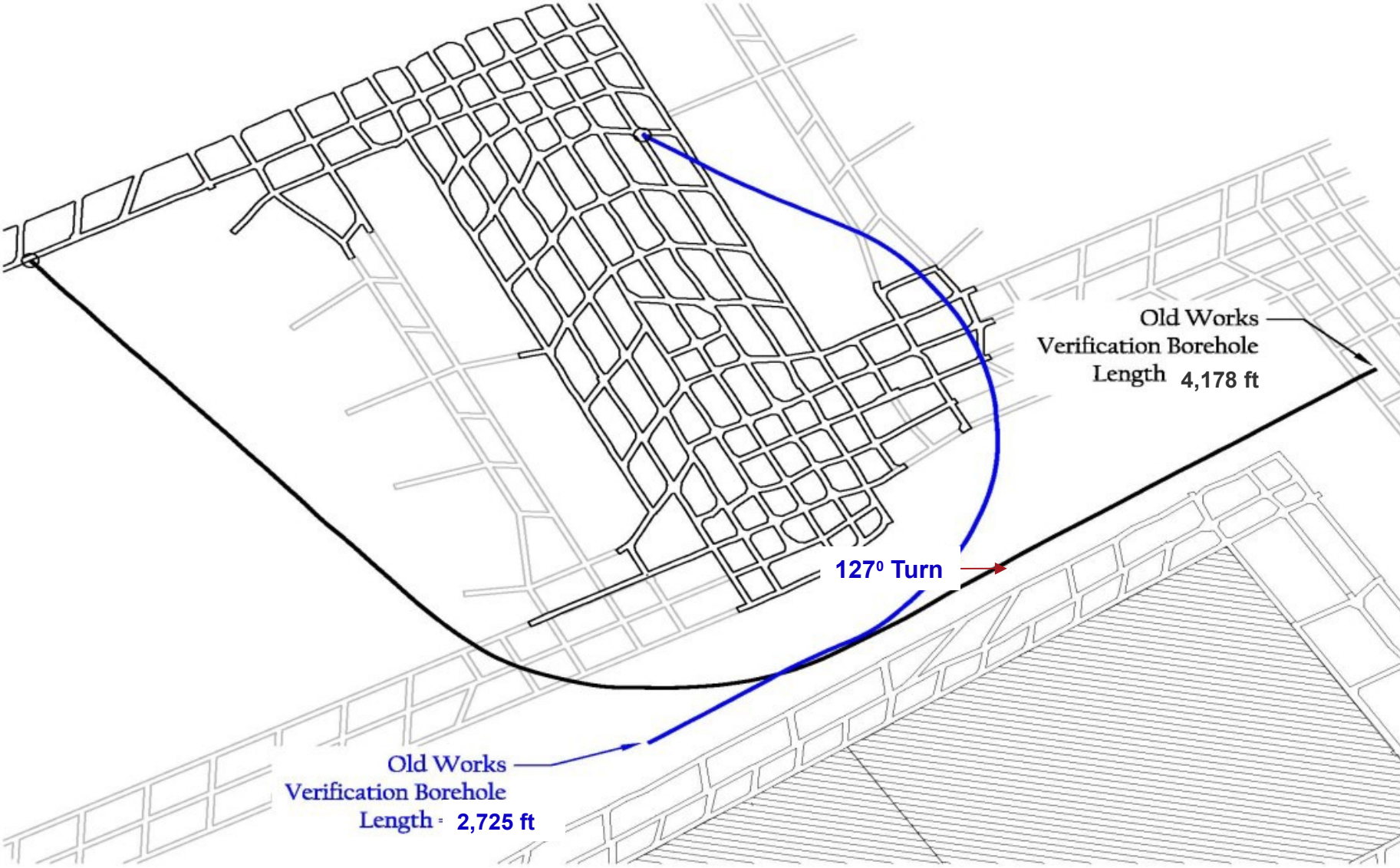
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1112 Glacier Drive  
Smithton, Pa 15478

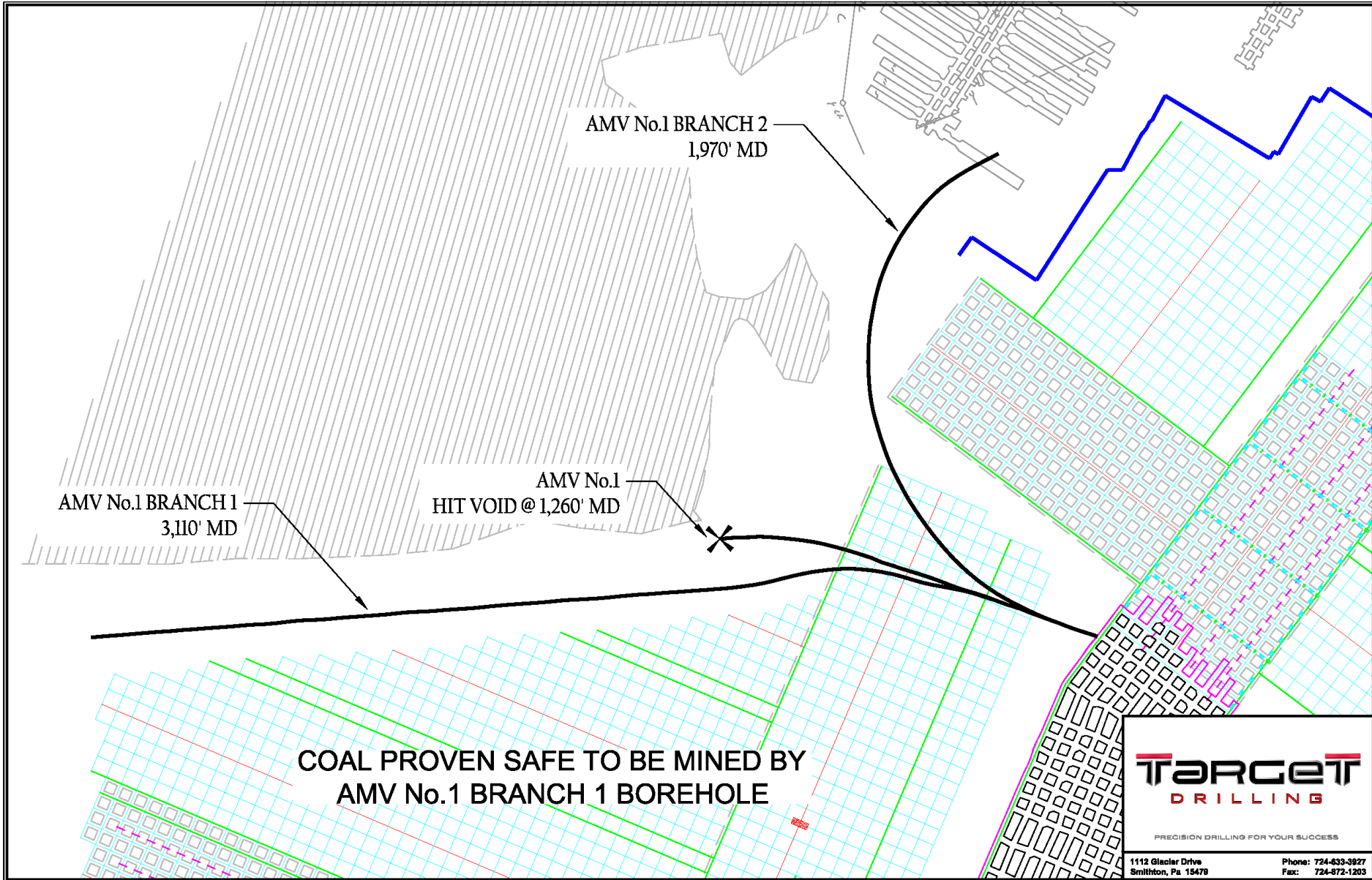
Phone: 724-633-9927  
Fax: 724-872-1203



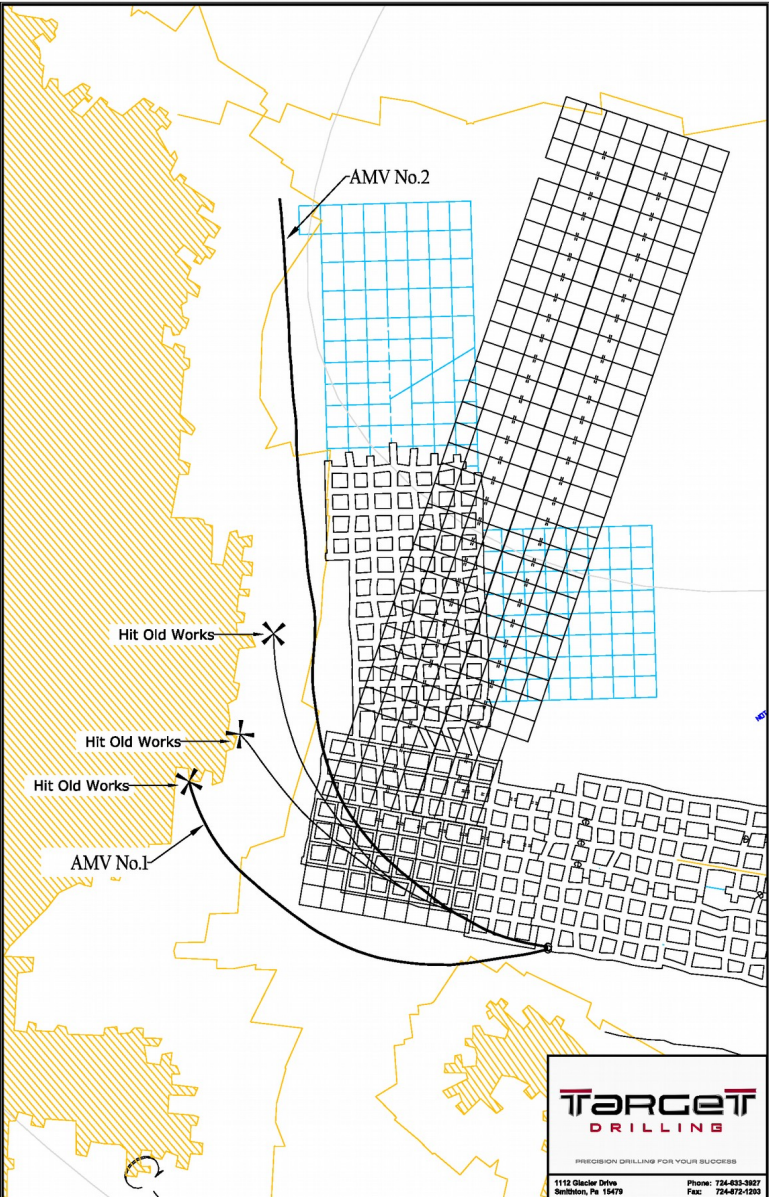
# Extreme Curvature for AMV Borehole to “Box Out” Entries



# AMV Borehole With Multiple Branches To Prove Coal Present



# AMV Borehole With Multiple Intercepts – Plug & Continue



**TARGET**  
DRILLING

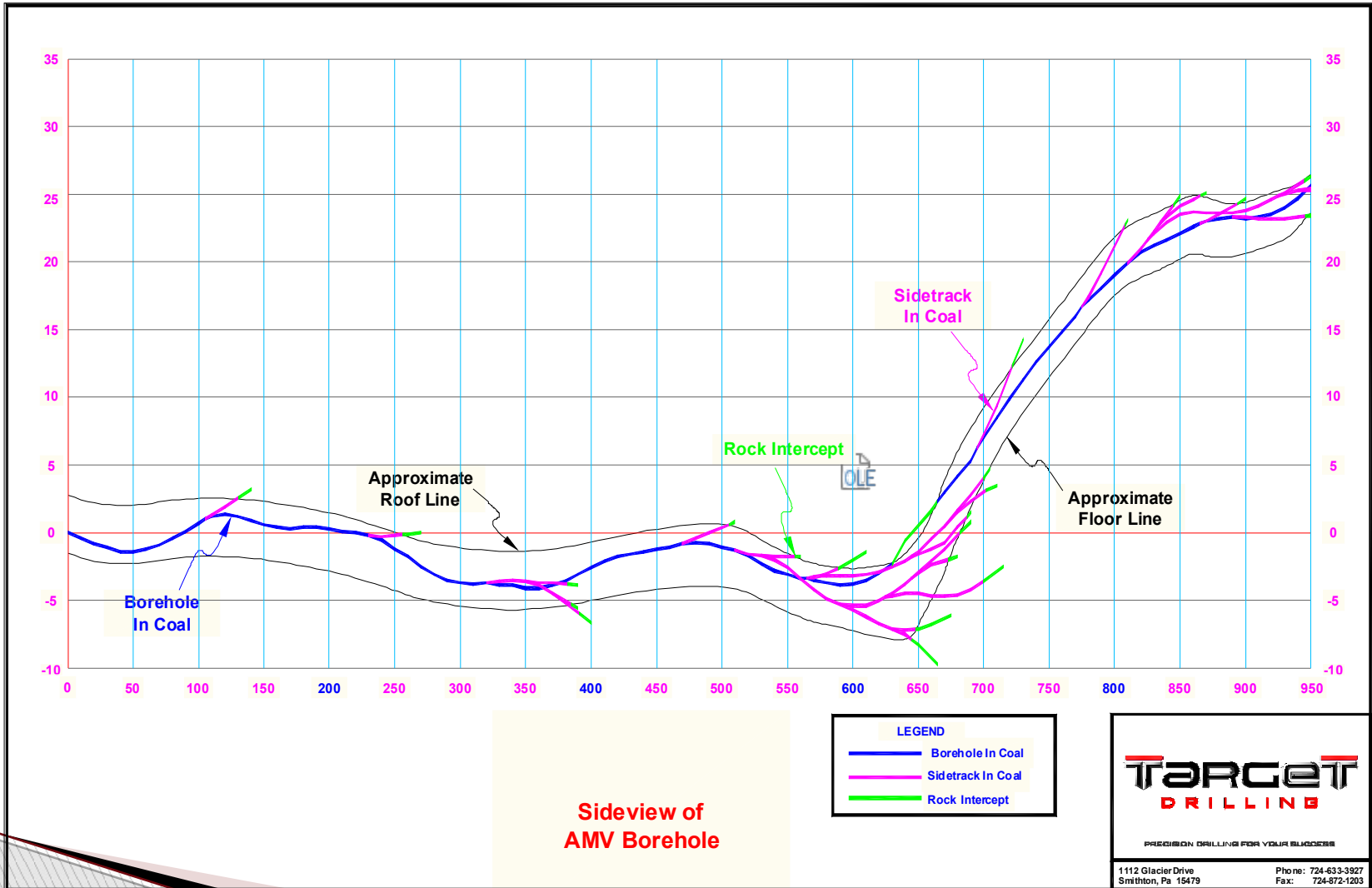
PRECISION DRILLING FOR YOUR SUCCESS

1112 Glacier Drive  
Sellersville, Pa 17170

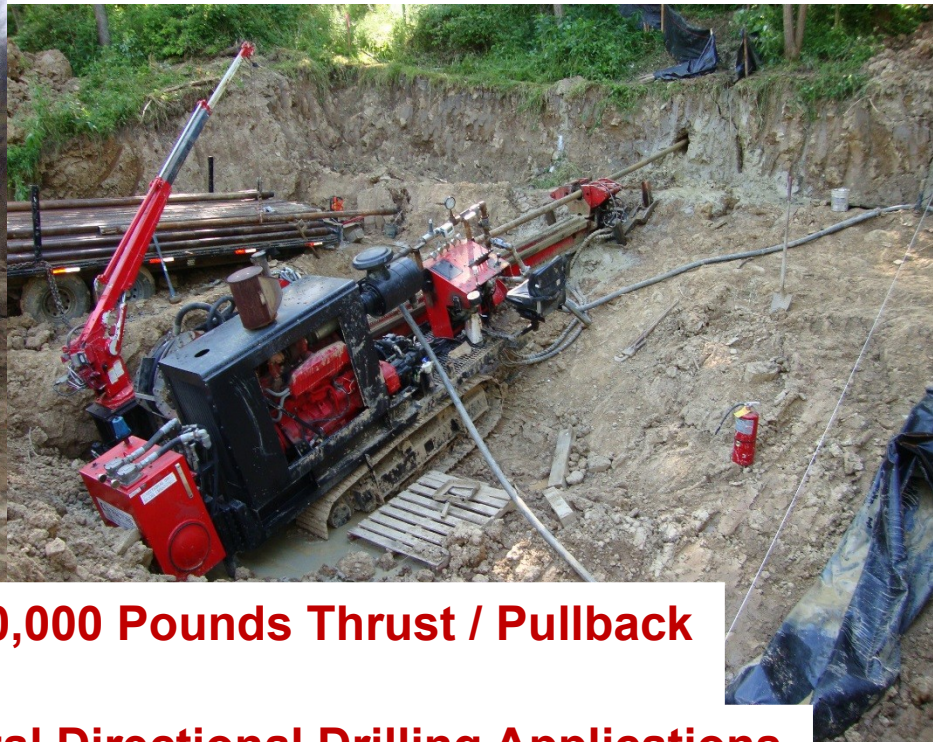
Phone: 724-833-3827  
Fax: 724-872-0235



# TD In-Mine Boreholes Delineate Coal Elevation & Thickness







**TD's 6015 Diesel Powered Rig – 70,000 Pounds Thrust / Pullback**

**Coal Mining Related Outcrop Horizontal Directional Drilling Applications**



**Drill in Very Difficult Terrain**



**Drill Large Diameter Cased Boreholes**

**Reclamation Permit Acid Mine Drainhole**



# Keep On Pluggin' Away – 125 Miles of Borehole Plugged to Date

	<u>Distance Plugged</u>		<u>Volume Mixed/Pumped</u>	
	<u>Meters</u>	<u>Feet</u>	<u>Liters</u>	<u>Gallons</u>
In-Mine Boreholes	51,863	170,155	1,323,535	349,641
Surface CBM Coal Later	<u>148,855</u>	<u>488,368</u>	<u>1,949,104</u>	<u>514,899</u>
Totals	200,718	658,523	3,272,638	864,540



# Plugging CBM Coal Laterals and In-Mine Boreholes

- ▶ *TD Polymer Gel used to plug CBM Well coal laterals and in-mine boreholes prior to mining*
- ▶ Plugging is done prior to mining from Surface
- ▶ Minimal interaction with mining operations
- ▶ TD has designed safe, efficient, cost effective, easy to use packers for mine-through's
- ▶ TD experience allows operators to accurately plot and plan for SAFE mine-throughs

# Target's "Today's Directional Drilling"

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- ***Comprehensive Longwall Degasification*** – TD has proven the effectiveness of degasifying the coal being longwall mined, and the upper coalbed through its surface CBM wells and in-mine horizontal boreholes enhancing safety and increasing productivity.
- TD's advanced applications of taking directional drilling to "***NEW EXTREMES***" for coal mine operators
- ***TD Continues to Evolve Its Directional Drilling Equipment Capabilities to Enhance Mining Safety and Efficiency*** by developing new horizontal rig and borehole navigation equipment



Target Drilling Inc.  
1112 Glacier Drive  
Smithton, PA 15479

For More Information Please Contact:

Matthew Yearsley  
Drilling Operations Manager  
[mattyearsley@targetdrilling.com](mailto:mattyearsley@targetdrilling.com)  
Office: 724-633-3927, Ext . 14  
Cell: 724-728-7685  
Fax 724-872-1203

[www.targetdrilling.com](http://www.targetdrilling.com)

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