



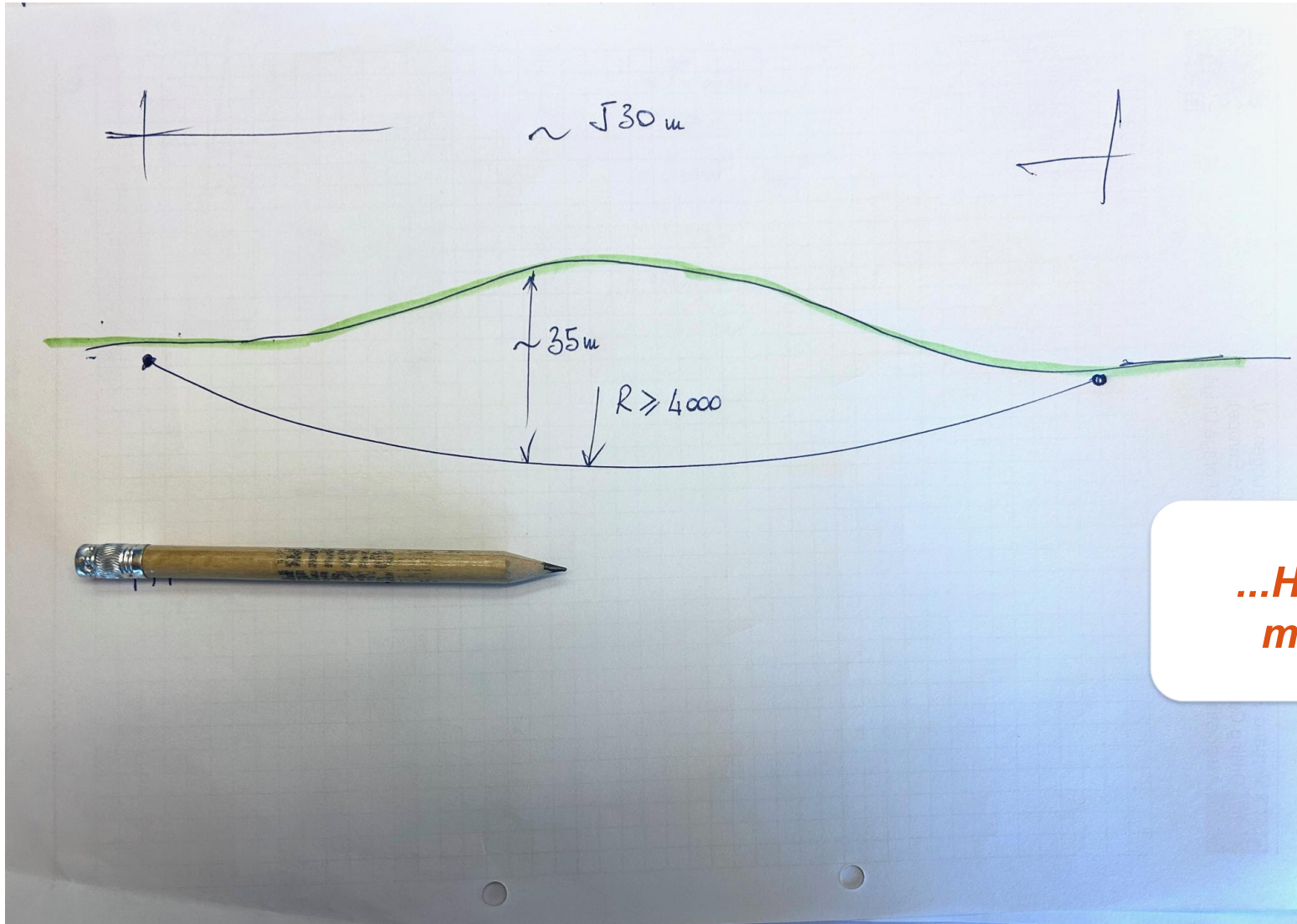
Drilling Contractors Association (DCA-Europe)

CHALLENGES AND SOLUTIONS IN A **" PIPELINE INSTALLATION

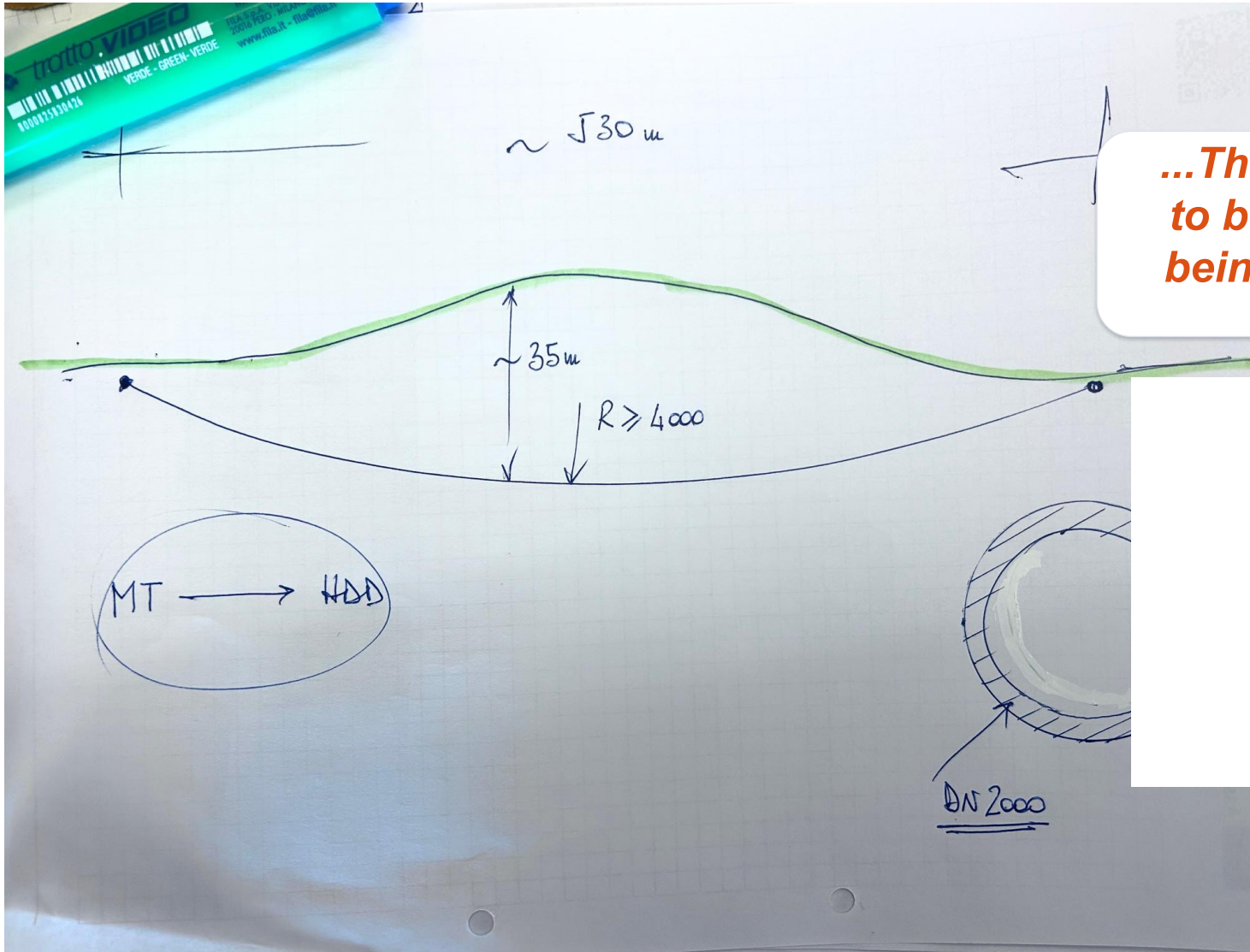
"Monte Tiglio Crossing" Case Study

Thruster-Assisted HDD (T.TOC), and Centrifugal slurry Management

Cesena, Italy



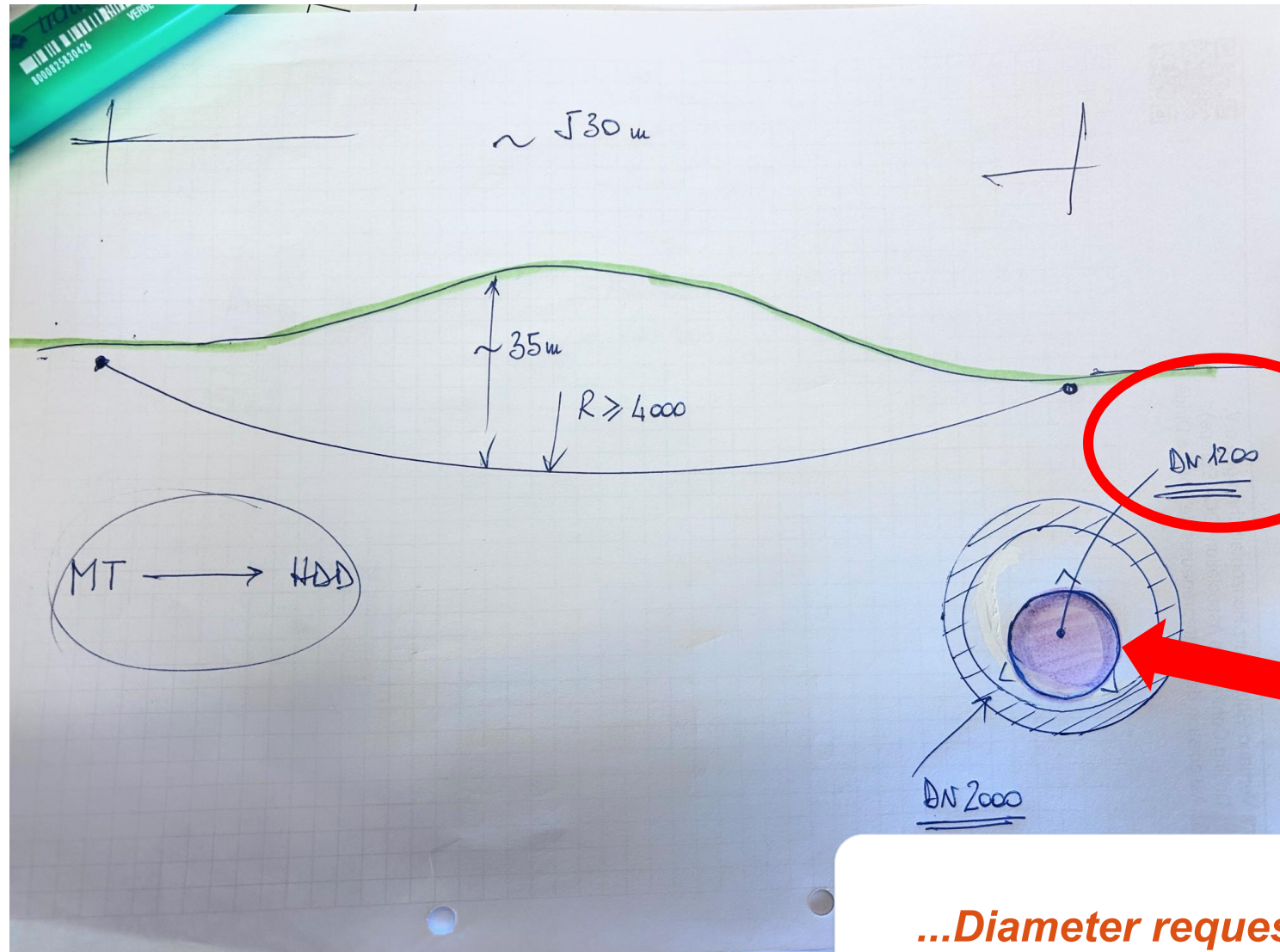
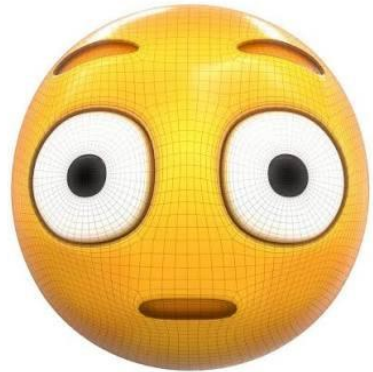
...Hey guys, tell me instinctively, how much is challenging this ... 1 to 10



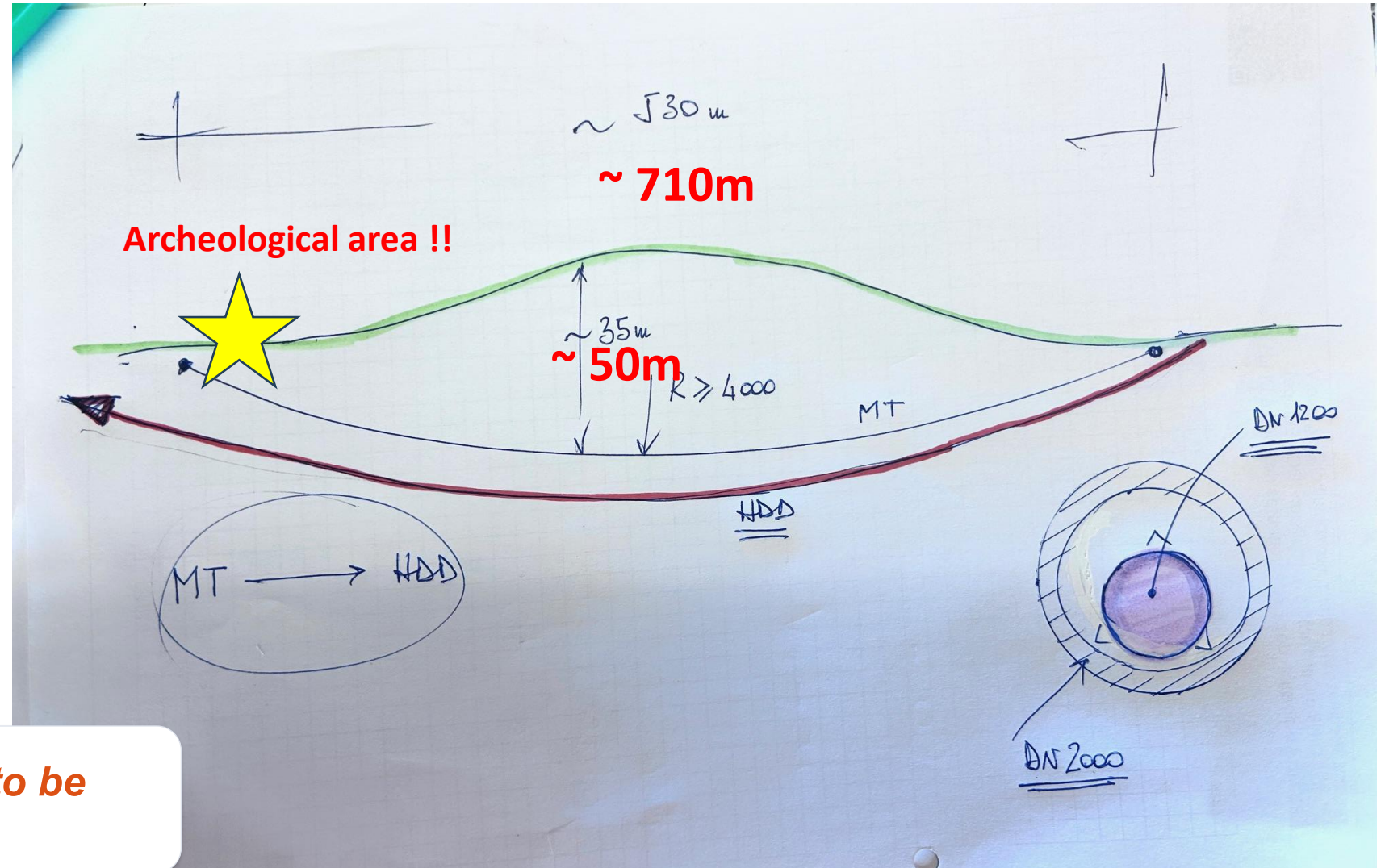
...This crossing, actually, was designed to be realized by MT technique... Now is being to be converted to HDD crossing

...





...Diameter requested is 48"...



...but the crossing had to be re-designed...



T.TOC variant eliminates shafts and heavy concrete segments required for microtunneling

A detailed comparison between the original tender microtunneling design and the executed T.TOC (Thruster-Assisted HDD) solution:

ORIGINAL TENDER DESIGN: MICROTUNNELING

Rigid Design: 529m microtunnel with outer diameter of 2400 mm using precast concrete pipes.

Major Shafts: Deep concrete thrust and reception shafts required, resulting in a significant civil construction footprint.

Cement Backfilling: Complete grouting of the annular space between DN2000 and DN1200 required

High Risk: Significant groundwater management risks in shallow alluvial deposits near the Savio River basin.

EXECUTED SOLUTION: T.TOC (THRUSTER-ASSISTED HDD)

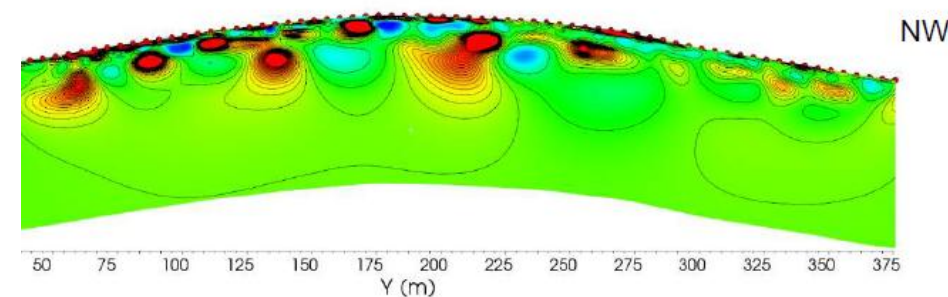
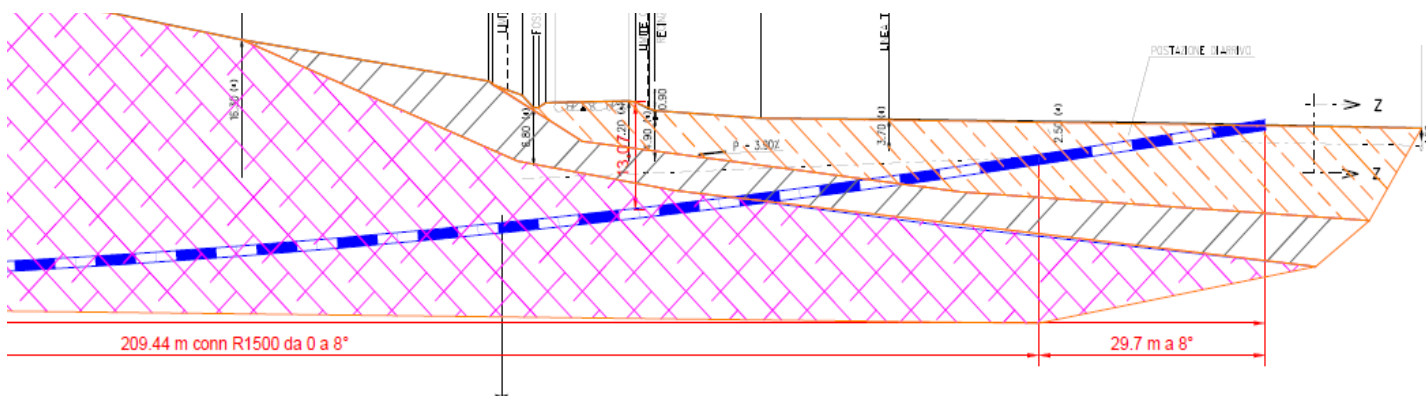
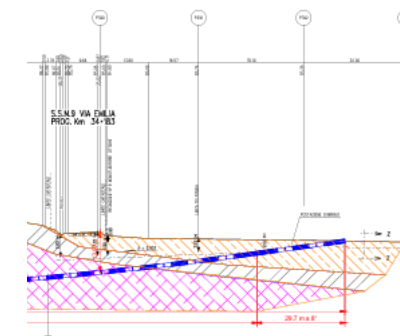
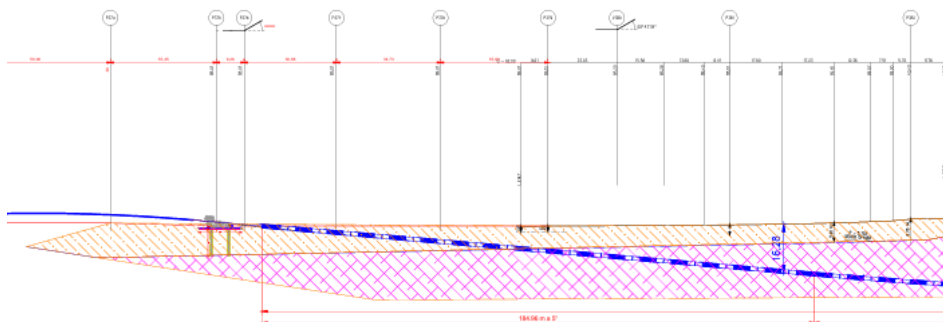
No Concrete Segments: Direct installation of the 48-inch steel pipeline coated with 3.3 mm PEAD.

No Deep Shafts: Surface entry and exit areas, completely eliminating major underground excavations.

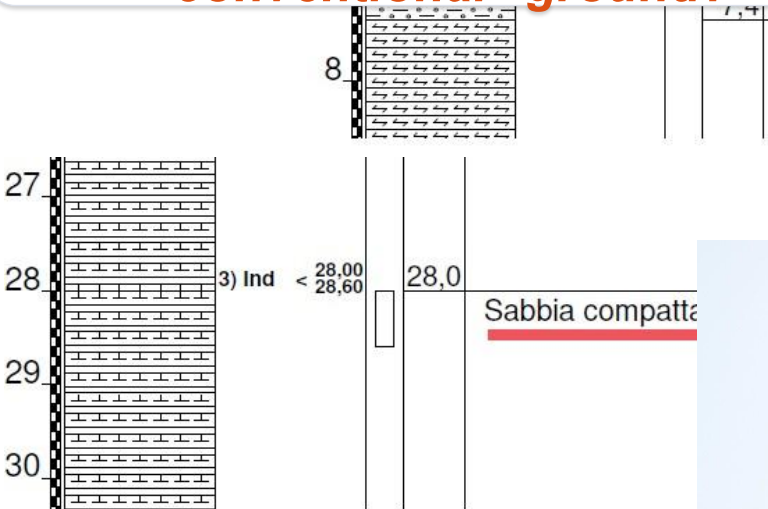
Integrated Utilities: Installation of an auxiliary DN 200 (8") service pipeline alongside for continuous slurry recycling.

Flexible Path: Optimized Optimized 701.4 m curved HDD alignment adapted to the terrain, avoiding local water pipelines and an important archaeological area

WHAT ABOUT GROUND CONDITIONS ??

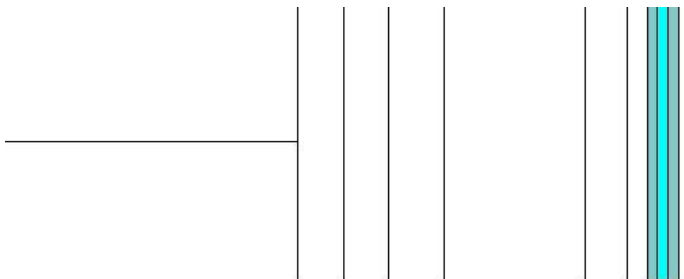
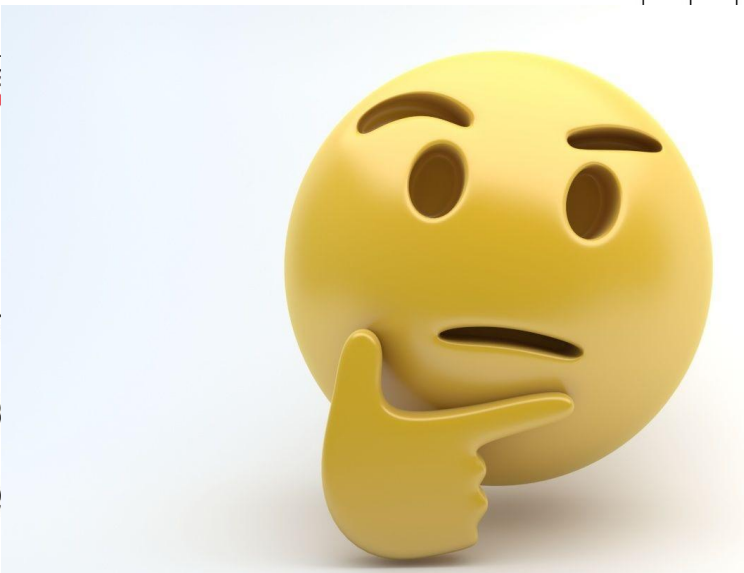


Will we dealing with rocky terrain or "conventional" ground?

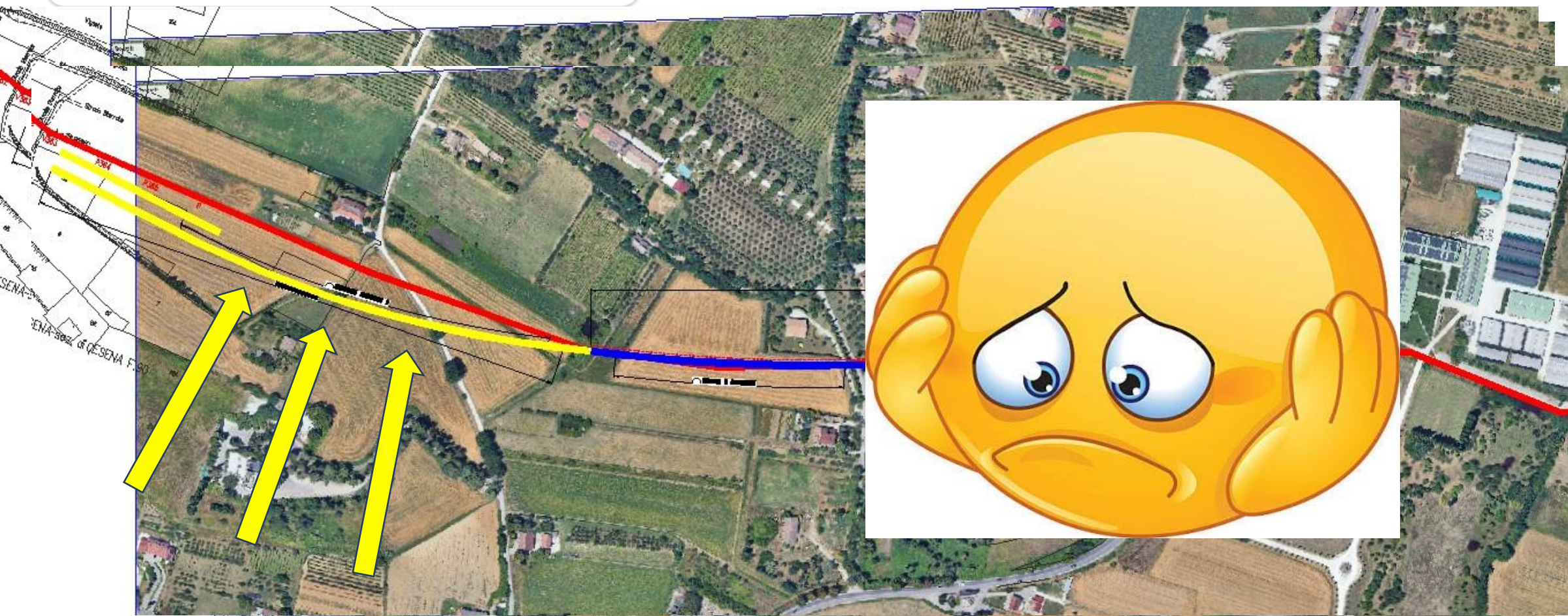


Argilla sovraconsolidata parzialmente litificata - a tratti siltosa, colore grigio chiaro

6,6 15-25-30 55



What about the pipe string ?



...Summary of key critical aspects

701.4 Meters

Total drilling length under Monte Tiglio hill

48-Inch (DN 1200)

Massive steel pipeline diameter with sacrificial wrapping

70 MPa Bedrock

Maximum rock compressive strength (cemented sandstone and marl)

Long Stop for welding during pipe-pull

24hrs stop for alignment, welding, writing, wrapping, ...contingencies...

Plan/elevation deviation of the pipe-string

23° plan. deviation ... 7° exit angle... 750m vertical bend radius, 1000m horizontal bend radius...

Drill Cuttings & Drilling Fluid management

...bit balling, mudweight increasing, viscosity increasing, torque,... volumes (cutting, water, fluid)

...Summary of key critical aspects

701.4 Meters

Total drilling length under Monte Tiglio hill

48-Inch (DN 1200)

Massive steel pipeline diameter with sacrificial wrapping





70 MPa Bedrock

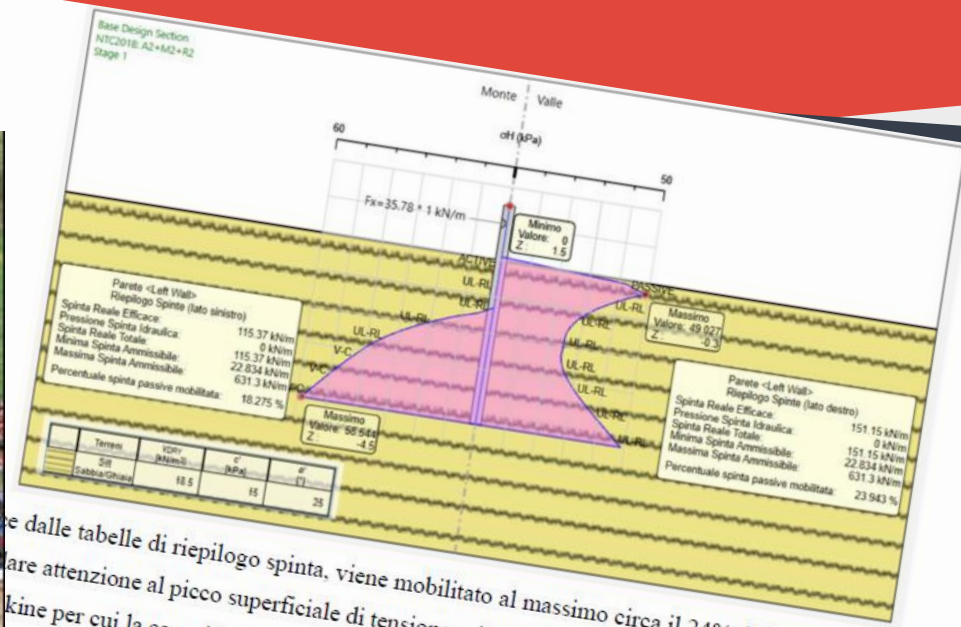
Maximum rock compressive strength (cemented sandstone and marl)





Plan/elevation deviation of the pipe-string

23° plan. deviation ... 7° exit angle... 750m vertical bend radius, 1000m horizontal bend radius...



Le dalle delle tabelle di riepilogo spinta, viene mobilitato al massimo circa il 24% della spinta passiva.
 Fare attenzione al picco superficiale di tensione orizzontale a valle σ_{hE} ($z = 0,3 \text{ m}$) = $49,03 \text{ kN/m}^2$, si sfrutta
 kine per cui la capacità orizzontale del terreno a quella profondità è pari a:

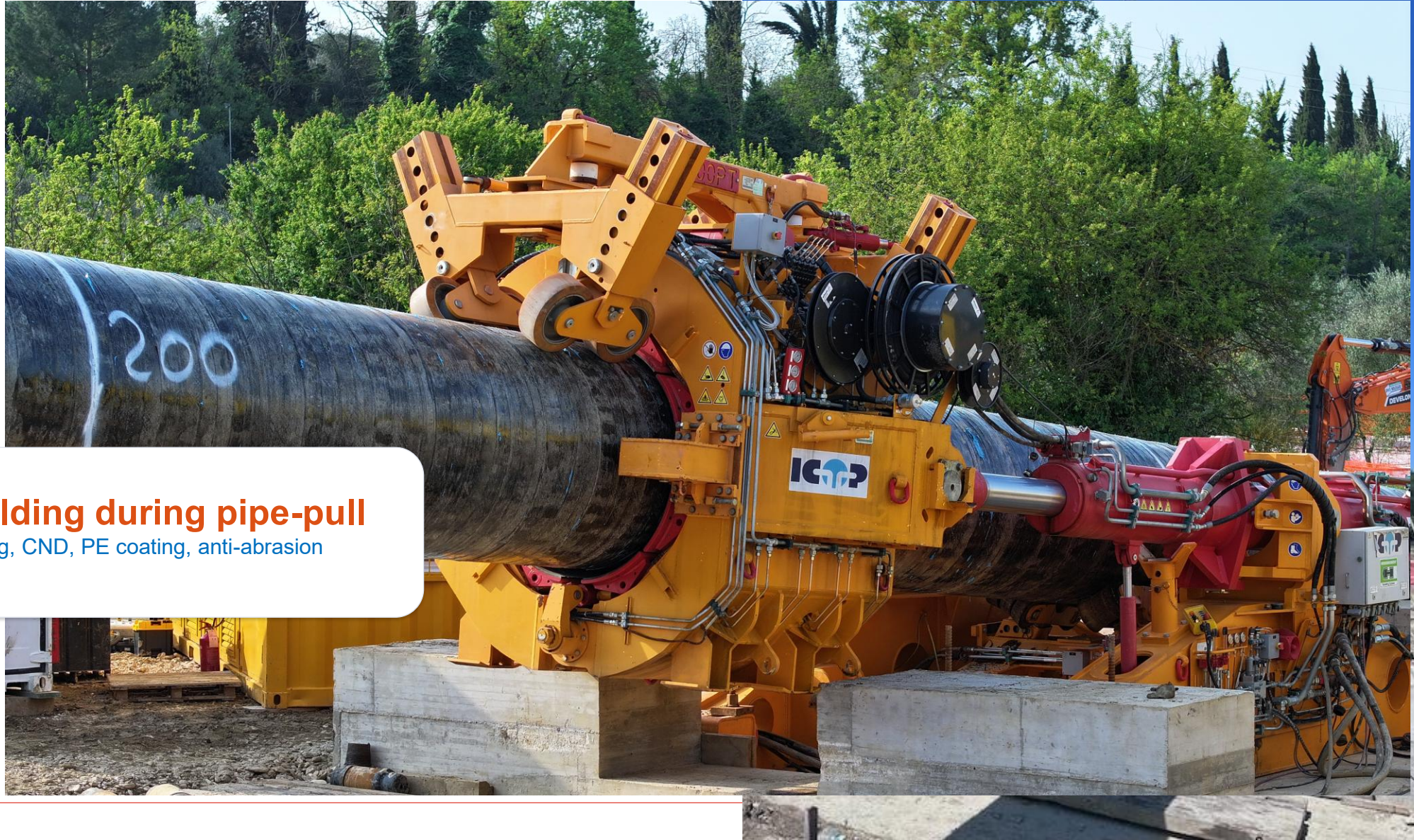
$$\sigma_{h,R} = K_{p,d} \gamma z' + 2c_{d,v} \sqrt{K_{p,d}} = 50,70 \text{ kN/m}^2$$

$$\sigma_{h,R} = K_{p,d} z \gamma' + 2c'_d \sqrt{K_{p,d}} = 50.70 \text{ kN/m}^2$$

Plan/elevation deviation of the pipe-string

23° plan. deviation ... 7° exit angle... 750m vertical bend radius, 1000m horizontal bend radius...





Long Stop for welding during pipe-pull

24hrs stop for alignment, welding, CND, PE coating, anti-abrasion wrapping, ...contingencies...



Pipe Thruster overcomes exponential breakout forces after a 13-hour welding pause

THE INTERMEDIATE WELDING PAUSE

13-Hour Critical Pause: Required to weld the two pipe strings, run 100% UT/RX tests, restore the PE coating, and apply a high-abrasion wrapping.

slurry Gelation: The resting bentonite slurry becomes thixotropic, forming a gel layer that binds the pipe.

Bore Constriction: Clays squeeze around the static pipeline, creating a severe clamping effect.

Breakout Peak: Pullback force needed to restart could exceed 150-200 t (or more?) .

PIPE THRUSTER HK500PT ASSISTANCE

500-Tonne Hydraulic Force: Provides a massive pushing force at Exit Point to break static friction.

Rig Stress Relief: Kept tension on the main HK300T rig below a safe 100 tonnes during the critical breakout restart.

Anchorage Plate: Pushing reaction absorbed by a special concrete slab (13.5x6m) tied with 14 inclined micropiles.

Safe Completion: Enabled smooth, continuous pullback with zero pipeline damage or structural failures.

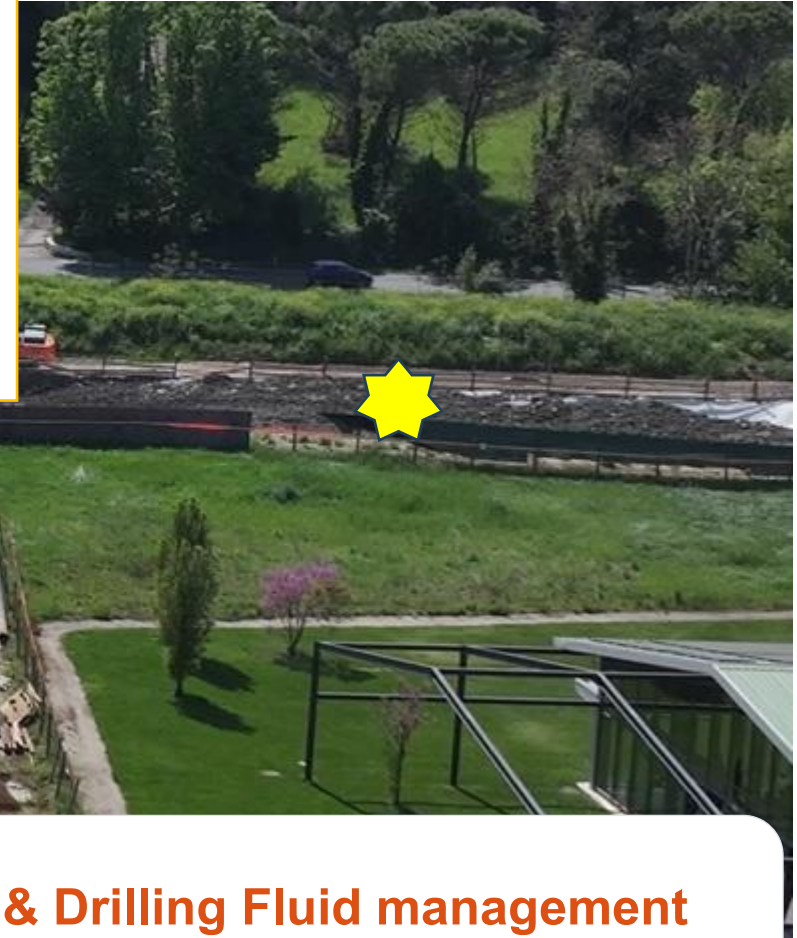


Water storage

Mud storage

Fluid tanks

Cuttings pit



Drill Cuttings & Drilling Fluid management

...bit balling, mudweight increasing, viscosity increasing, torque,... volumes (cutting, water, fluid)

Clay soil / clay cuttings



Mud weight

Viscosity



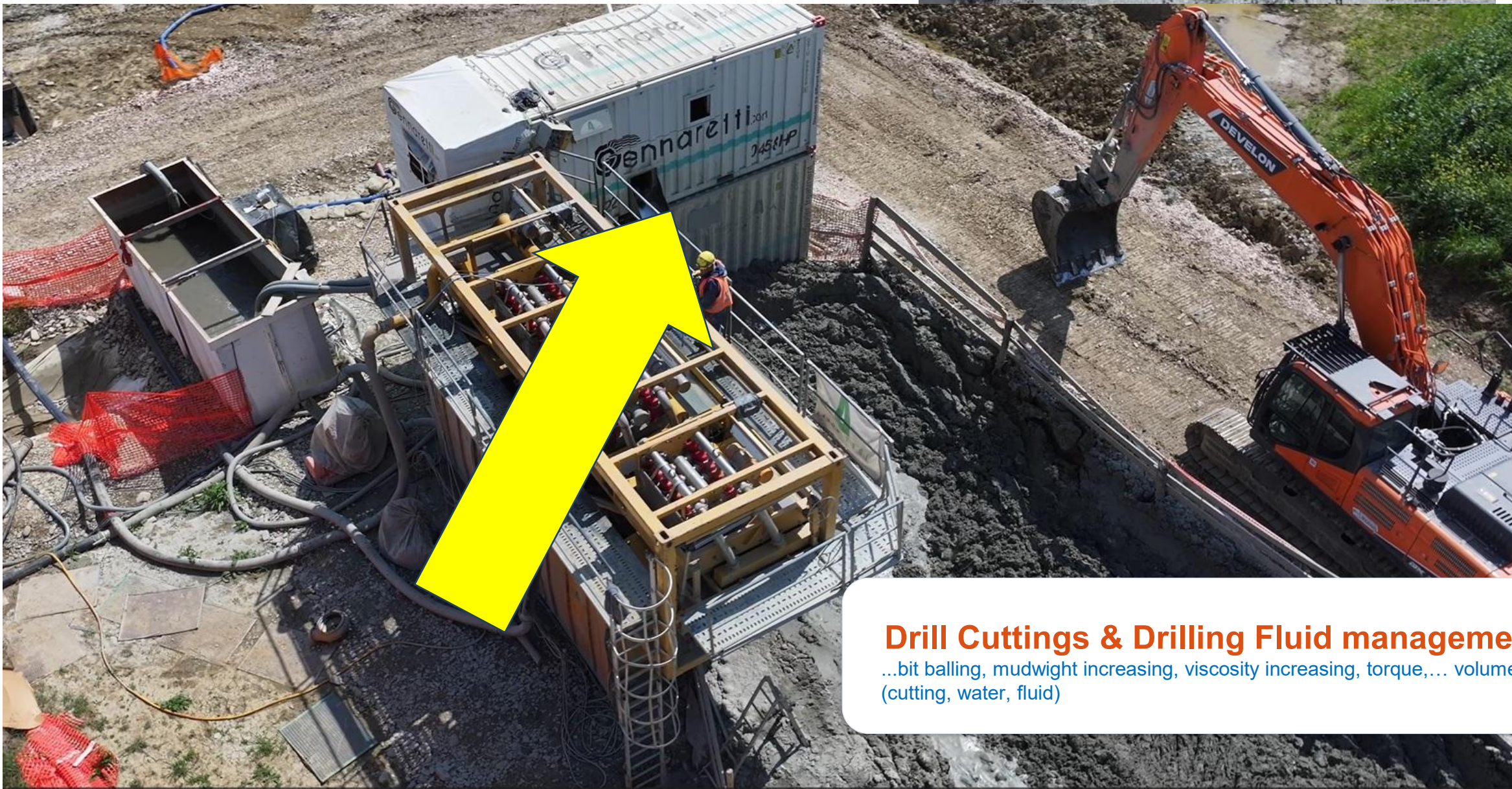
Water for dilution

Circulating volume

Wet solids

Drill Cuttings & Drilling Fluid management

...bit balling, mudweight increasing, viscosity increasing, torque,... volumes (cutting, water, fluid)



Drill Cuttings & Drilling Fluid management

...bit balling, mudweight increasing, viscosity increasing, torque,... volumes (cutting, water, fluid)



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SECTION 3

GENNARETTI DECANter CENTRIFUGE TECHNOLOGY

An in-depth look at Gennaretti separation principles, dual operating modes, and dynamic electro-hydraulic control.

Decanter centrifuge: the final barrier for solid-liquid separation

In trenchless technologies (HDD, microtunneling, Direct-pipe), the centrifugal decanter holds a highly strategic role. It represents the final and most advanced stage of the fluid recycling/dewatering line.

By continuously extracting ultra-fine solids, the decanter transforms a costly liquid waste into two highly valuable resources:

1. Clarified Water/Fluid: Immediately returned to the slurry system, closing the water loop.
2. Dry Solid Cake: Concentrated solids that are cheap to transport and dispose of or sometimes even reused.

WHY DECANTER CENTRIFUGE IS ESSENTIAL?

Protects Rig Equipment: Eliminating fine abrasives reduces wear on expensive high-pressure slurry pumps and drill bits.

Slashes Disposal Costs: Liquid slurry is expensive to dispose of. Drying it into a compact cake cuts disposal volumes up to 70%.

Conserves Freshwater: Maximizes fluid reuse, making the project highly sustainable and viable in water-scarce areas.

Maintains Slurry Properties: Prevents slurry density from climbing, which maintains drilling rate of penetration (ROP).



...INTO THIS...



TURN THIS...

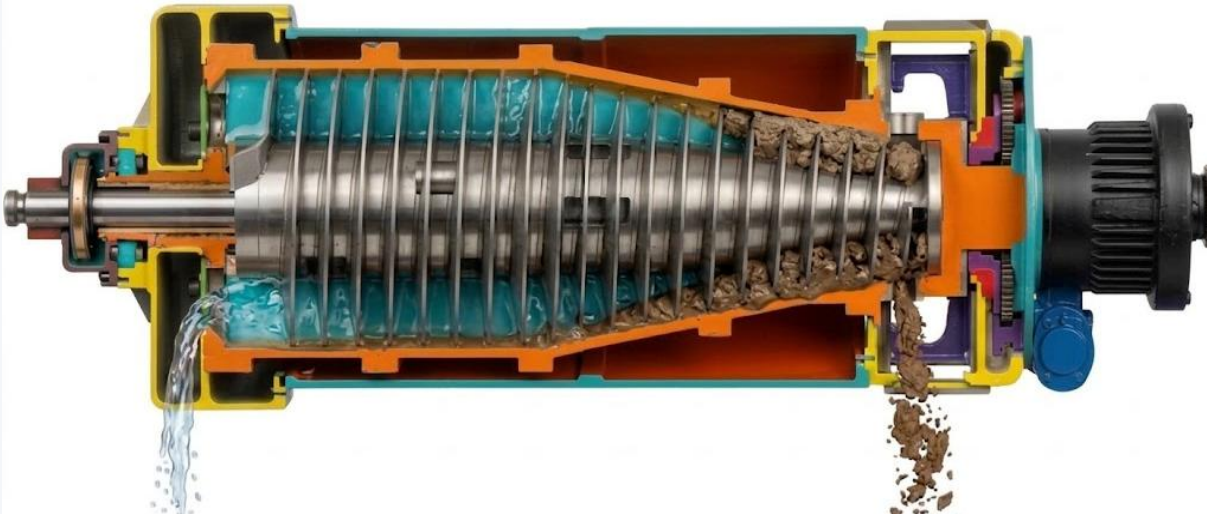
..AND THIS



High-speed rotation sedimentation through centrifugal force

A centrifugal decanter operates on the principle of accelerated sedimentation. In a static tank, fine particles settle out of a liquid slowly due to gravity. Inside the centrifuge, high-speed mechanical rotation generates centrifugal forces thousands of times stronger than gravity.

This force separates the drilling slurry (a two-phase mixture) based on the difference in specific gravity between the heavier solid particles and the lighter fluid carrier.



CORE MECHANICAL COMPONENTS

Bowl: A solid steel horizontal cylinder / conical log that spins at high speeds to generate G-force, forcing solids to deposit against the inner wall.

Screw: A screw that rotates inside the bowl at a slightly different speed, pushing the settled solids toward the discharge ports.

A four-stage continuous cycle

1. SLURRY FEEDING

Pre-screened drilling slurry is pumped continuously into the centrifuge through a central feed tube, entering the core of the high-speed rotating bowl.

2. G-FORCE SEPARATION

The massive centrifugal force drives heavier solid particles to the inner wall, while the lighter fluid remains as a concentric pool at the center.

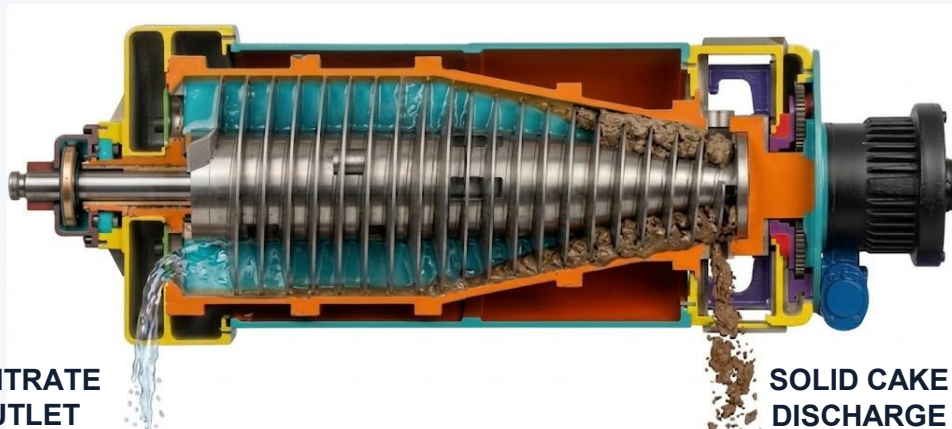
3. CENTRATE OUTLET

The clarified liquid (centrate) flows over the adjustable decanter bowl liquid levels at the rear end, immediately recovered for drilling, disposal or site water (new benotnite, washing, anti dust, etc.).

4. DRY SOLID CAKE DISCHARGE

The screw continuously scrapes the deposited solid cake from the wall, pushing it out the tapered end as dry, shovelable waste.

SLURRY FEEDING



CENTRATE
OUTLET

SOLID CAKE
DISCHARGE

The decanter centrifuges working modes

SOLID CONTROL / RECYCLING MODE

No Chemical Additives: Operates purely through physical G-force separation. No polymers or coagulants are added to the feed.

Bentonite Preservation: Specifically engineered to selectively remove silts and abrasive fines while keeping active bentonite in the fluid.

Fluid Rigeneration: Keeps slurry properties within spec, recycling the fluid continuously during standard drilling.

Silt-Marl Formations: Most effective in marly or silty grounds.



No use of chemicals means: THE SOLID OUTPUT IS A SUB PRODUCT, NOT A WASTE AND LONGER LIFE OF THE BENTONITE FLUID

DEWATERING MODE

Chemical Conditioning: Uses flocculants and coagulants to bind ultra-fine clays and colloids into large flocs.

Slurry Volume: Reduction: Specifically targets exhausted, high-density slurry that can no longer be physically recycled.

Water Clarification: Produces highly clarified water (SST < 100 mg/l) for mixing new slurry or washing equipment.

Clay Formations & Project End: Essential when drilling in clay and for final site cleanup.



Use of chemicals means: VERY HIGH REDUCTION OF WASTE VOLUME (with less €/t costs) AND REUSE OF WATER.

The decanter centrifuges working modes



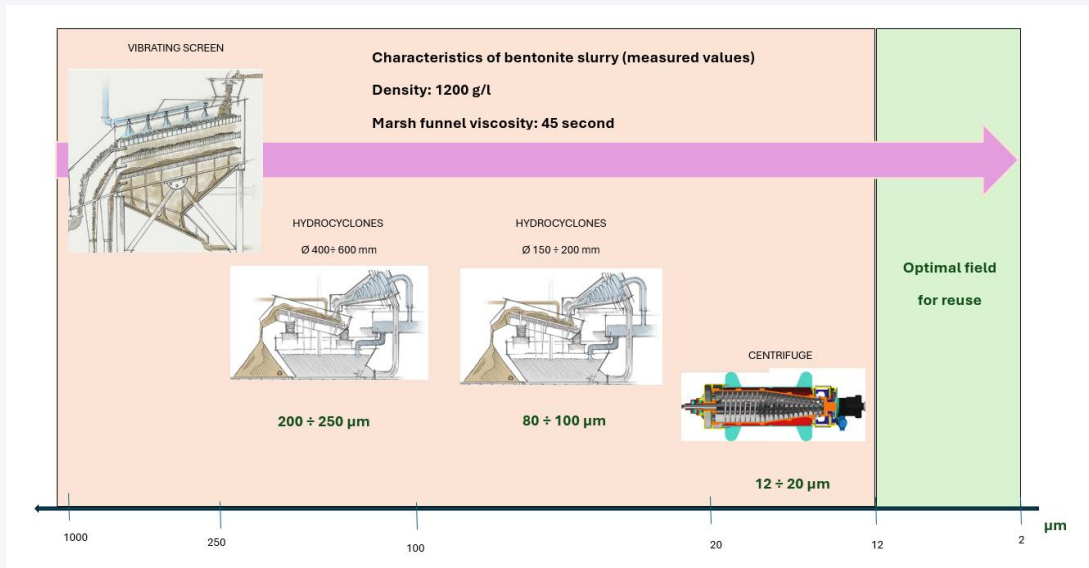
JOB SITE – CESENA, Italy

The Monte Tiglio Crossing

Solid Control - Recycling preserves active bentonite while stripping ultra-fine abrasive silts

Solid Control – Recycling mode selectively strips cuttings based on size and specific gravity. While shakers and hydrocyclones take out sands and silts above 80 ÷ 100 microns, the centrifuge reaches deeper, stripping the remaining abrasive silts.

Crucially, it is adjusted to allow active bentonite platelets to remain in the fluid. This prevents the loss of expensive drilling additives and preserves the slurry's viscosity while removing the dangerous abrasive fractions.



SS $\approx 45\% \div 50\%$

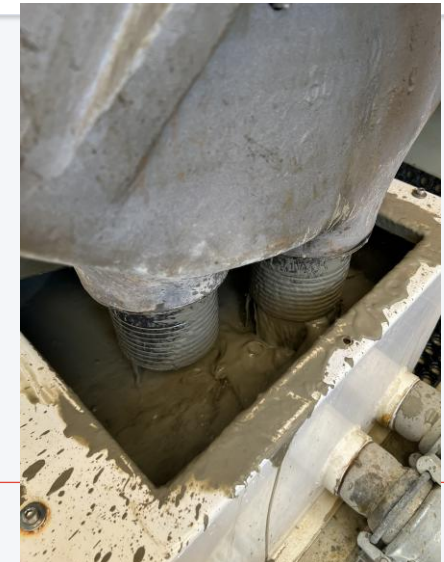
Dry matter content of the discharged solid cake. Highly shovelable and easy to handle.

Mf $\approx 12\% \div 25\%$

Mass finer (particelle fini) remaining in the recycled slurry, consisting of beneficial active bentonite.

Particle Cut: 12-20µm

The optimal range targeted to strip abrasive silt particles while preserving bentonite platelets.



Chemical dewatering isolates ultra-fine clays to recover clean water

When drilling slurry reaches its critical density limit and can no longer be recycled, it must be dehydrated. This process uses high chemical conditioning in combination with maximum centrifugal force.

By adding polymers, we force the ultra-fine clays to cluster. The centrifuge then easily separates the mixture, yielding a highly concentrated solid cake and clear, transparent centrate water.



SS $\approx$ 55% ÷ 65%

Dry matter content of the discharged solid cake. Extremely compact, reducing waste volume drastically.

SST < 80-100 mg/l

Total suspended solids in the clear liquid outfall. Transparent, clean water ready for reuse or discharge.

70% Slurry Volume Cut

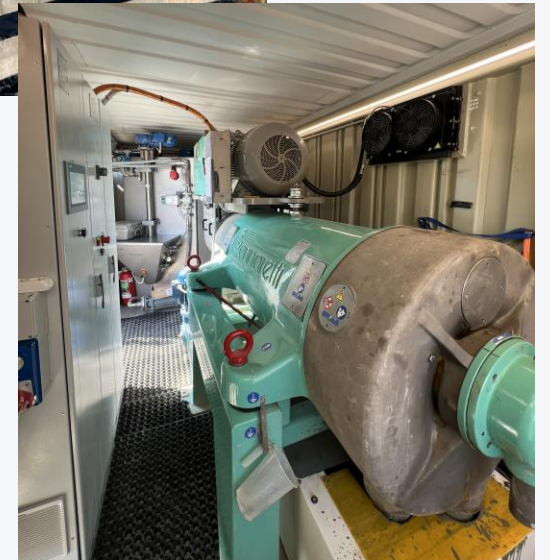
Chemical conditioning and high G-force reduce the physical volume of waste slurry by up to 70%.

Independent bowl and built on hydraulic screw drive...zero downtime

In modern drilling works, the decanter centrifuge is an essential component of the excavation cycle, directly dictating advance rates through efficient slurry separation. Overcoming the frequent clogging and performance drops caused by feed density swings requires specific engineering solutions:

- **Heavy-Duty Construction**
- **Wear-Resistant Screw**
- **Hydraulic Screw Drive & Dynamic Control**

Given its decisive role on site, excavation contractors benefit significantly from fully mastering decanter centrifuge technology, developing strong in-house operational know-how in close collaboration with leading equipment manufacturers.





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SECTION 4

OPERATIONAL RESULTS & CASE HISTORY

Analyzing the real-world application, slurry-control performance, and quantified environmental and economic impacts at Monte Tiglio.



Slurry data decanter centrifuge acts as the 4th stage of the recycling layout prevents slurry density spikes and reduces frac-out risk

4th STAGE DEPLOYMENT

At the Monte Tiglio cantiere, the high-speed slurry Data Gennaretti decanter centrifuge was integrated directly into the recycling layout as the 4th and final stage of treatment.

The centrifuge was placed in line after the desilter cyclones. It received the sub-desilter fluid (containing particles under 15 microns) and ran continuously, preventing the buildup of dangerous fine solids in the slurry pits in real-time.

SOLID CONTROL / RECYCLING PERFORMANCE IN CLAY

During the pilot hole (Ø 12" 1/4) and subsequent 5 reaming phases (up to Ø 56"), the drill crossed thick sequences of reactive, swelling clays of the Fontanelice Member.

As these clays mixed with water, they suspended as colloid fractions. If left unchecked, slurry density would have quickly risen above the critical limit of 1.30 kg/dm³, increasing hydrostatic pressure and risking a frac-out.

INTEGRATION HIGHLIGHTS

In-Line Layout: Placed on a flat platform next to the slurry storage tanks, receiving slurry via a dedicated feed pump.

Continuous Bypass Line: Connected to the DN 200 return pipe to continuously strip fines from slurry pumped from the exit point.

Integrated Prep Unit: Coupled with an automatic polymer preparation unit to mix and dose conditioning chemicals in real-time.

Flexible Settings: Allowed operators to toggle between solid control and Dehydration (dewatering) in seconds.

OPERATIONAL OUTCOMES

Density Controlled (< 1.25 g/cm³): Centrifuging in solid control mode continuously stripped the swelling clays, keeping density stable.

Viscosity Maintained (45-55 s): Retained beneficial bentonite platelets while discharging abrasive silts, keeping viscosity in spec.

Low slurry Dumps: Kept slurry in circulation for several cycles, completely avoiding the need to dump and remix slurry.

Reduced Friction: Clean slurry kept the annulus open, reducing drag forces on the drill string and preventing stuck tools.



Project-end dewatering collapses liquid slurry volumes by 70%

FINAL SITE CLEANUP CHALLENGE

At the end of the pullback, ... a massive volume of exhausted, high-density drilling slurry in the storage pits.

Disposing of this as liquid waste would have been extremely expensive under local environmental laws. To solve this, the centrifuge system was switched to Dehydration mode, utilizing polymers to completely collapse the slurry.

DEHYDRATION OUTCOMES

Water Chiarification (SST < 100 mg/l): Recovered clear water in large quantities, reused for high-pressure washing and site cleanup.

Dry Solid (SS ≈ 55-65%): Reduced the remaining slurry to a dry, compact solid cake.

Liquid Waste Cut: Reduced the total volume of waste slurry to be hauled away by 70%.

Massive Landfill Savings: Solid cake was cheap to transport and dispose of as solid waste, avoiding expensive liquid-waste handling.



A closed-loop system reduces waste volumes, truck traffic, and water footprint

~60% WASTE CUT

VOLUME & LANDFILL SAVINGS

By drying exhausted slurry into a compact cake, total waste volume was slashed by 70%. This completely eliminated the need for expensive liquid-waste transport and disposal fees, saving significant budget.

LOWER EMISSIONS

TRUCK TRAFFIC REDUCTION

Recycling centrate water and dumping only dry solid cake eliminated dozens of daily vacuum truck and water tanker trips. This drastically reduced the project's heavy traffic impact on local roads and cut CO2 emissions.

90% WATER RECYCLE

WATER CONSERVATION

The high-speed centrifuge recovered thousands of cubic meters of clear water. This closed water loop minimized freshwater extraction from the Savio basin, ensuring full ecological compliance.

Synergy between T.TOC mechanical force and centrifugal slurry control is the new standard

KEY PROJECT TAKEAWAYS

Value Engineering Victory: Converting the microtunnel project to a T.TOC variant avoided massive deep shafts, precast concrete structures, and severe groundwater risks.

Thruster-Rig Synergy: Coupling the HK300T rig with the HK500PT thruster successfully overcame extreme breakout forces after the critical 13-hour pause.

Centrifuge Vitality: The high-speed centrifuge proved to be the indispensable 4th stage of the separation circuit, keeping slurry density and viscosity perfectly in check.

FUTURE INDUSTRY GUIDELINES

Plan Centrifuges Early: High-speed centrifuges should be standard equipment on all large-diameter, long-distance trenchless crossings.

Optimize Chemical Dosage: Real-time slurry monitoring and automatic polymer prep systems are essential to handle alternating geology.

Adopt Combined Pull-Push: Pushing assistance via pipe thrusters provides critical safety margins during intermediate pullback pauses.

A New Standard: The success of Monte Tiglio sets a new benchmark for high-performance, sustainable utility crossings globally.



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THANKS FOR YOUR ATTENTION...
GOOD LUCK
WITH YOUR CHALLENGES
