

WHEN REALITY DIFFERS FROM THE GROUND MODEL

30th DCA Annual Congress

30.09. – 02.10.2026

Rom

Dr. Christoph Donié | Dr. Donié Geo-Consult GmbH

Jaqueline Farias Ewald | Dr. Donié Geo-Consult GmbH

Philipp Dick | x-plan Schnau engineering GmbH & Co. KG

How can we manage geological uncertainty in HDD projects?

GEOLOGICAL MODELLING

Jaqueline F. Ewald

What do we actually know?

PLANNING

Philipp Dick

What does this mean for design?

TROUBLESHOOTING

Dr. Christoph Donié

How do we act under uncertainty?

DCA

DR. DONIÉ
GEO-CONSULT GMBH



BEFORE MAKING ANY DECISION

Understand the Ground

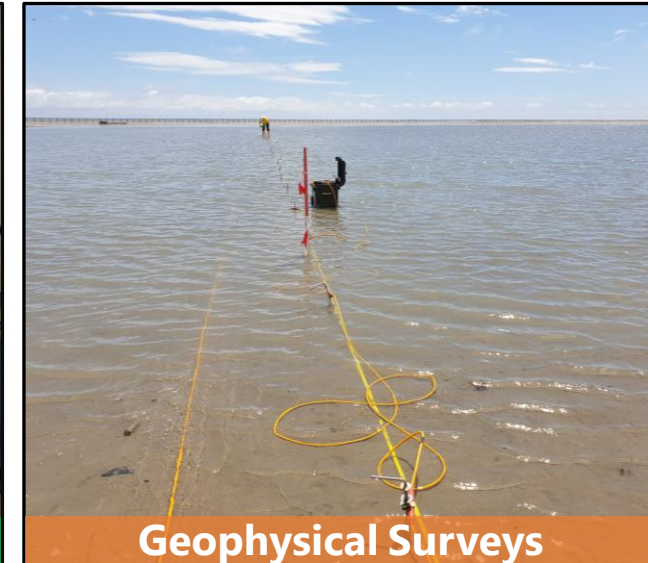
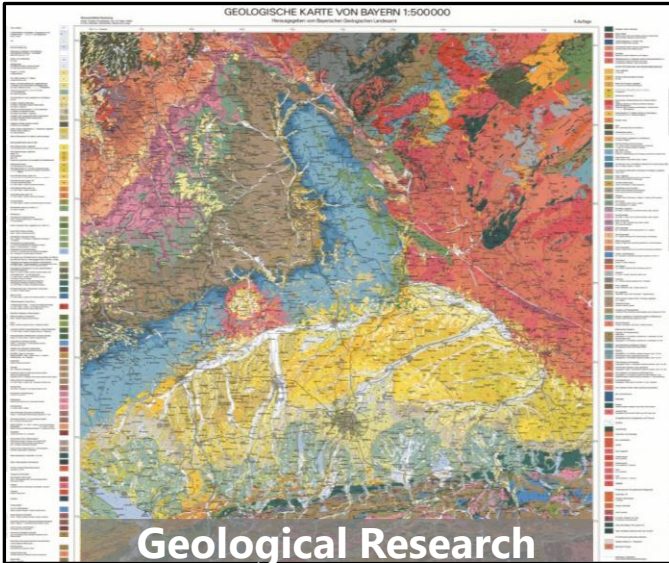
Geology • Geophysics • Ground Investigation • HDD Design

When do we have 100 % certainty?



Understanding geological models and their limitations

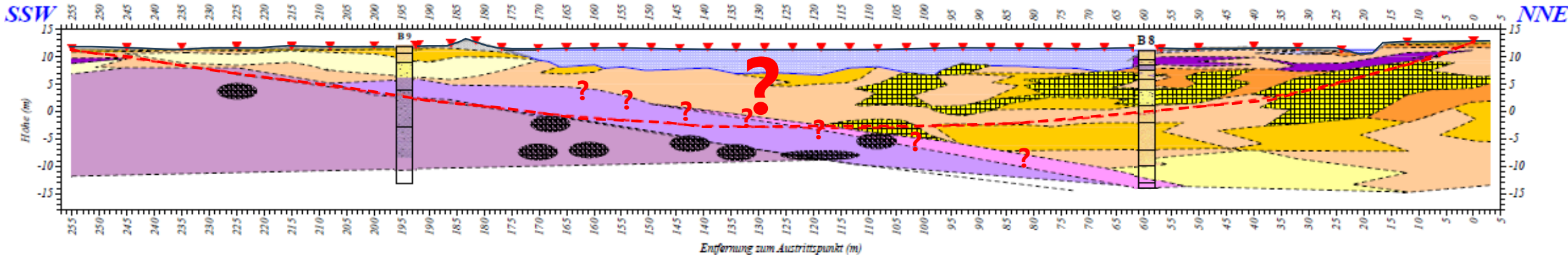
Geological models integrate different sources of information



Geotechnical , Geophysical, and Integrated Ground Investigation Reports

Should a geological model try to look precise, or should it clearly show where the interpretation is uncertain?

A useful model must provide a sufficiently clear basis for engineering decisions, but it must also distinguish between:



Observed information

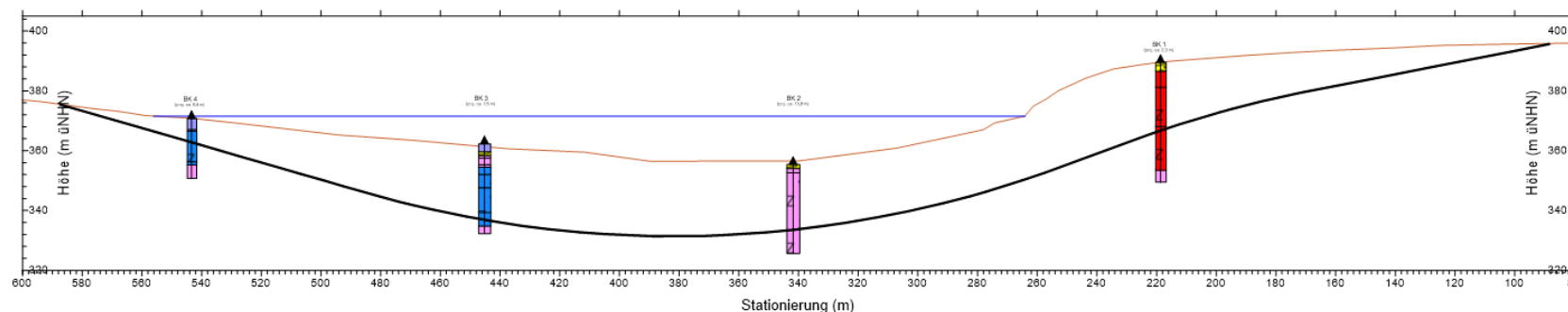
Uncertainty

Interpretation

Remain uncertainty

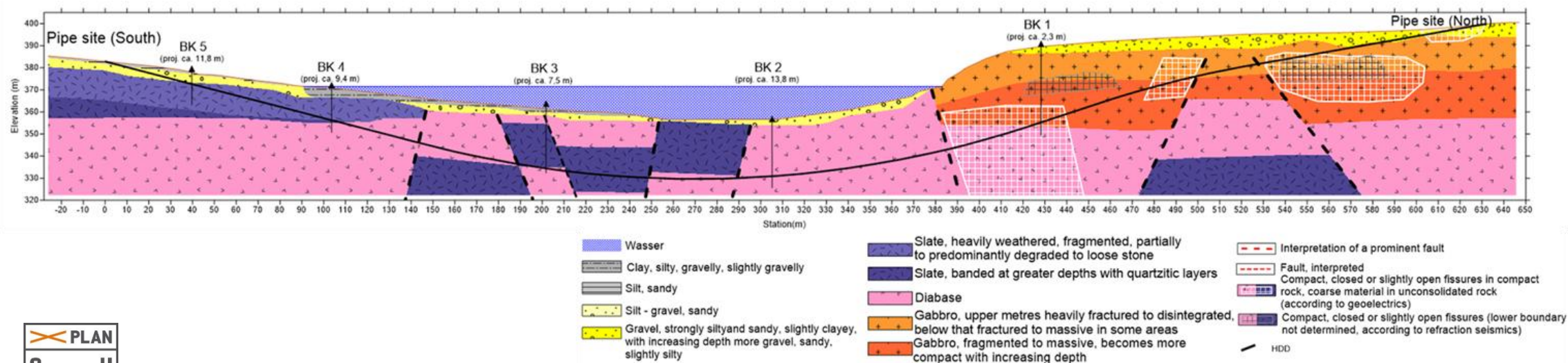
Reality is usually more complicated

4 Boreholes - Completely different lithologies



SSW

NNE



What is the most important conclusion that every geotechnical report for an HDD project should provide?

GROUND PARAMETERS

GROUNDWATER SITUATION

GEOLOGICAL MODEL

OTHER INFORMATION ?

HDD SUITABILITY

REMAINING UNCERTAINTIES

RISK ASSESSMENT



From geological model to engineering decision



STEP 1

**Feasibility / Suitability
of the HDD Method**

STEP 2

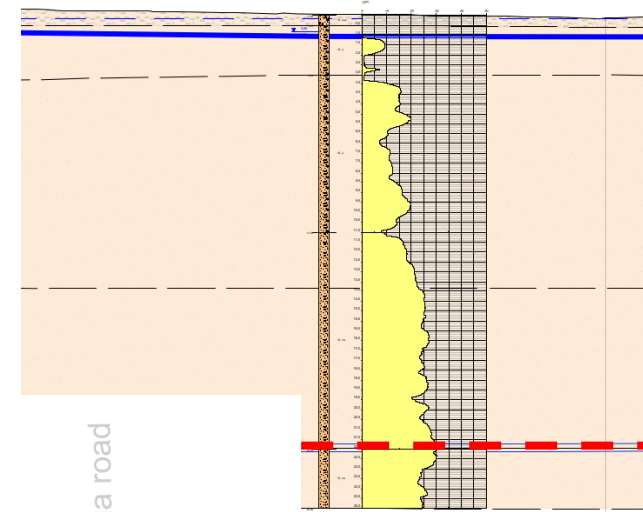
**Converting geological
information into planning
decisions**

- drilling alignment
 - rig size
 - drilling tools
 - drilling fluid concept
- remaining uncertainties /
contingency measures

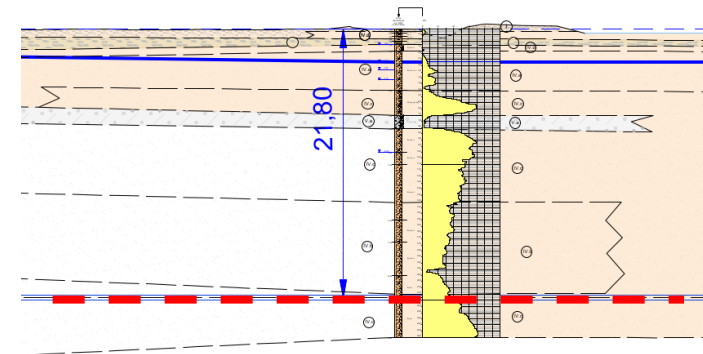
CHALLENGE: defined assumptions versus ranges and probabilities

Project situation

- Drilling with 800 m length
 - Expected soil: topsoil / peat / sand and gacial clay
 - Coverage: ≈ 22 m
 - 8 exploration boreholes
 - Geophysics completed
 - Geological model prepared
-
- HDD construction started
 - Significant drilling fluid losses
 - Assumption: coarse permeable layer encountered
 - Layer not (clearly) shown in the original model



stoelinga road



What should happen first?

(the client has been informed. Answer was: no idea. You are the expert.)

(significant losses can't be accepted)

A

Continue drilling while adjust the drilling fluid

B

Stop the operation immediately. Leave job site

C

Review the geological model and all construction observations to find a new alignment

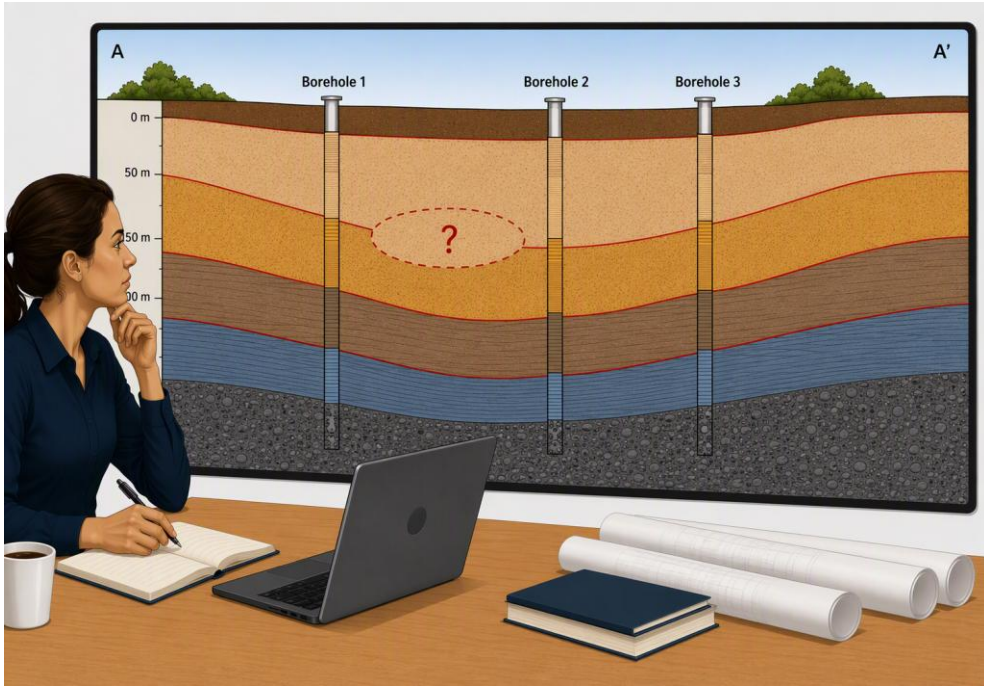
D

Carry out additional investigations before making any other decision

Was the model wrong?



NOT NECESSARILY



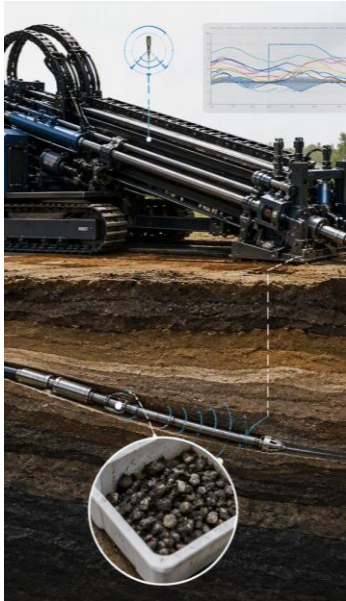
CHECK

- ✓ Underestimated indications
- ✓ A local geological feature between boreholes
- ✓ Geophysical resolution limitations
- ✓ New evidence revealed during construction

Was the model consistent with the information available at the time, and was the uncertainty communicated appropriately?

Start with the information already available

1 INFORMATION FROM CONSTRUCTION SITE

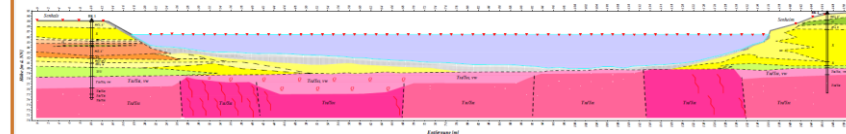
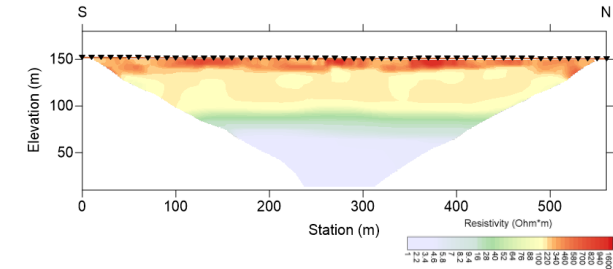


- ✓ Exact position and depth of the event
- ✓ Fluid pressures and returns
- ✓ Drilling fluid losses
- ✓ Cuttings
- ✓ Steering behaviour
- ✓ Detailed observations from the drilling crew
- ✓ Drilling parameters

COMPARE & REVIEW

2 EXISTING SITE DATA

Depth [m]	Log	Description
0.0	Topsoil	Silty, sandy, brown, with roots
2.0		
4.0	Sand	Fine to medium sand, slightly silty, yellowish brown
6.0		
8.0		
10.0	Limestone	Moderately weathered, light grey, weak to medium strong, partly fractured
12.0		
14.0		
16.0	Crystalline rock	Weathered to slightly weathered, grey, strong
18.0		
20.0		
22.0		



- ✓ Borehole records
- ✓ Geophysical data
- ✓ Geological model

What does the project team need now?



Which additional information can help us most reducing uncertainties?

MORE BOREHOLES

ADDITIONAL GEOPHYSICS

FULL DATA REVIEW

**REVISED GEOLOGICAL
INTERPRETATION**

LABORATORY TESTS

OTHER INFORMATION ?

**Geological uncertainty cannot be eliminated.
It should be identified, communicated and
managed.**

„After all, ‘burying one’s head in the sand’ is not an engineering decision – justified decisions begin with an understanding of the ground conditions.“

Thank you!