
”Scenarios” Et nyt Horizon 2020 forskningsprojekt vedrørende PFAS relatedede problemstillinger

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- 4 årigt Horizon 2020 projekt (Nov 2021-nov 2025)
- 19 partnere fra hele Europa + Israel
- Budget 12 mill €





INNOVATIVE KNOWLEDGE

Sustainable, viable, cost effective PFAS monitoring & remediation technologies.



LOW COST

FOCUS of RTD & DEMO

- Detection & Removal of PFAS from groundwaters, drinking water, wastewater, slurries
- Detection & Removal PFAS from soils
- Feasibility and scale-up for field testing
- Human biomonitoring
- Hazard & Risk Assessment for PFAS



NEARLY ZERO ENERGY



GREEN

FOCUS of DISSEMINATION & EXPLOITATION

Direct actions towards uptake:

- **Replication and partner agreements** for post-Project EU-wide exploitation
- **Value chain** supported by exploitation professionals for post-Project uptake
- **Clustering** with ongoing research activities for synergies
- **Clear leveraging** of past and ongoing research at partner organisations.



SUSTAINABLE

VIABLE IMPACTS

Technology, Consortium, Stakeholder and Community impacts:

- New technologies for PFAS
- Sustainable water & soil treatment systems
- Communication to 500,000, targeted dissemination and outreach to over 15,000 stakeholders
- Reduction of contamination by PFAS and human health protection
- Support to policy and decisions makers
- Ecosystem restoration & biodiversity protection
- Worldwide scale-up via coordinator

- **WP3 Environmental fate of PFAS (BGU) *MONITERING AF PFAS SPREDNING I JORD OG LOSSEPLADSFYLD***

Task 3.1 PFAS pollution potential of landfills

Task 3.2 PFAS transport in the unsaturated zone and groundwater of contaminated lands

Task 3.3 Controlled experiments for determination of PFAS transport properties

Task 3.4 Modelling of PFAS transport in the subsurface

- **WP7 Validation and demonstration (Envytech) *OPSAMLING AF PFAS FRA VAND OG JORD***

Task 7.1 Human biomonitoring program and Risk Assessment (DEMO 1, Pillar 1 detection and Pillar 2 Risk Assessment)

Task 7.2 Design, construction and evaluation of up-scaled units for demonstration purpose

Task 7.3 Demonstration of remediation activity in soil and underground water

Task 7.4 Demonstration in a drinking water treatment plant

- **WP6. Innovative Nearly Zero Energy remediation solutions (FORTH) *(DESTRUCTION AF PFAS CONCENTRAT)***

Task 6.1 Development of Cold Plasma and other advanced oxidation systems for pollution control and remediation

Task 6.2 Innovative PFAS remediation techniques by means of Physical Separation FASS

Task 6.3 Development and testing of (biologically) activated adsorbents for water remediation and soil stabilization

Task 6.4 Hybrid remediation approaches and systems scale-up

- **Udpege to pilots-sites til indsamling af prøver til laboratorieforsøg/feltforsøg**
- **Opstille højopløselig geologisk/hydrogeologisk model** for Korsør Brandskole og Trelleborg brandøvelsesplads
- **Avanceret monitering og prøvetagning** af den umættede zone under PFAS/PFOS hot spots. (tidsserie med monitering af vand/PFAS i den umættede zone i lossepladsfyld og under naturlige geologiske forhold)
- **Indsamling af jord/vandprøver** fra den umættede og mættede zone til laboratorieforsøg
- **Udvikle og afprøve "State of the art" oprensningsmetoder.** SAFF/kold plasma destruktion/bioremediation på laboratorieskala og på de udvalgte feltlokaliteter. Første anlæg opsættes i Korsør sommeren 2023.

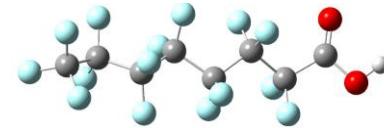
SAFF – Surface Active Foam Fractionation



Perflourinated substances has:

- Hydrophilic head – Head loves water
- Hydrophobic tail – Tail hates water

More scientific wording:
Langmuir constant $>1 \ 10^{-6}$ can be caught



The bubble becomes the perfect environment,
PFAS >C6 – tail sticks in the bubble, easy to remove

Primary step: 10 x conc Secondary Step: 1500 x conc Tertiary Step: 500-200 x conc



Removal effects using JUST air – No consumables

Comparison of results of PFAS removal rates for
Groundwater/ Leachate / Fire Fighting water /
Surface water runoff at airport



Provets märkning	OPEC GW Australia 150 000 m3	NSR Leachate 30 000 m3	Telge Leachate 250 000 m3	Löt Leachate 15 000 m3	Miljöbo leachate 9000 m3	Swedish Airport 40 m3	Fire Fighting water Refinery 12 000 m3
PFDA (Perfluordekansyra) (ng/l)	100%	100%	100%	100%	100%	100%	100%
PFNA (Perfluornonansyra) (ng/l)	100%	100%	100%	100%	100%	100%	100%
6:2 FTS (Fluortelomer sulfonat) (ng/l)	100%	100%	100%	100%	100%	100%	99,50%
PFOA (Perfluoroktansyra) (ng/l)	100%	100%	100%	100%	99%	98%	99%
PFOS (Perfluoroktansulfonsyra) (ng/l)	100%	99%	98%	100%	100%	100%	100%
PFHxS (Perfluorhexansulfonsyra) (ng/l)	97%	100%	100%	99%	99%	79%	99,50%
PFHpA (Perfluorheptansyra) (ng/l)	67%	99%	98%	90%	92%	99%	95%
PFHxA (Perfluorhexansyra) (ng/l)	20%	54%	29%	35%	10%	0%	35%
PFPeA (Perfluorpentansyra) (ng/l)	24%	0%	3%	38%	7%	0%	0%
PFBA (Perfluorbutansyra) (ng/l)	21%	8%	1%	0%	0%	0%	0%
PFBS (Perfluorbutansulfonsyra) (ng/l)	22%	43%	10%	19%	8%	0%	52%
Total PFAS conc.	4 000 ng/l	6 000 ng/l	4 000 ng/l	15 000 ng/l	4 000 ng/l	4 000 ng/l	100 000 ng/l

Screening af potentielle sites

Forundersøgelser på udvalgte sites

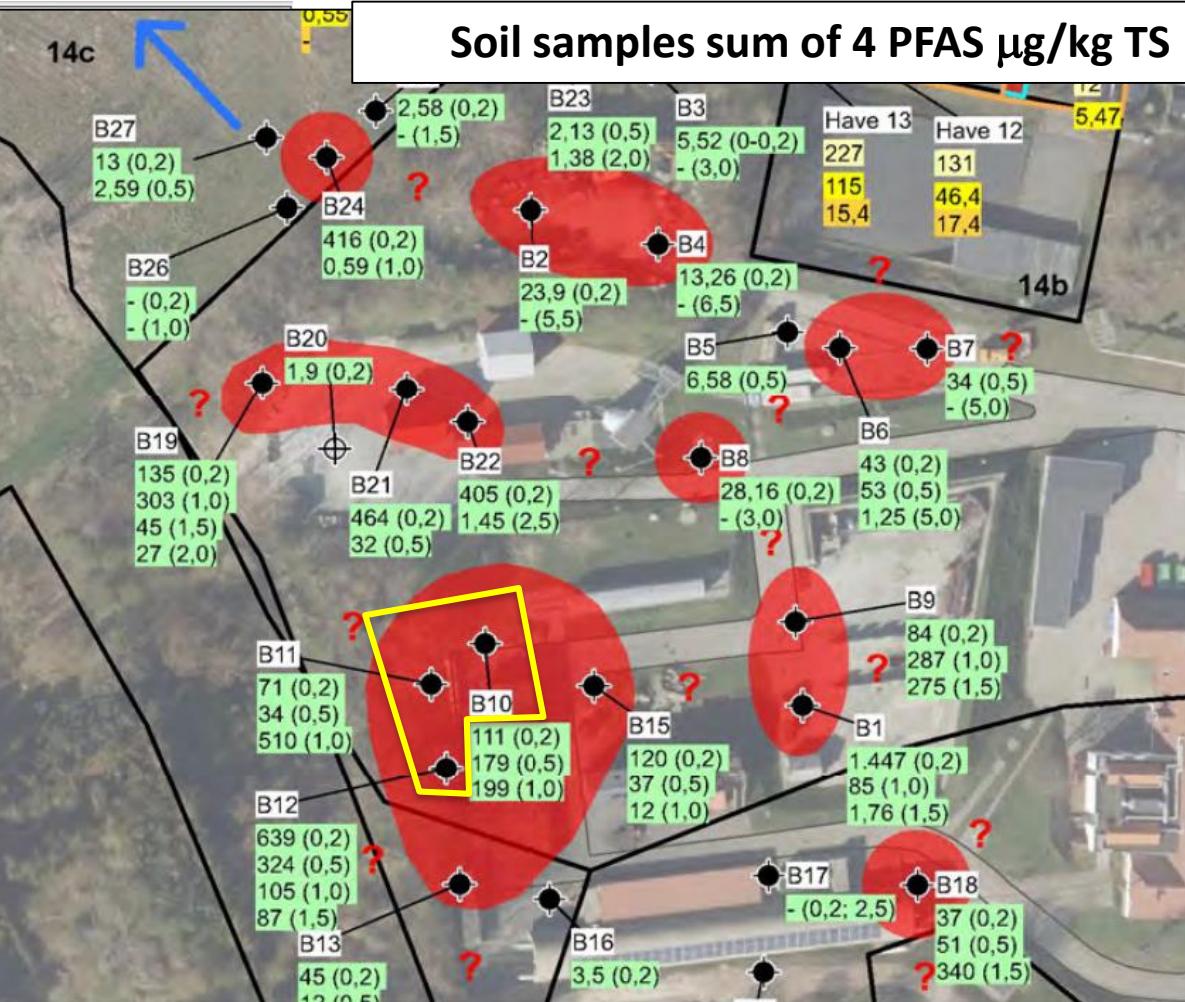
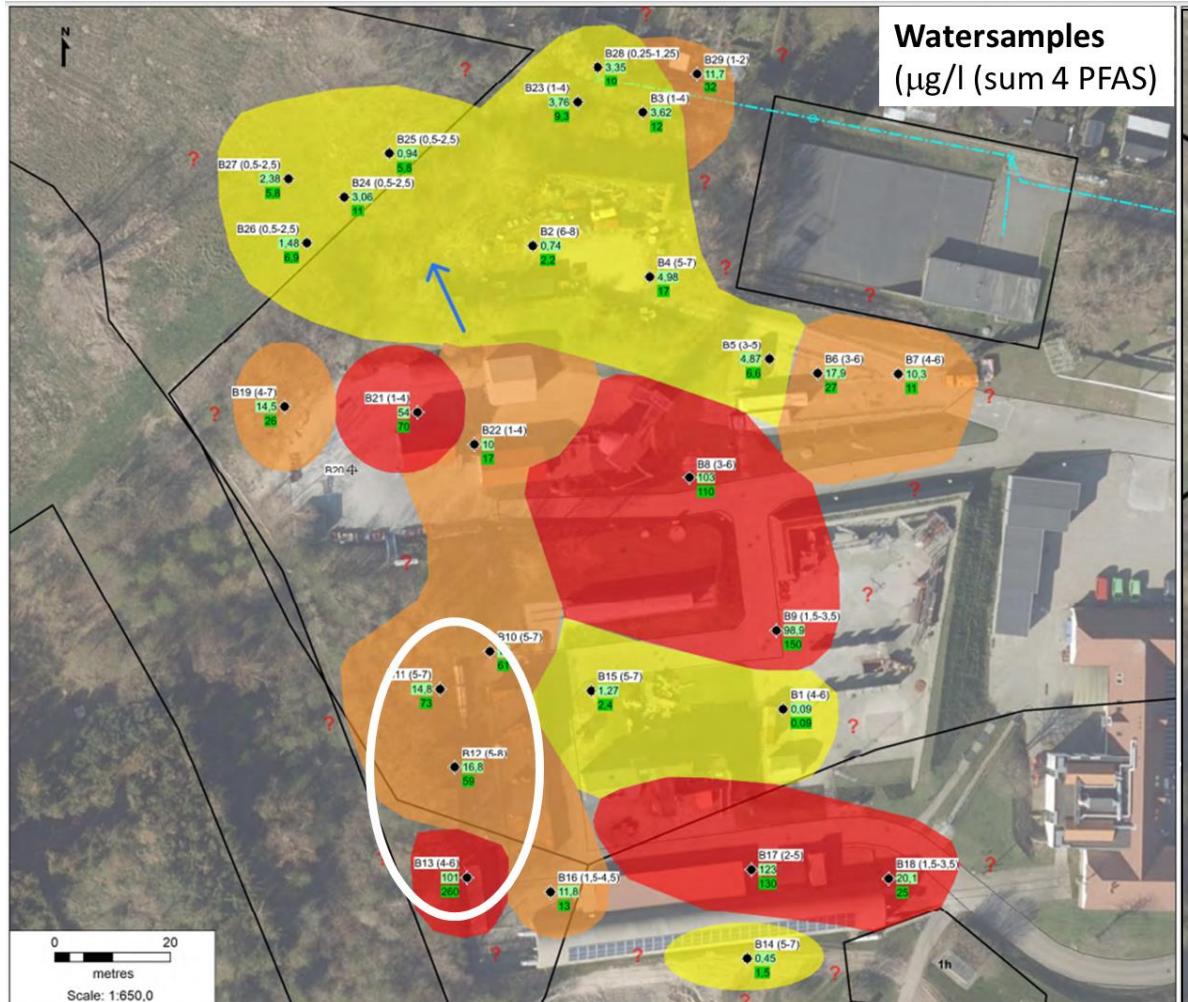
Udvælgelse af 2 sites

- Trelleborg: brand-øvelsesplads på Losseplads ud til å-system
 - Korsør:
Brandskole/brandøvelsesplads
glacial geologi ud til å/marint
system,



Korsør brandskole





Indledende boring K1



Drill log page 1/1			Borehole no: K1	Pl: KEK
Project 205579			Driller Id: Mats	Coordinator:
Borehole: Korsoer			Start date:	Gw. table m b.g.s.:
			End date:	kote, terrain: ROK:
Depth.m.	Filter	Drilling method Transitions	Grainsize clay silt fine sand Medium sand coarse sand gravel stone	Description and geological setting
0,5 -		Rotary Auger		Mull, sandy topsoil brown CaCO ₃ poor Sandy till, clayey, silty, few stones, yellowish brown CaCO ₃ poor Sand, medium, light yellowish brown CaCO ₃ poor "meltwatersand"
1,0 -				Sandy till, w. clayey, silty, some gravel, brown CaCO ₃ poor Sand, medium, light reddish brown CaCO ₃ poor "meltwatersand"
1,5 -				Sandy till, w. clayey, silty, some gravel, reddish brown CaCO ₃ poor Sand, medium, light yellowish brown CaCO ₃ rich "meltwatersand"
2,0 -				Clay silty, massive, brown, CaCO ₃ rich "meltwater-clay" Sand, fine, medium, coarse, laminated, light yellowish brown CaCO ₃ rich "meltwatersand"
2,5 -				Sandy till, w. clayey, silty, some gravel, few stones, sandstringer, brown, CaCO ₃ rich, "flowtill"
3,0 -				Sandy till, w. clayey, silty, some gravel, few stones, sandstringer, brown, CaCO ₃ rich, "flowtill"
3,5 -				Sand, medium, coarse, gravelly, light yellowish brown, CaCO ₃ rich "meltwatersand"
4,0 -				Sand, medium, coarse, light yellowish brown CaCO ₃ rich "meltwatersand"
4,5 -				Sand, medium, coarse, gravelly, light yellowish brown, CaCO ₃ rich "meltwatersand"
5,0 -				Sand, medium, coarse, gravelly, few stones, light yellowish brown, CaCO ₃ rich "meltwatersand"
5,5 -				Sand, medium, coarse, gravelly, light yellowish brown, CaCO ₃ rich "meltwatersand"
6,0 -				Sand, medium, coarse, gravelly, few stones, light yellowish brown, CaCO ₃ rich "meltwatersand"
6,5 -				Sand, medium, coarse, gravelly, few stones, light yellowish brown, CaCO ₃ rich "meltwatersand"
7,0 -				Sand, medium, coarse, gravelly, few stones, light yellowish brown, CaCO ₃ rich "meltwatersand"
7,5 -				Sand, medium, coarse, gravelly, few stones, light yellowish brown, CaCO ₃ rich "meltwatersand"
8,0 -				Sand, medium, coarse, gravelly, few stones, light yellowish brown, CaCO ₃ rich "meltwatersand"



Issø-
bakker



Strømliniet
bund-
moræne
og ås



NØ-isens
rand-
moræner



Mindre
rygge på
dødis-
moræne



Smelte-
vands-
flod



Bælthav
Isstrøms
rand-
moræner



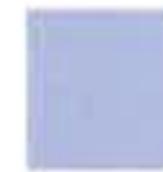
Dødis-
lavning



Istdæmmet
sø

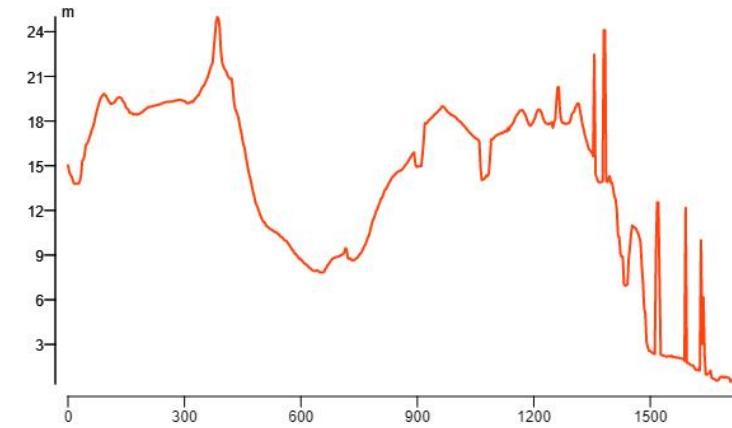
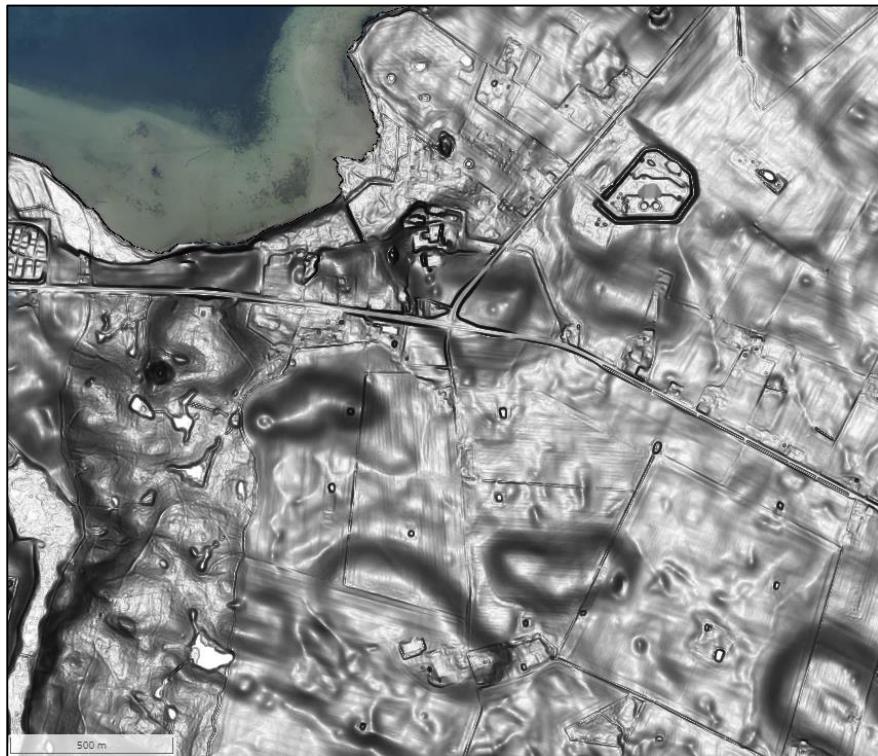


Målt
retning af
istryk

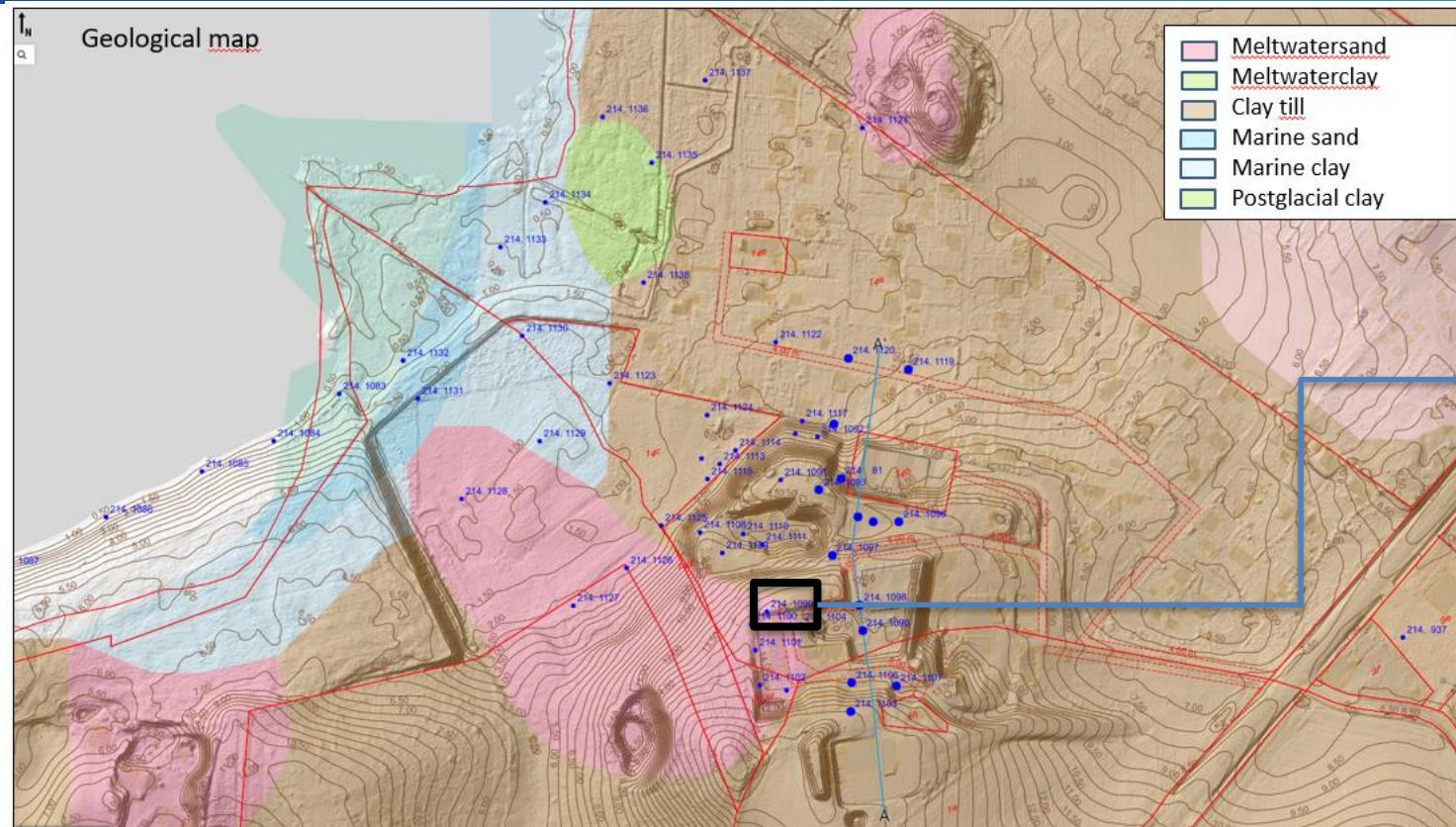


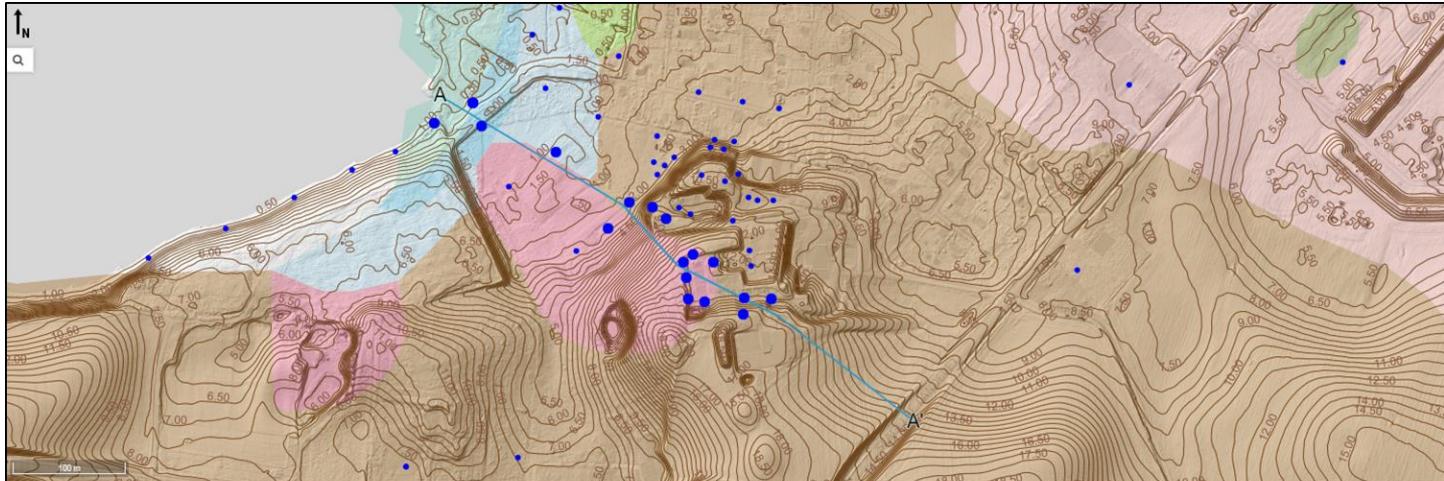
Postglacial
havbund

Højde model

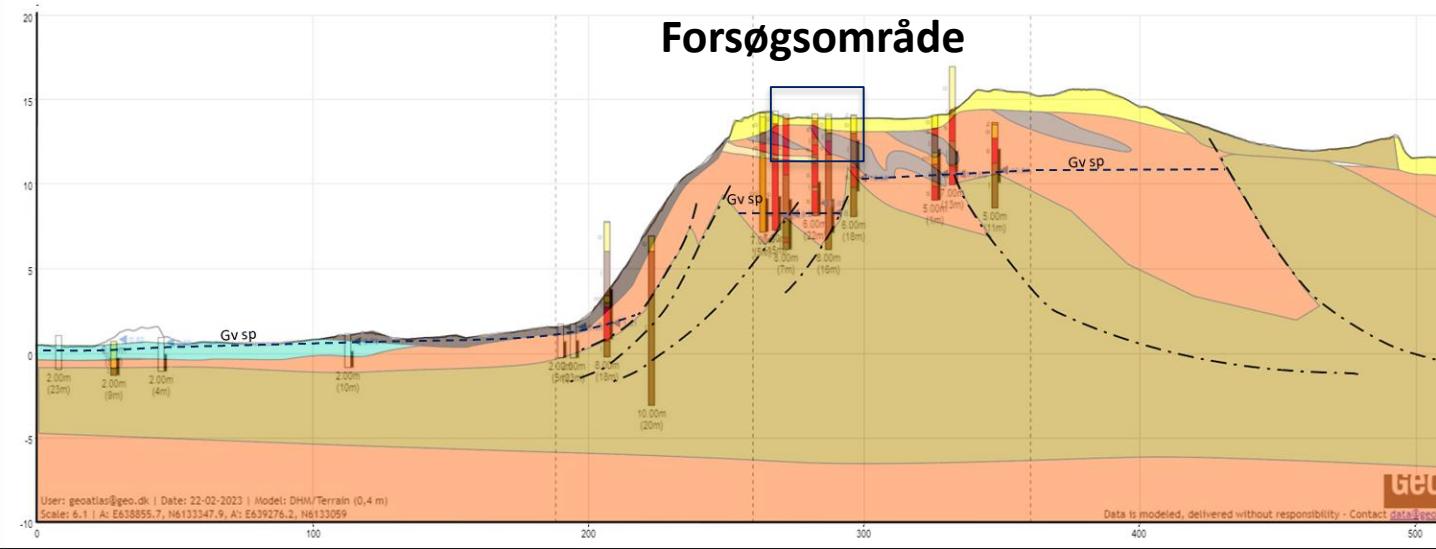


Geologisk ramme

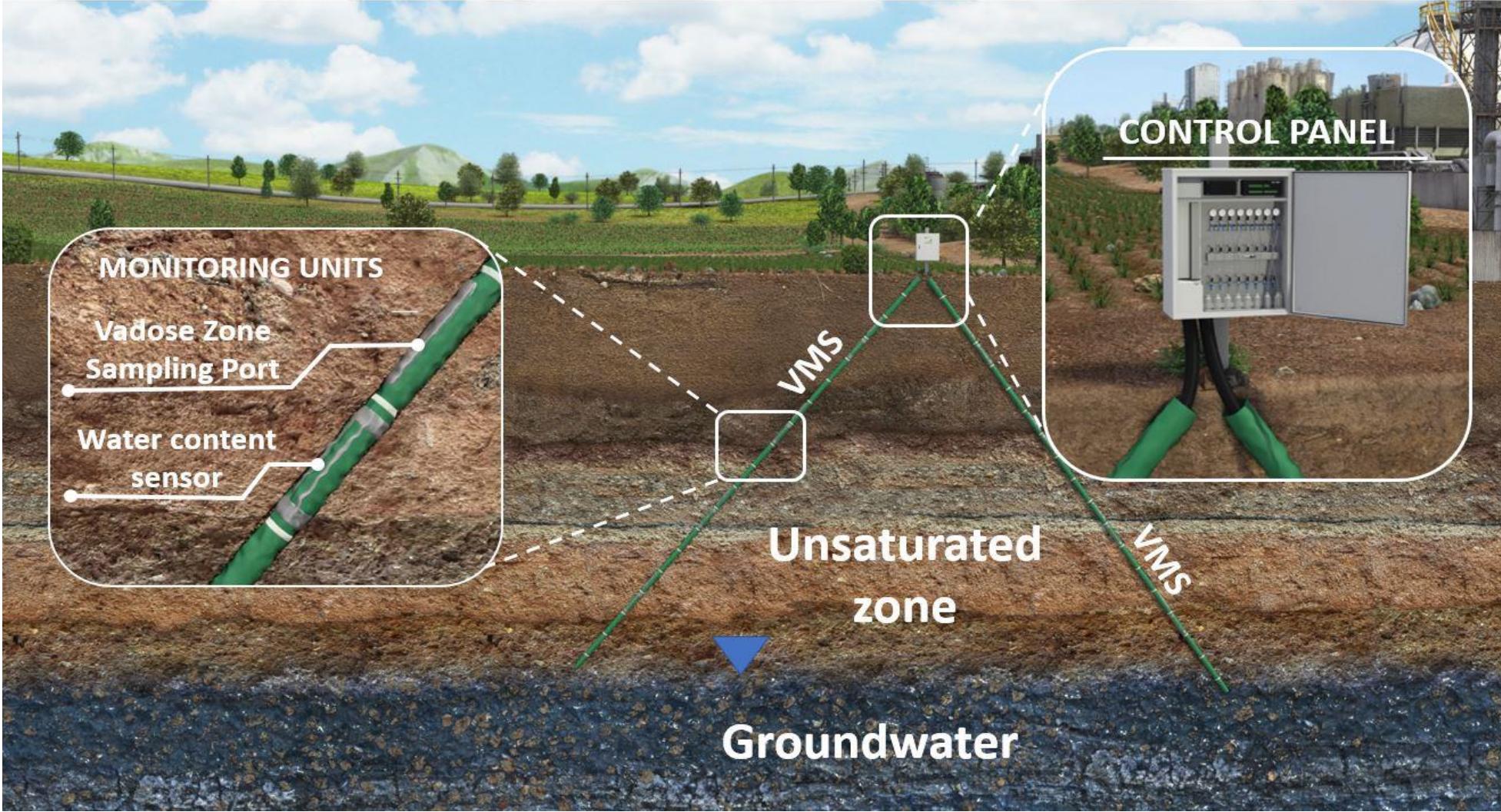




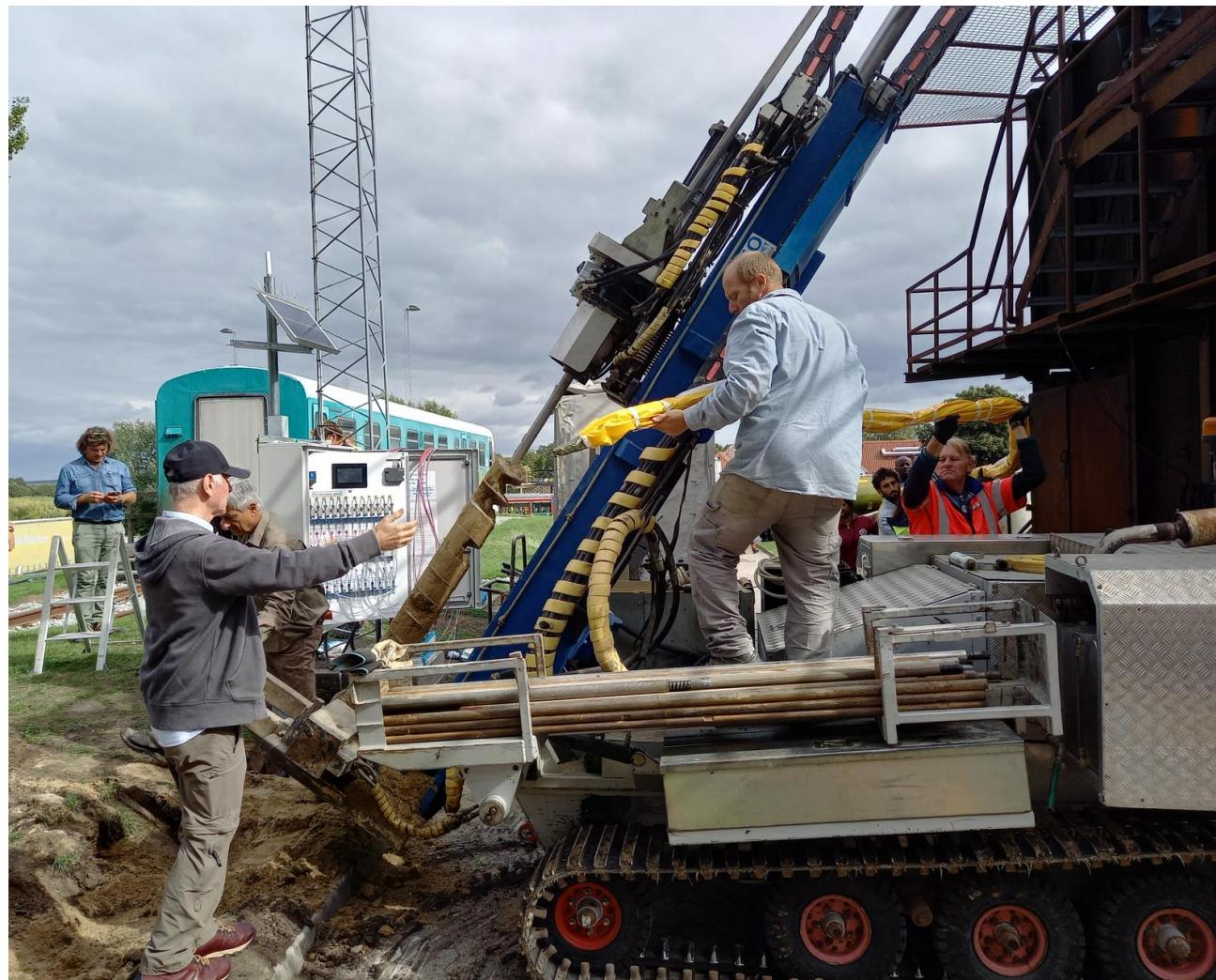
Forsøgsområde



- Prøvetagning af vand i forskellige niveauer under uforstyrret sediment i den umættede zone.
- **Vandprøver** udtages typisk 1 gang pr mdr.
- **Vandmætning, temp** og **tryk** måles kontinuert og sendes direkte til modtager online.
- Detaljeret overblik over hvornår og hvor meget PFAS der udvaskes fra jorden og siver ned til grundvandet i forhold til klimatiske forhold.
- Mulighed for kontrollerede nedsivningsforsøg
- Mulighed for forsøg med ”flushing” af de øvre jordlag.



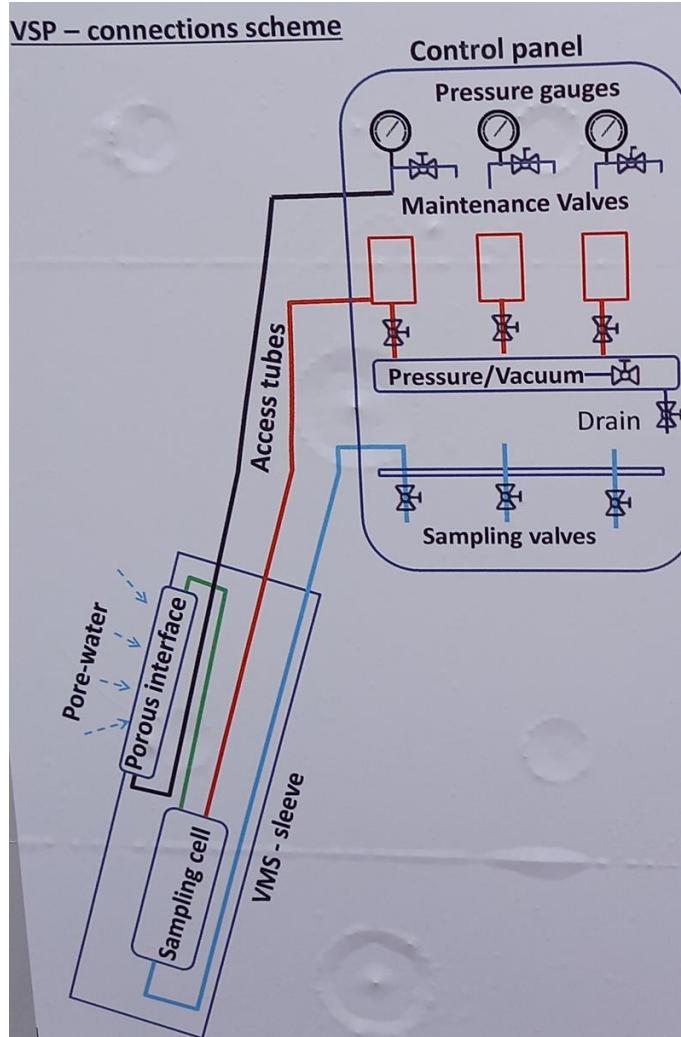
Forberedelse af "Anakondaen" Moniteringsboring



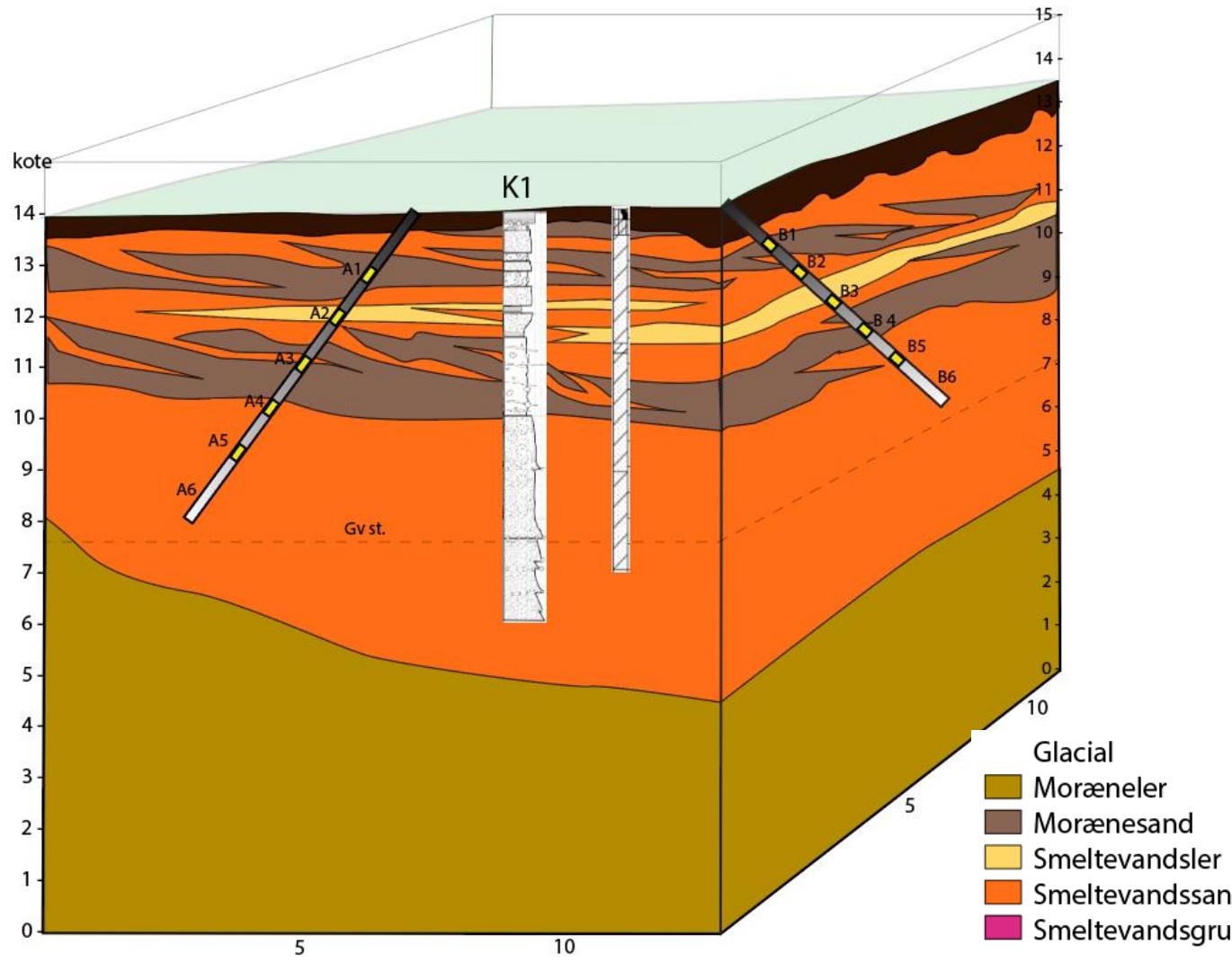
Installering af "Anakondaen"

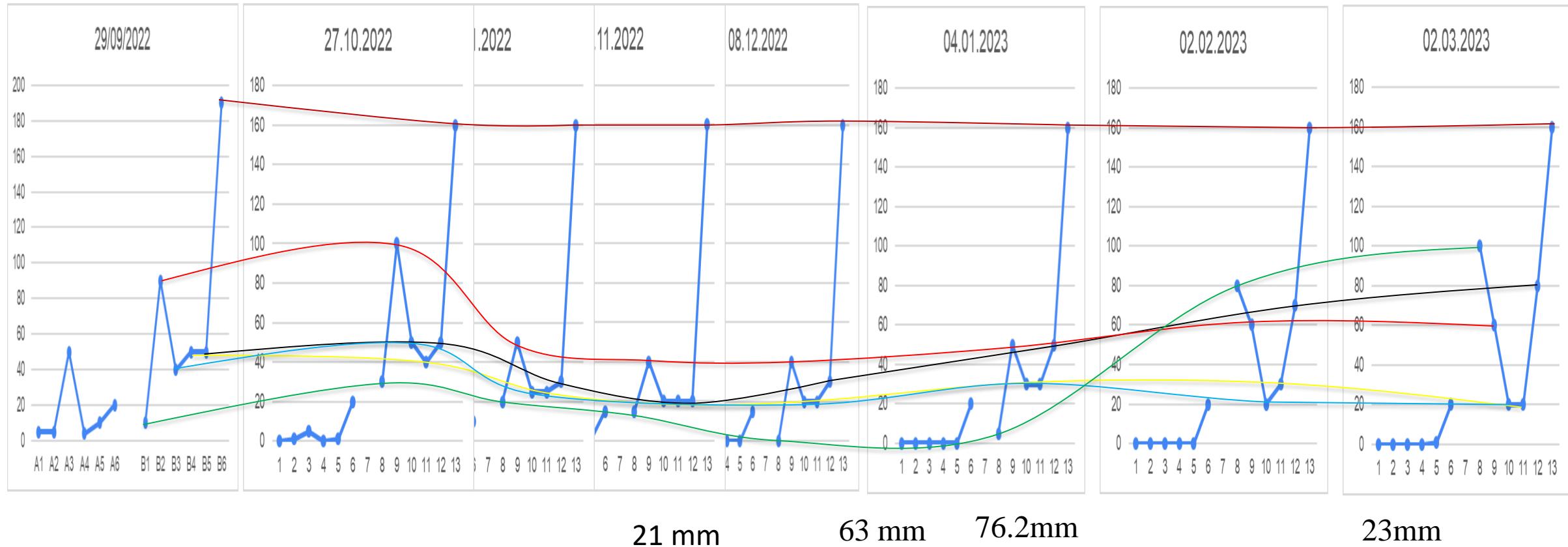


"anakondaen" pumpes op (fyldes med cement) så den forsegler kontakten til indersiden af borehullet dernæst forbindes alle slanger og ledninger til prøvetagningspanelet

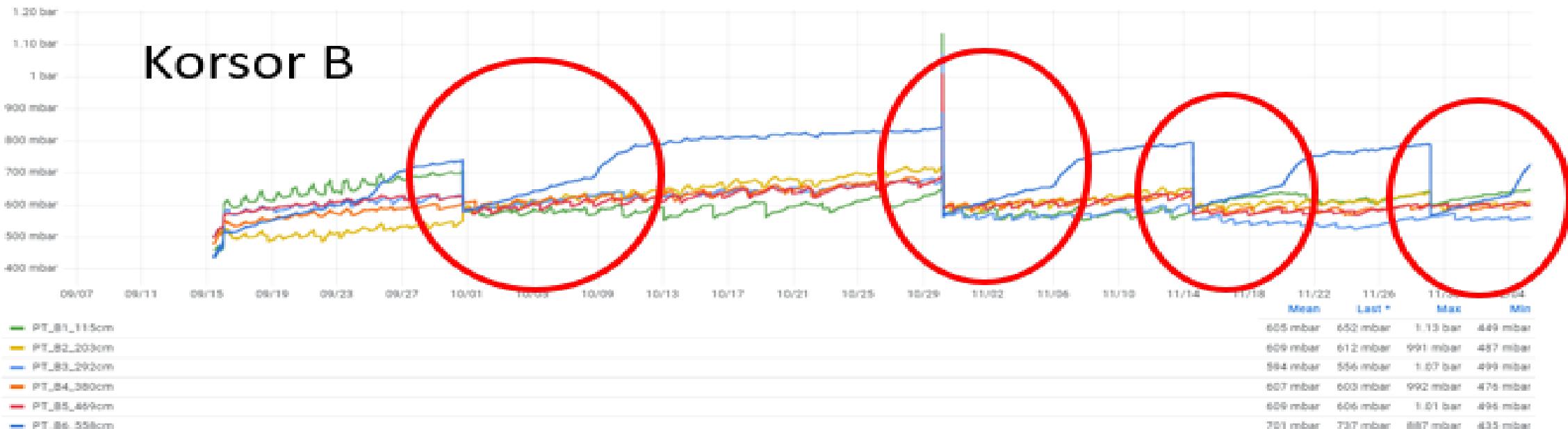


Lokal geologisk ramme på undersøgelsesområdet

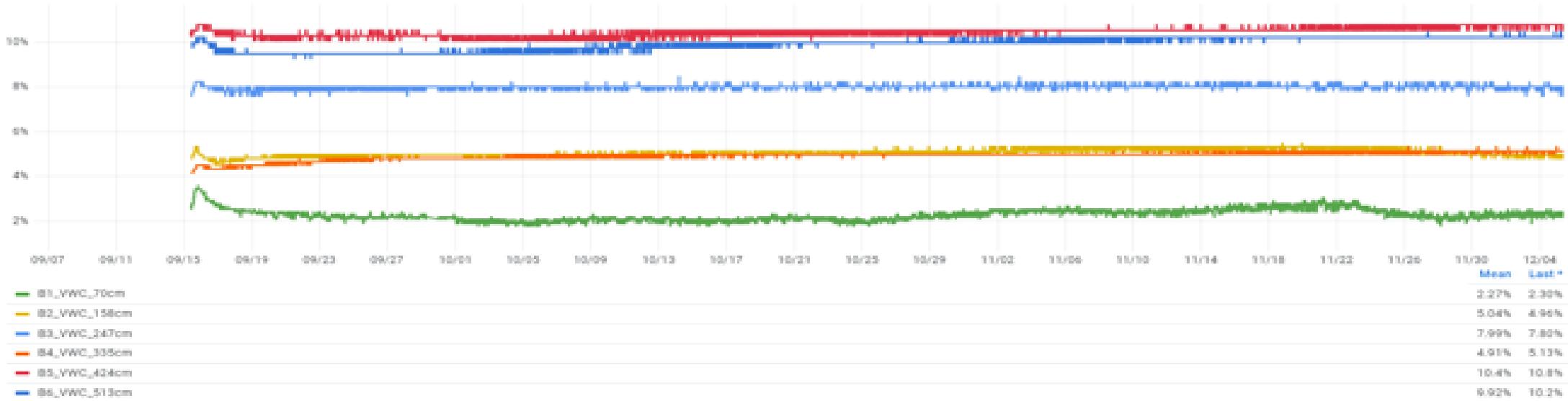




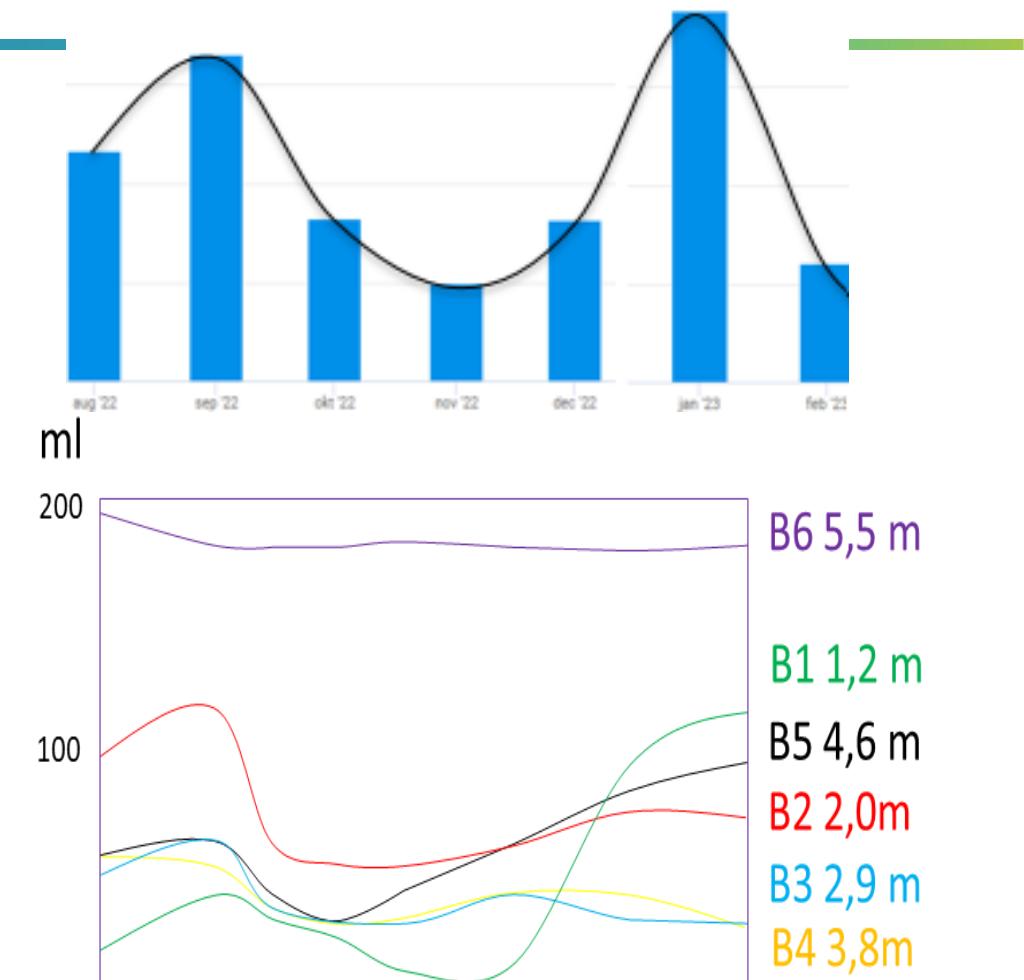
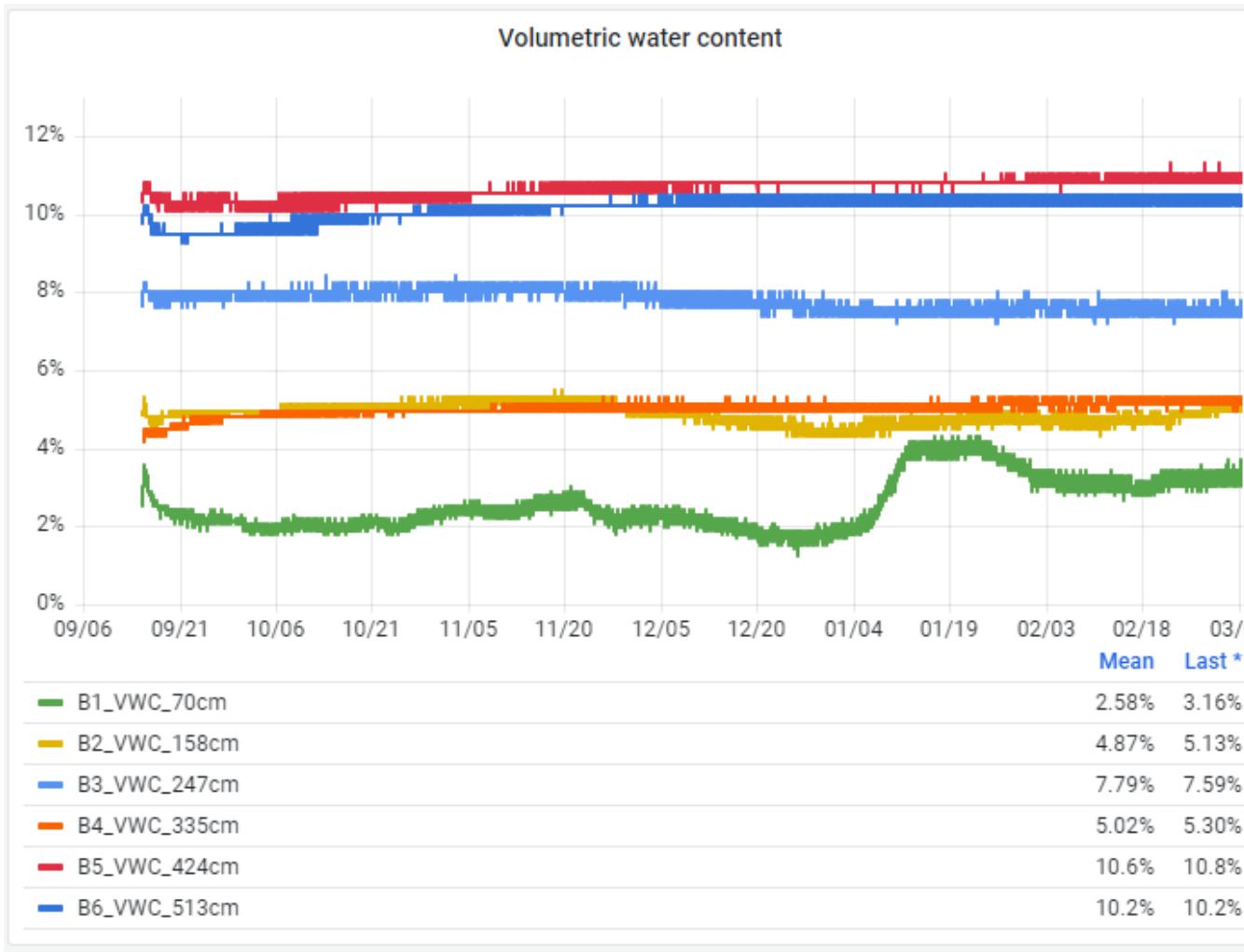
Korsor B



Volumetric water content



Vandmætning vandprøvetagning Korsør B



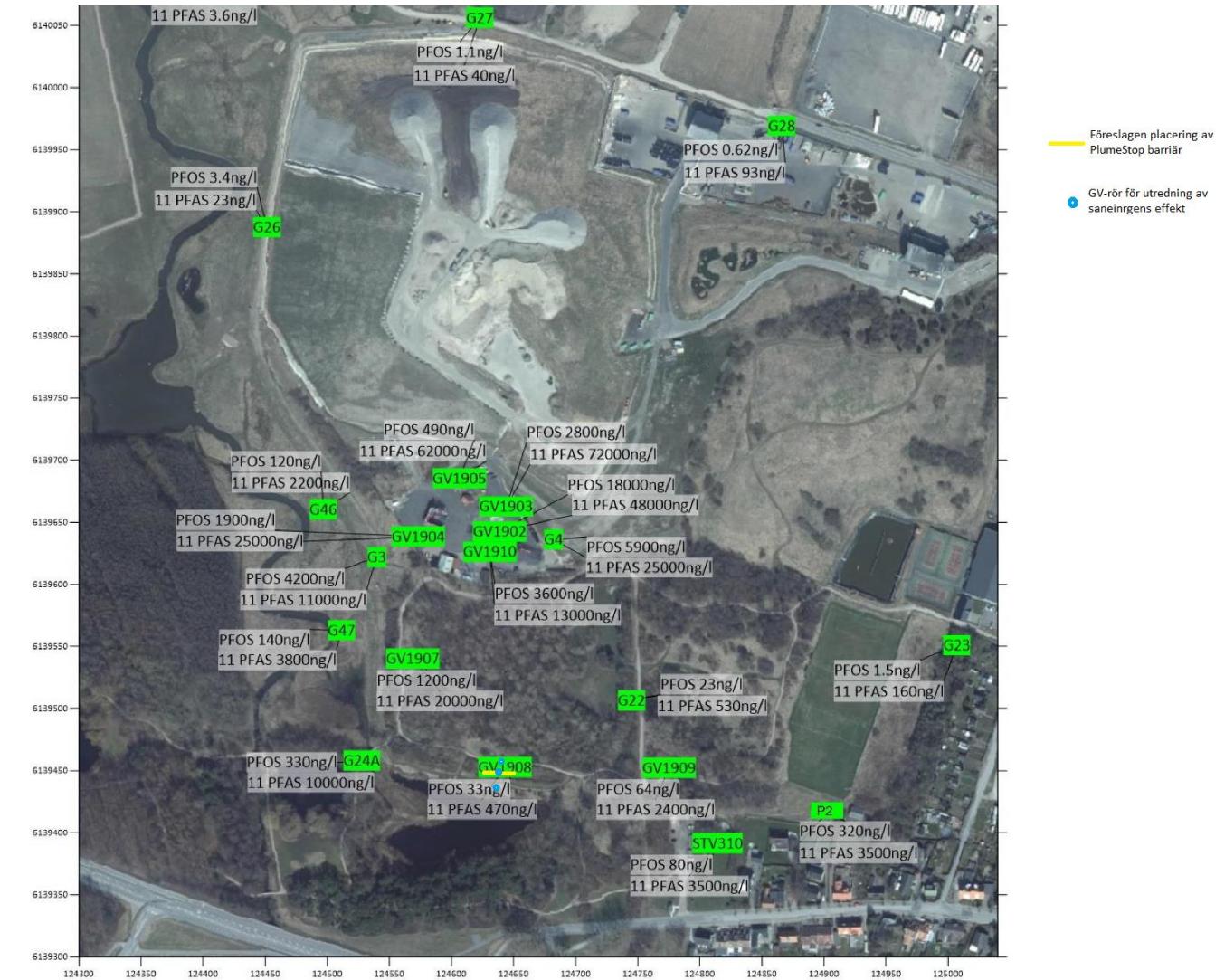
Sep 29

Mar 02



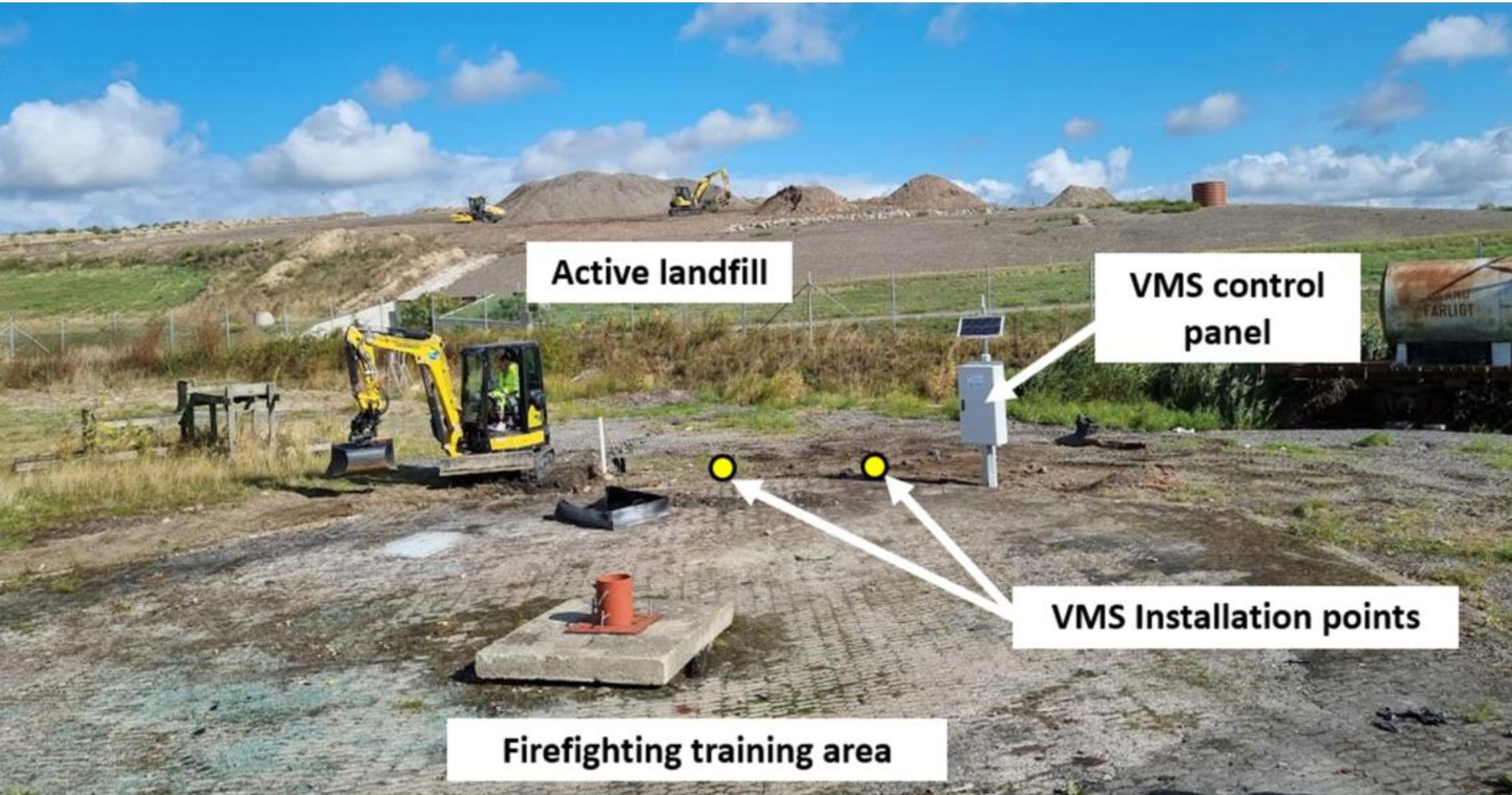
Forurening med PFOS og 11 PFAS

Provplats	PFOS (ng/l)	PFAS Σ11 (ng/l)
G2	1,1	3,6
G22	23	525
G23	1,5	159
G26	3,4	22,7
G27	1,1	39,5
G28	0,62	93,4
G3	<u>4 200</u>	10 850
G4	<u>5 900</u>	24 982
G46	<u>120</u>	2 215
G47	<u>140</u>	3 830
GV1902	<u>18 000</u>	48 179
GV1903	<u>2 800</u>	72 433
GV1904	<u>1 900</u>	25 130
GV1905	<u>490</u>	62 490
GV1907	<u>1 200</u>	20 020
GV1908	33	466
GV1909	<u>64</u>	2 447
GV1910	<u>3 600</u>	12 570
GV24A	<u>330</u>	10 020
P2	<u>320</u>	3 520
STV310	<u>80</u>	3 520



Prøvetagningsboringer





Supplerende borer

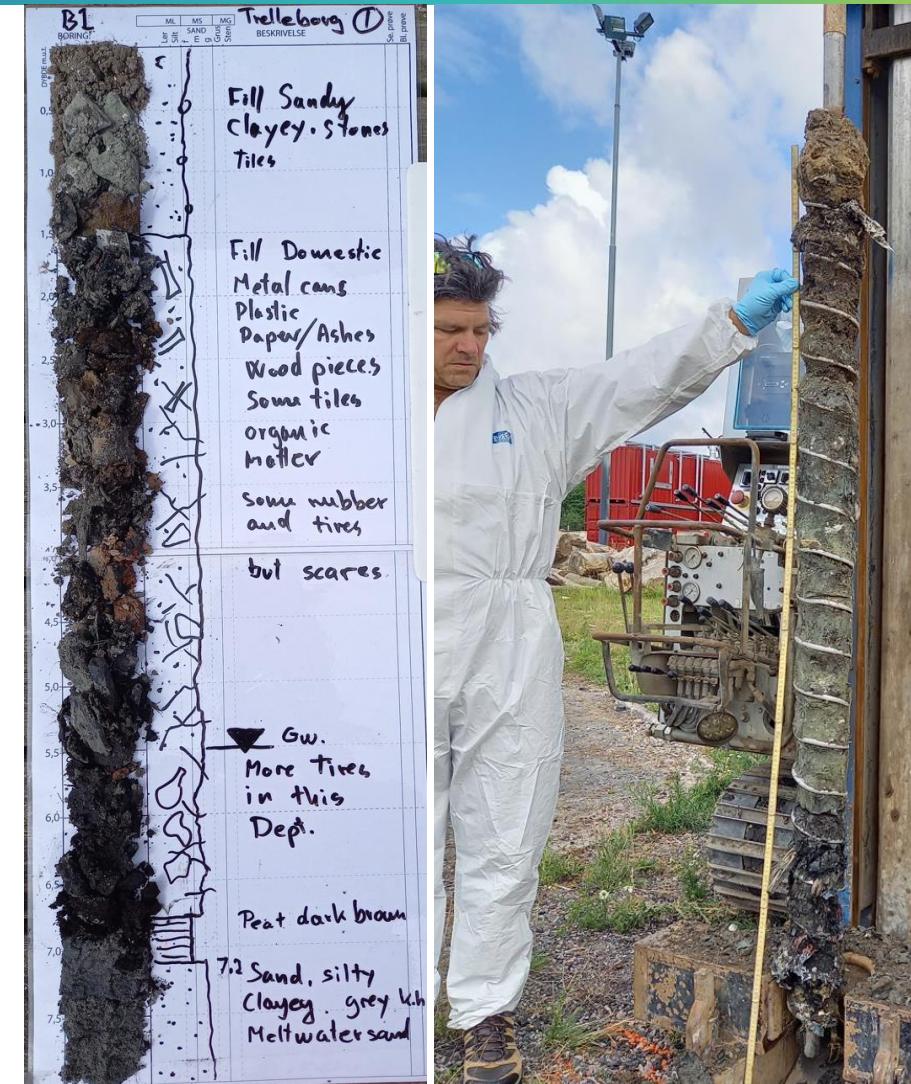


Trelleborg geologisk setting

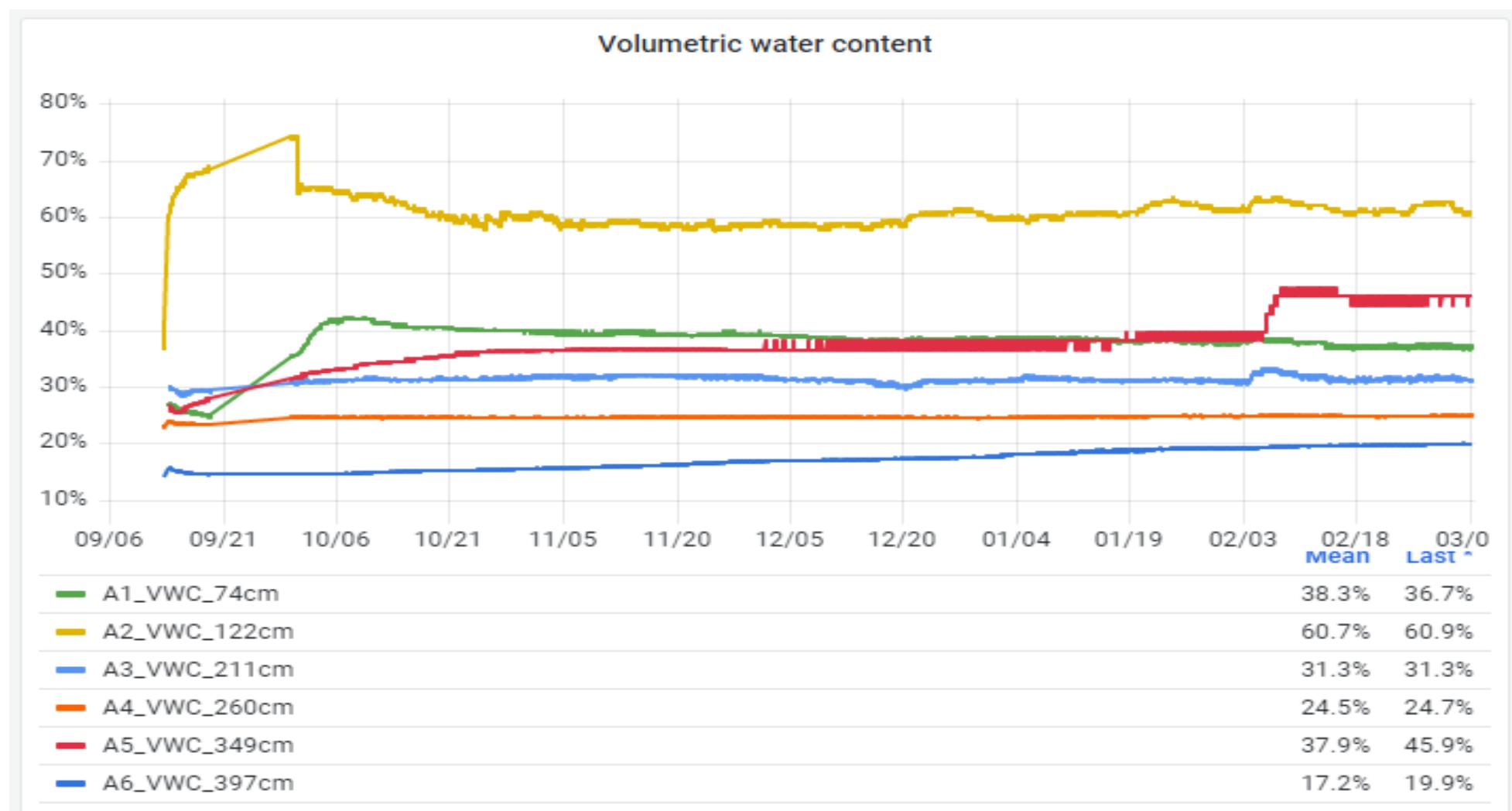
Losseplads FYLD
blandet med sand/ler

Losseplads FYLD
Dækrester træ metal
Plastic beton tegl
slagger

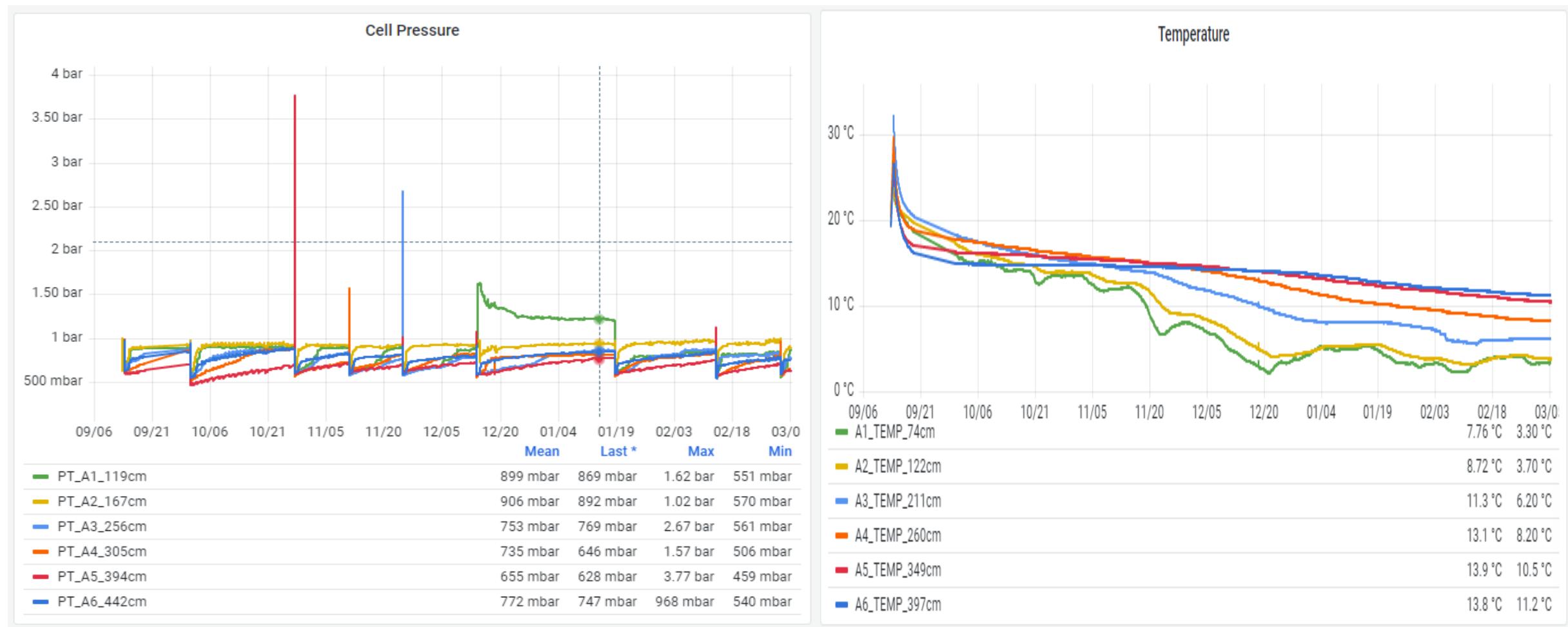
Tørv
Smeltevandssand
Moræneler



Trelleborg Vandmætning



Tryk og Temperatur



**ANALYSER FORSINKET
KLAR OM 1 UGE**



- **Forsat monitering** af PFAS transport i den umættede zone og udvalgte infiltrationsforsøg med tracer-test på VMS system (Geo, BGU)
- Opstille **regional geologisk 3-Model** i GeoatlasLive (Geo)
- Teste **SAFF** på indsamlede vandprøver **Benchscale** (Envytech)
- Forsøg med **soil-washing** af indsamlede jord prøver (Envytech)
- Vurderer potentielle for **Bio-remediering** af opdyrkede bakterier (UPO)
- Skumkoncentrat "destruktion i laboratorie ved hjælp af "**kold plasma**" teknologi (FORTH)
- Installering af ny opgraderet **pilot SAFF** opstilling til aktiv reduktion af PFAS i overfladevand fra pladsen (Envytech)
- **Åbne for andre test muligheder med vores forsøgsopstillinger, Besøg vore stand og lad os diskuterer mulighederne for SCENARIOS samarbejde.**



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Thank you for
your attention



Vil du vide mere så kontakt