

REMTECH
Europe

**BIOLOGICAL ANAEROBIC DEGRADATION OF VOCs COMBINED WITH
RECIRCULATED (HEATED) GROUNDWATER**

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**RemTech Europe – Soil Remediation
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GreenSoil

- Innovative General Contractor specialized in bioremediation



Brazil

Office: Sao Paulo

The Netherlands

Office: Papendrecht

Belgium

Office: Genk / Ghent

Project file

Client	Confidential
Location	Confidential (France)
Period	2016-2021
Contaminant type	1,2-DCA and DCM (mainly) in soil and groundwater
Project scope	Pilot test and full scale cVOC remediation: bioremediation and heating
Remedial strategy	In situ enhanced anaerobic degradation of groundwater contamination In situ heating of groundwater by aboveground heating and recirculation
Up to date	Pilot test successfully completed. Full scale remediation.
Next steps	Full scale in situ biological remediation. Anticipated remedial time groundwater = 2 years.

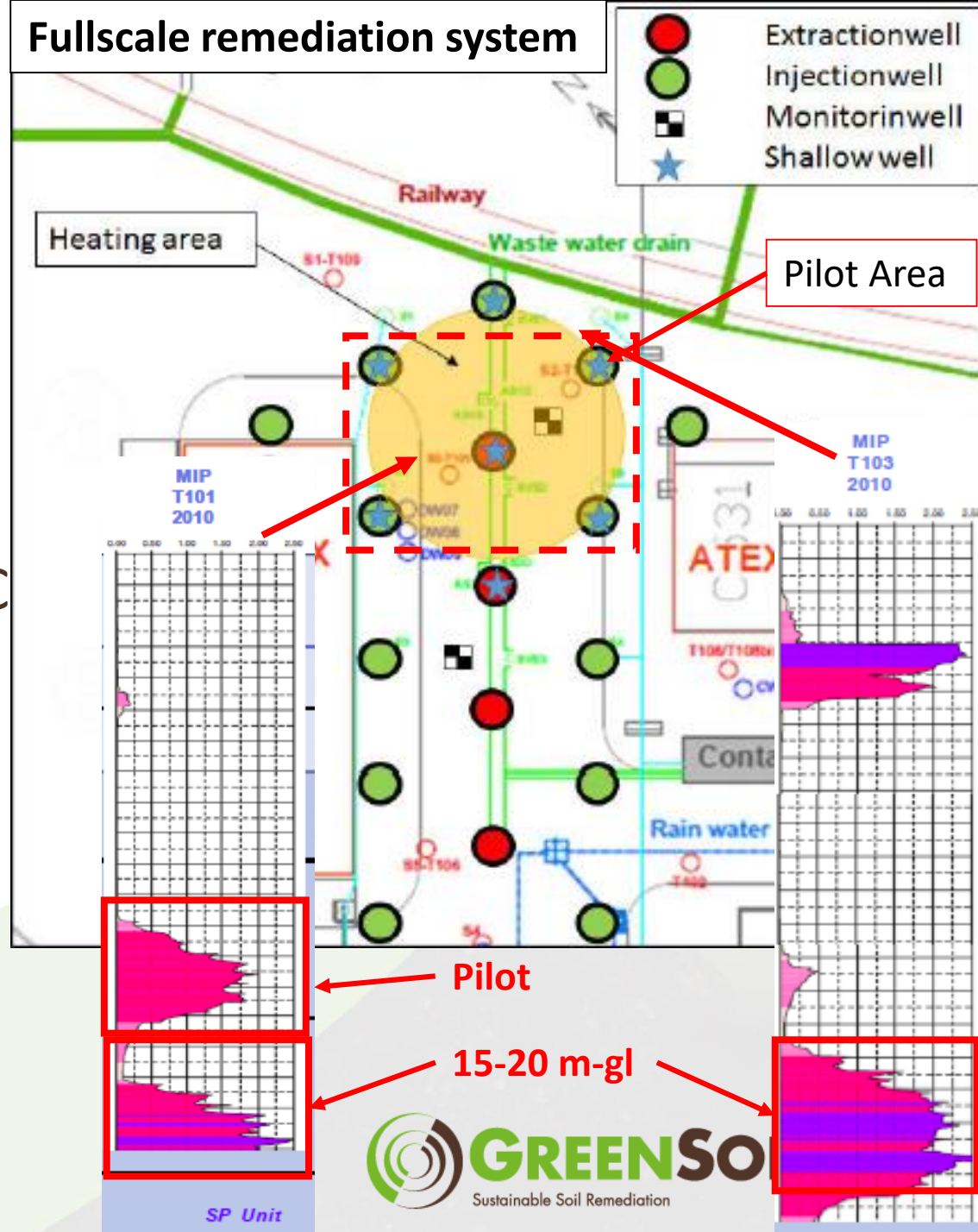
Pilot test set-up

Remediation objective is to protect underlying aquifer

- Stimulation of anaerobic biodegradation
- Limited heating of the soil to about 25° C

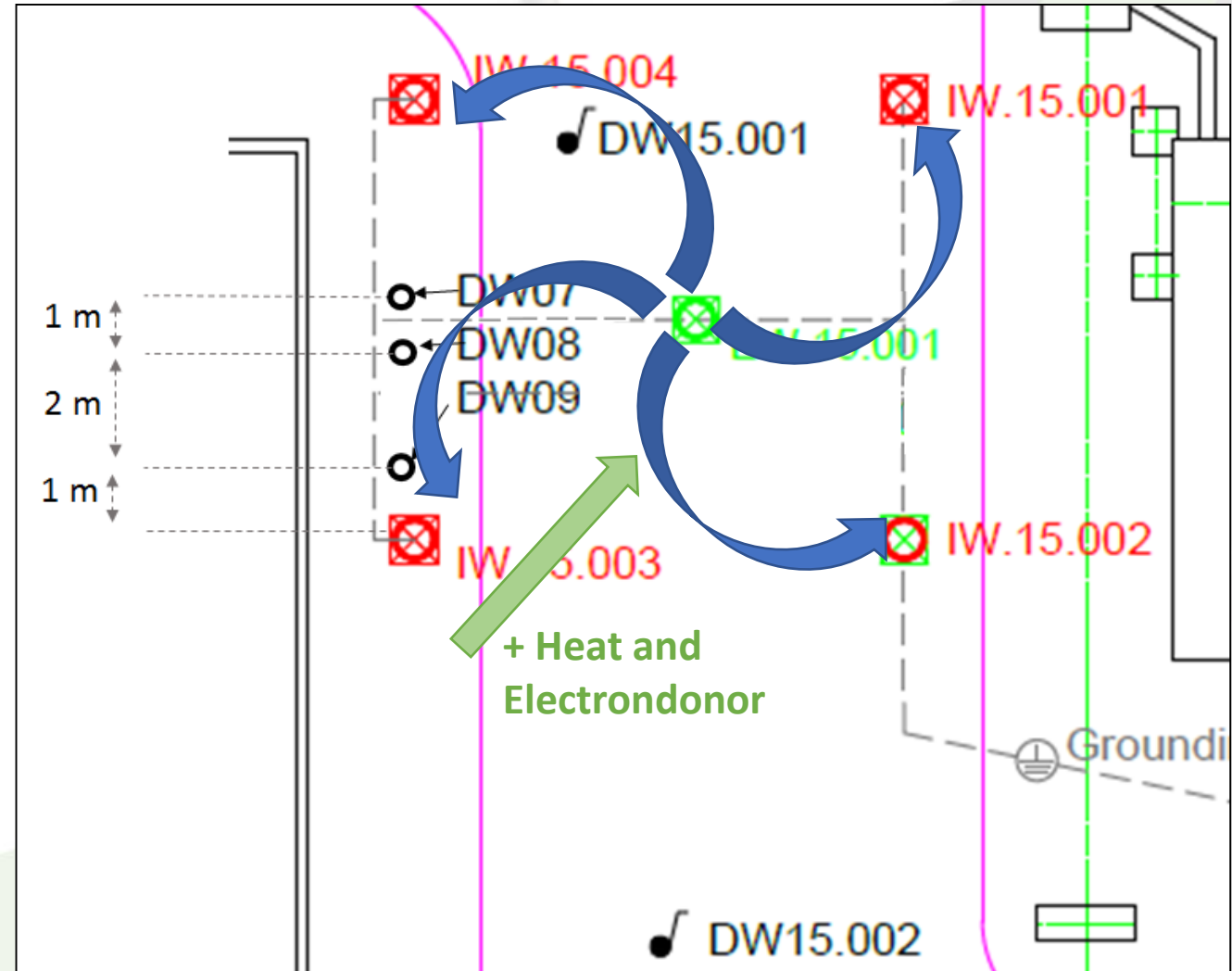
Pilot:

- 1 layer (11-15 m-bgl)
- Follow-up over 6 months period



System Installation

- 1 extraction well
- 4 infiltration wells
- 2 new monitoring wells
- 6 Divers (Temperature) in wells
- Control unit:
 - Control panel
 - Piston pump
 - Heater
 - Dosing unit (Dehalo-GS)



Operation & Maintenance Phase

First 3- months issues:

- Pistonpump :
 - Problems with proces controls / stable operation of system
→ Submersible pump
- Heater (flow throug cell):
 - clogging with chalk / unknown depositions (stoney)
→ Frequent maintenance / cleaning of the heater



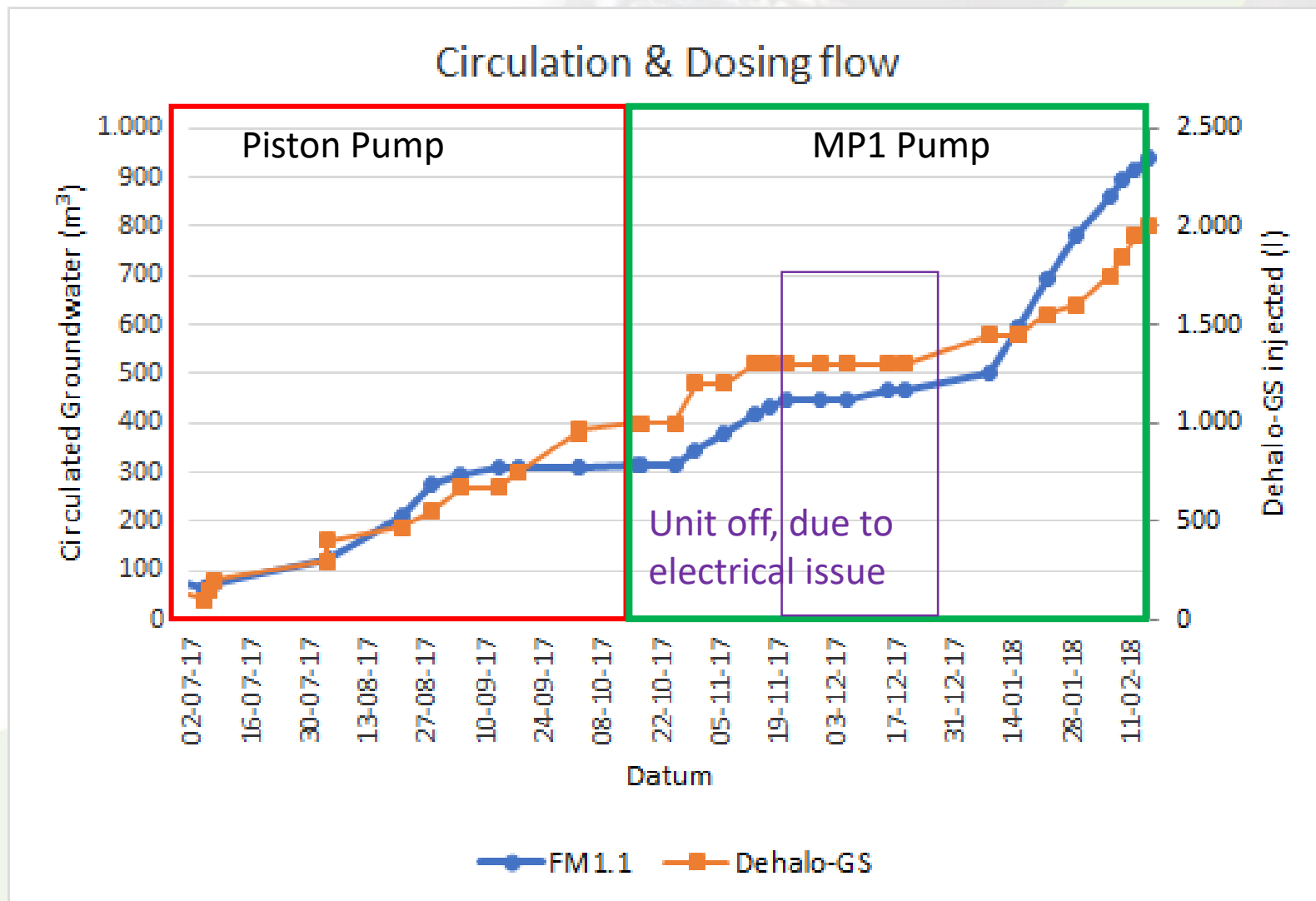
Results – Scaling heater

- Stone like material
- Not completely “soluble” in strong acid
- Strong sulfide odor

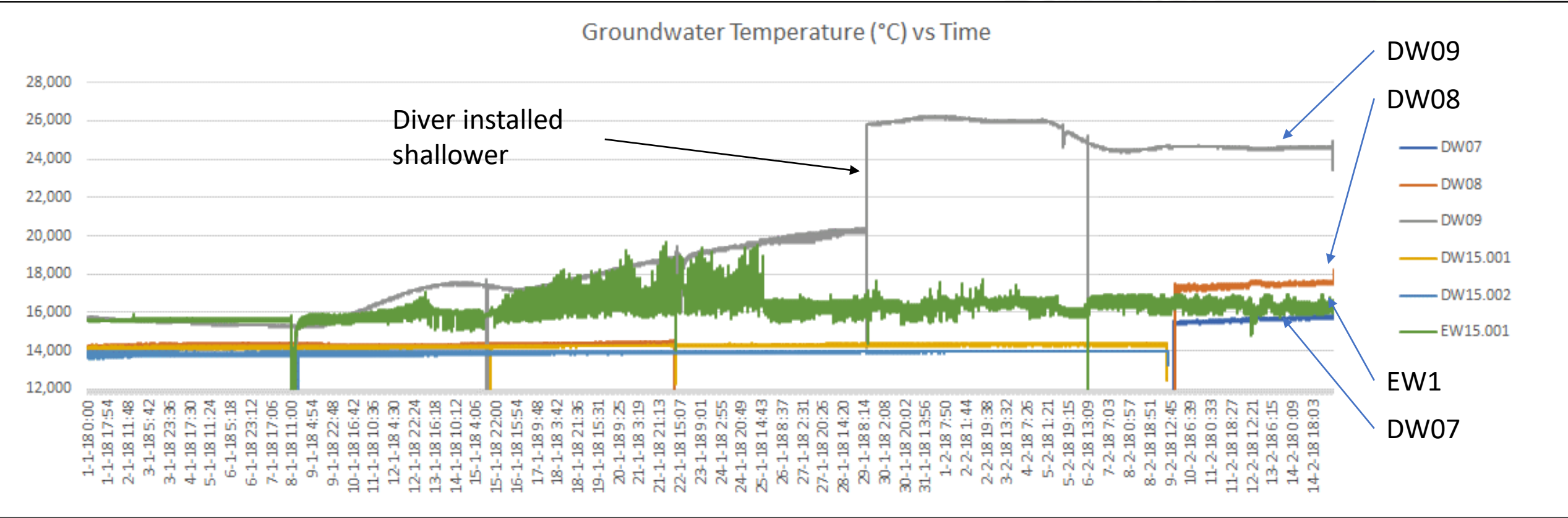


Results – Proces parameters

- MP1-pump
flow $\sim 0.6\text{-}0.7 \text{ m}^3/\text{hr}$
- $\sim 2,000 \text{ L}$ of Dehalo-GS
/ 6 months.

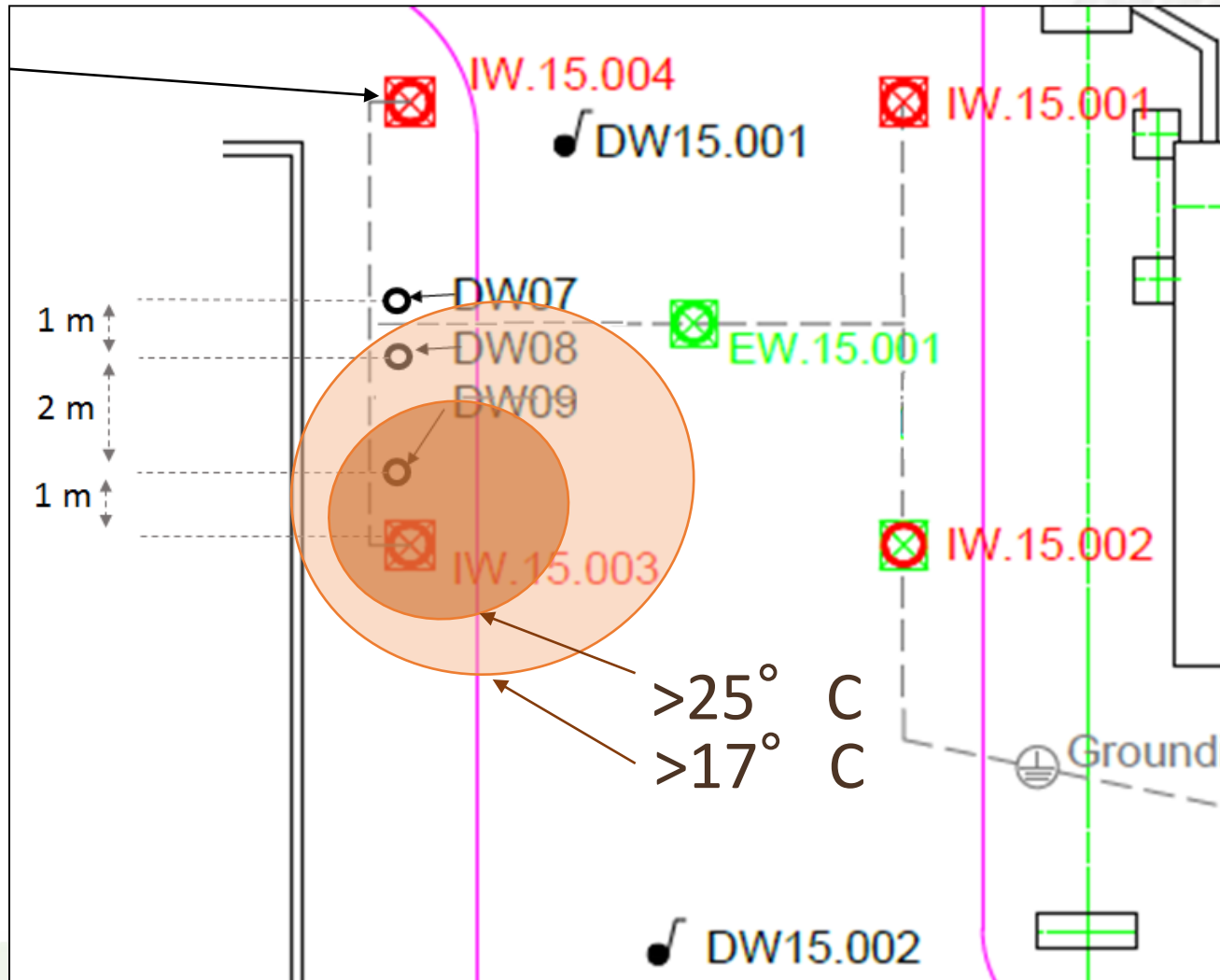


Results - Temperature

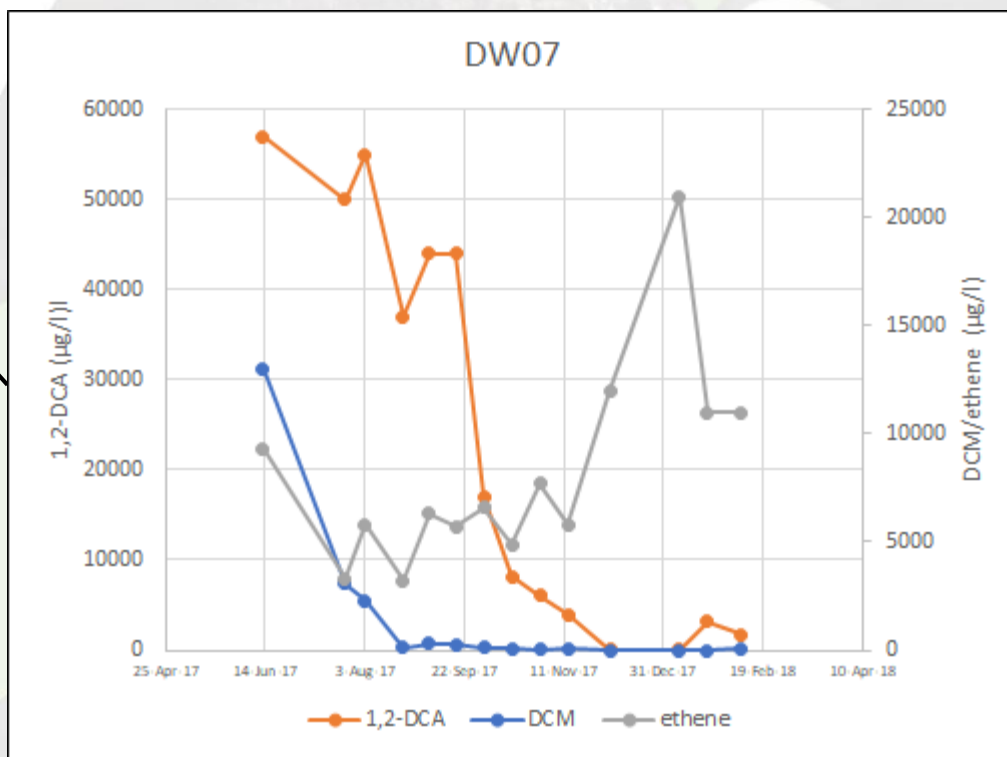
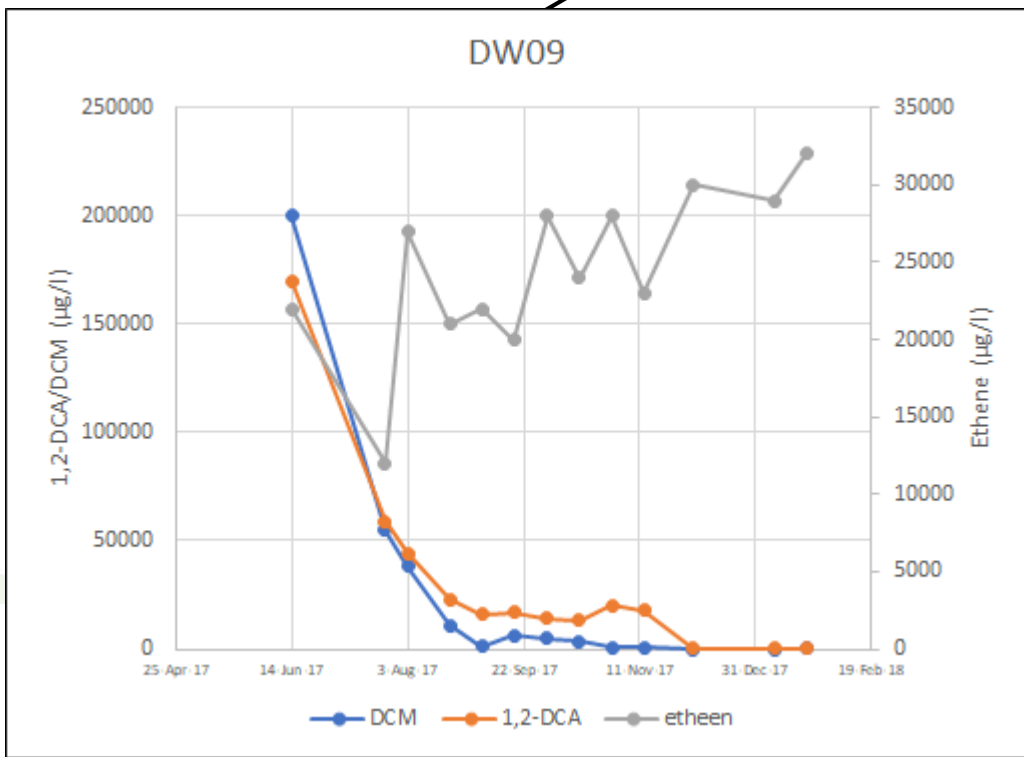
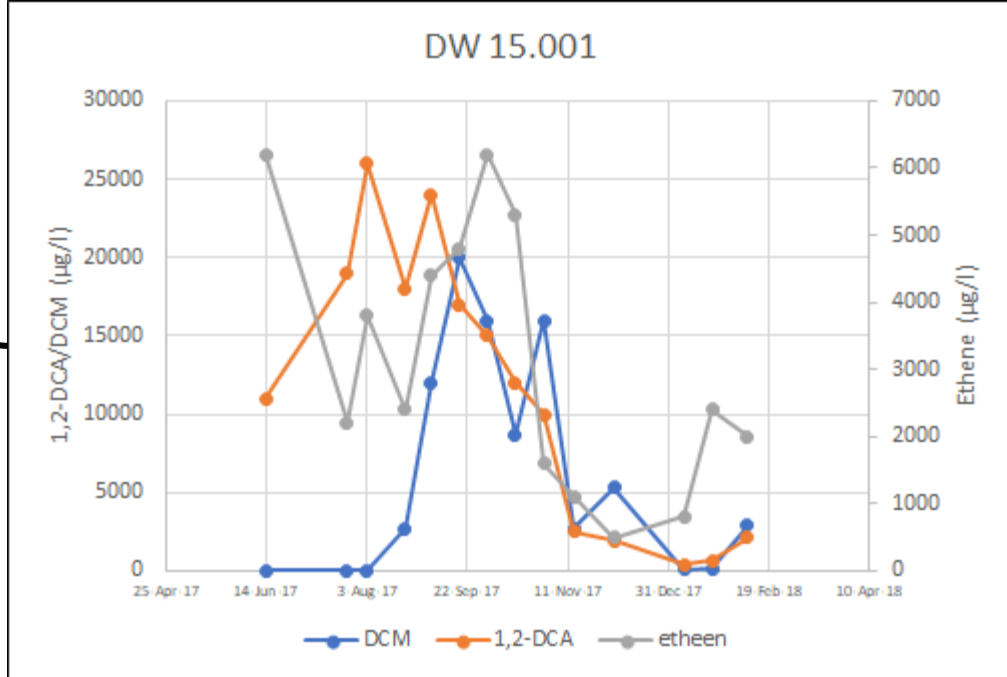
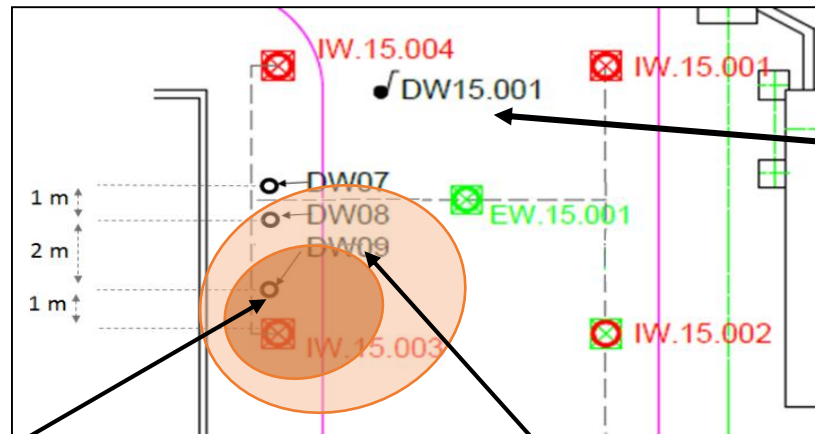


Results - Temperature

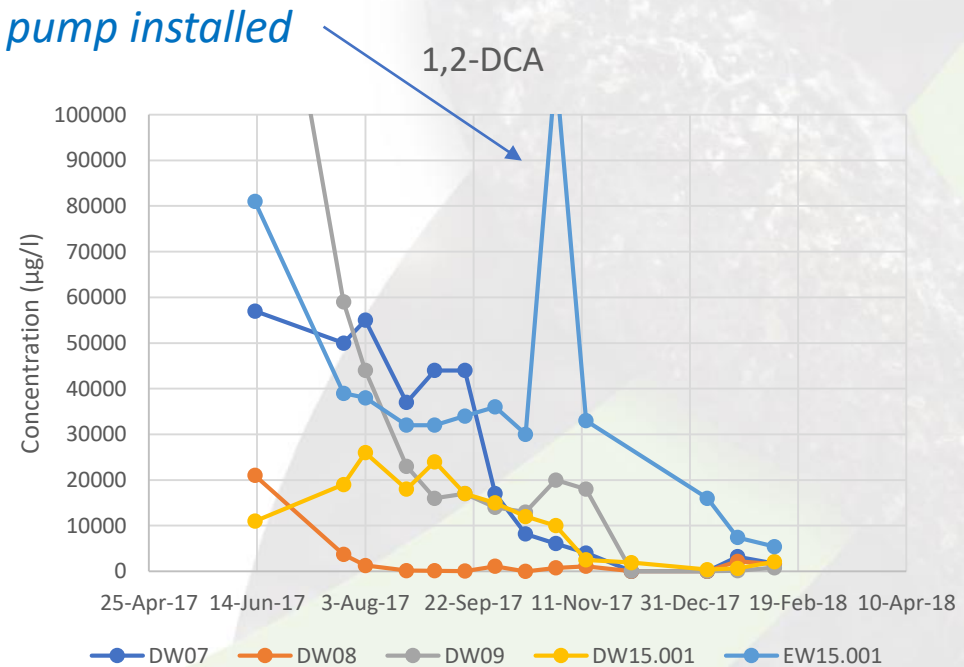
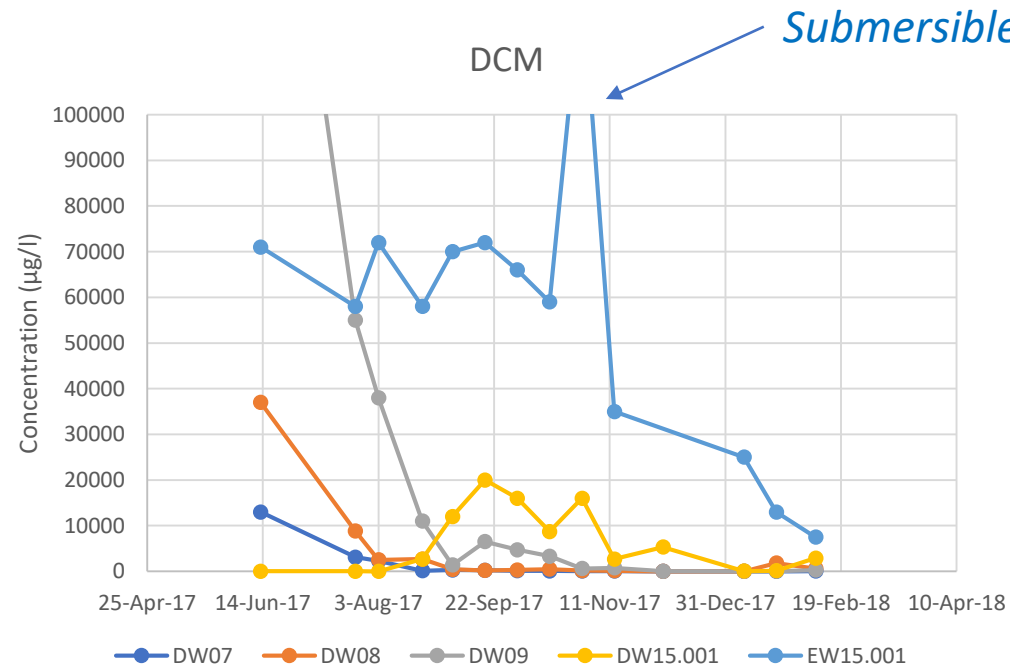
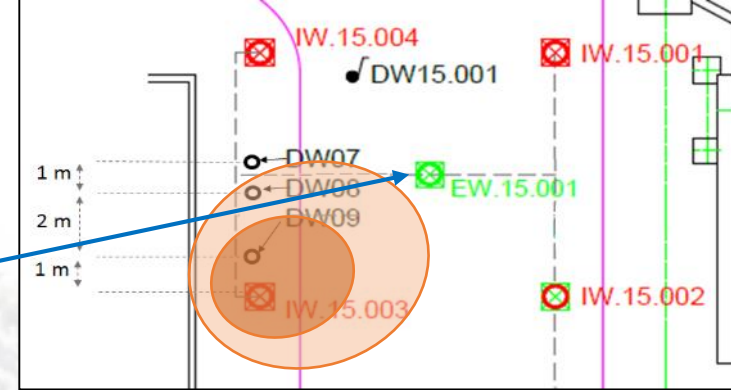
Not operational



Results - Analytical

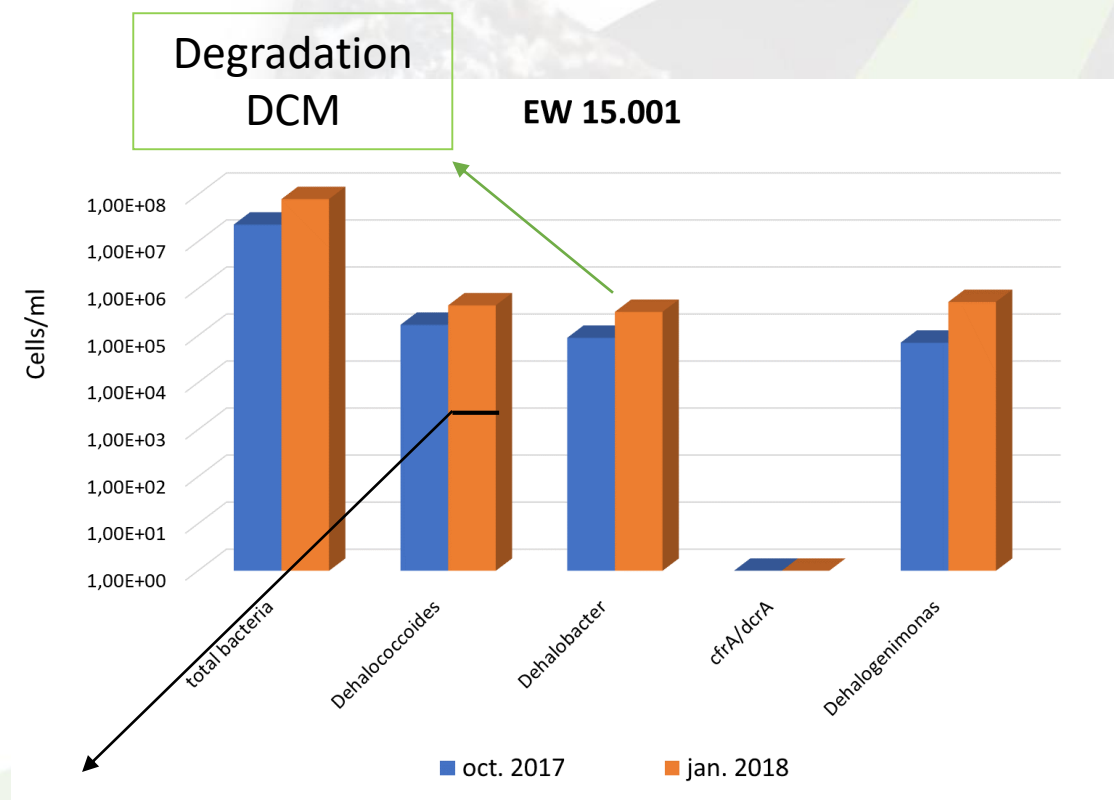
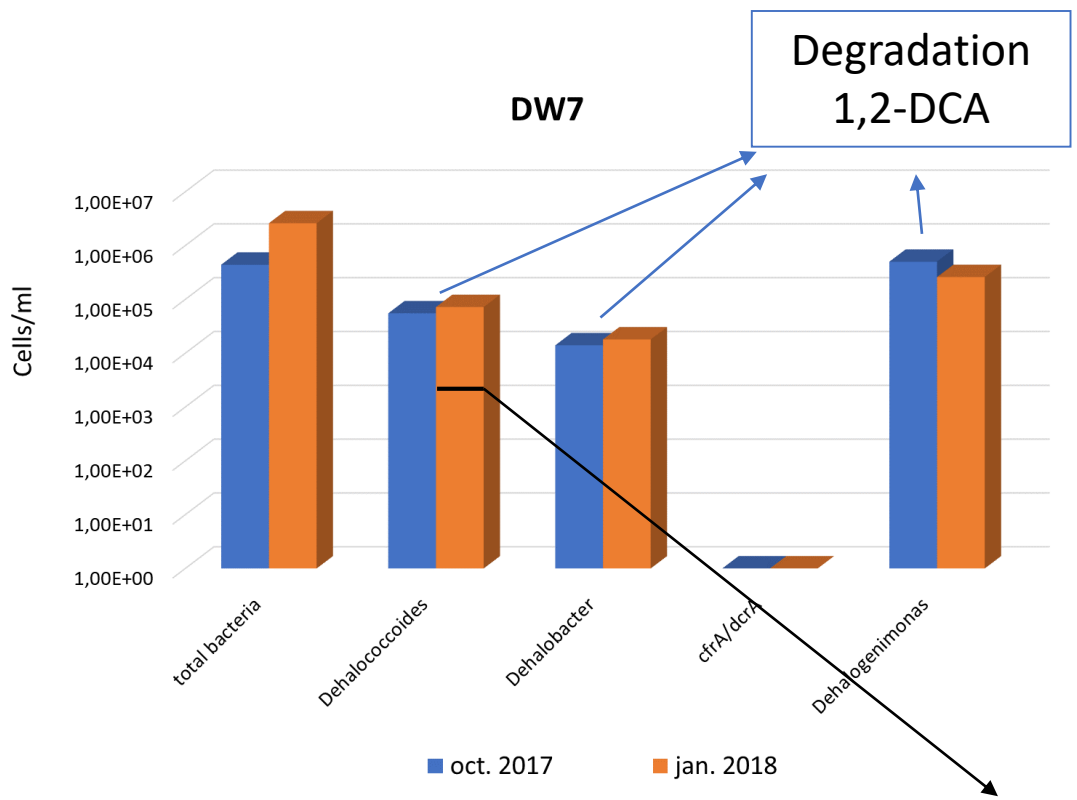


Results - Analytical



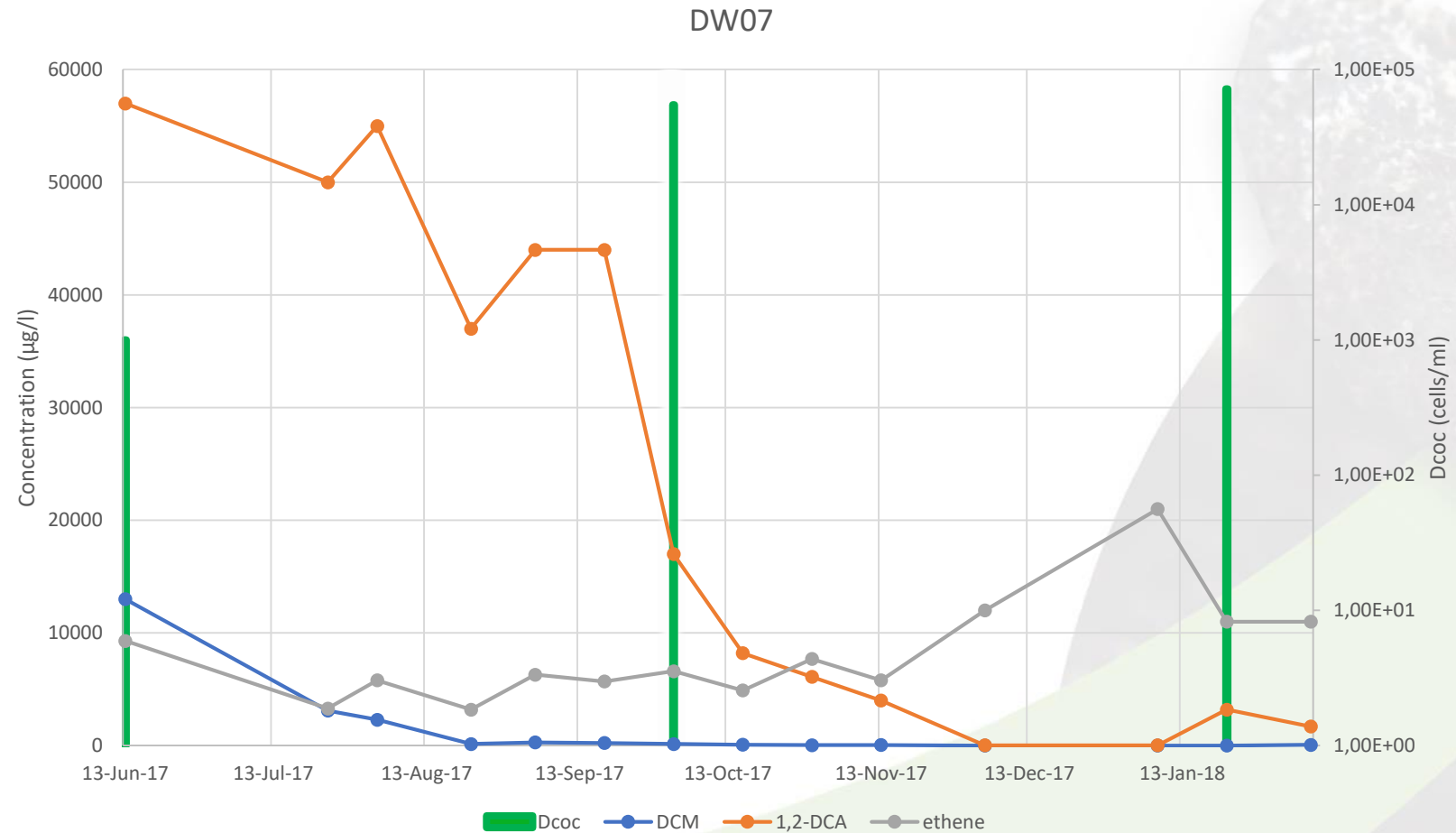
Peak in Oct/Nov, possibly due to increased mobilisation followed by increased flow of MP1 pump

Results - Molecular



Pre-investigation
(*Dehalococcoides* 10⁶ cells/l)

Results - Molecular



Conclusion Pilot

- Strong decrease of both 1,2-DCA and DCM concentrations (95-99%)
- Increase of ethene (degradation product) in majority of wells
- Degradation potential confirmed by molecular analyses
- Only limited mobilization/attraction due to increased flow/heating
- Strong decrease even with only electron donor dosing

Pilot - Fullscale

Pilot usefull to better design Full scale:

- Deepwell pumps instead of aboveground pumps / larger diameter well
- Continuation of the pilot to maintain the good conditions / biological activity
- Full scale started in Q1 2019 – 3 layered system

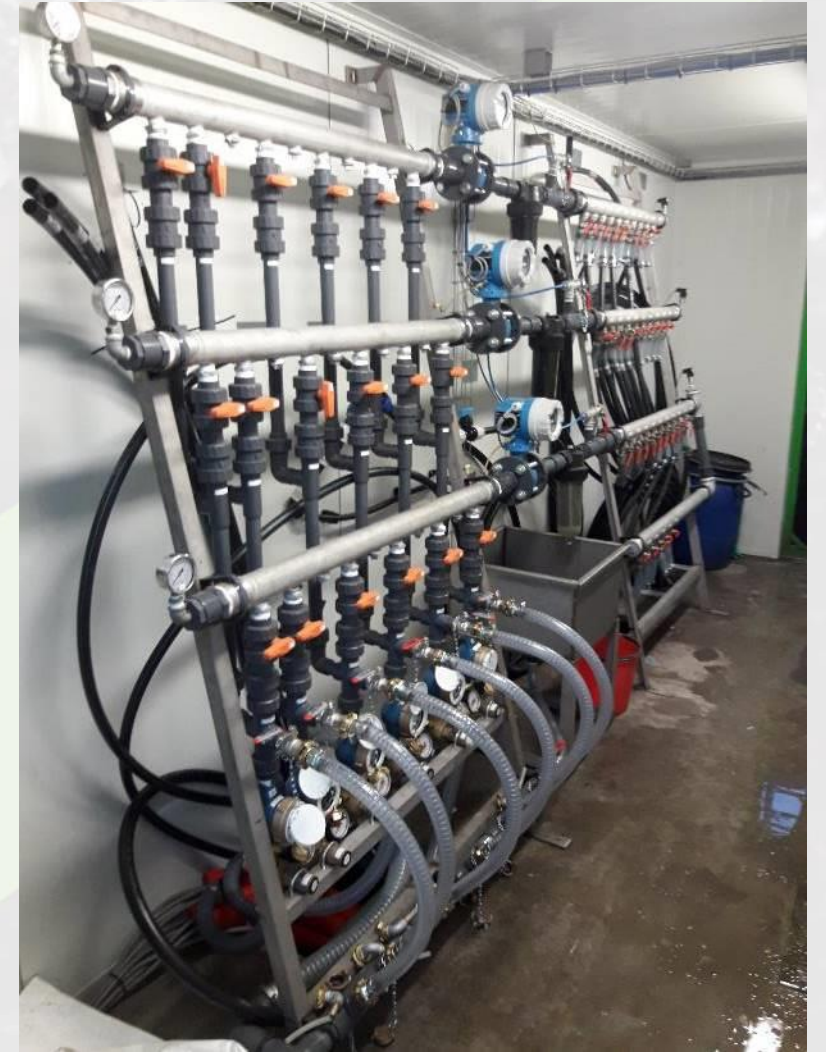
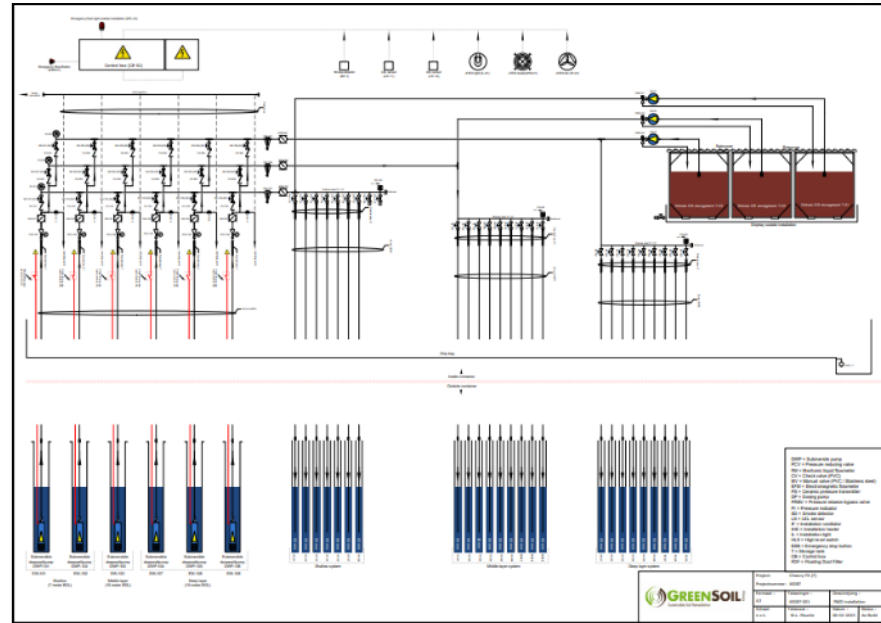
Heating only optional:

- No clear benifit of heating
- If needed use steam of site to heat (to avoid problems with clogging and high power consumption)

Full scale: in situ system



Thank you for your attention!



Contact details

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