LIFE POP WAT

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14th International HCH and Pesticides Forum

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Senior Researcher

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EXPERIENCE FROM OPERATION AND TUNNING OF WETLAND+® TECHNOLOGY FOR TREATMENT OF HCH-CONTAMINATED WATER

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- **Masaryk University, Czech Republic:**

  Josef Zeman

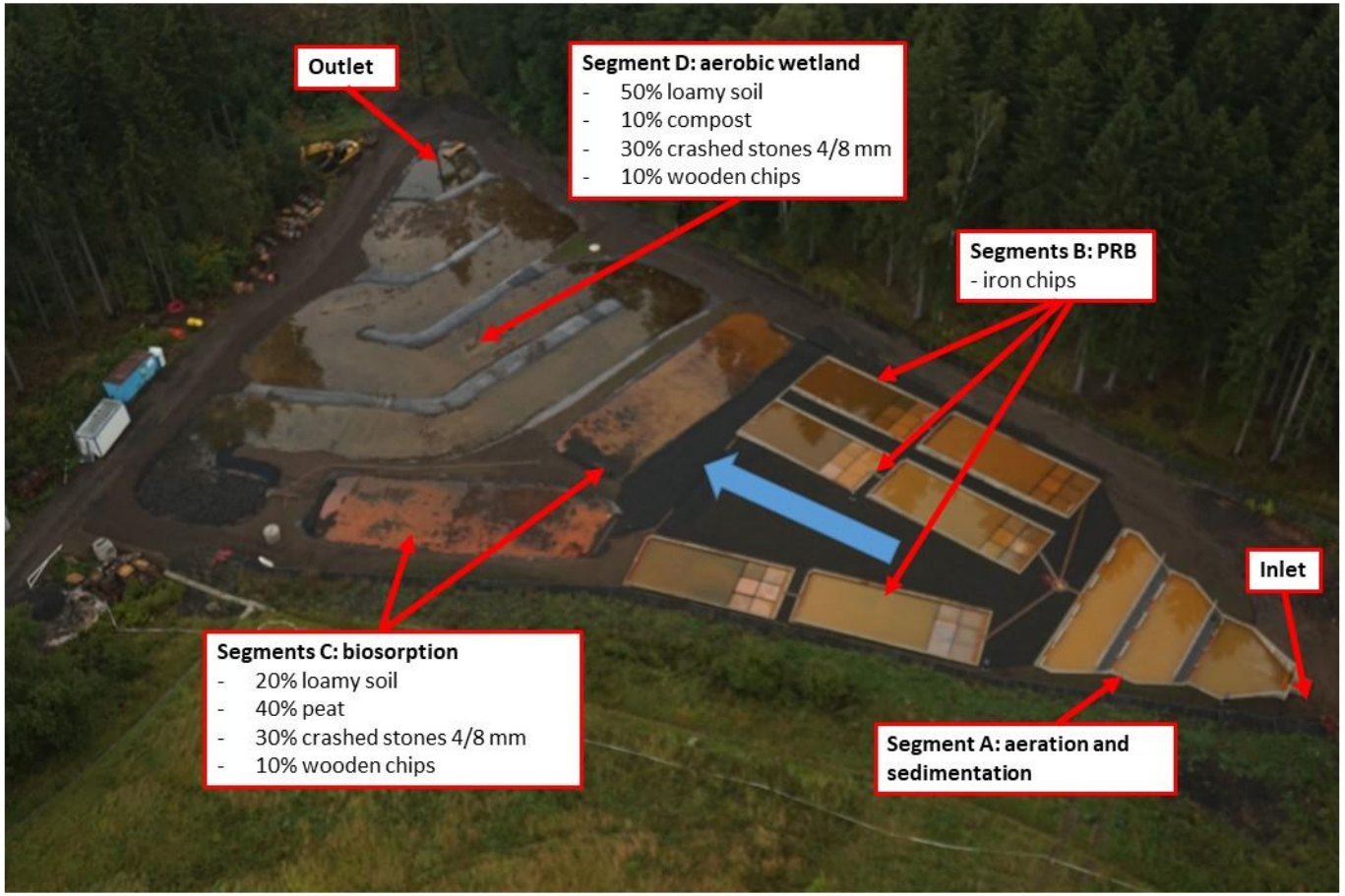
- **DIAMO s.p., Czech Republic:**

  Petr Brůček

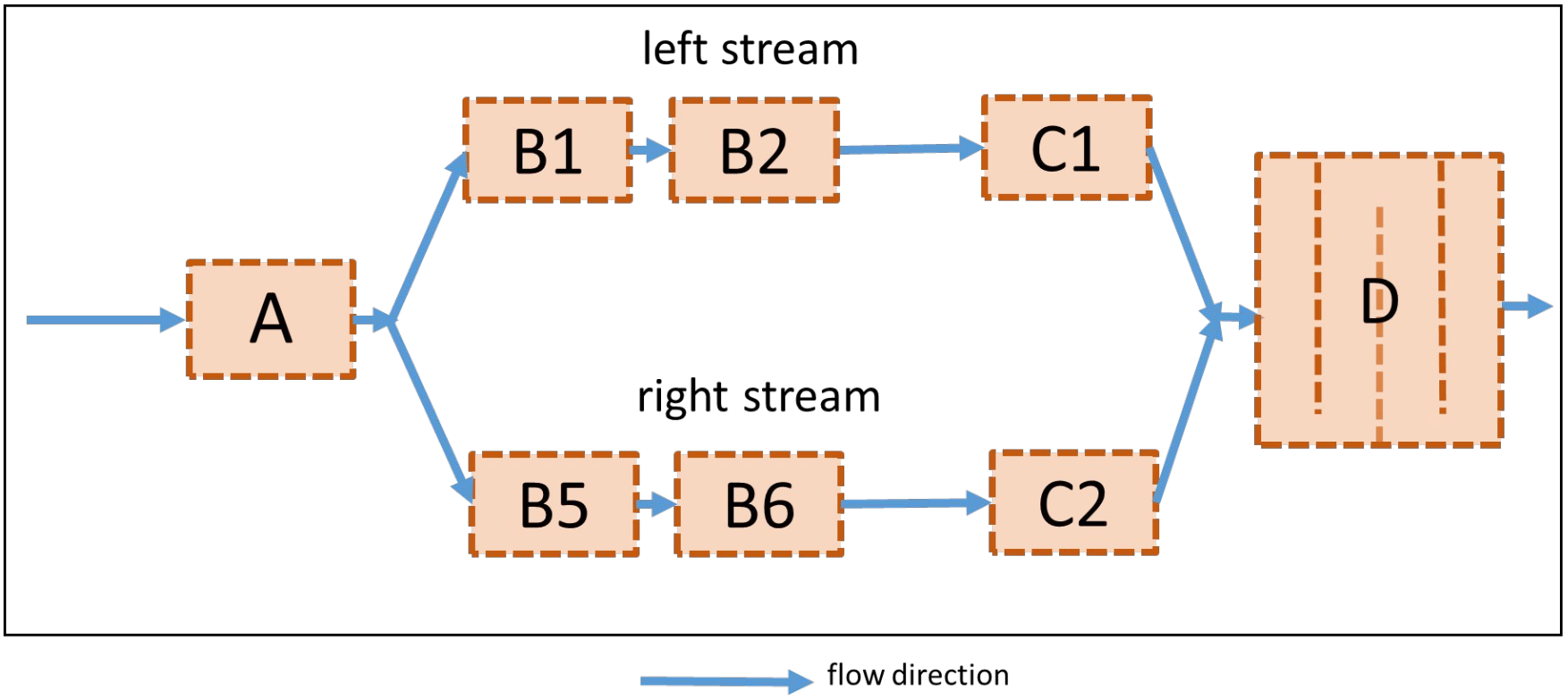
- **Photon Water Technology s.r.o., Czech Republic:**

  Petr Kvapil, Vojtěch Antoš

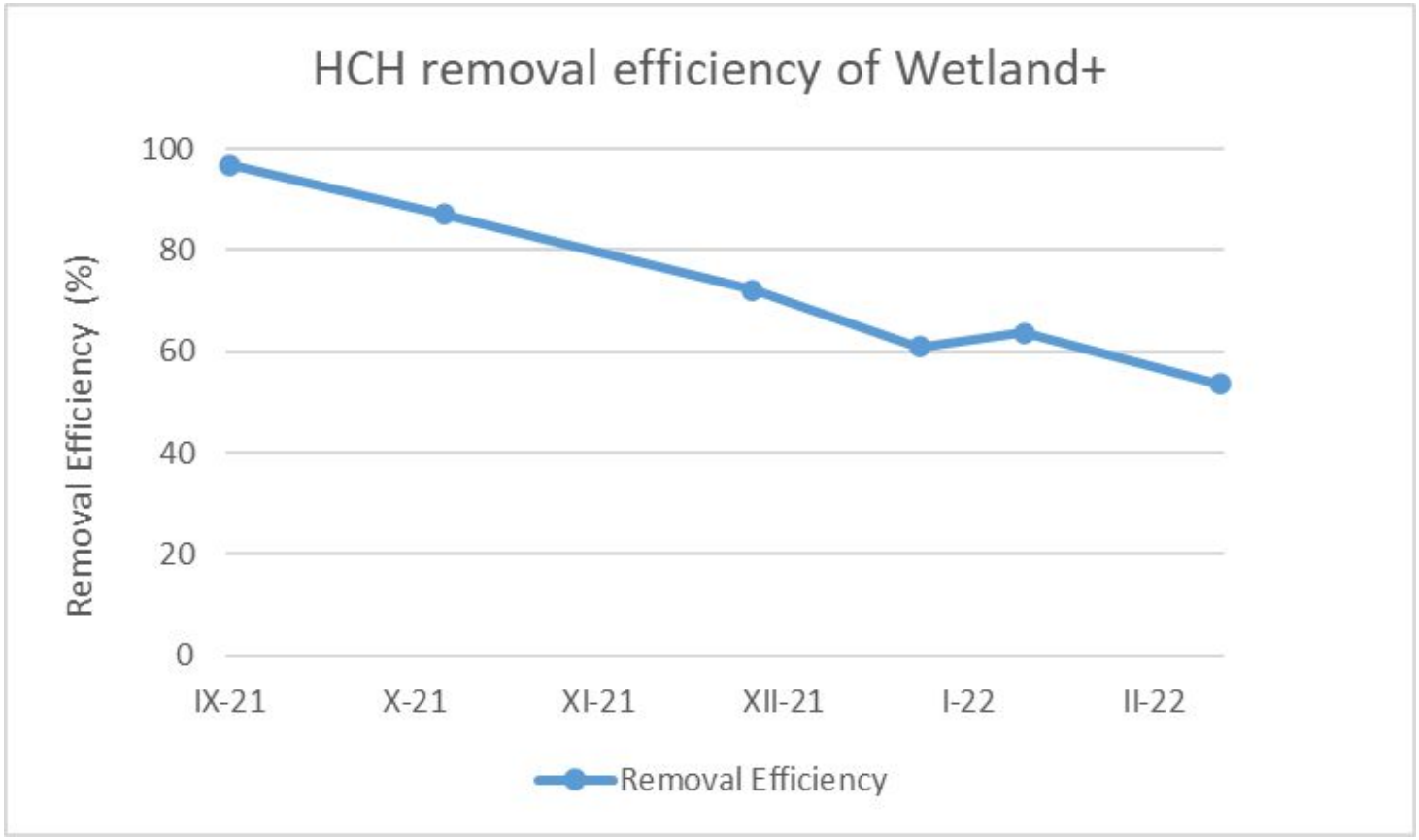
Wetland+ layout



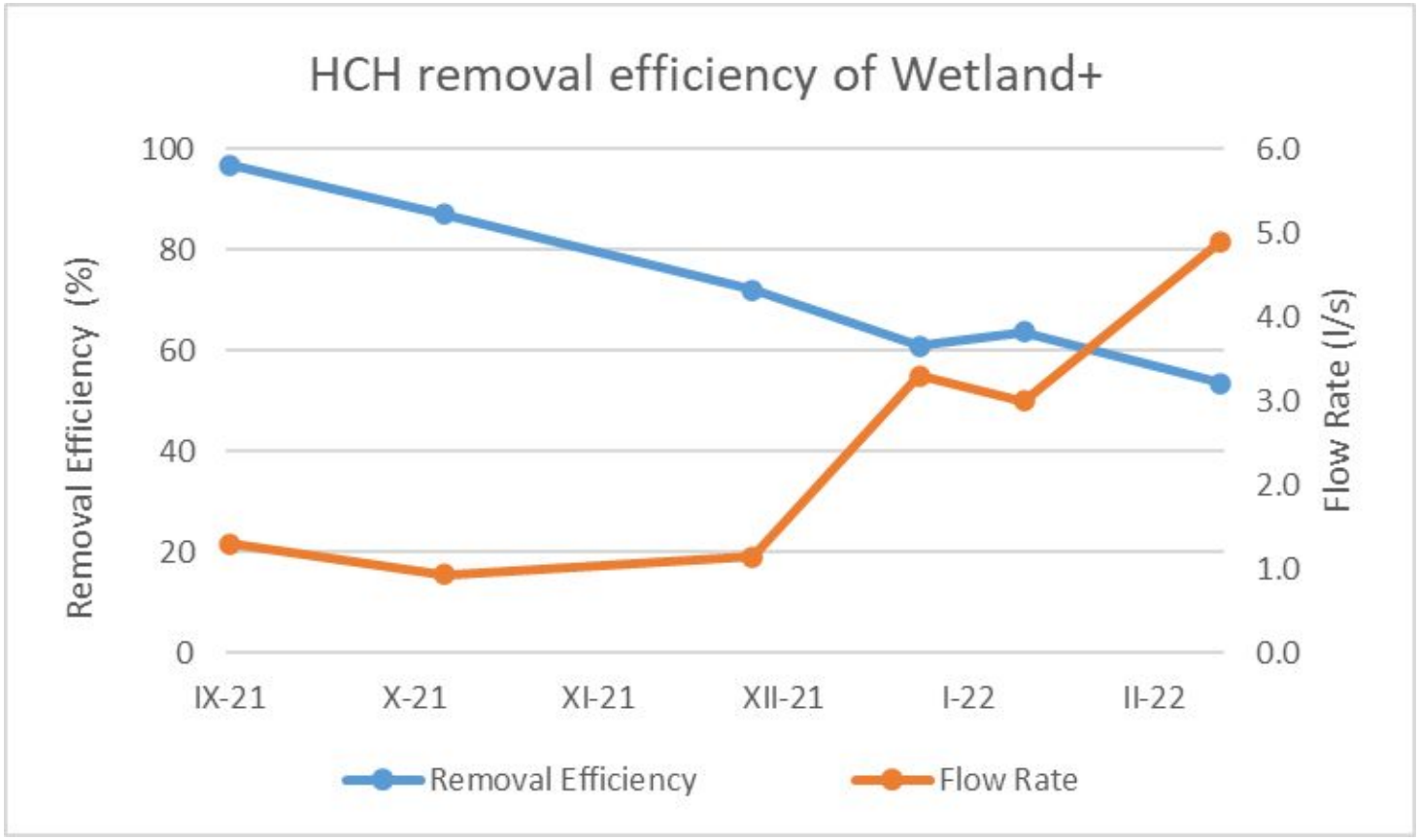
Wetland+ system operated in the period IX.2021 – VI.2022



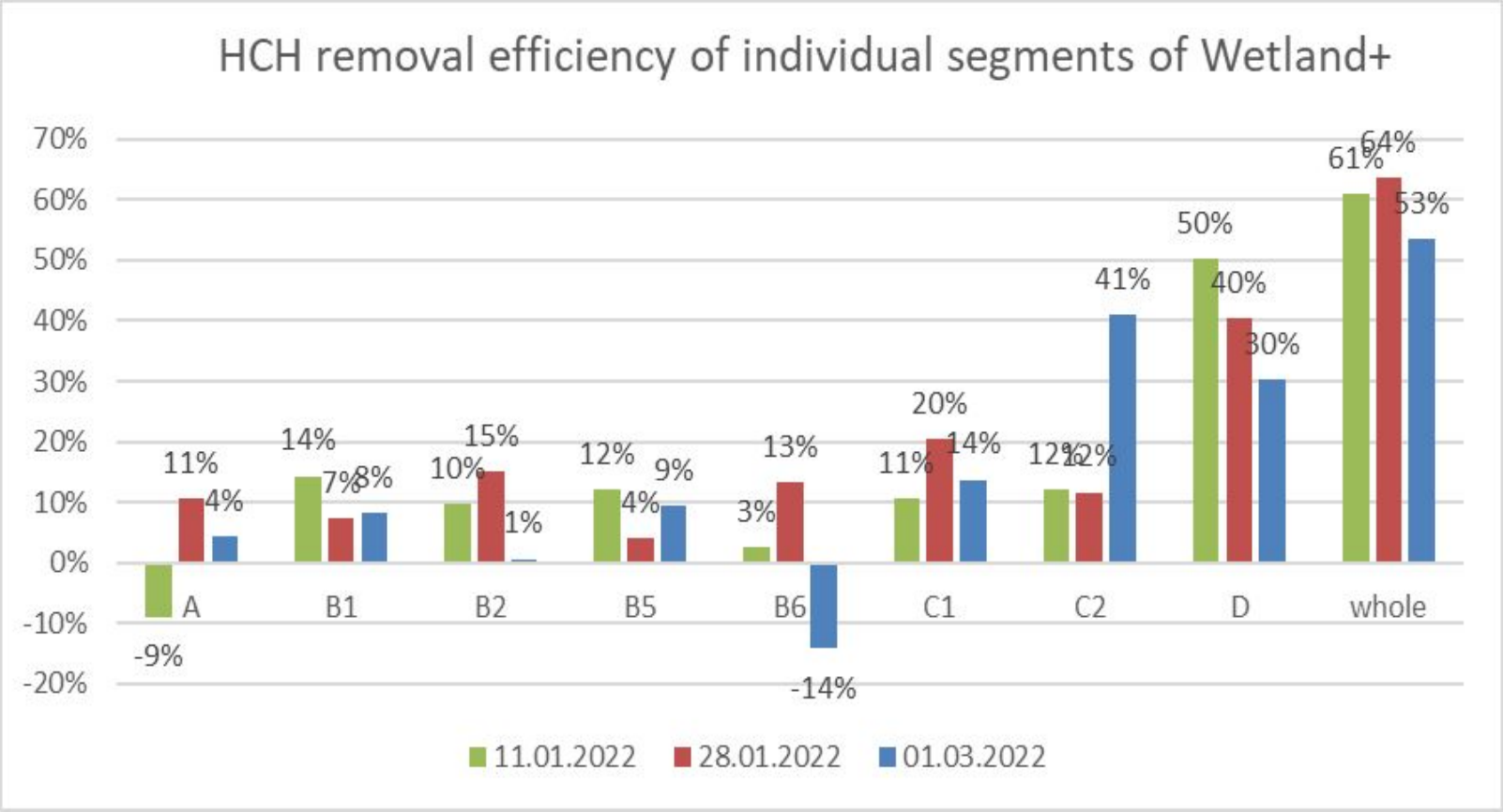
Wetland+ monitoring system



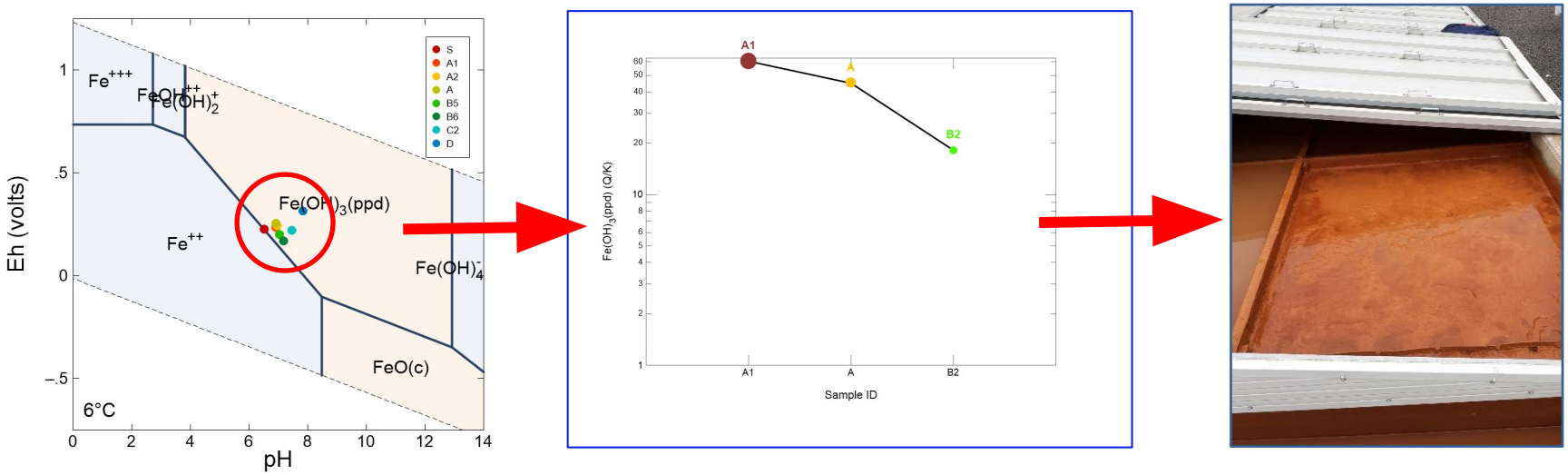
Wetland+ monitoring system



Wetland+ monitoring system

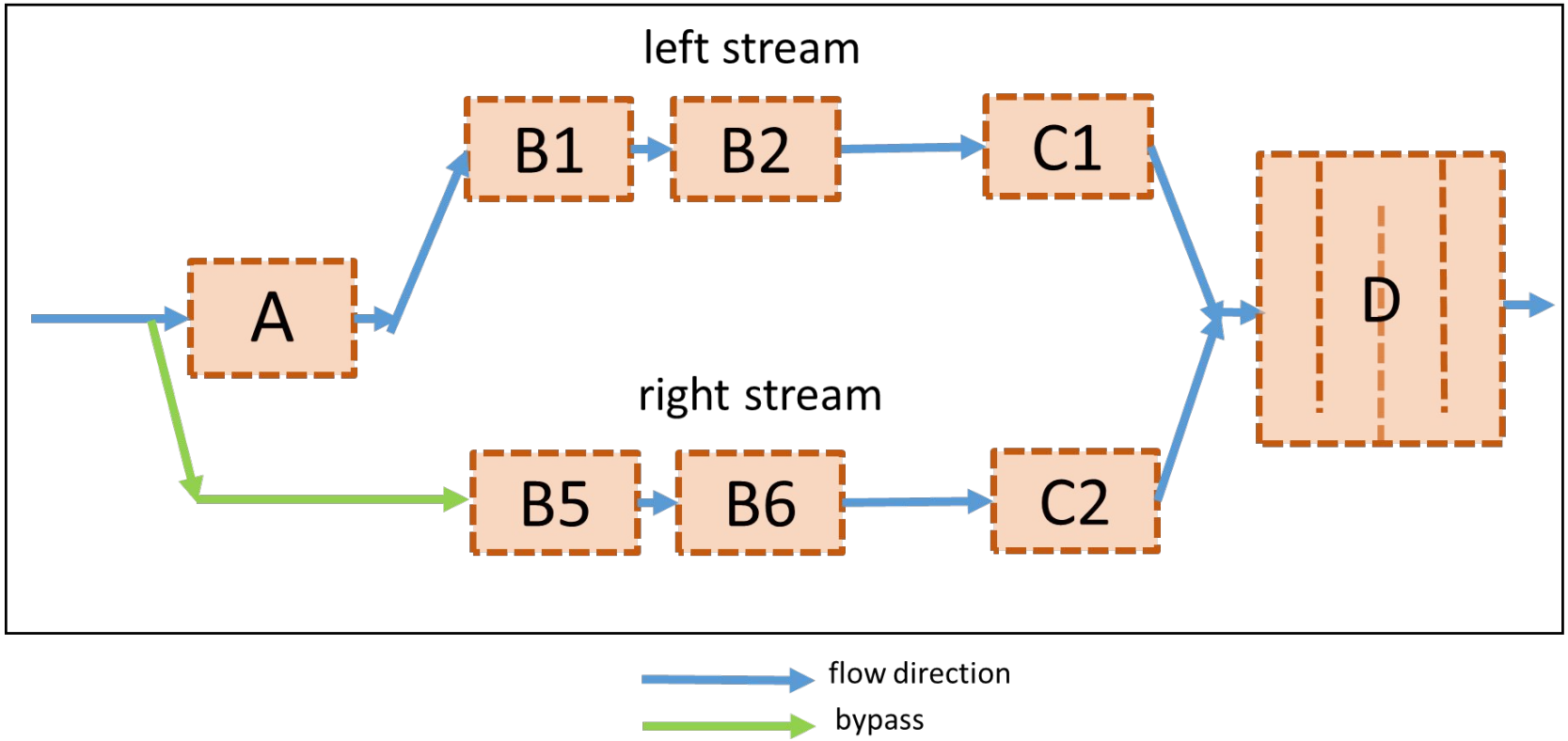


Wetland+ - efficiency analysis:

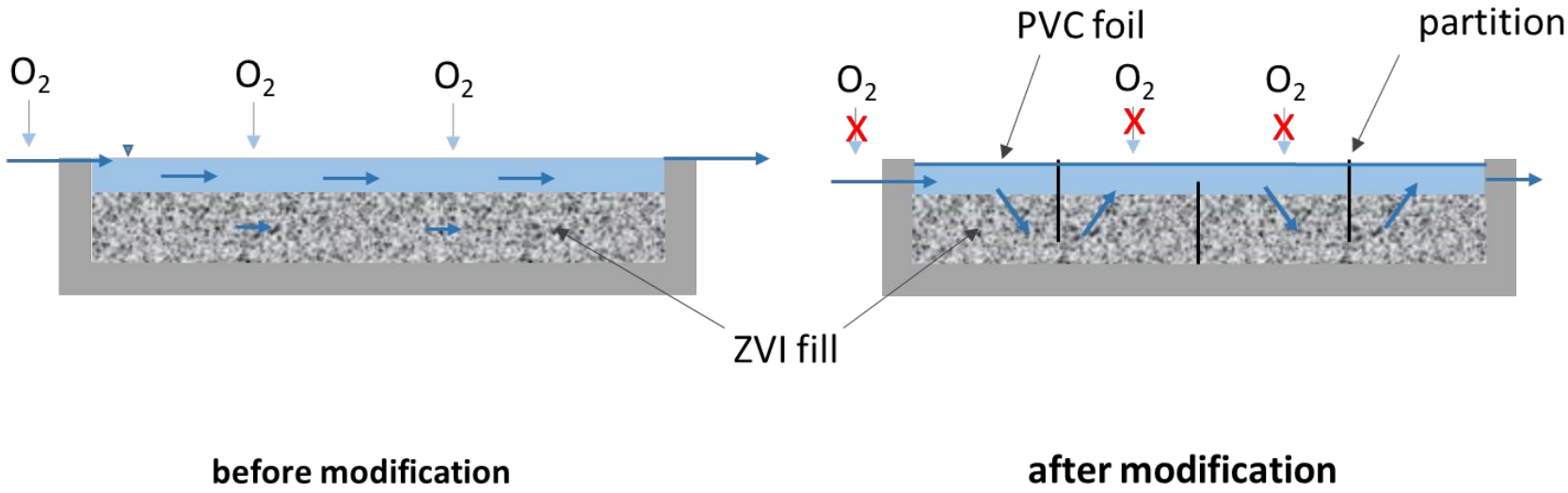


- Current flow through segments B (macroFe^0) and chemical content of inflow water result in aerobic rather than anoxic corrosion of Fe^0.
- Aerobic corrosion of Fe^0 does not generate H_2, that is main reducing agent for highly chlorinated organic compounds, incl. HCH.
- Furthermore, $Fe(OH)_3$ precipitates under aerobic conditions that rapidly clogs and deactivate macroFe^0.

Wetland+ modification

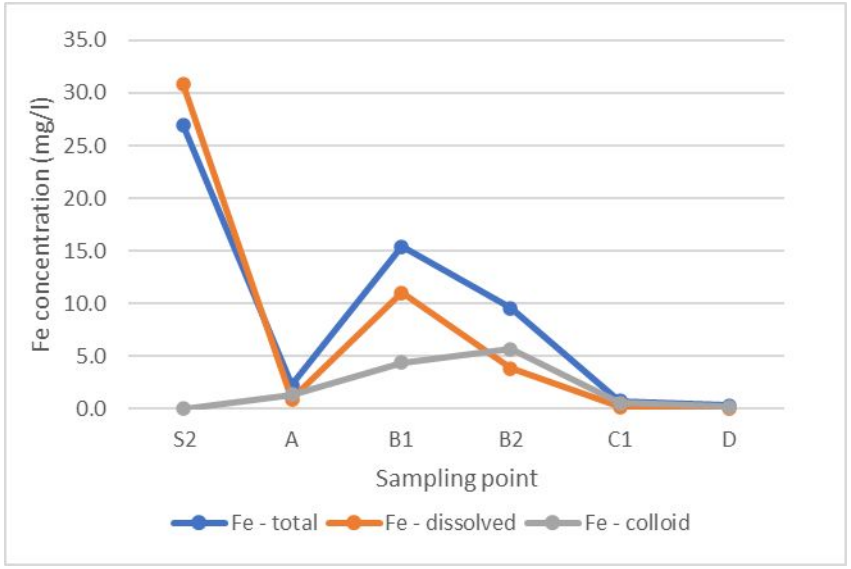


Wetland+ modification

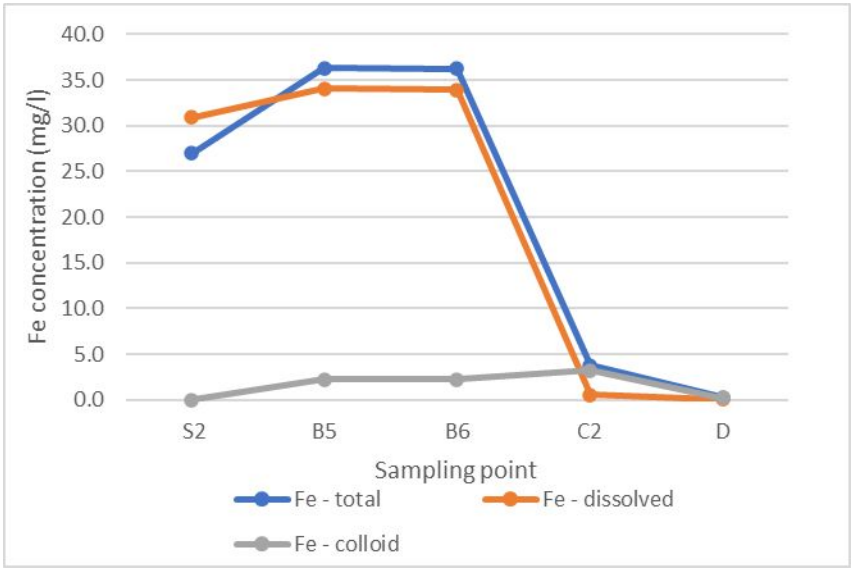



June/July 2022

Wetland+ monitoring – August 2022 data

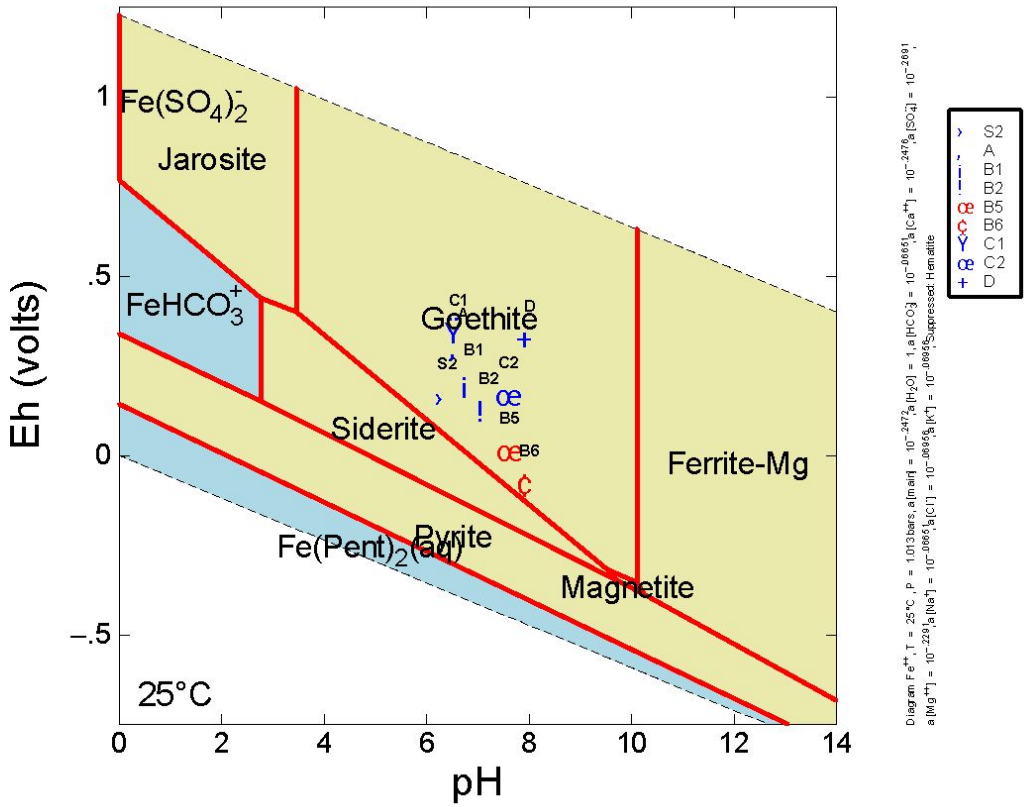


B1 – B2 pathway
(unmodified)

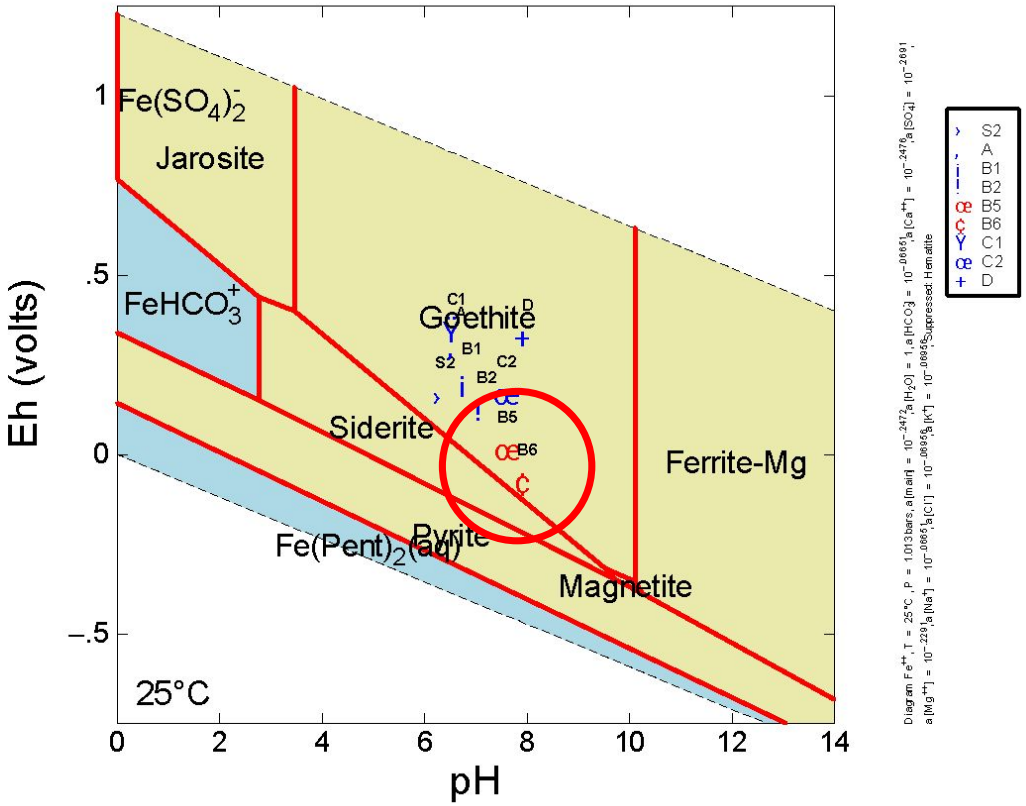


B5 – B6 pathway
(modified)

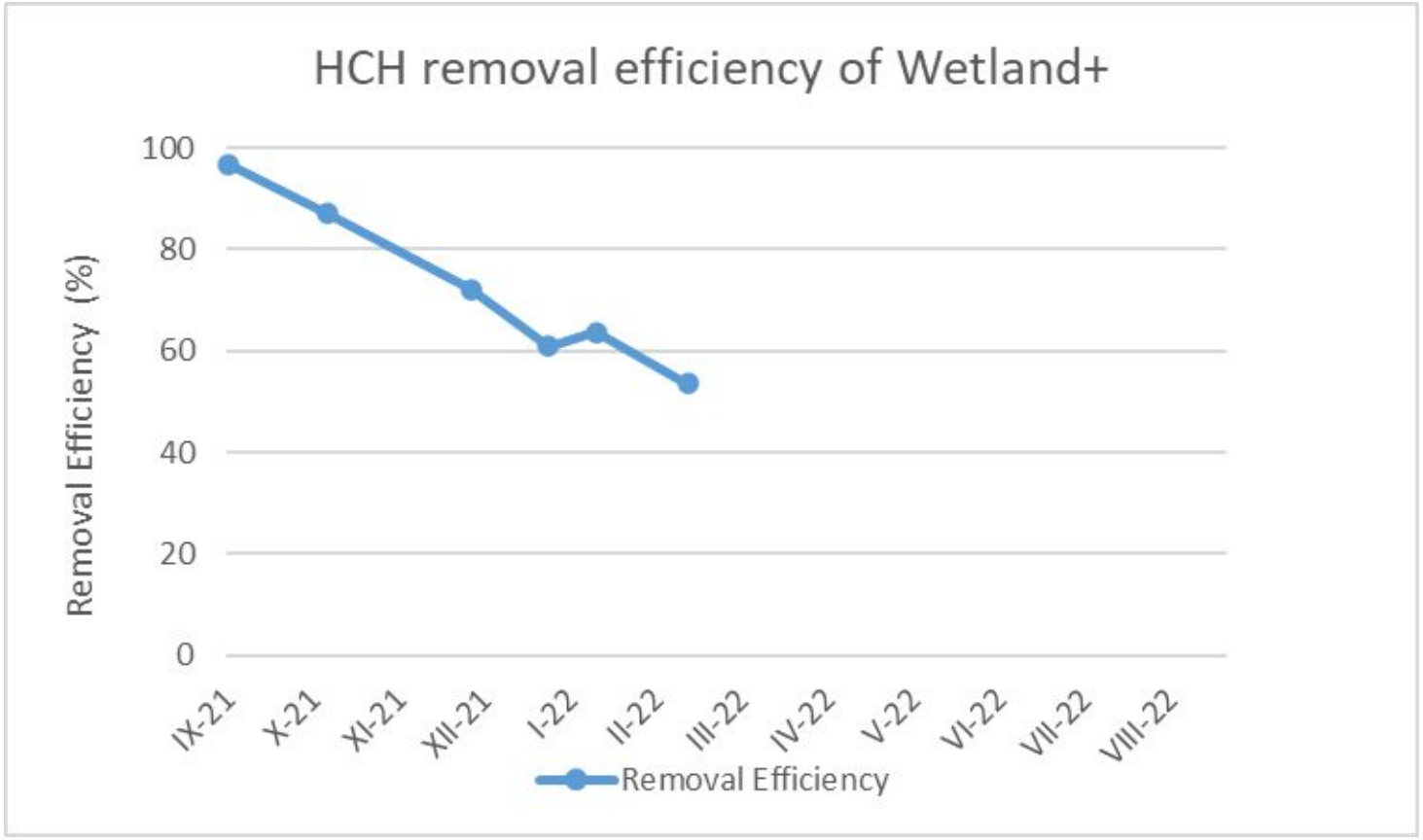
Wetland+ related research – geochemical modeling



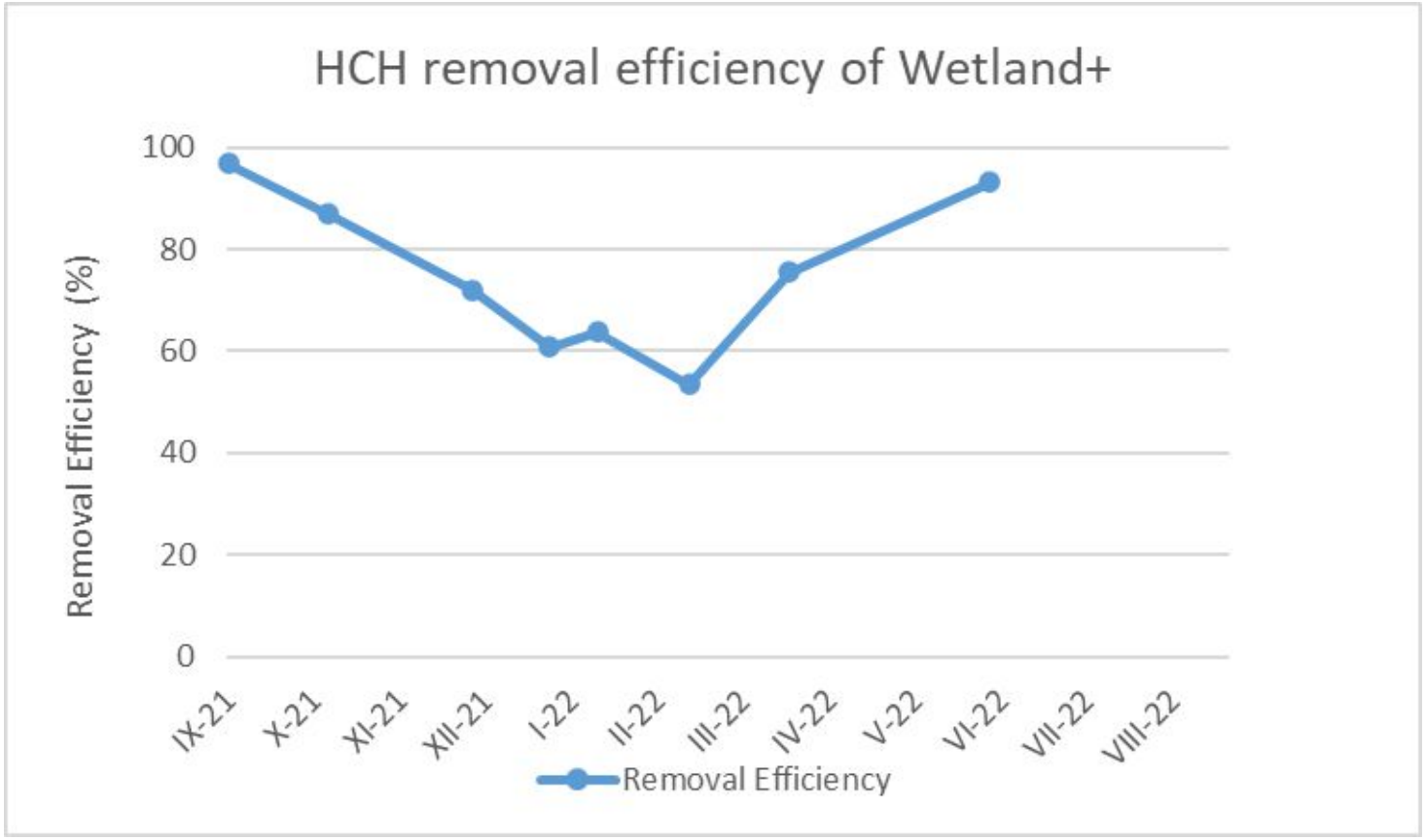
Wetland+ related research – geochemical modeling



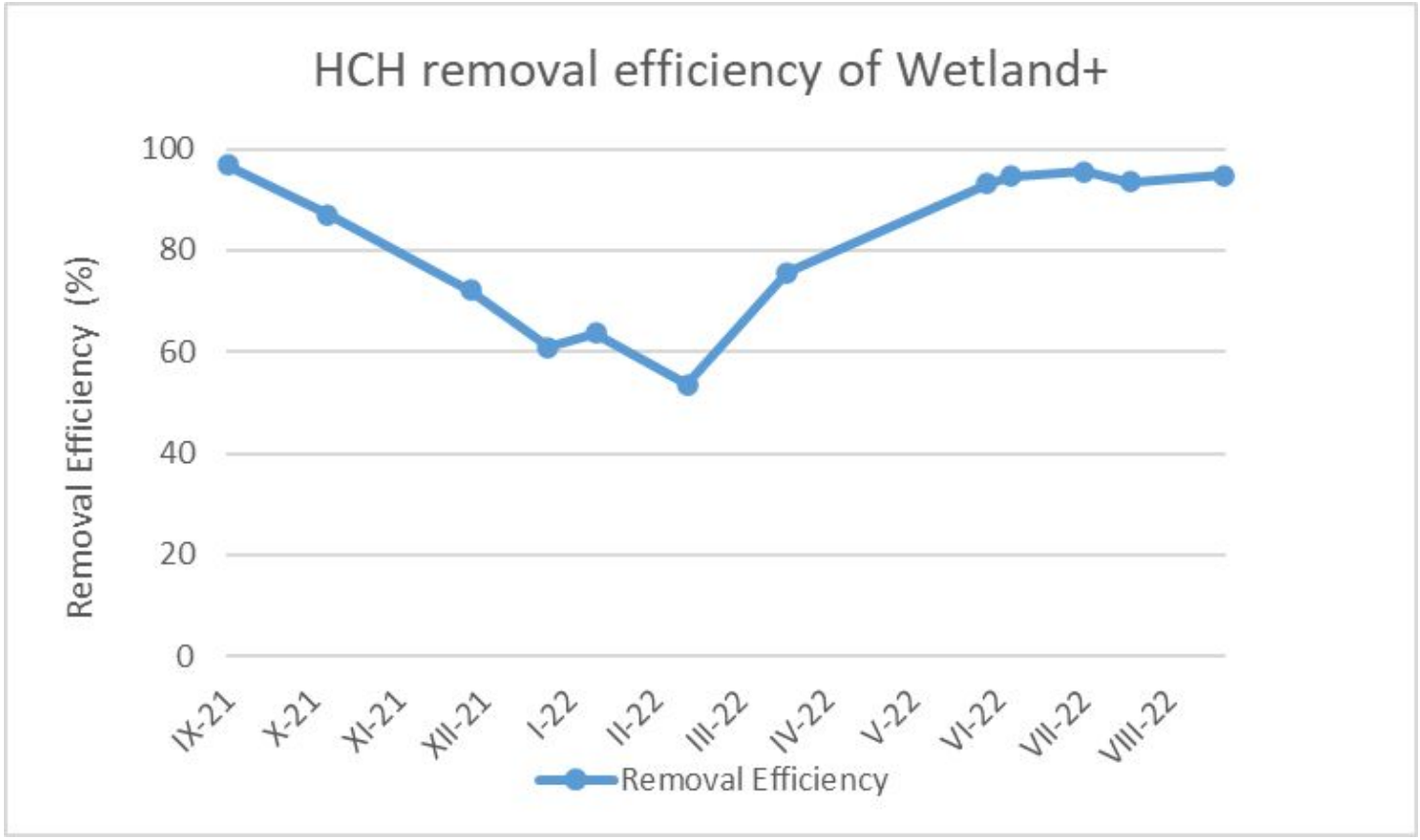
Wetland+ monitoring



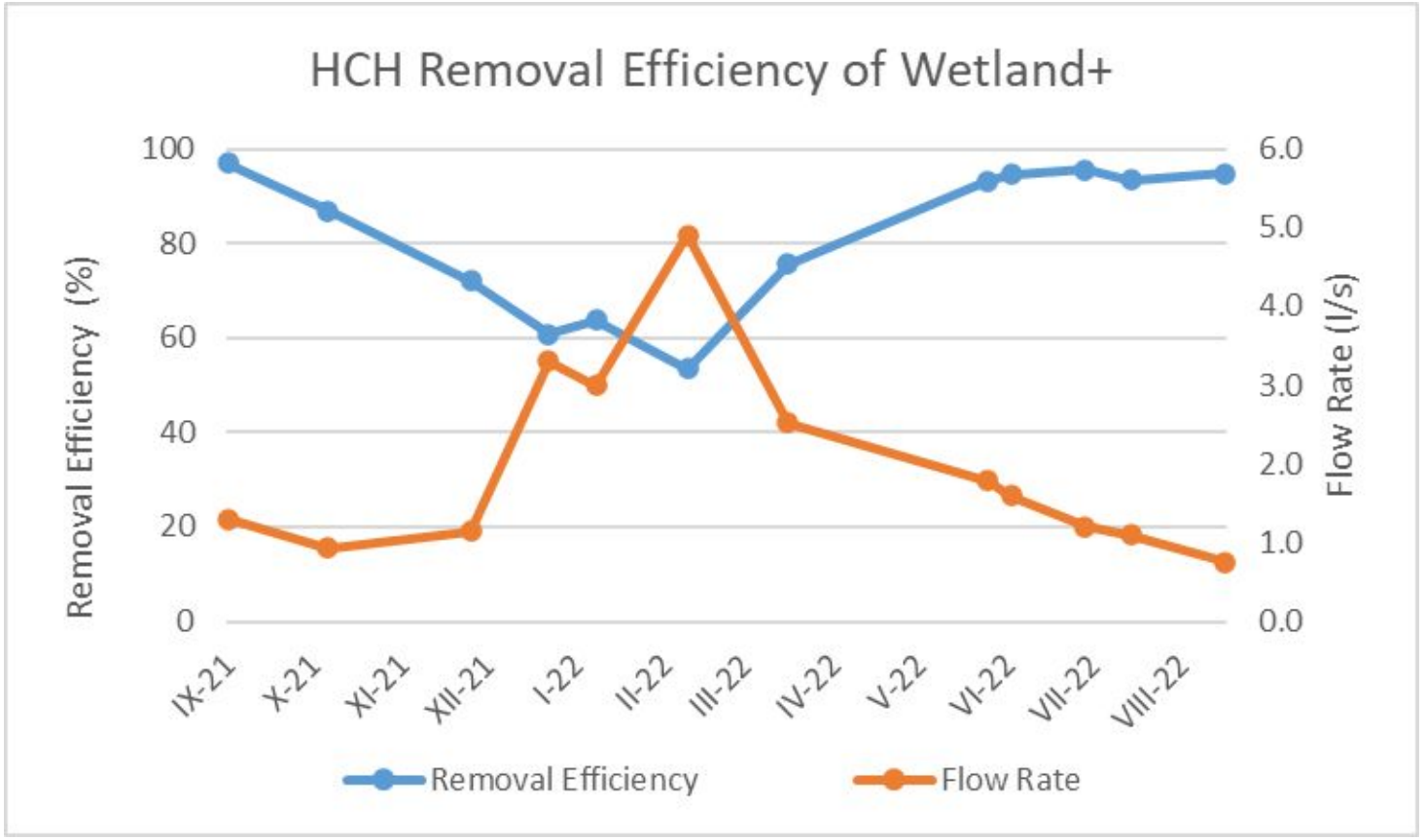
Wetland+ monitoring



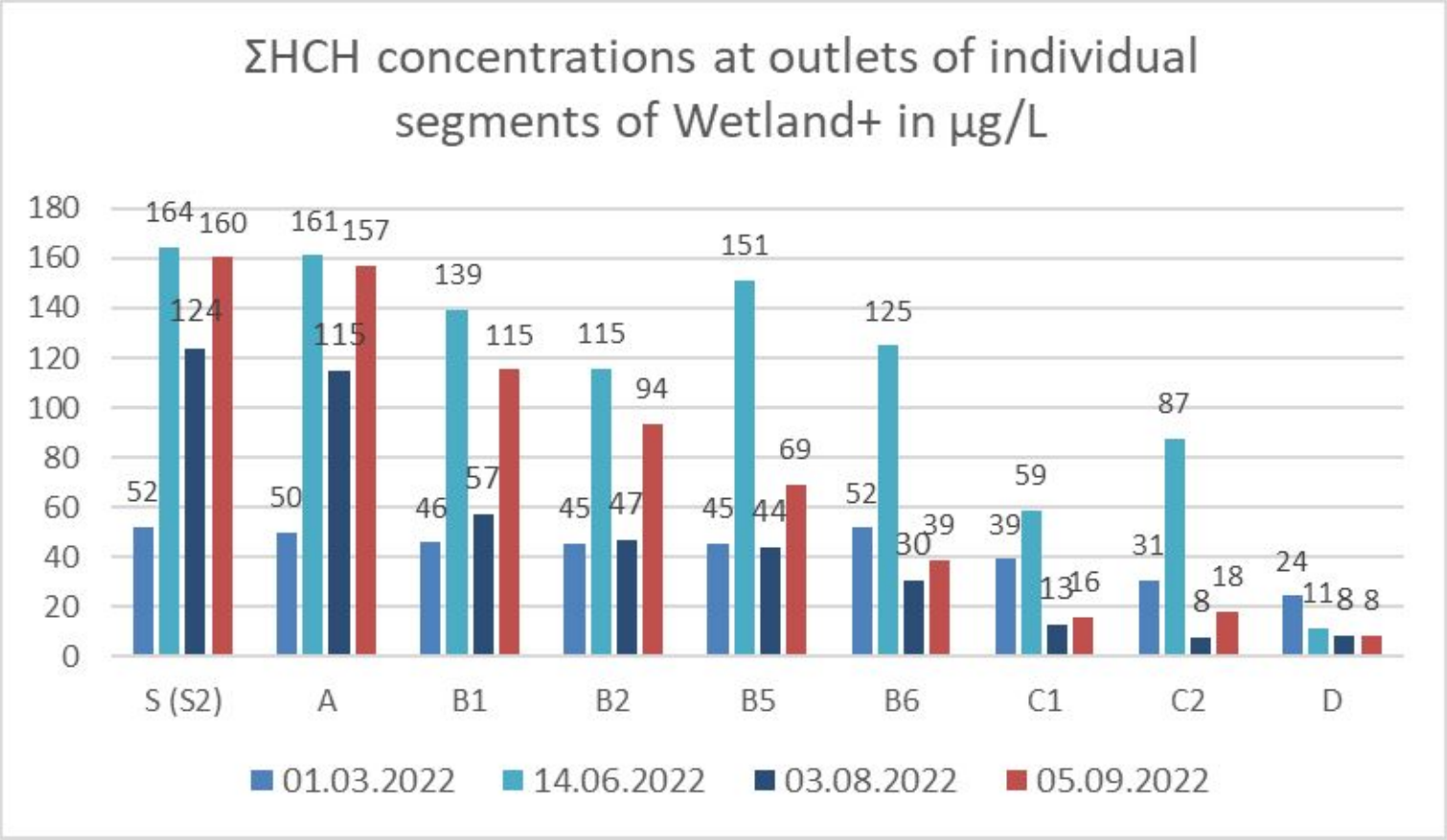
Wetland+ monitoring



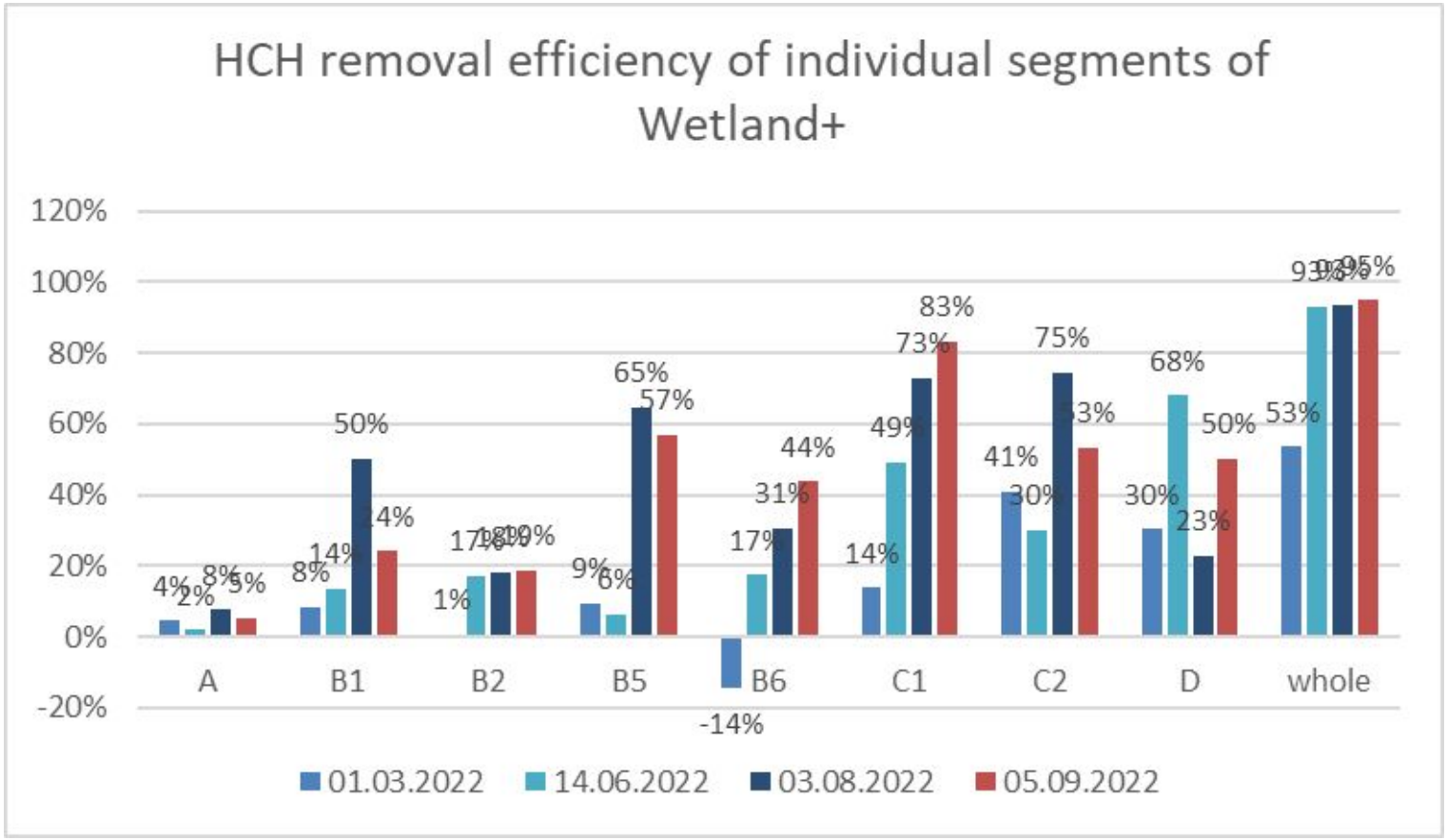
Wetland+ monitoring



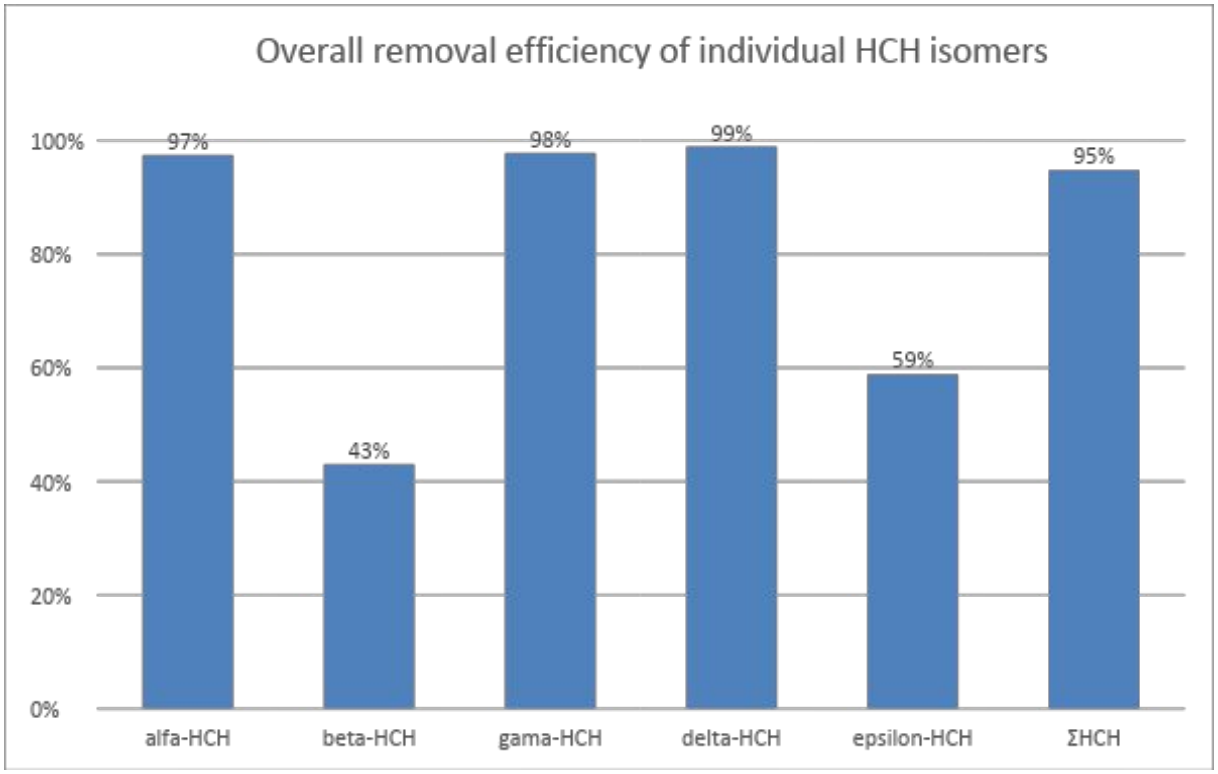
Wetland+ monitoring



Wetland+ monitoring

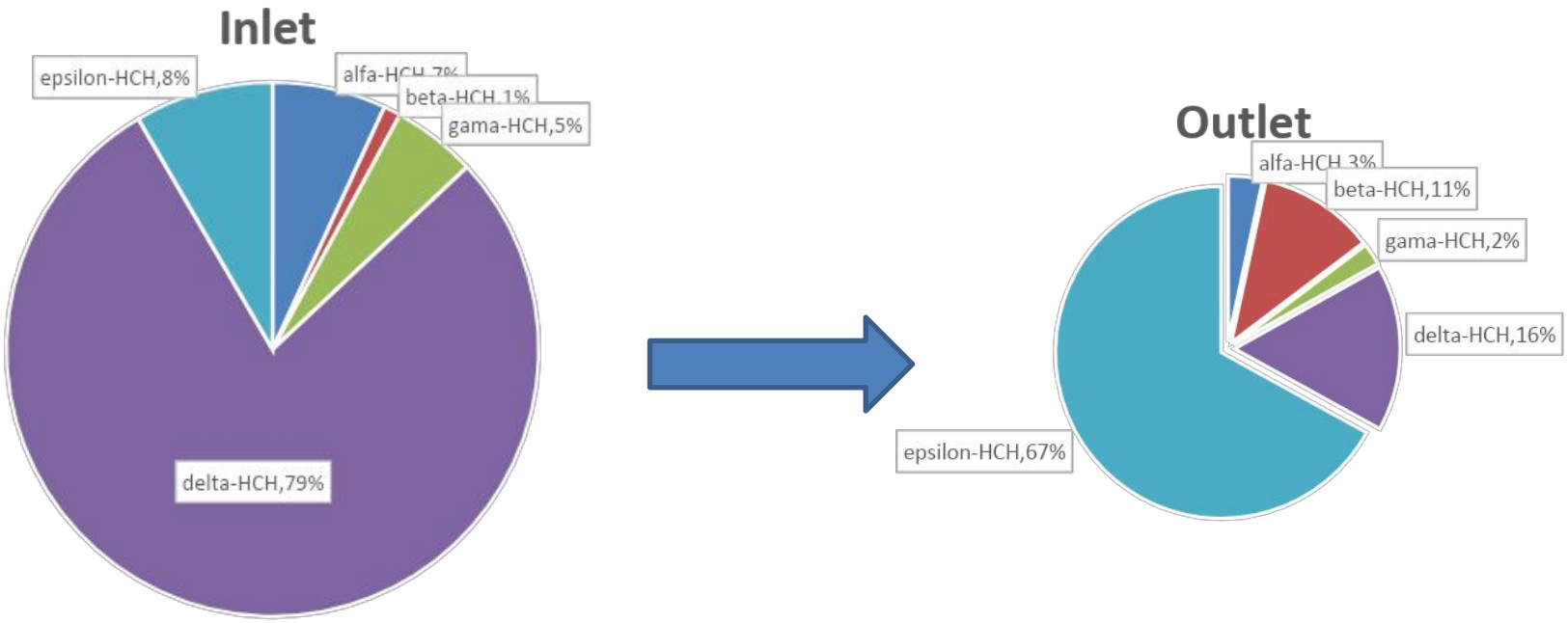


Wetland+: Overall Removal Efficiency of HCH Isomers



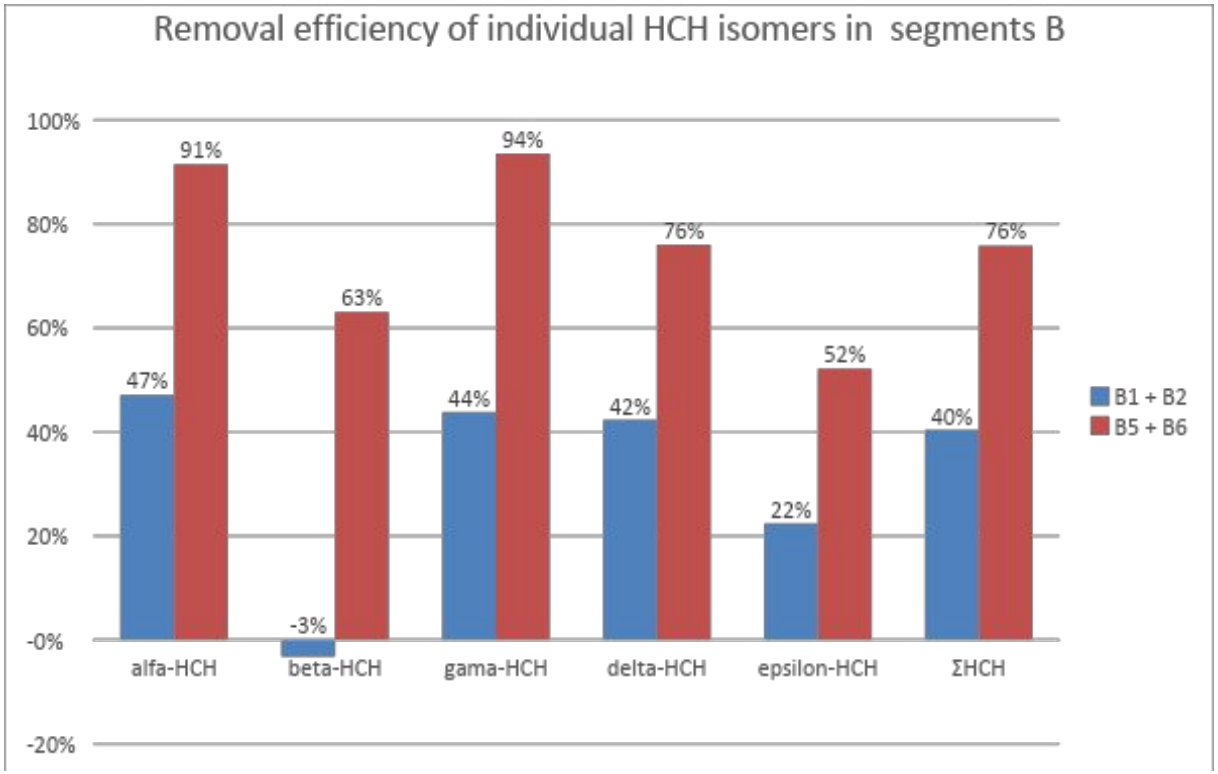
September 2022 data

Wetland+ monitoring



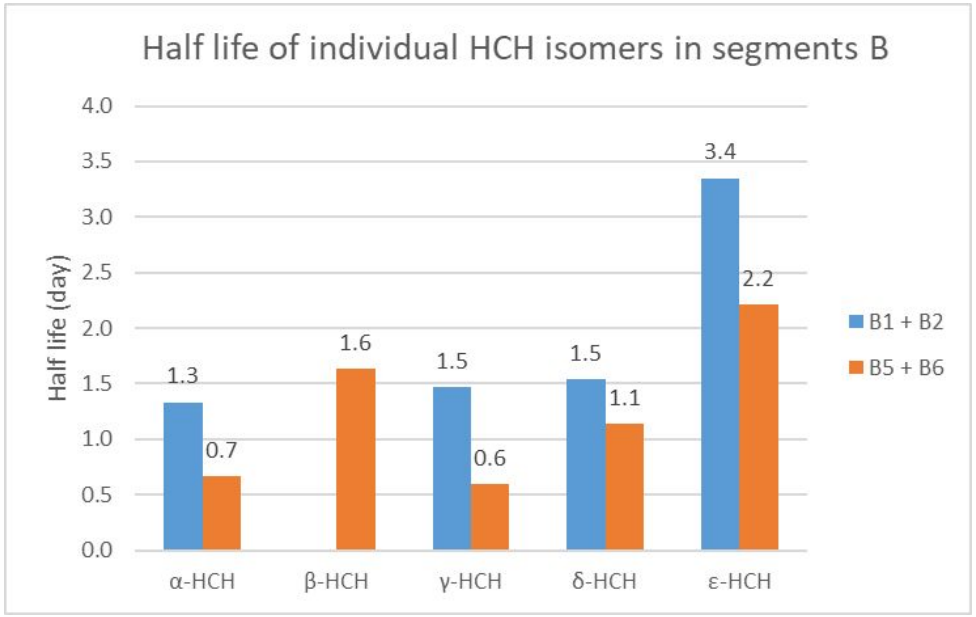
September 2022 data

Wetland+: Removal Efficiency of HCH Isomers in Segments B



September 2022 data

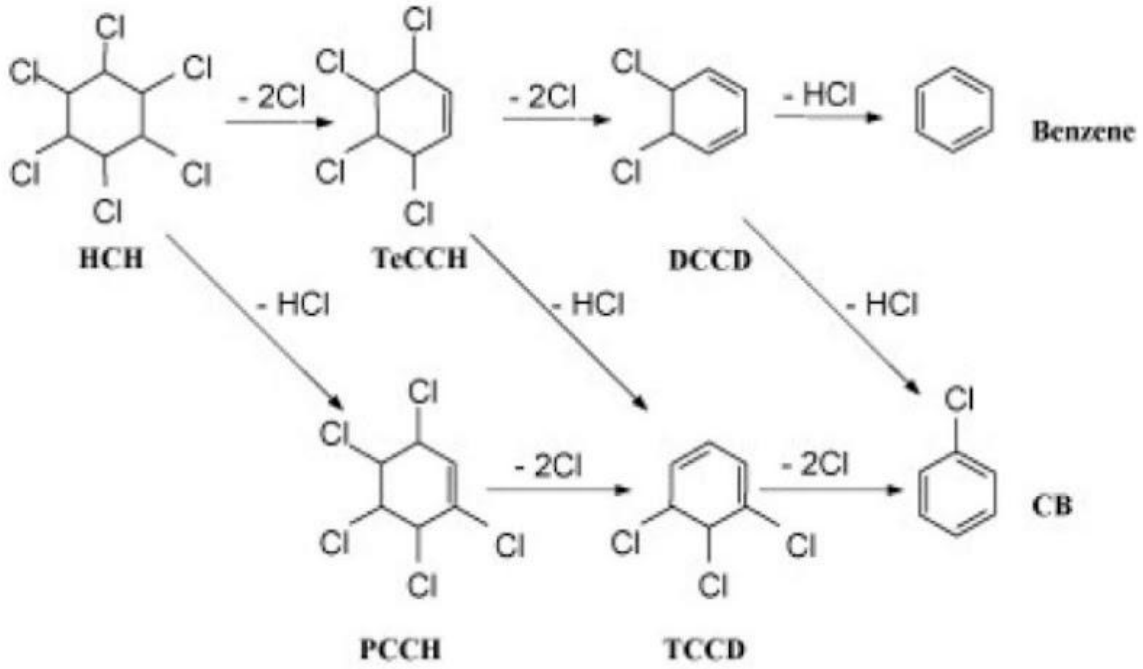
Wetland+: Removal Efficiency of HCH Isomers in Segments B



September 2022 data

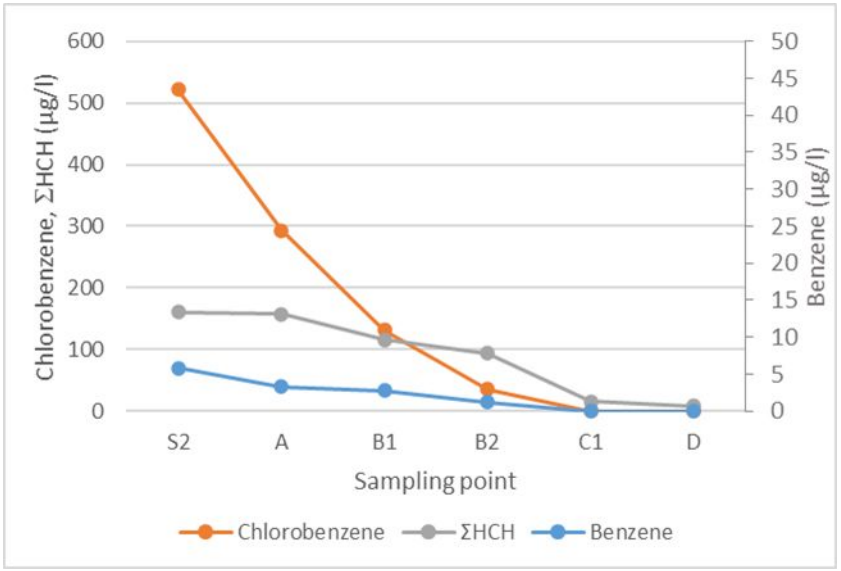
decay rates: α = γ > δ > β > ε

Wetland+: analysis of degradation pathways

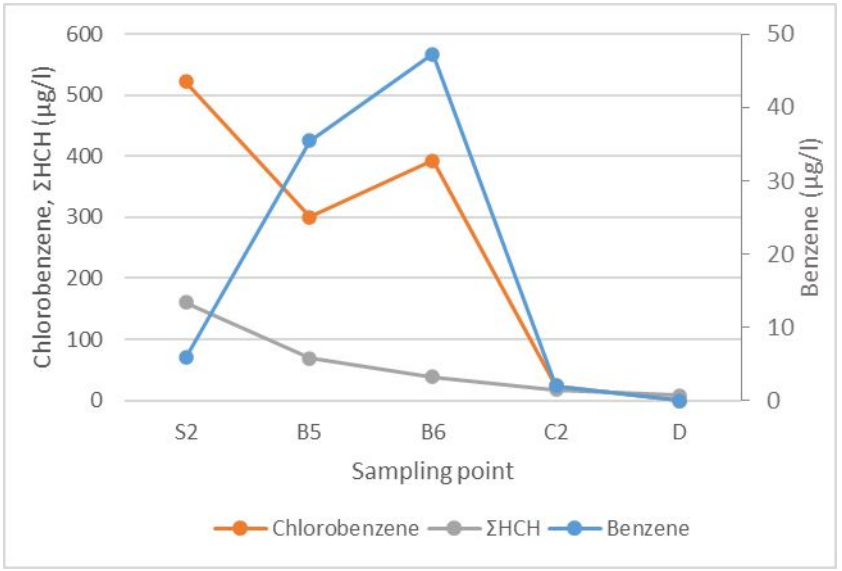


Possible pathways of lindane dechlorination by ZVI (Wang et al. 2009)

Wetland+ monitoring



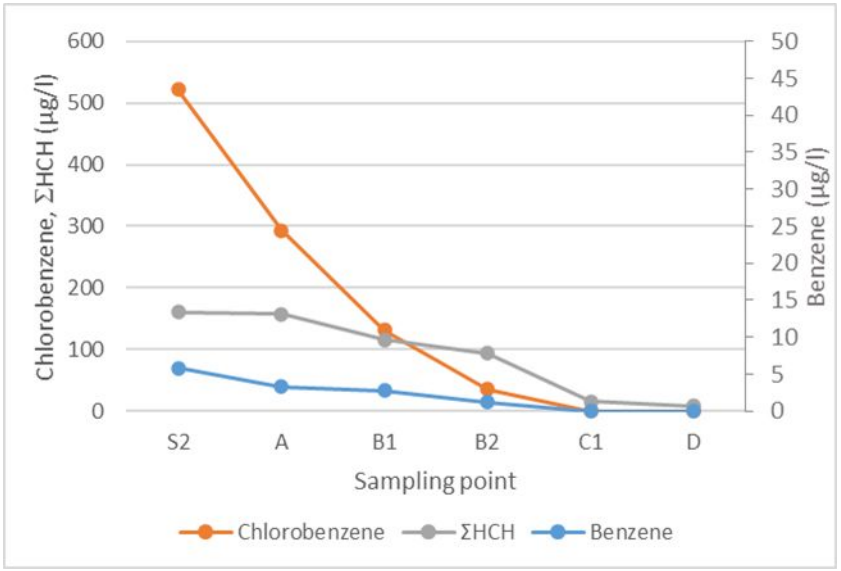
B1 + B2 pathway
(unmodified)



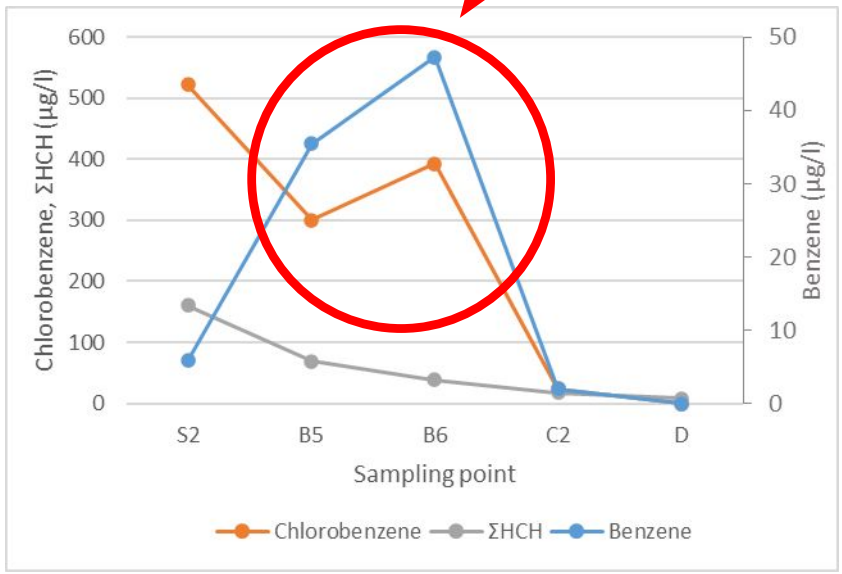
B5 + B6 pathway
(modified)

Wetland+ monitoring

products of HCH dechlorination



B1 + B2 pathway
(unmodified)

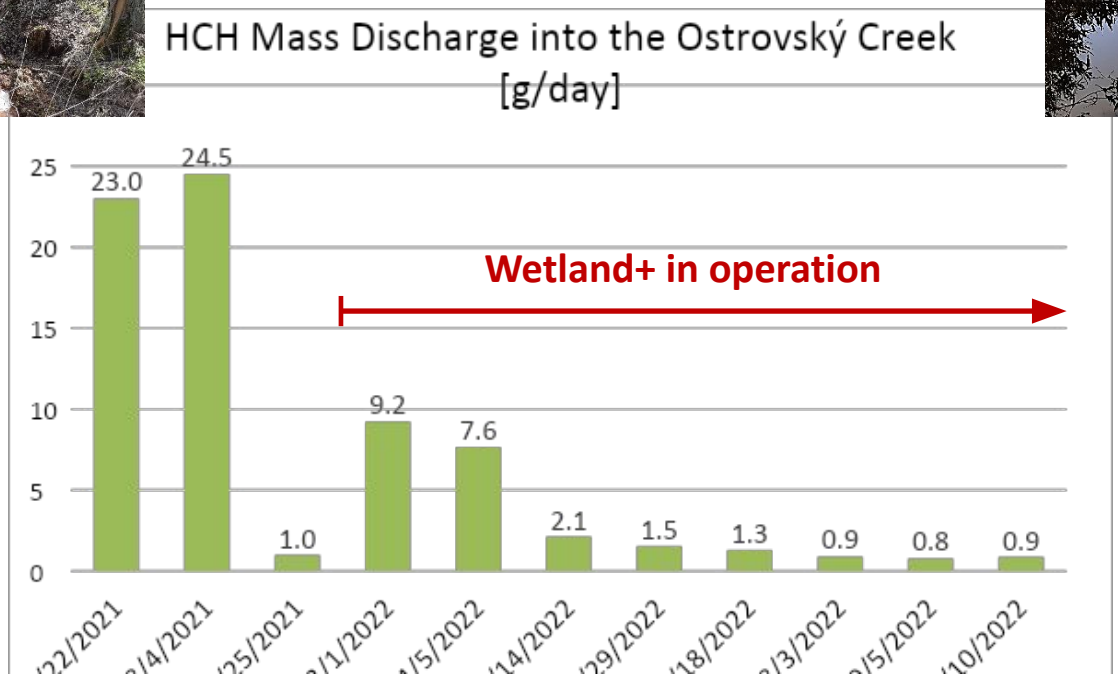


B5 + B6 pathway
(modified)

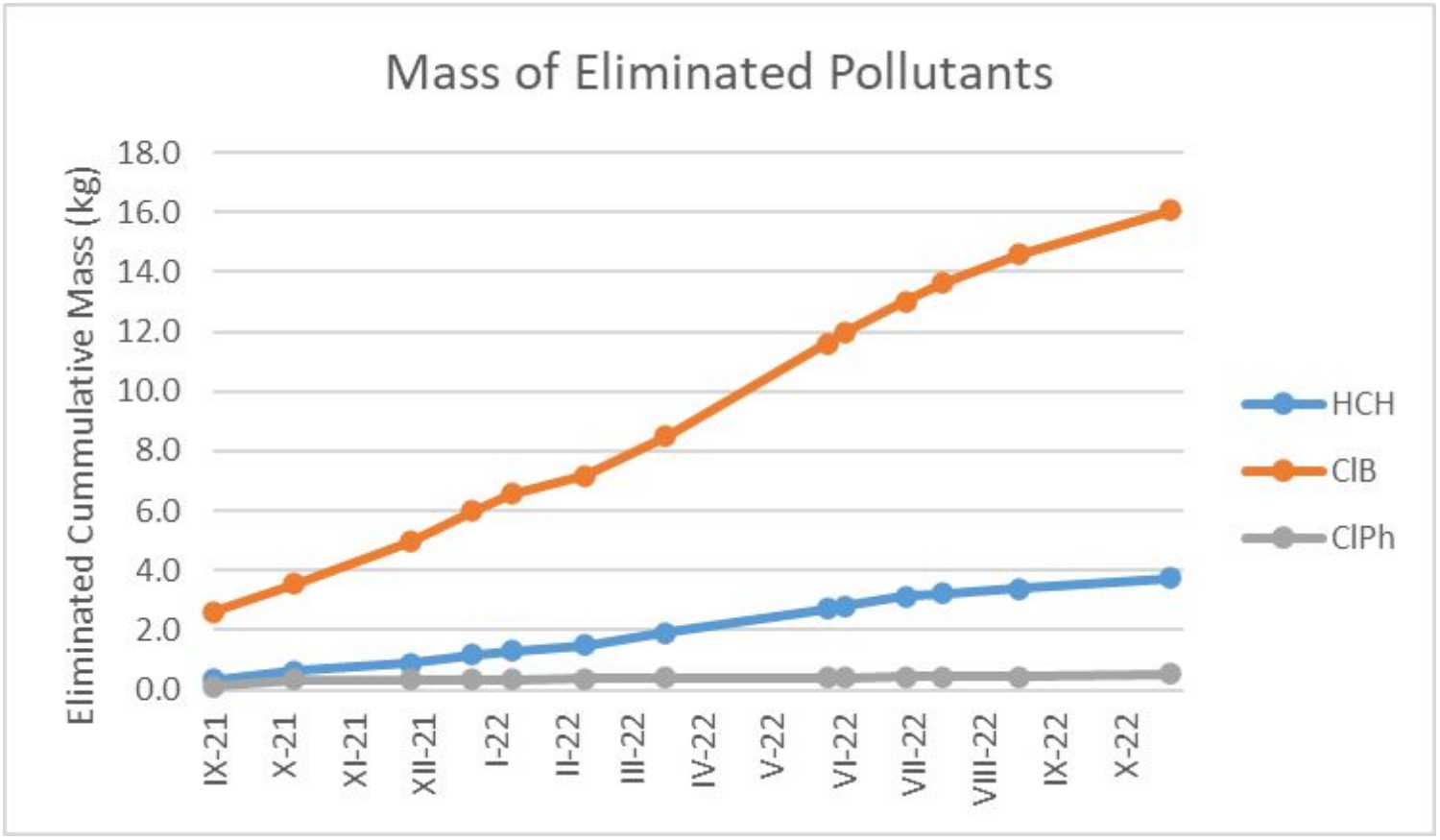
Wetland+ Mass Discharge

Ostrovský Creek

Horní Štít Pond



Wetland+ Eliminated Mass



Summary

- ✔ Modification of Wetland+ at Hájek led to low HCH concentrations at the outlet (<10 µg/l), and high HCH removal (95% to date);
- ✔ Various removal efficiency for individual HCH isomers: α = γ = δ > β = ε
  - → δ-HCH dominates at the inlet, ε-HCH dominates at the outlet;
- ✔ HCH mass discharge to the Ostrovský Creek decreased from 23 to 25 g/day to 0.8 – 0.9 g/day (approximately 97% decrease);
- ✔ Till 10 November 2022 P1 removed :
  - approximately 3.8 kg HCH
  - approximately 16 kg ClB
  - approximately 0.5 kg ClPh
- ✔ Further modification needed to sustain efficiency!!

Thank you for your attention!