



Field study and model simulations of
sulfur and nitrogen transformations in a
rising main receiving nitrate dosing

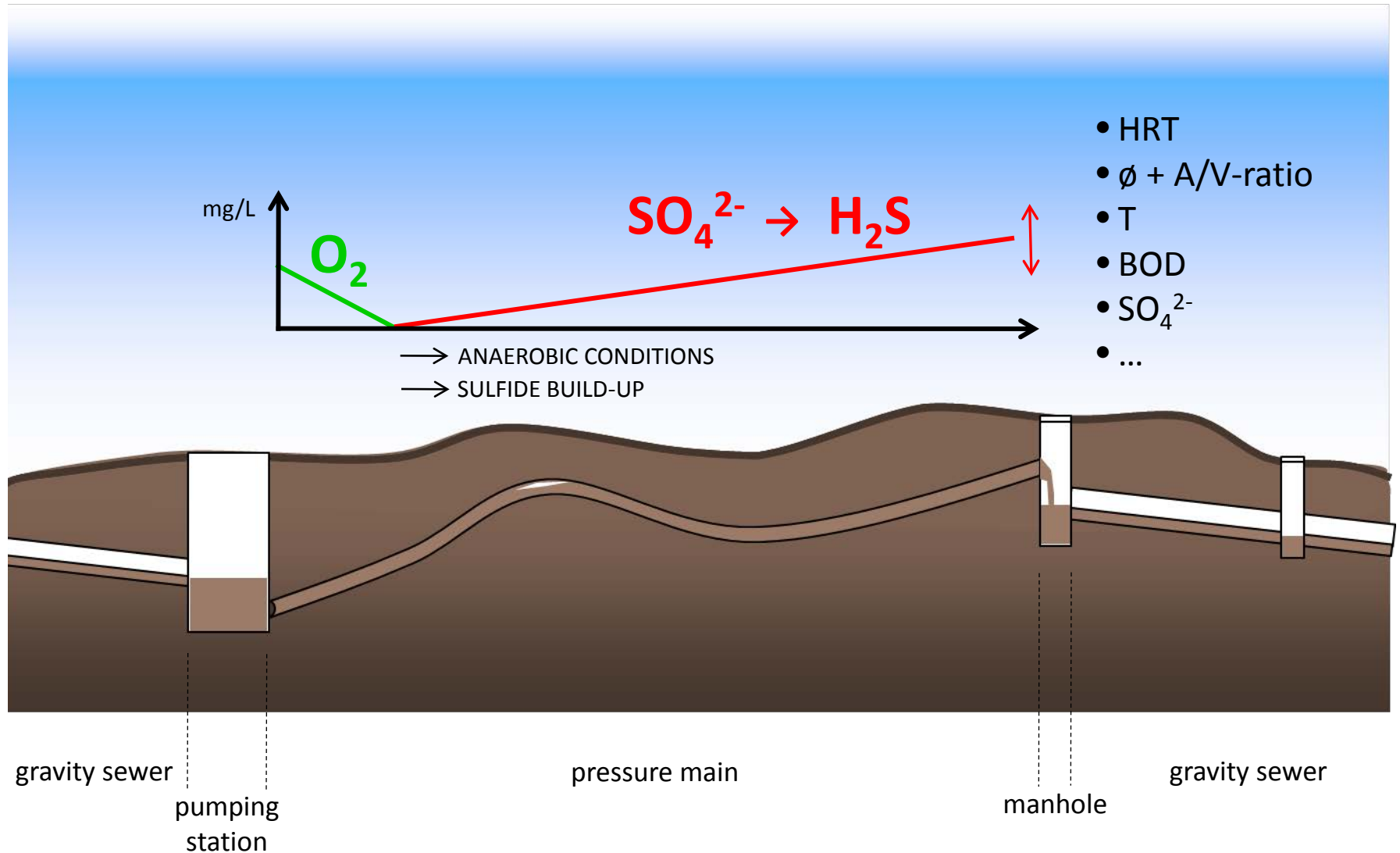
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Marjoleine Weemaes, Greet De
Guedre, Boudewijn Van De Steene

- Collection and treatment of municipal waste water in Flanders, Belgium
- 247 wastewater treatment plants, 1174 pumping stations and 4735 km of (mainly concrete) collector sewers



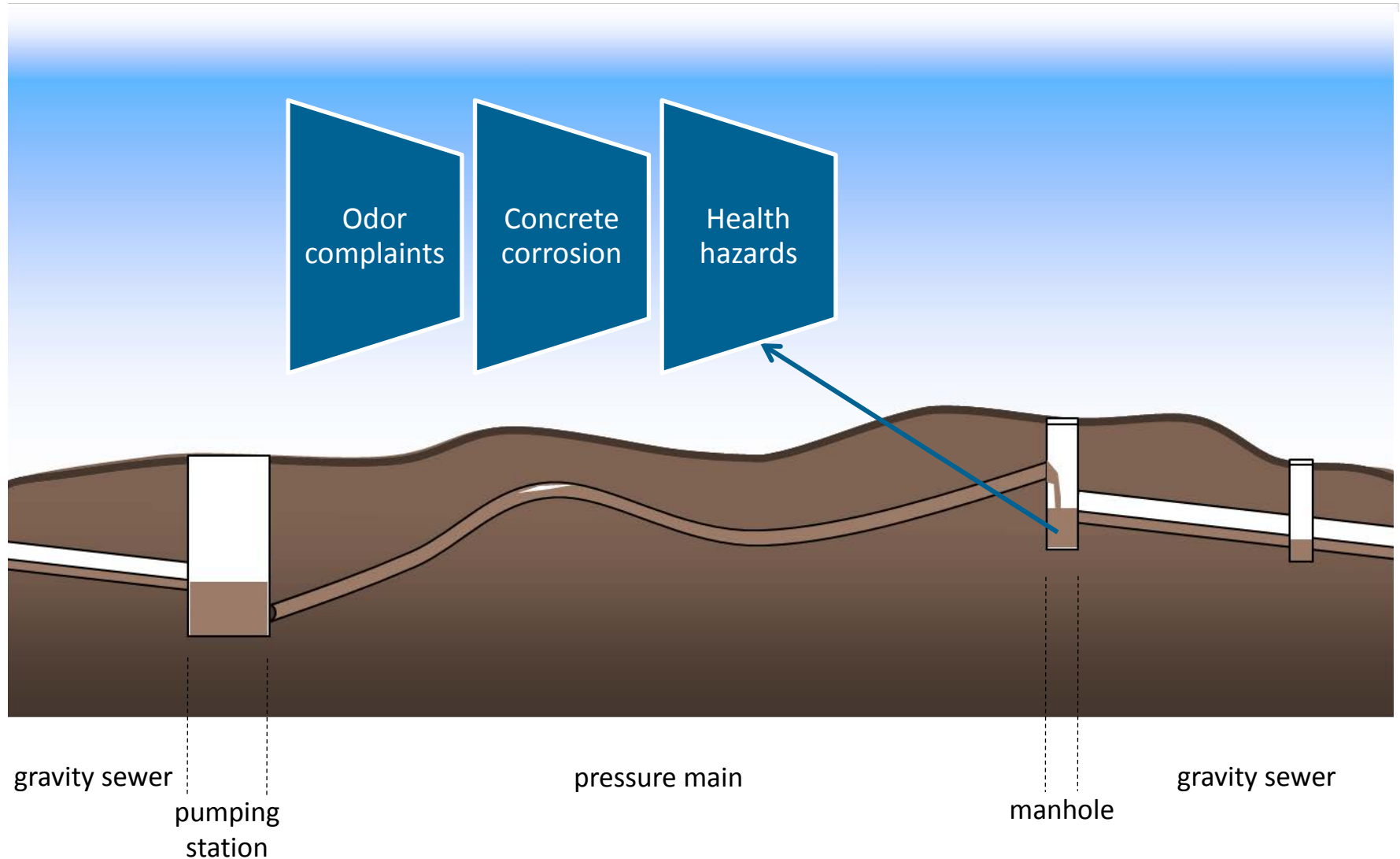
Hydrogen sulfide / H₂S in sewers

Sulfide is formed under anaerobic conditions, e.g. in **pressure mains**



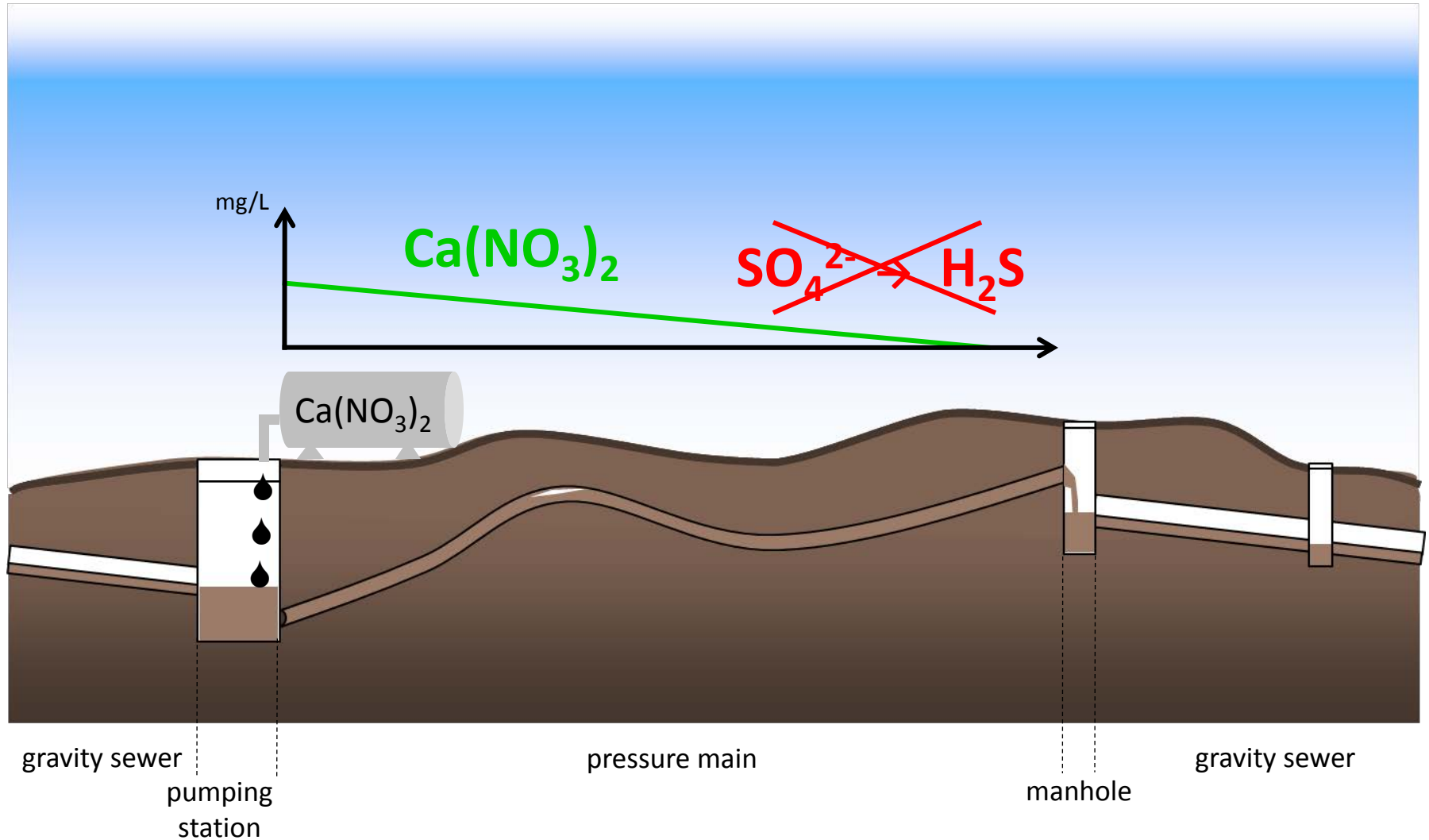
Hydrogen sulfide / H₂S in sewers

Consequences of H₂S formation



How to deal with H₂S?

Dosing of chemicals in pumping station



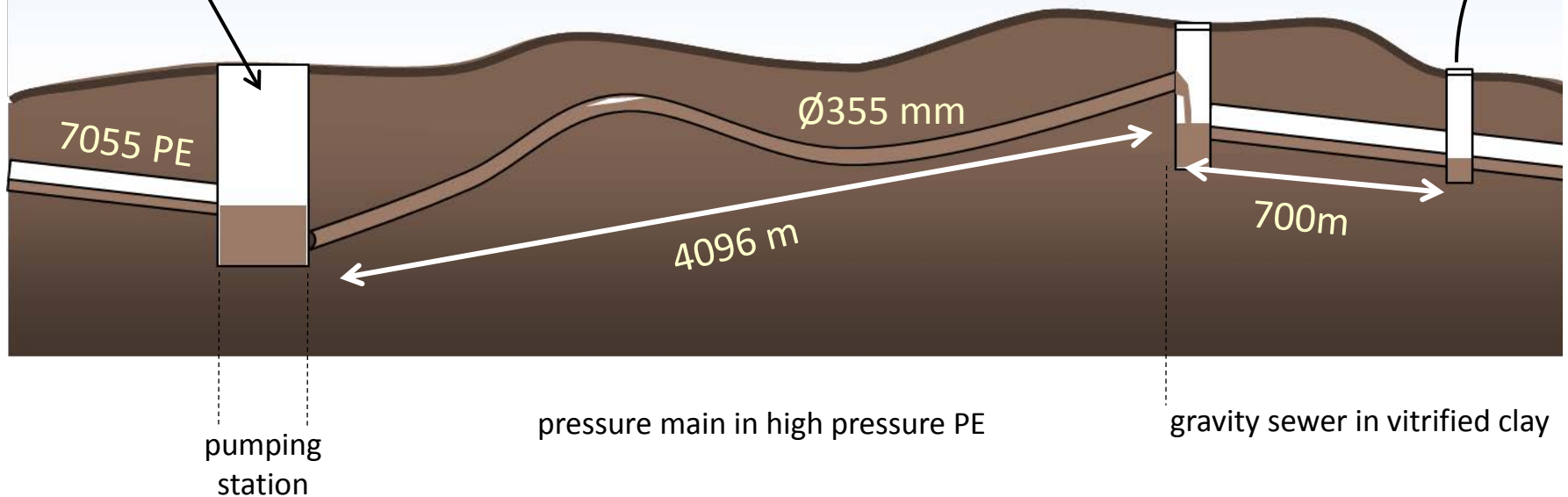
Site description

Nitrate dosing tank:



Required dose: 140 ton/year
Cost price: **40.000€/year**
Dynamic model to describe nitrogen transformations

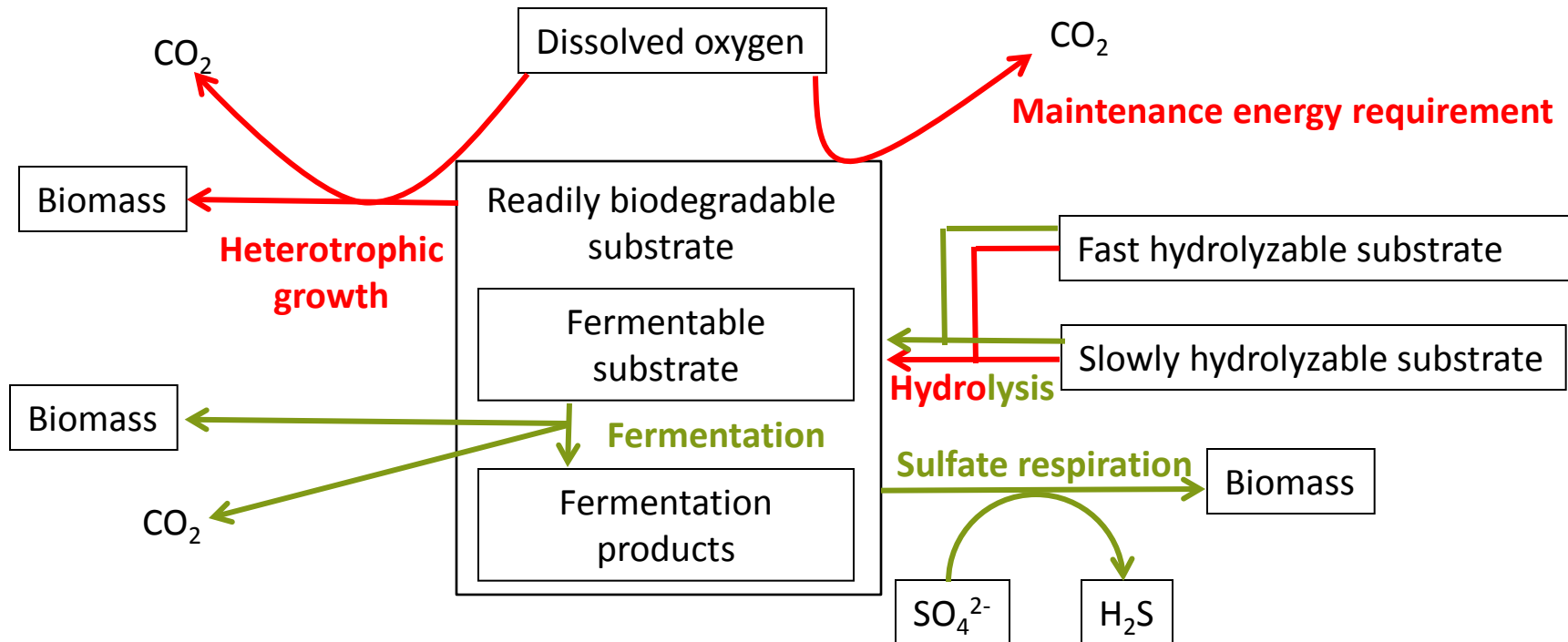
Odor complaints



Model approach

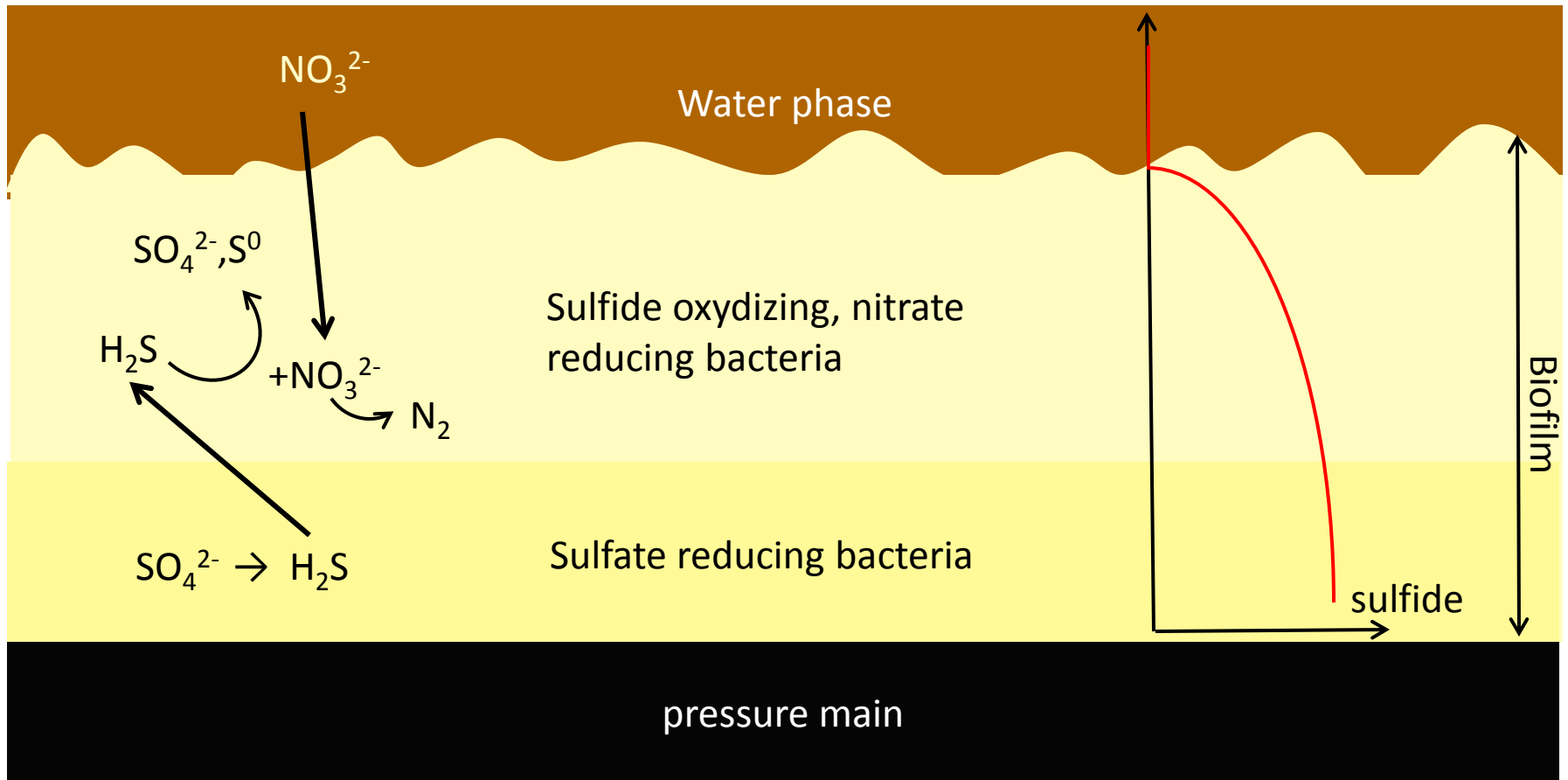
Aqua3S: Aquafin's model library for Simulating Sulfides in Sewers (Donckels, 2012)

Aerobic + anaerobic carbon and sulfur transformations: existing WATS model



Nitrate dosing

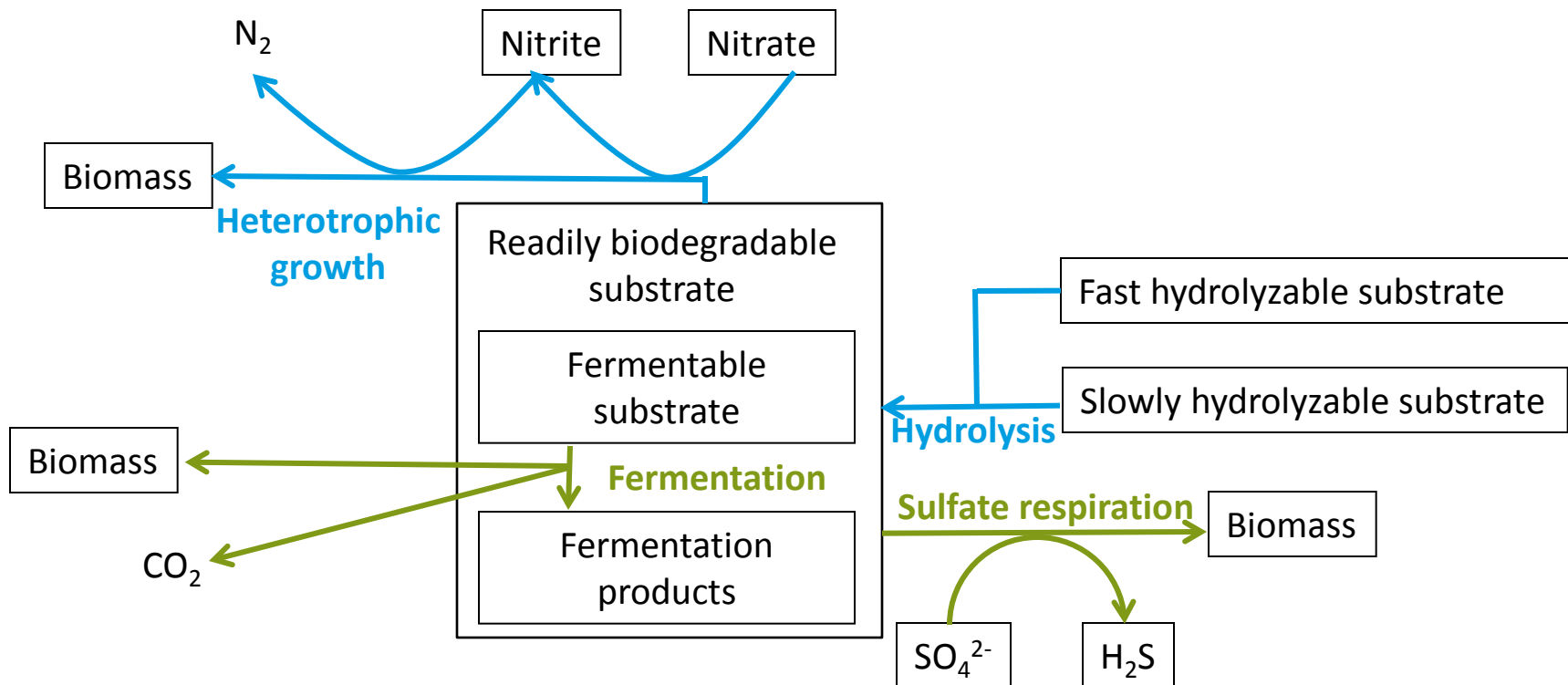
- A shift in active bacterial population
- Stimulation of sulfide-oxidizing nitrate-reducing bacteria



Model approach

Aqua3S: Aquafin's model library for Simulating Sulfides in Sewers (Donckels, 2012)

Anoxic transformations



- Two step denitrification processes: formation of intermediate nitrite
- Sulfide oxidation not included

Calibration and validation

1/hour

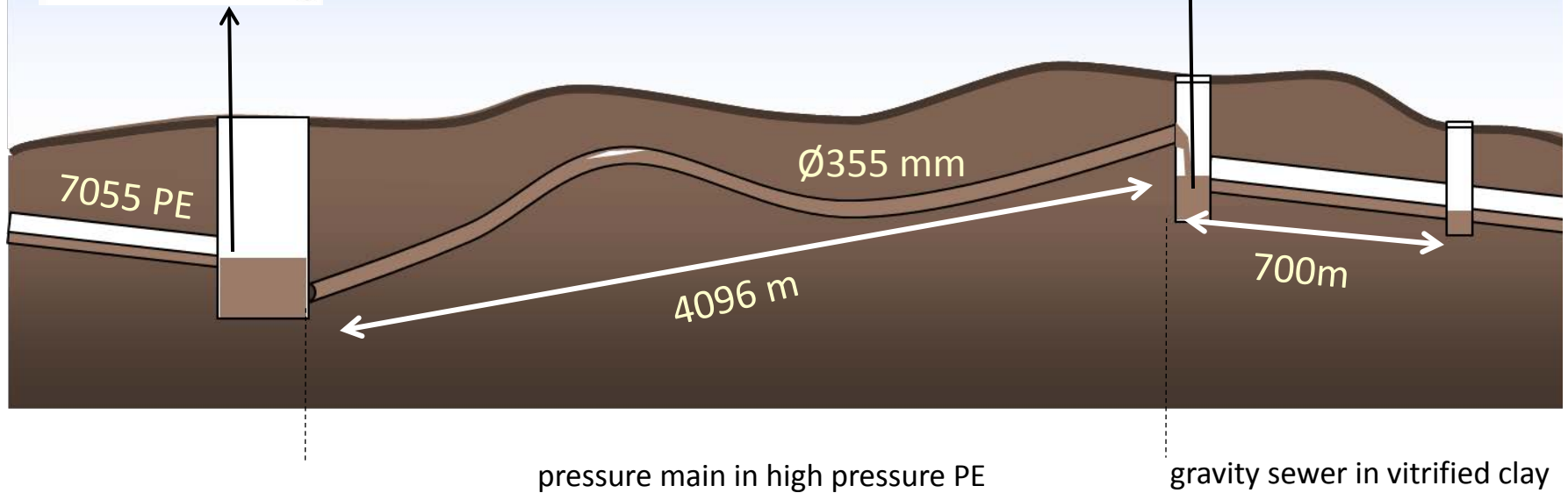


- Nitrate
- Nitrite
- COD
- BOD
- VFA
- sulfate



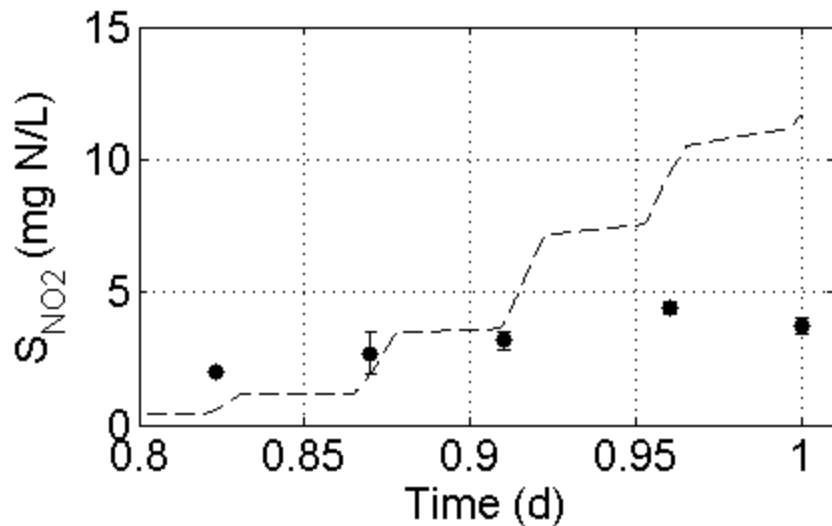
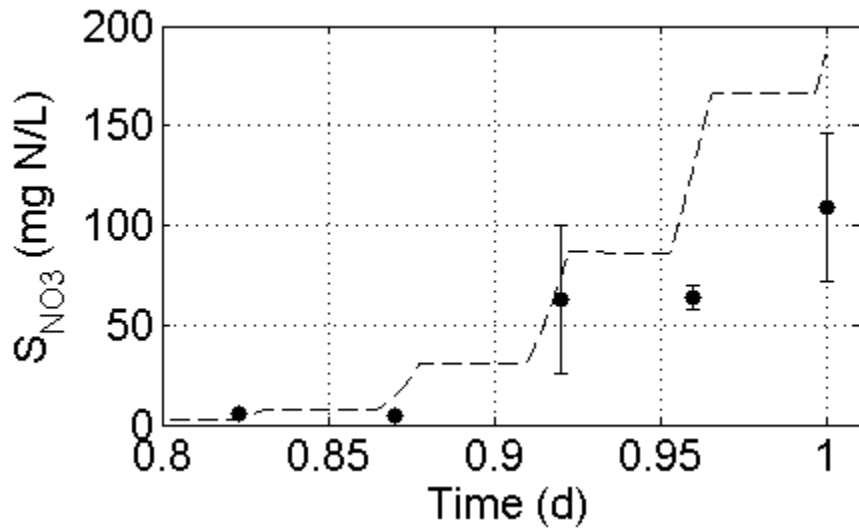
Grab samples:

- Nitrate
- Nitrite

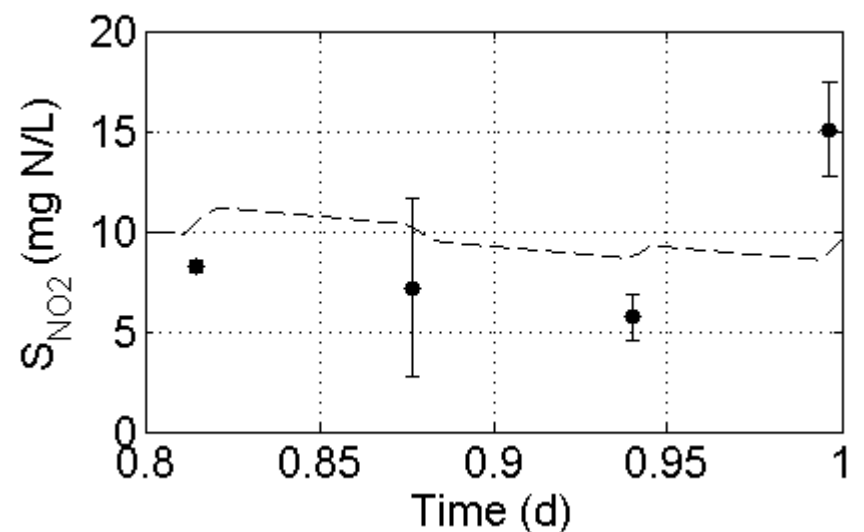
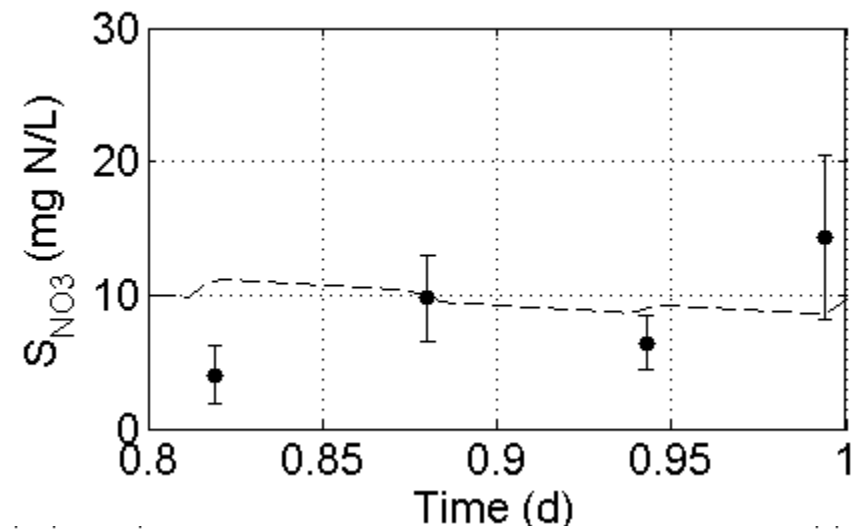


Field campaign 1&2

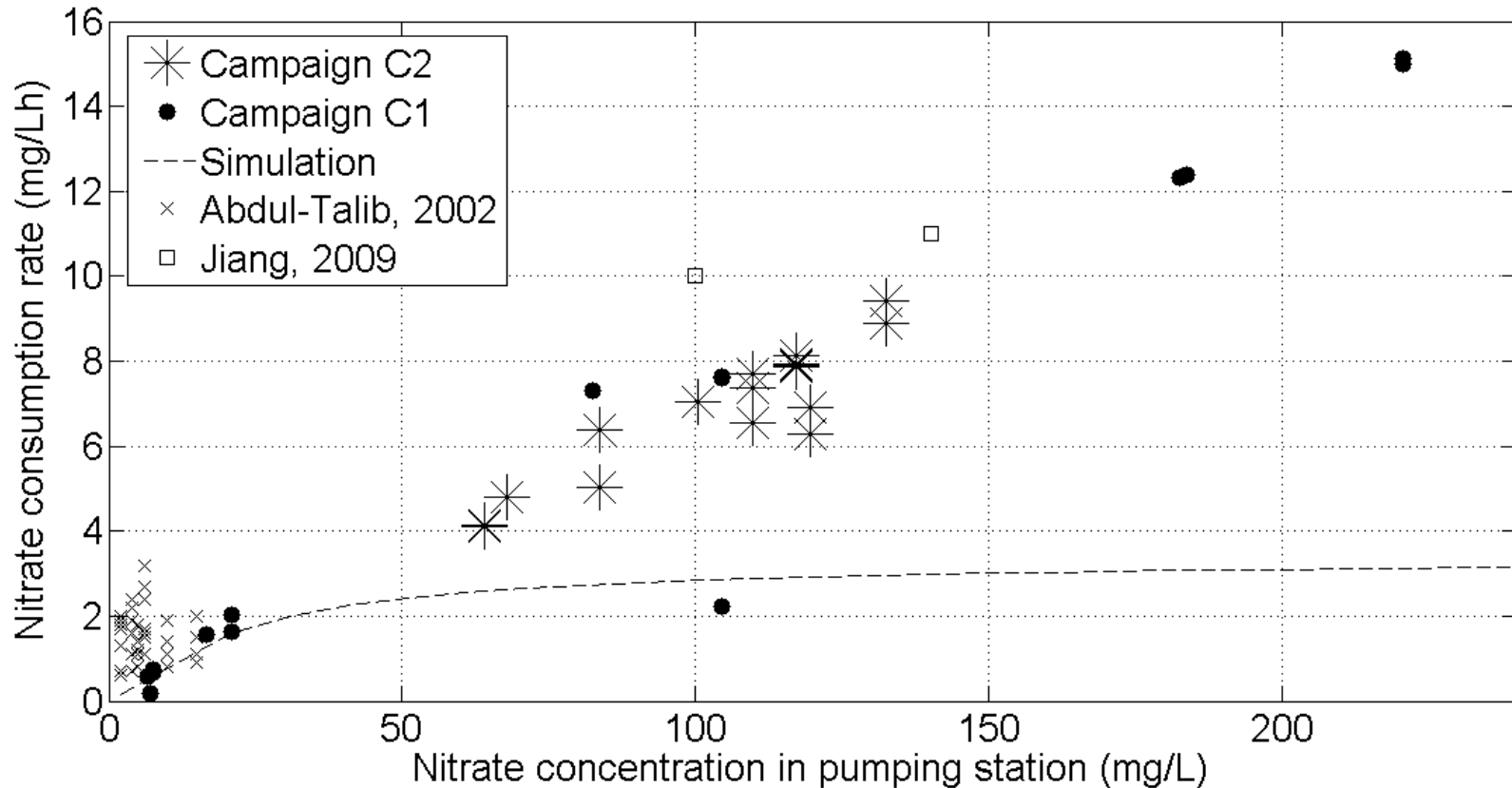
CAMPAIGN 1



CAMPAIGN 2



Denitrification rates



- Denitrification rates are underestimated: additional anoxic processes:
 - Oxidation of sulfides by nitrate

Conclusions



- Model concept based on two-step denitrification not sufficient to describe field data
- Include sulfide oxidation in model concept

Thank you for your attention!