Ultra Low P Consents

EWWMC

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Content

- Basis of P removal
- DynaSand Operation
- UK Experience
- Case Studies
- Conclusion
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Why Remove P

- Water Framework Directive
- Environmental Quality Standards

Environment Agency

Review of best practice in treatment and reuse/recycling of phosphorus at wastewater treatment works

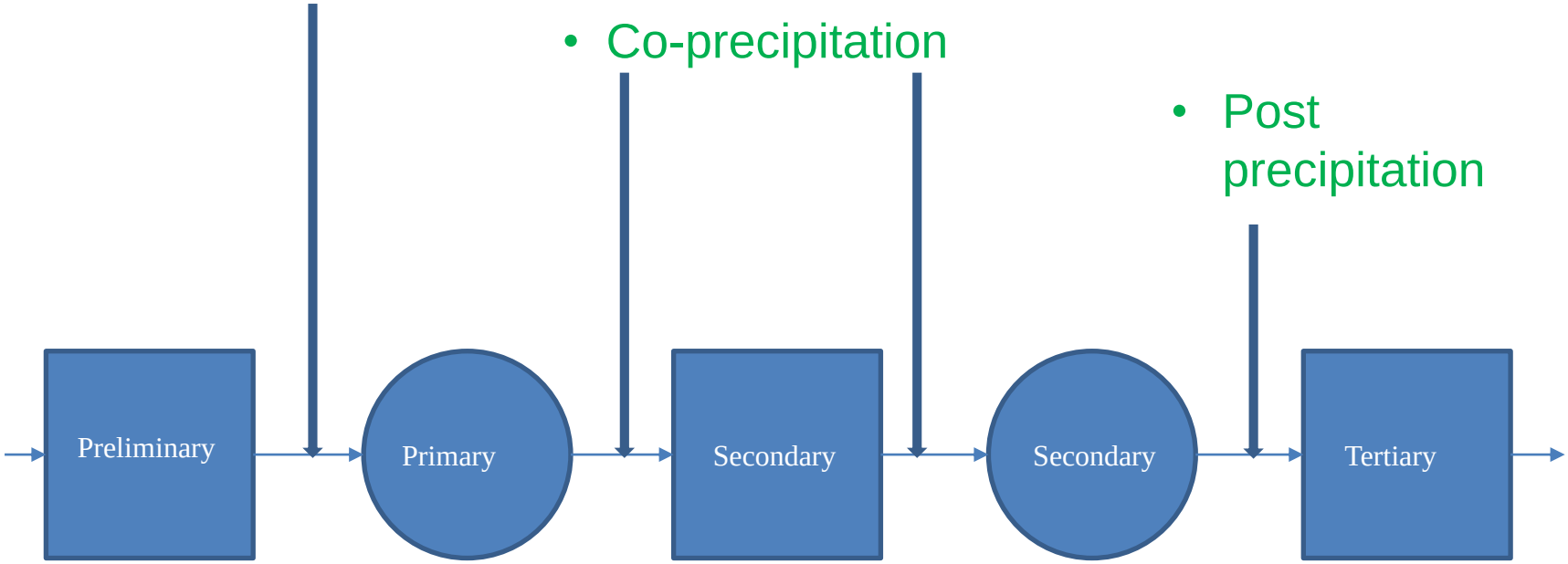
P Removal

- Biological
- Chemical
  - Aluminium
  - Iron
    - Ferric
    - Ferrous
  - Calcium

The case studies presented today are based on aluminium or iron dosing, directly onto the filters, but often have other P removal techniques upstream.

P Removal

- Dosing Point
  - Pre-precipitation
  - Co-precipitation
  - Post precipitation

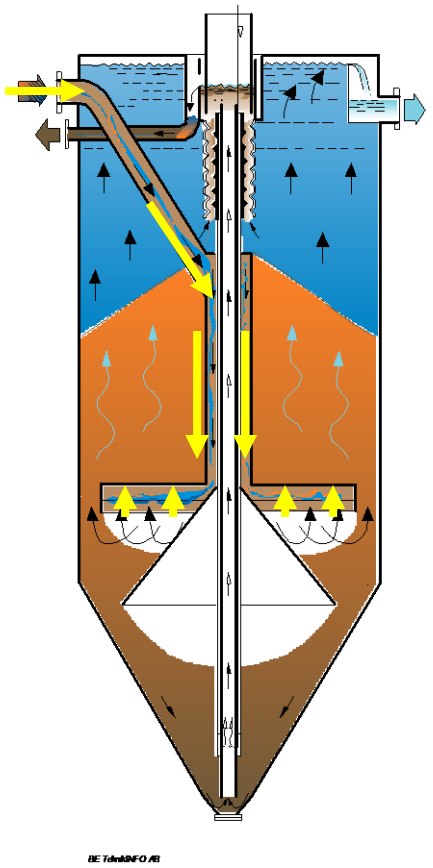


How Does a DynaSand Work?

- The DynaSand filter works by trapping particles from the water within the sand bed.
- The trapped particles and sand then increase the filtration effect capturing more solids.
- The filter is backwashed continuously by raising sand and the captured matter to the top of the filter where it falls through a sand washing labyrinth.
- The trapped particles are released into the washwater and the sand returns to the top of the sand bed.

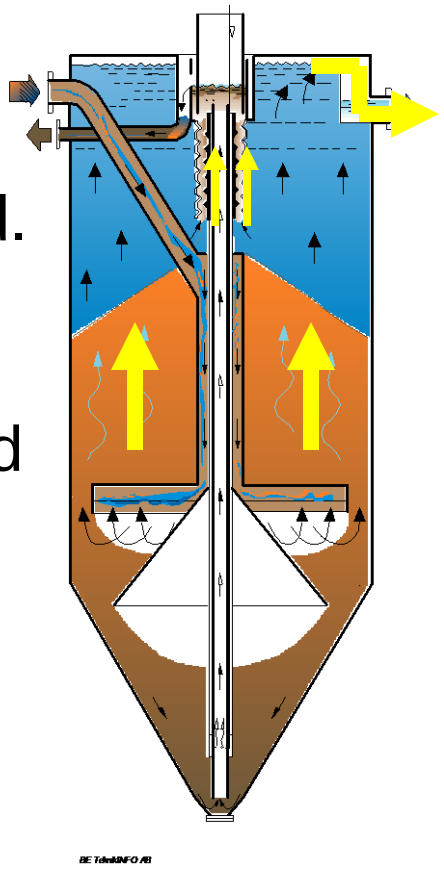
DynaSand Operation

1. Water enters through the top of the unit and is piped through a central column down to the distribution arms which radiate out the water evenly over the entire bed surface area.



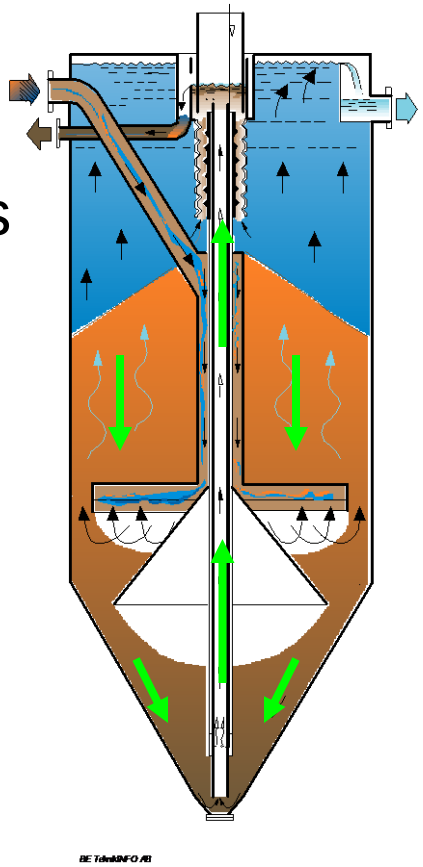
DynaSand Operation

2. Water flows up through the sand bed in which particles are trapped. After the water has been through the sand it either flows out the filtrate weir or up through the sand washer



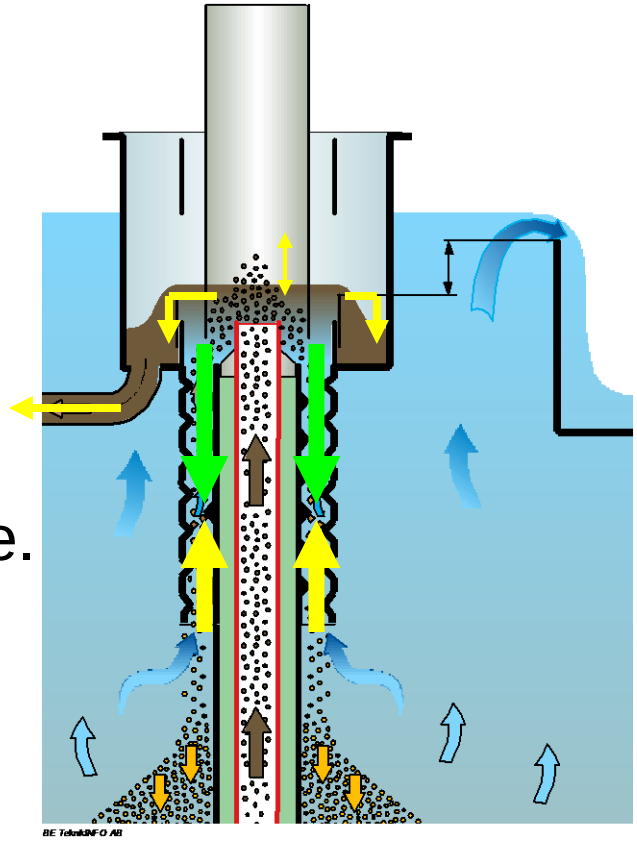
DynaSand Operation

3. The action of the air lift pump pulls sand down through the filter, then up through the pump to the sand washer.



DynaSand Operation

4. The sand then falls through the washer and is cleaned by the counter current treated water. The dirty washwater then falls over an washwater weir. The difference in the height between the weirs determines the washwater flow rate.

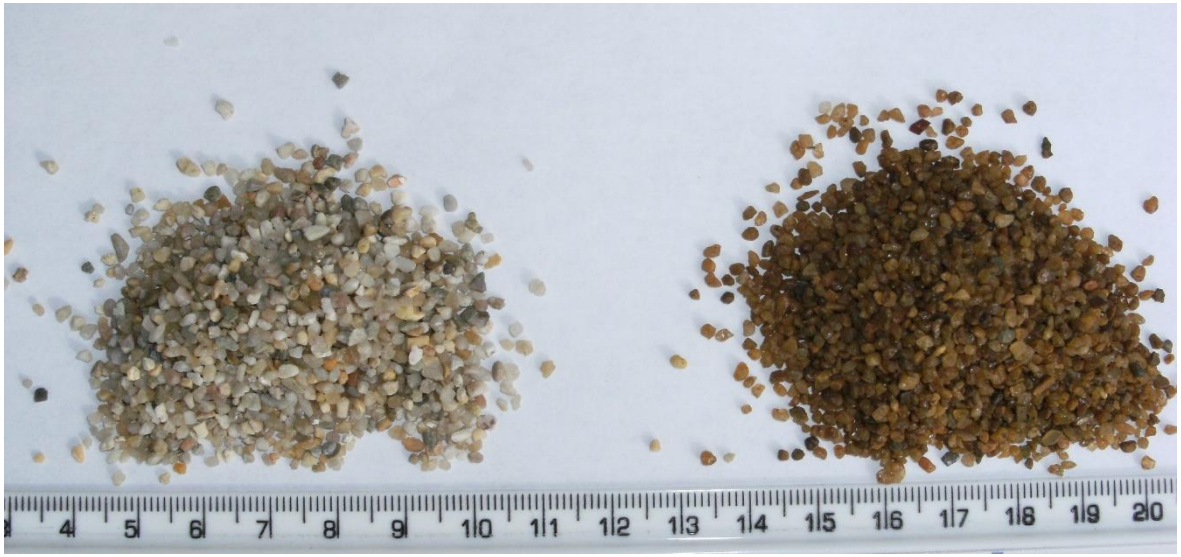


UK Experience

- There are over 30 sites operating on a P remove duty in the UK, some of which have been in operation for nearly 20 years.
- This is often coupled with an iron consent or even ammonia consent (DynaSand Oxy)
- Typical total P levels after the filter are less than 0.5 mg/l
- Type of upstream dosing varies, but is often pre final settlement.
- Typical loading rates are up to 12 m/h at full flow to treatment

UK Experience

- Some sites have had a build up to iron on the surface of the sand media over time, this has sometimes caused the media for form into large blocks, leading to the need for replacing or acid washing the media.



New Sand

Used Sand

Case Studies

- The following case studies are from all over the world, and show an extended history of very low P levels in final effluent.

Växjö, Sweden

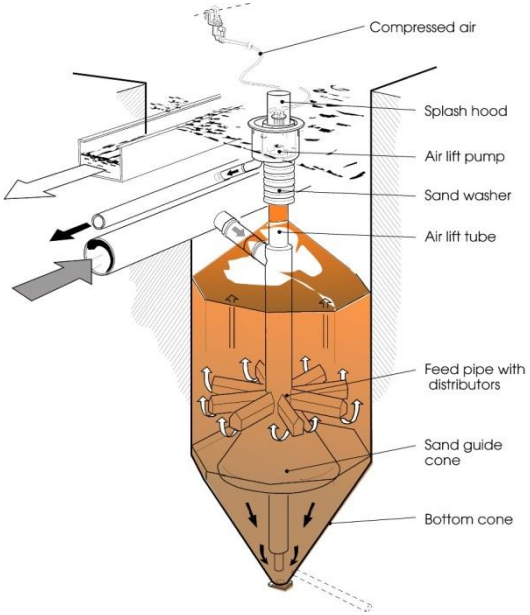
- 80,000 PE
- 3000 m^3/h maximum flow
- In operation since 1996

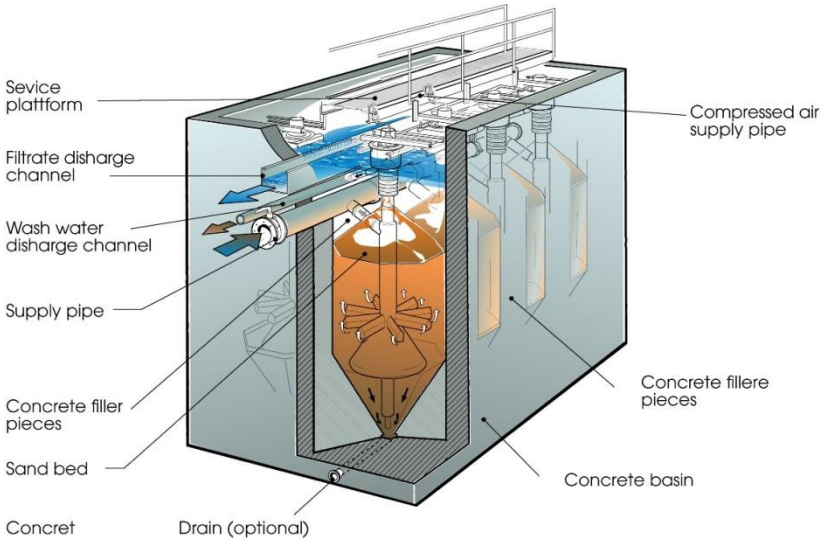
Växjö, Sweden

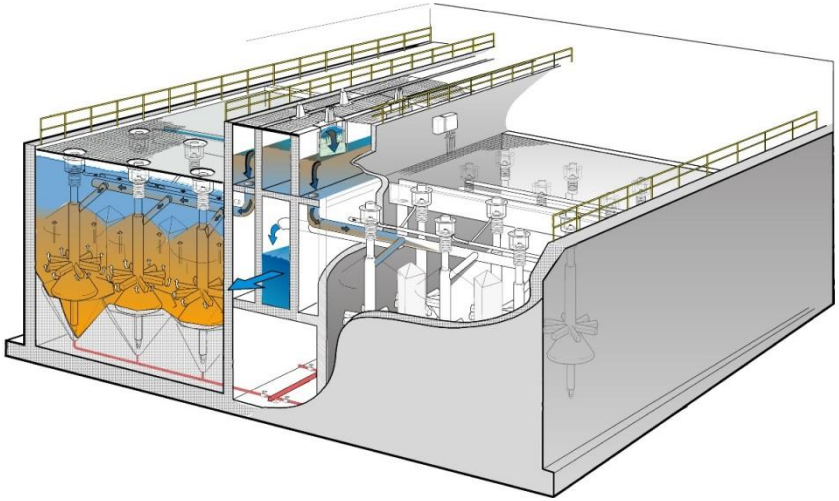
NORDIC WATER

Hydro International

Concrete Filter



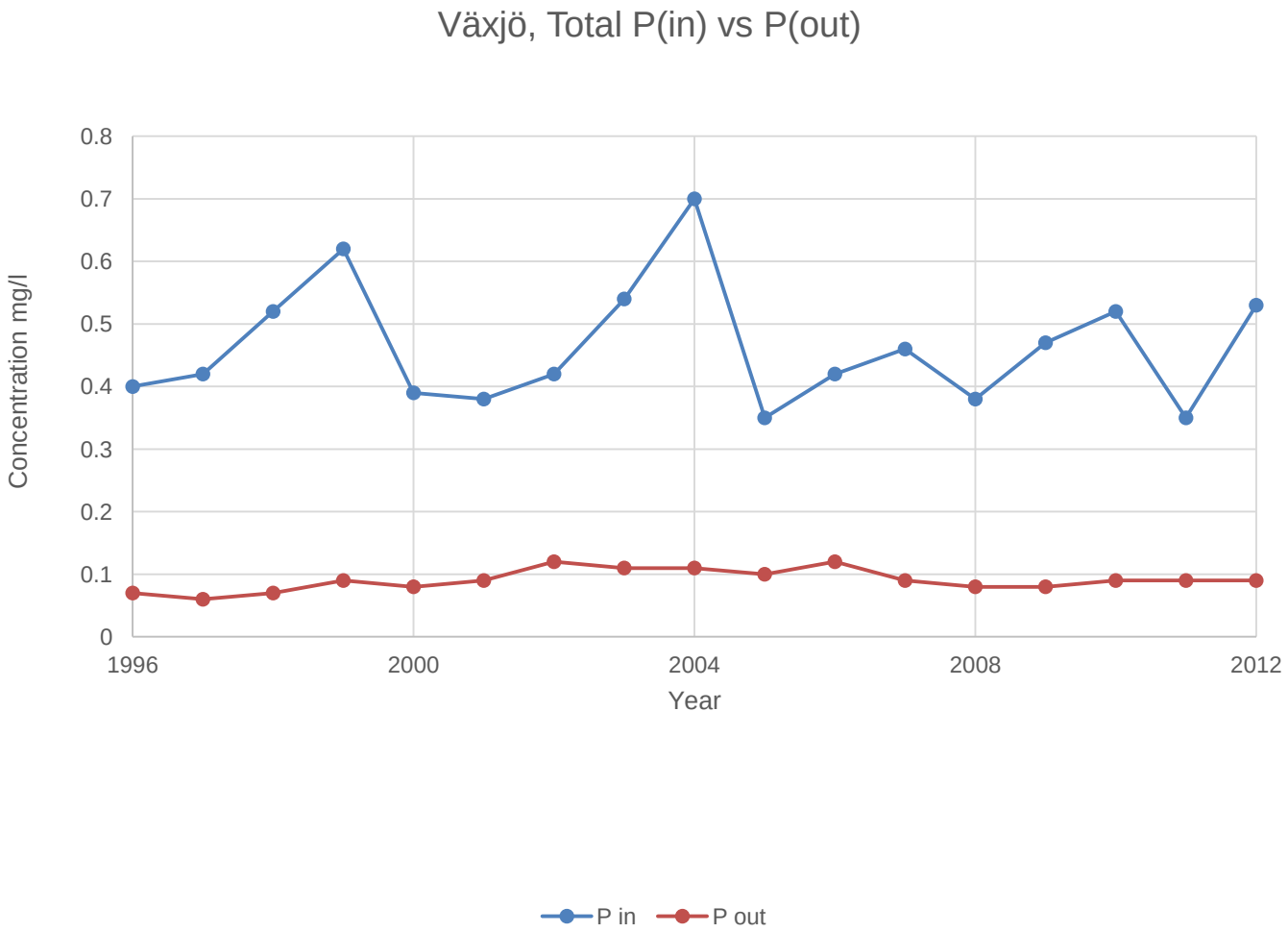




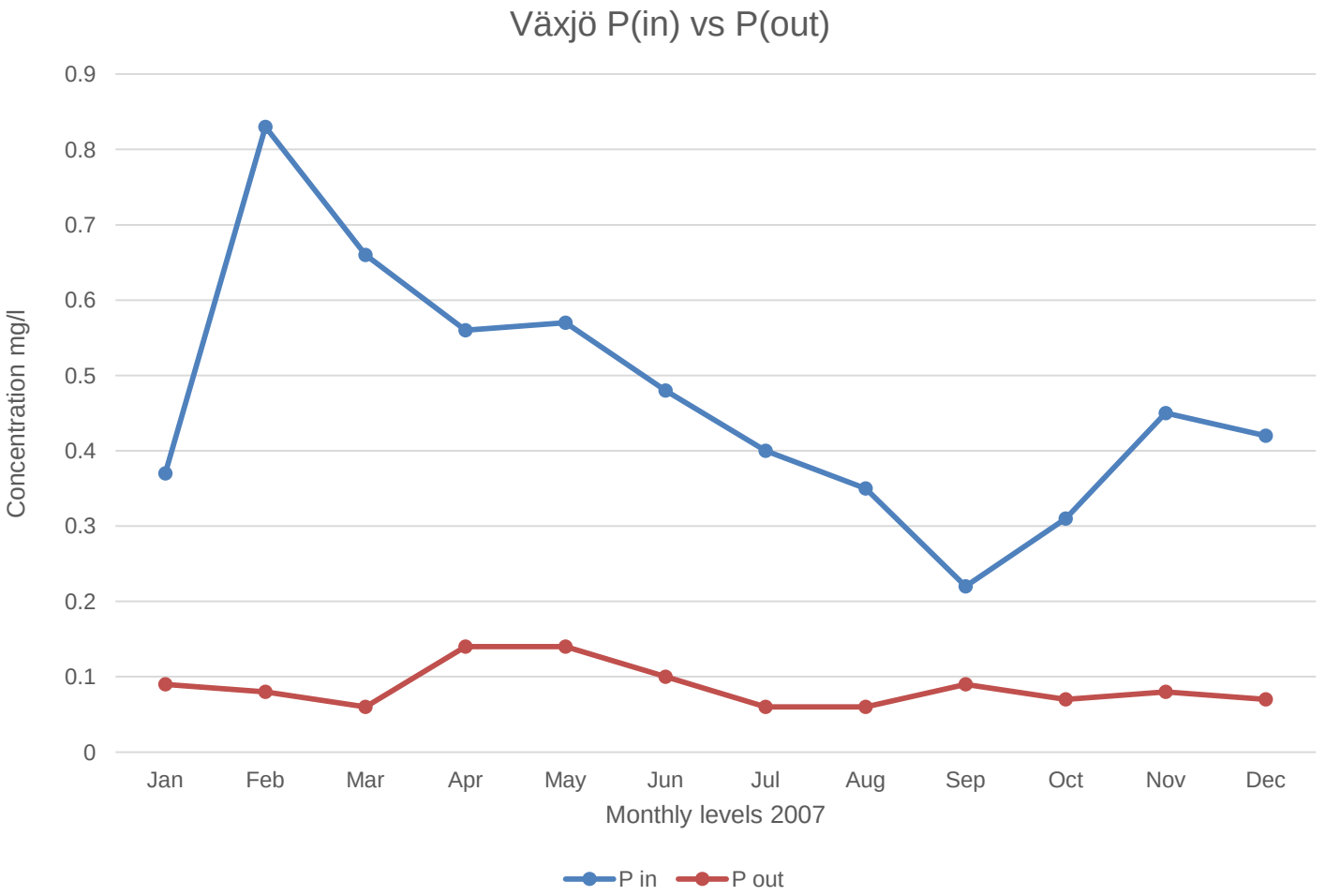
Växjö, Sweden

- 6 basins, each with 10 filters in a 2 by 5 format
- Total filtration area is 300 m^2
- Hydraulic loading rate is 10 m/h
- Total suspended solids required at less than 8 mg/l
- BOD less than 10 mg/l
- Total P less than 0.2 mg/l

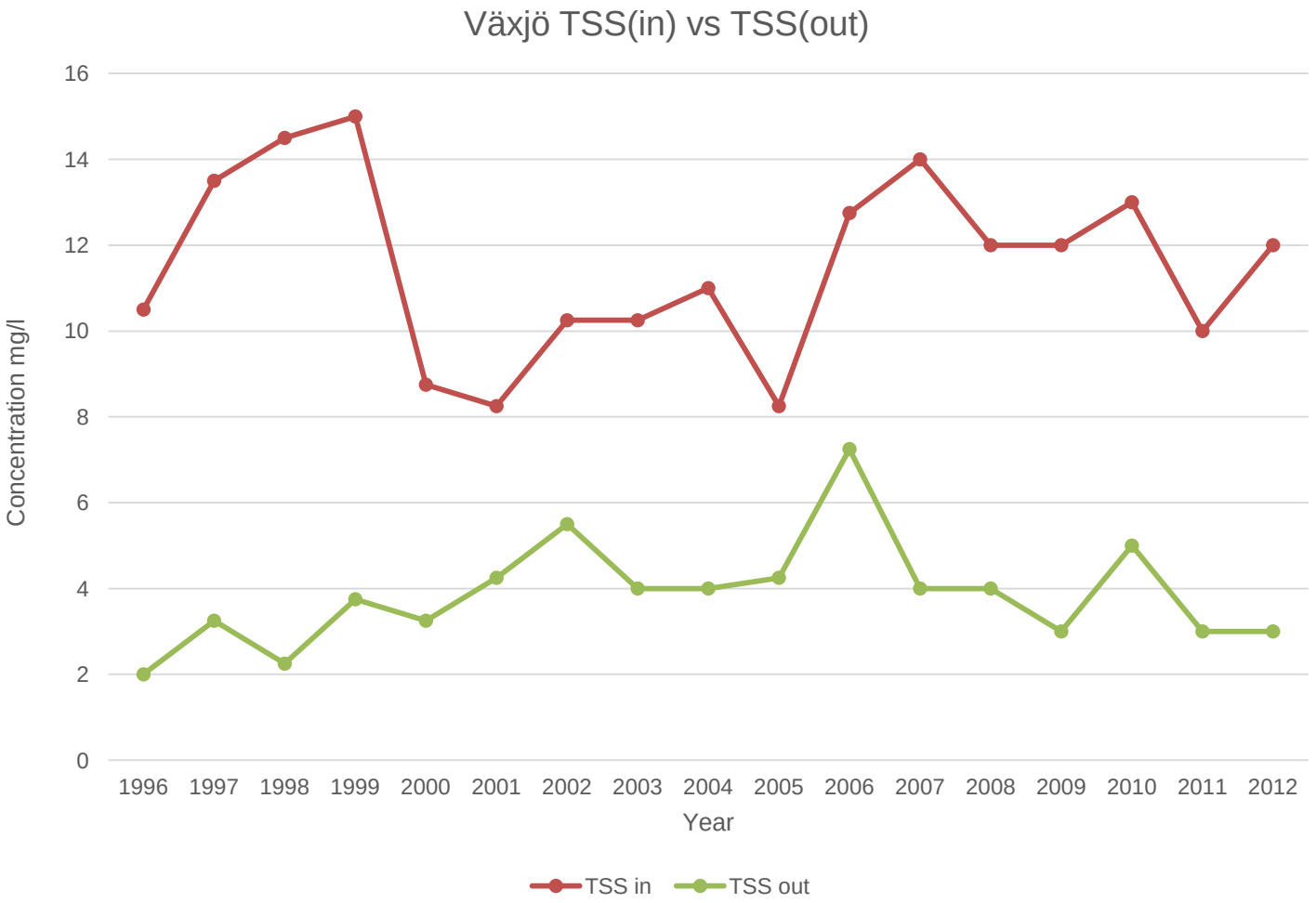
Växjö, Sweden
Long term results



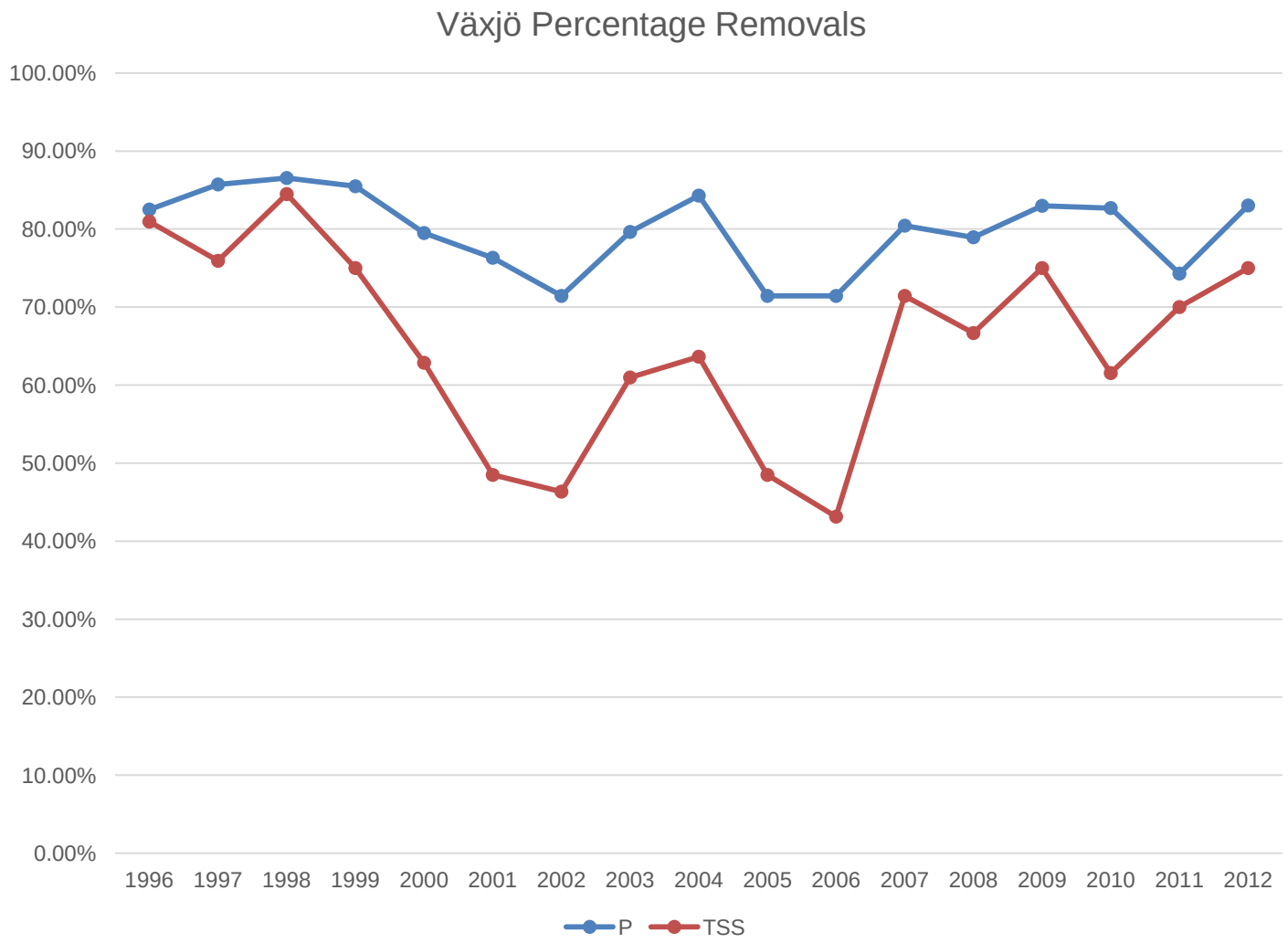
Växjö, Sweden
Annual breakdown



Växjö, Sweden TSS



Växjö, Sweden
Percent Removals

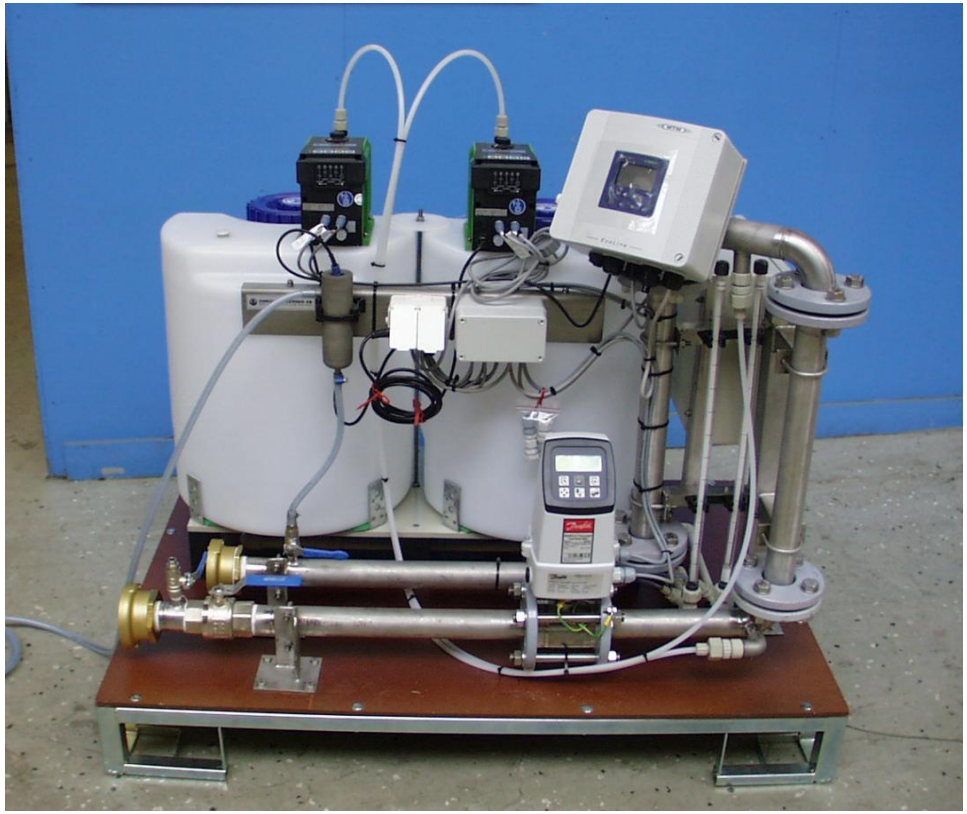


Finnish Pilot Studies

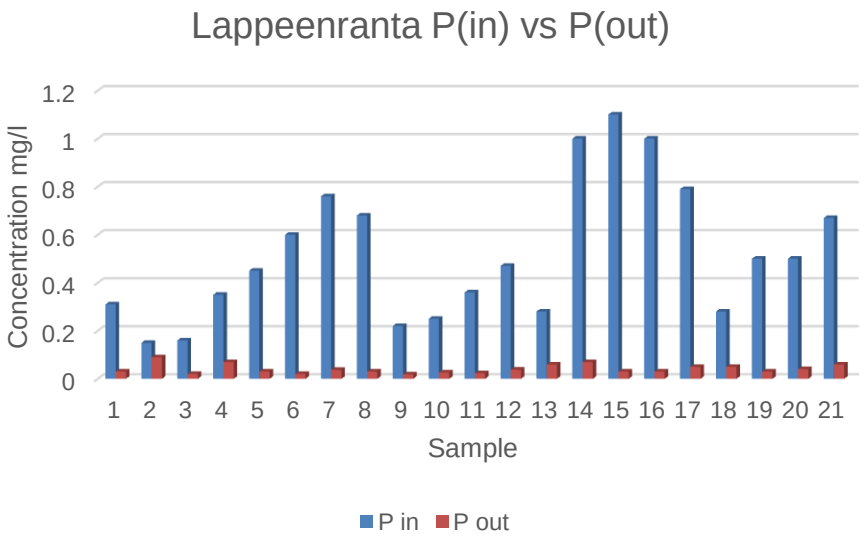
- Lappeenranta
- Tampere
- Kuopio
- Hyvinkää

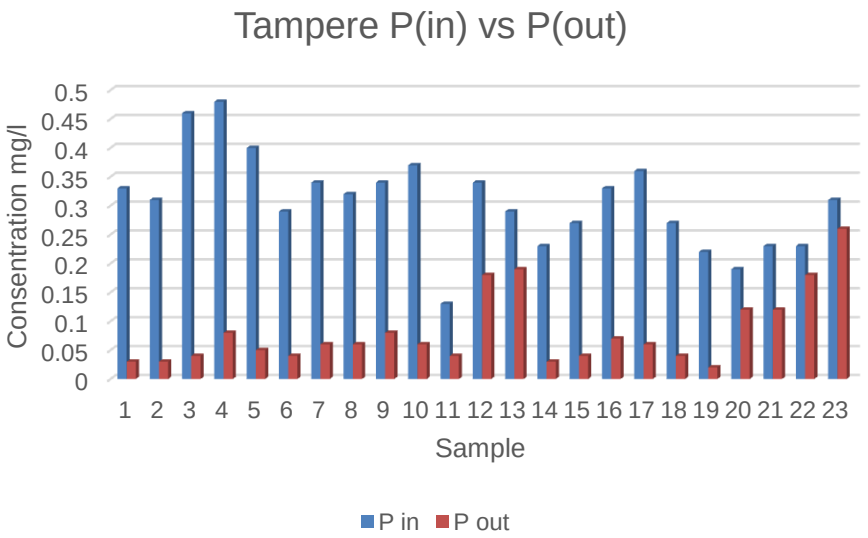
- All pilot studies using a DST07D (0.7 m^2 surface area)
- Flow rate is 3.5 to 8.4 m^3/h
- Hydraulic Loading Rate is 5 to 12 m/h
- Dosing with Aluminium Chloride

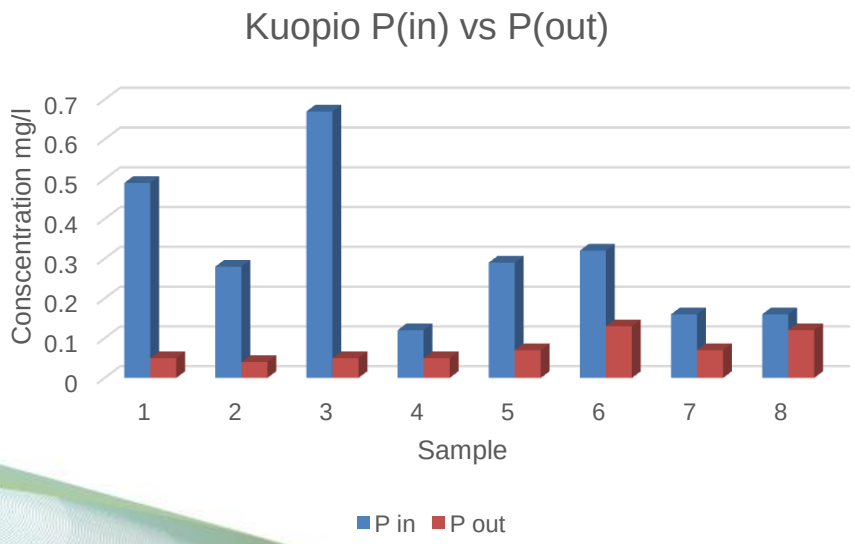
Finnish Pilot Studies

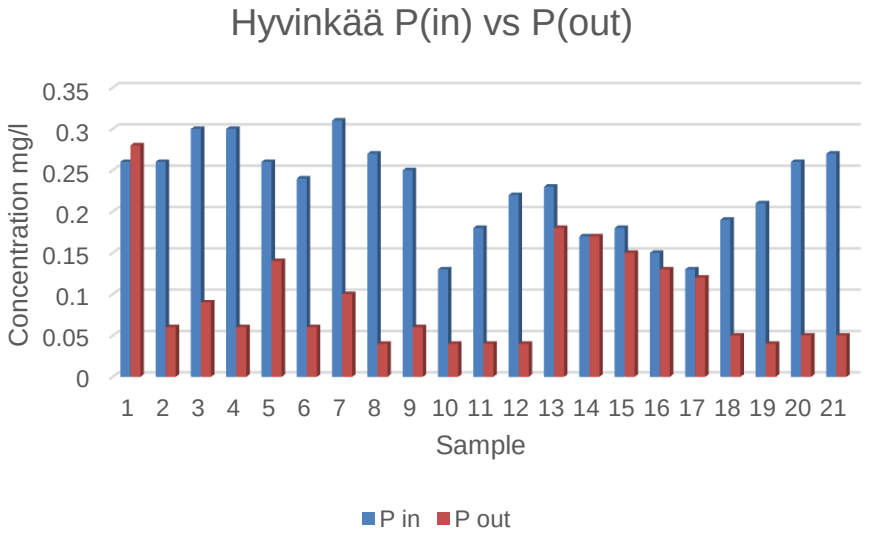


Finnish Pilot Studies









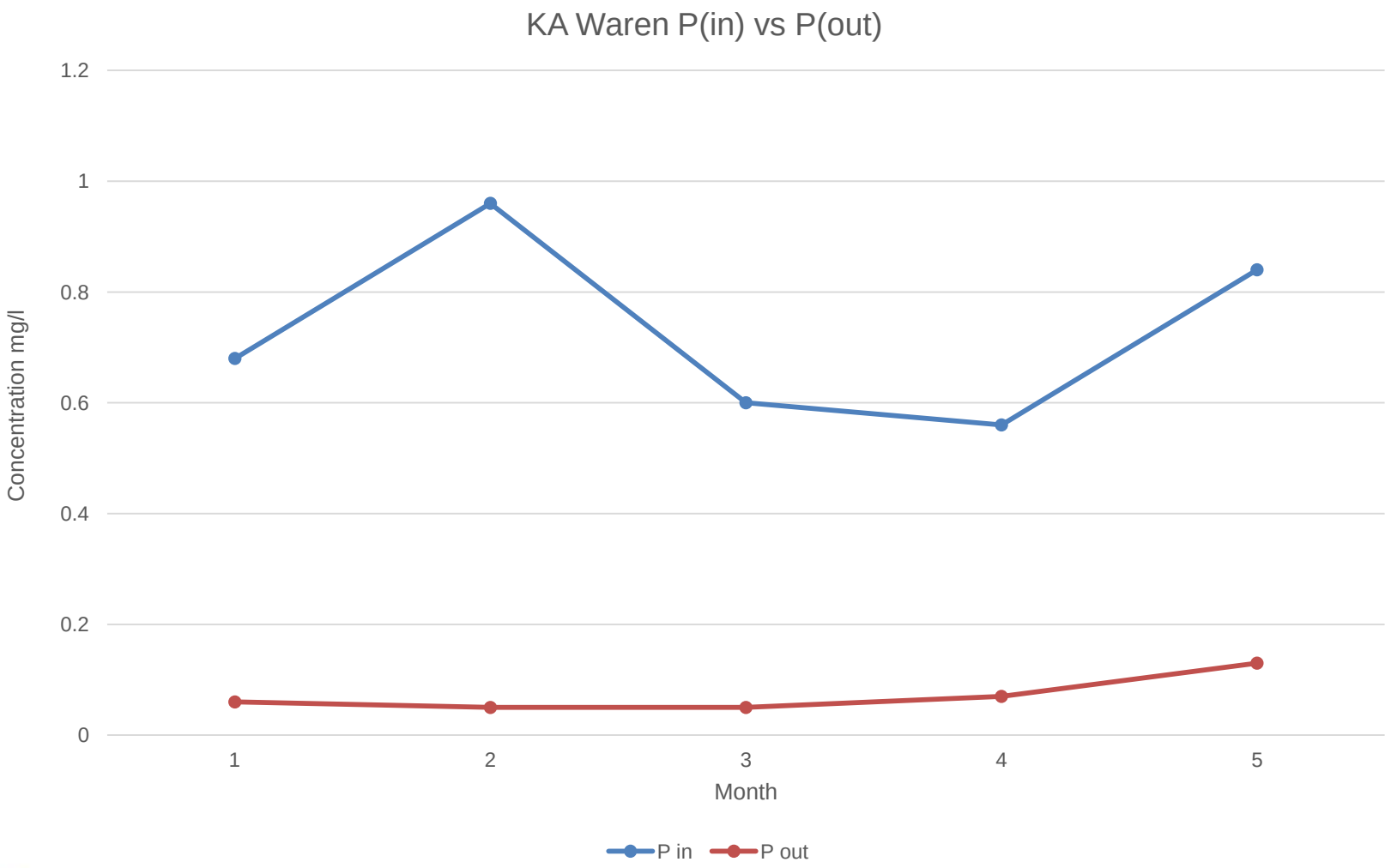
Kuopio WWTP

- Full Scale Plant due Spring 2014
- Maximum flow 2500 m^3/h
- 30 DynaSand DS6000B (180 m^2 of surface area)
- Hydraulic loading rate up to 13.9 m/h
- Chemical dosed Al or Fe (still open)

KA Waren, Germany

- Flow rate is 460 to 700 m^3/h
- Utilises 9 off DS6000 filter in 3 blocks of 3 filter
- 54 m2 of surface area
- Hydraulic loading rate is 8.5 to 13 m/h

KA Waren


KA Waren P(in) vs P(out)
1.2
1
0.8
0.6
0.4
0.2
0
Concentration mg/l
1
2
3
4
5
Month
P in
P out

New Hamburg, Ontario, Canada

- 12 filters
- Total P limit is 0.3 mg/l
- Operating range is 0.05 to 0.15 mg/l P
- Aluminium Sulphate used and is considered the limiting factor

Håbo Kommun, Sweden

- In operation since 1994
- Uses 15 DST50D filters
- Flow rate is 400 to 800 m^3/h
- Hydraulic loading rate is 10.7 m/h
- Total P in effluent is 0.06 mg/l

Conclusion

- Low Phosphate consents are coming
- A combination of biological and chemical removal will be required to meet objectives
- The DynaSand filter has shown over a number of years and a number of sites that levels of less than 0.2 mg/l can be achieved constantly with a single stage filter.

NORDIC WATER

Hydro International

Questions?

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