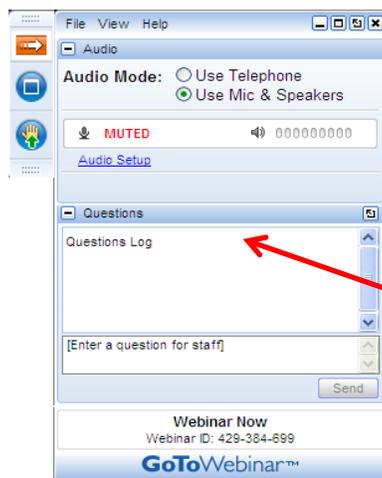




## How to Participate Today



- **Audio Modes**
  - Listen using Mic & Speakers
  - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- **Submit your questions using the Questions pane.**
- **A recording will be available for replay shortly after this webcast.**

VEOLIA

**Reasons for Primary Treatment**

- Reduce load to secondary treatment
- Improve energy recovery (carbon management)
- Savings for the consumer

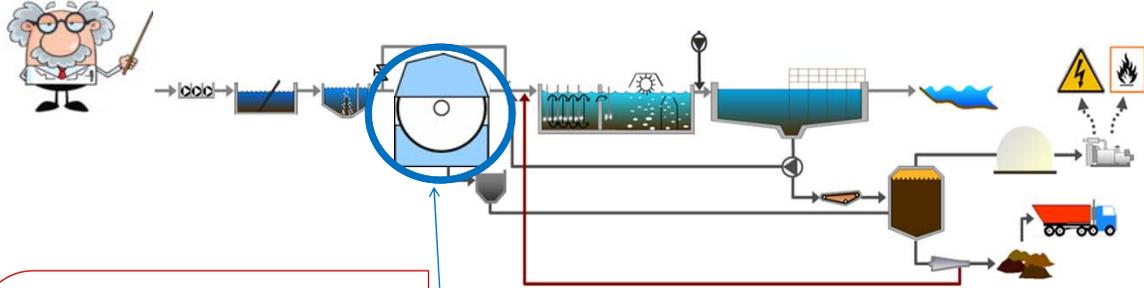
WATER TECHNOLOGIES

**Standard Solution – Conventional Primary Clarifier**

**Conventional Clarifier**

- Large Footprint
- ~50% SS reduction
- Large area & residence time
  - Odors (expensive to cover)

Advanced Solution – Hydrotech Primary Filters



~~Conventional Clarifier~~

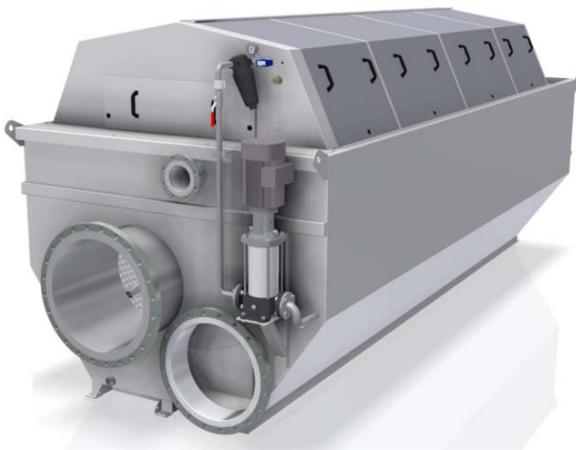
- ~~• Large Footprint~~
- ~~• ~50% SS reduction~~
- ~~• Large area & residence time~~
  - ~~• Odors (expensive to cover)~~

Hydrotech



- Small Footprint
- 50% to >90% SS reduction
  - Can target removal of TSS, TP, etc.
- Covered units, short residence time, easy O&M
  - Odors reduced and easier to control

Advanced Solution – Hydrotech Primary Filters



FOOTPRINT

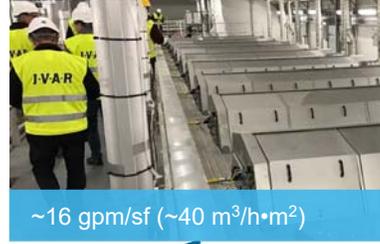


### Advanced Solution – Hydrotech Primary Filters (Footprint)

#### Conventional Clarifier



#### Hydrotech



### Advanced Solution – Hydrotech Primary Filters

#### Site Reference: Stavanger, Norway

- 500,000 population equivalent (p.e.)
- 65 MGD (10,250 m<sup>3</sup>/h)
- Inlet TSS up to 300 mg/L



*Advanced Solution – Hydrotech Primary Filters*

**Site Reference: Stavanger, Norway**



*Advanced Solution – Hydrotech Primary Filters*

**Site Reference: Stavanger, Norway**

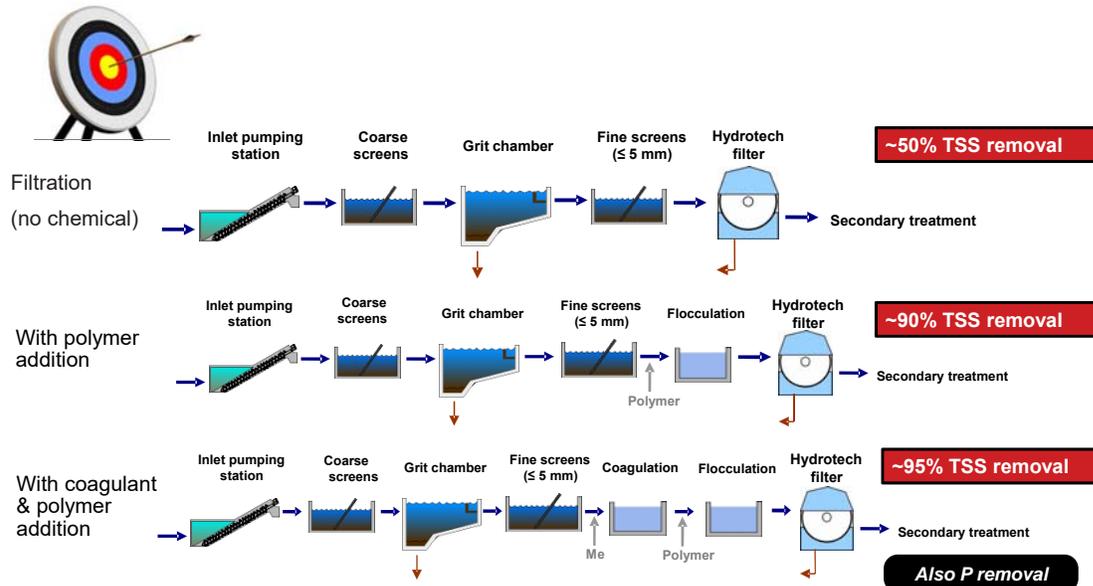


## Advanced Solution – Hydrotech Primary Filters

### PERFORMANCE



## Advanced Solution – Hydrotech Primary Filters (Performance)



Advanced Solution – Hydrotech Primary Filters (Performance)

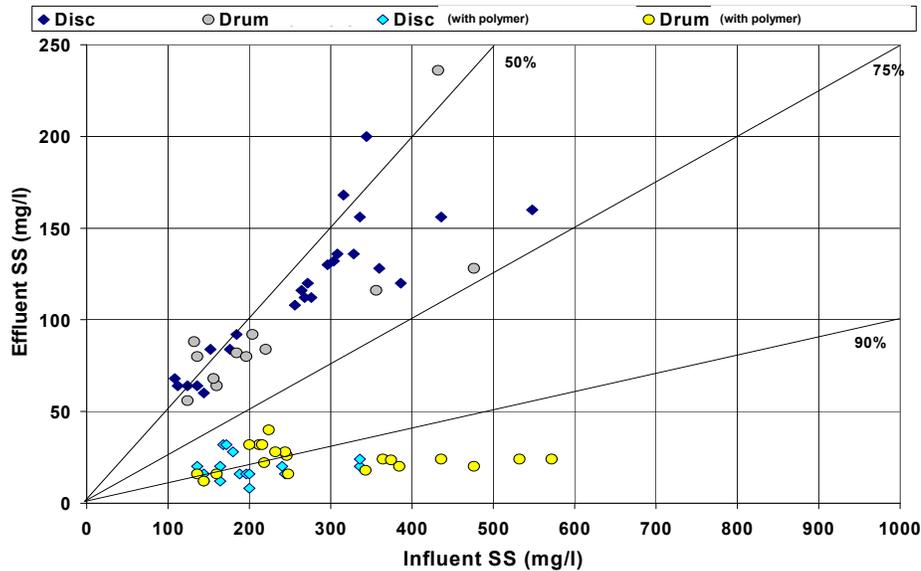


Reference Data: Malmö, Sweden

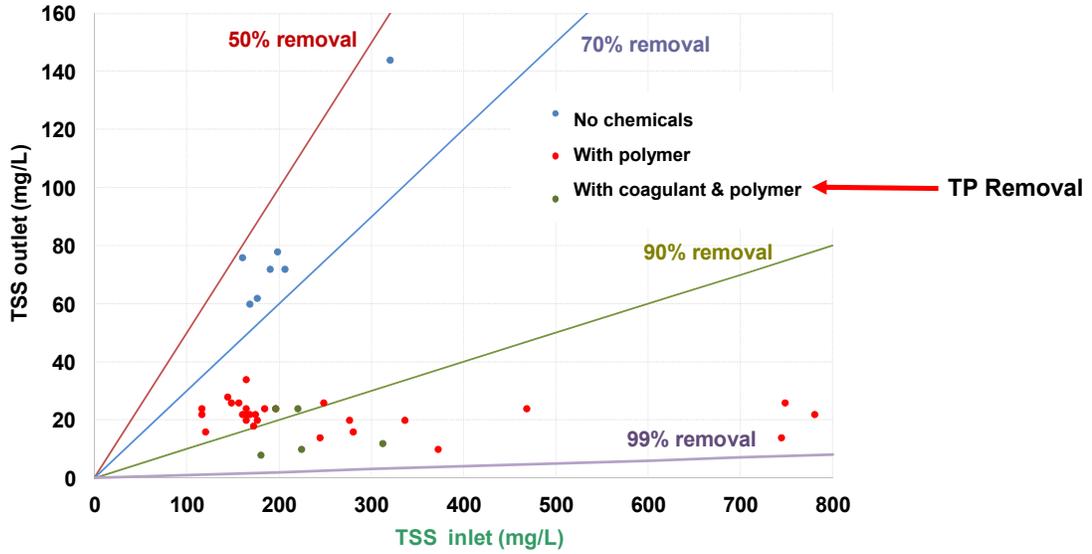


- Sjölunda WWTP
- Discfilter & Drumfilter
- With and Without chemical addition
- Inlet TSS up to 800 mg/L

Advanced Solution – Hydrotech Primary Filters (Performance)



## Advanced Solution – Hydrotech Primary Filters (Performance)



## Advanced Solution – Hydrotech Primary Filters (Performance)



Performance validated by inspection body ISO 17020 certified. Claims registered in EU registry of technologies for water treatment (ETV) Without chemicals With polymer addition

Daily averages

Weekly averages

Parameter	After or before Hydrotech drumfilter	Mean Value	Number of measures
<b>PERFORMANCE PARAMETER</b>			
Total suspended solids reduction	After	51% (from 11% to 70%)	21
<b>OPERATIONAL PARAMETERS</b>			
Quantity of flocculant	Before	No use of chemicals	/
Inlet flow	Before	Between 6 m <sup>3</sup> /hour and 29.9 m <sup>3</sup> /hour	Online measurement logged with an interval of 10 seconds during 48 days. Period of time with a technical issue due to pilot line scale were excluded from the mean.
Water temperature	/	16°C	Online measurement logged with an interval of 10 seconds during 48 days. Period of time with a technical issue due to pilot line scale were excluded from the mean.
Measure of pH	Before	7.4	21
	After	7.4	21
Concentration of alkalinity	Before	358.9	21
	After	344.5	21
Concentration of BOD	Before	135 (Min = 200, Max = 290)	6
	After	146.7 (Min = 110, Max = 170)	6
Concentration of total phosphorus	Before	6.8 (Min = 5.4, Max = 8)	6
	After	5.8 (Min = 4.6, Max = 7)	6
Concentration of TOC	Before	130 (Min = 110, Max = 150)	6
	After	130 (Min = 100, Max = 200)	6
<b>ENVIRONMENTAL PARAMETERS</b>			
Energy consumption of the drumfilter	/	14.1 Wh/m <sup>3</sup> 118.5 Wh/kg TSS removed	Online measurement logged with an interval of 10 seconds during 48 days. Period of time with a technical issue due to pilot line scale were excluded from the mean.
Percentage of operation time the filter has been in backwash mode	/	14%	Online measurement logged with an interval of 10 seconds during 48 days. Period of time with a technical issue due to pilot line scale were excluded from the mean.
<b>PERFORMANCE PARAMETER</b>			
Total suspended solids reduction	After	76%, standard deviation = 8%	21
<b>OPERATIONAL PARAMETERS</b>			
Quantity of flocculant	Before	2.4 mg polymer/L wastewater	Online measurement logged with an interval of 10 seconds during 43 days. Period of time with a technical issue (power failure, frozen pipe, no polymer dosing) were excluded from the mean.
Inlet flow	Before	29.9 m <sup>3</sup> /hour standard deviation = 1.1%	Online measurement logged with an interval of 10 seconds during 43 days. Period of time with a technical issue (power failure, frozen pipe, no polymer dosing) were excluded from the mean.
Water temperature	/	14.4°C	Online measurement logged with an interval of 10 seconds during 43 days. Period of time with a technical issue (power failure, frozen pipe, no polymer dosing) were excluded from the mean.
Measure of pH	Before	7.4	20
	After	7.6	20
Concentration of alkalinity	Before	332	21
	After	292	21
Concentration of BOD	Before	248, Min = 170, Max = 290	6
	After	141, Min = 68, Max = 260	6
Concentration of total phosphorus	Before	7.4, Min = 5.9, Max = 11	6
	After	5.1, Min = 4.1, Max = 7	6
Concentration of TOC	Before	155, Min = 130, Max = 200	6
	After	93.2, Min = 67, Max = 120	6
<b>ENVIRONMENTAL PARAMETERS</b>			
Energy consumption of the drumfilter (including drumfilter and chemical equipment)	/	130Wh/kg TSS removed	Online measurement logged with an interval of 10 seconds during 43 days. Period of time a technical issue due to pilot line scale were excluded from the mean.
Percentage of operation time the filter has been in backwash mode	/	42%	Online measurement logged with an interval of 10 seconds during 43 days. Period of time with a technical issue a technical issue due to pilot line scale were excluded from the mean.

## Advanced Solution – Hydrotech Primary Filters (Performance)



### Reference Site: Lyngby-Taarbæk, Denmark

- Mölleåverket WWTP
- Evaluated renovating existing 4 clarifiers vs Hydrotech filters
- Selected Hydrotech: better efficiency expected in smaller footprint

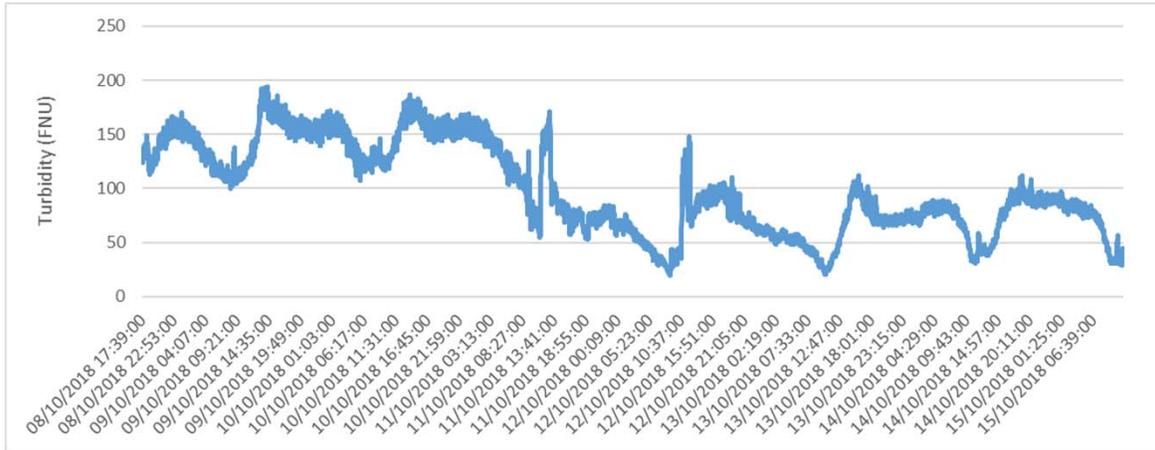


## Advanced Solution – Hydrotech Primary Filters (Performance)



## Advanced Solution – Hydrotech Primary Filters (Performance)

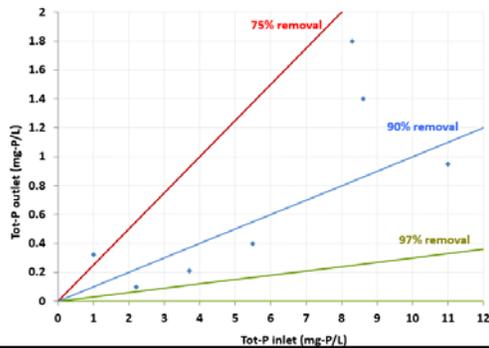
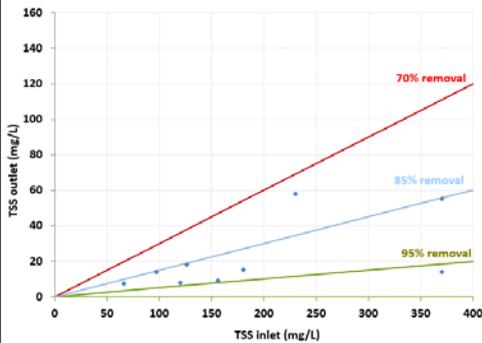
Up to 925 L/s water after coarse screens, and malfunctioning fine screens and sandtrap (influent 250- 1000 mg-SS/L)



## Advanced Solution – Hydrotech Primary Filters

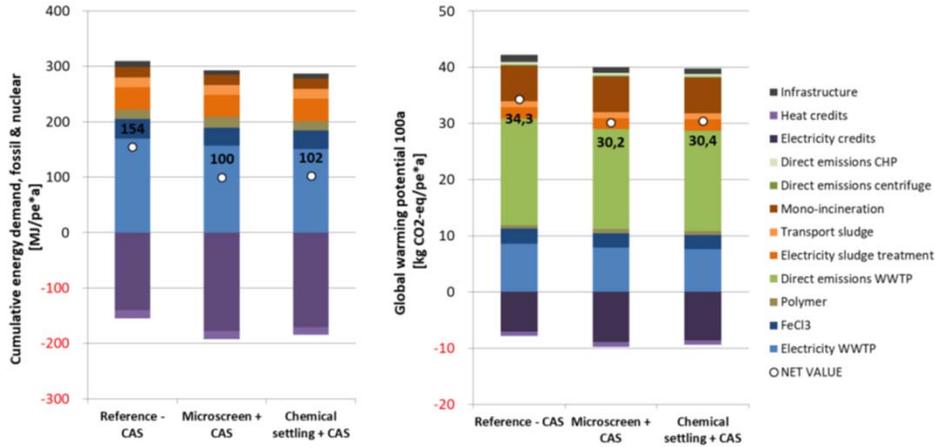
### Site Reference: Avesta, Sweden

- Näs WWTP, Startup 2010
- 1 Drumfilter, 2 stage chemical addition
- Inlet TSS up to 400 mg/L
- Inlet TP up to 12 mg/L



## Advanced Solution – Hydrotech Primary Filters (Performance)

50,000 PE, with chemical pre-treatment upstream



	Influent (mg/L)	Target effluent (mg/L)
TSS	214	-
COD	400	90
TN	37	18
TP	6	2

## Advanced Solution – Hydrotech Primary Filters



CONTROL



### Advanced Solution – Hydrotech Primary Filters



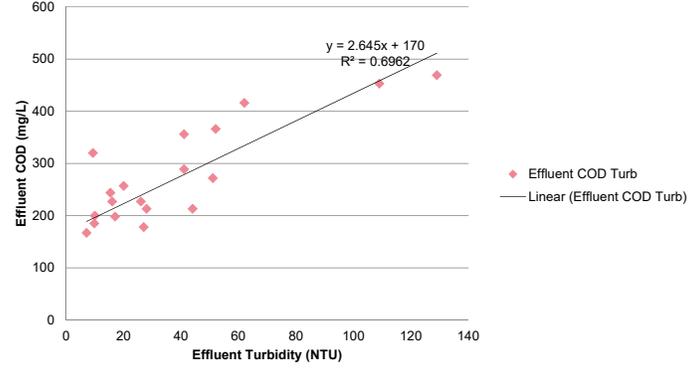
### WHY CONTROL CARBON REMOVAL?

- Minimize aeration cost
  - Chemical dosage cost < savings from reduced aeration
- Maximize biofuel production, while
- Stabilizing C/N ratio

### Advanced Solution – Hydrotech Primary Filters



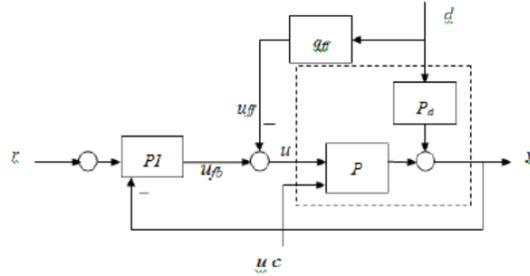
### WHY CONTROL CARBON REMOVAL?



Example:

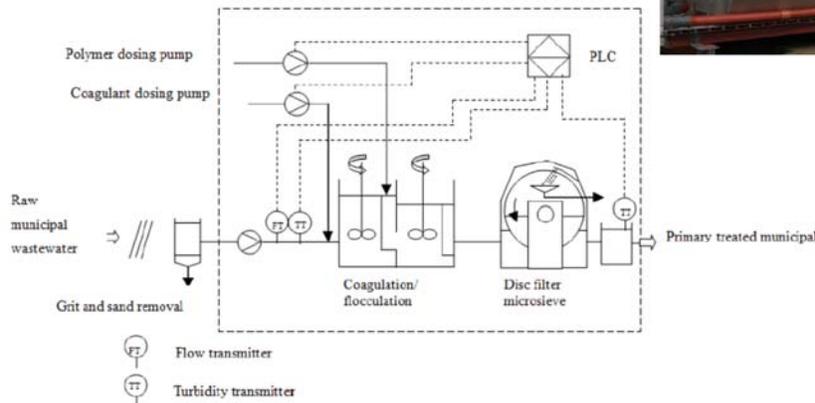
- Influent TN (NH4-N) 35 mg/L
- Desired C/N ration  $\approx$  8:1 for full denitrification using internal C
- Requires 280 mg/L COD = Effluent turbidity setpoint  $\approx$  45 NTU
- Remaining carbon = Biofuel

## Advanced Solution – Hydrotech Primary Filters (Control)

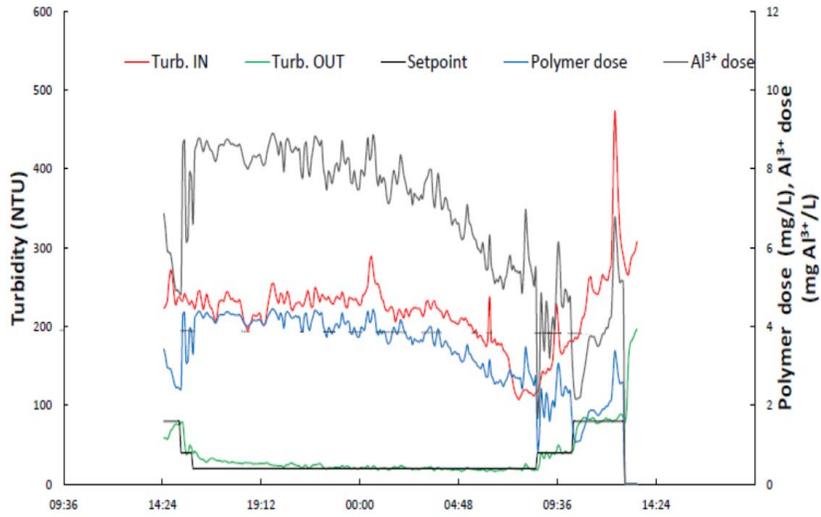


- PI feedback control is 100 year old, well proven technology.
- Feedforward combined with PI feedback control → faster response
- Microsieve effluent quality not sensitive to flow variations
- Short retention time in the coagulation and flocculation stage

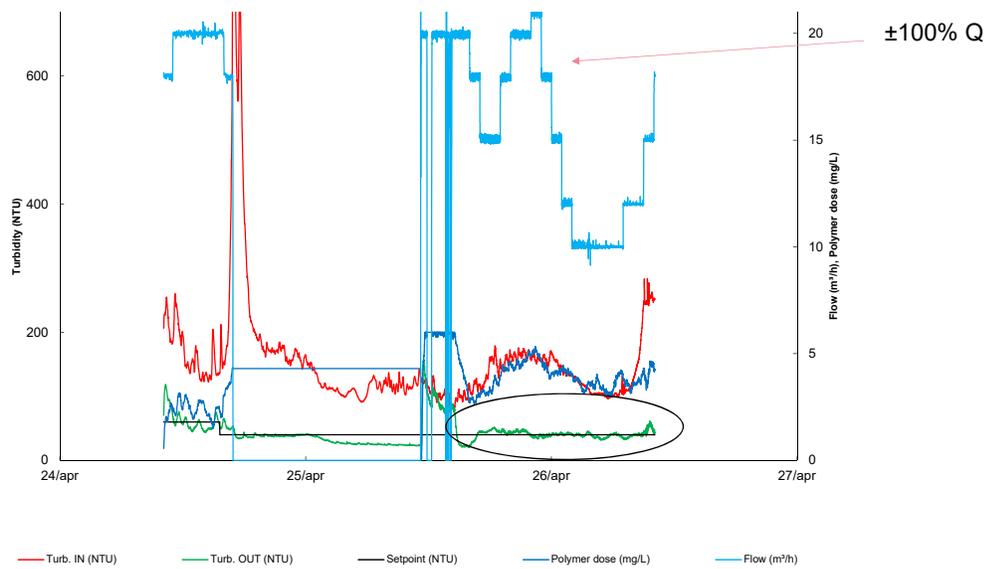
## Advanced Solution – Hydrotech Primary Filters (Control)



### Advanced Solution – Hydrotech Primary Filters (Control)



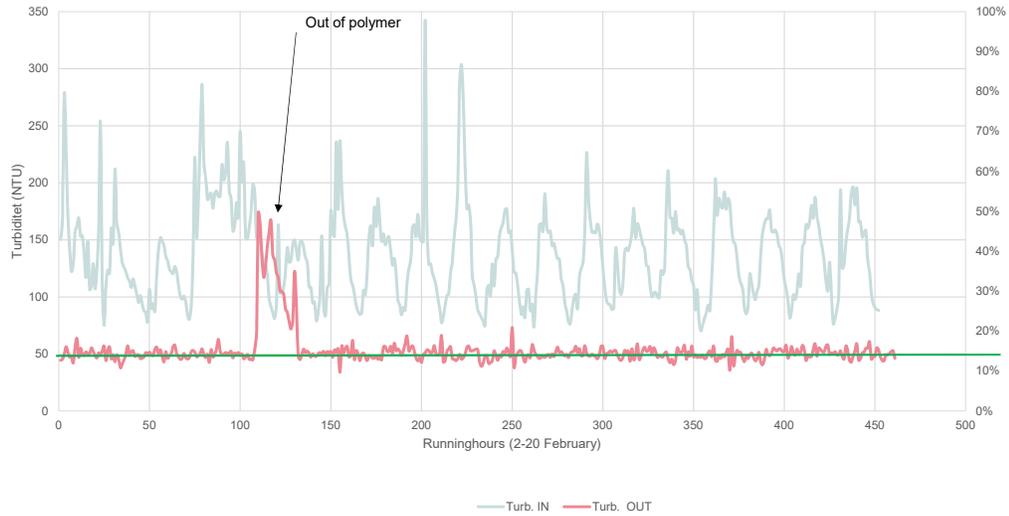
### Advanced Solution – Hydrotech Primary Filters (Control)



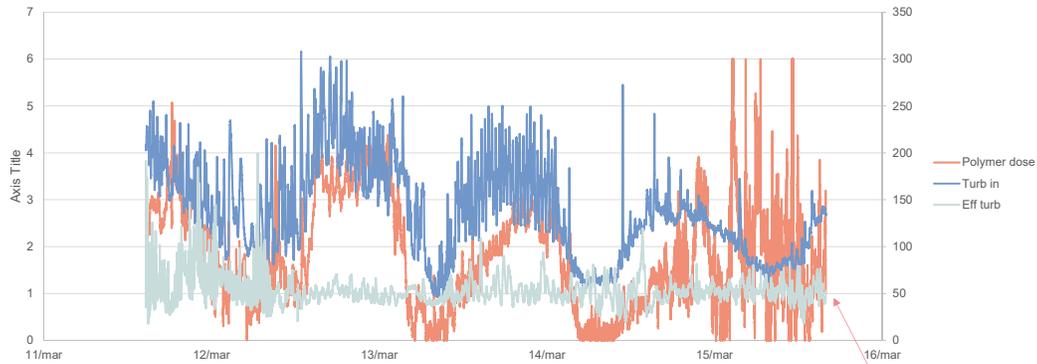
## Advanced Solution – Hydrotech Primary Filters (Control)



- Long Term stability!
- The controller continuously tries to eliminate the control error by adjusting chemical dose.
- Thus, system is self-stabilizing around the desired setpoint.



## Advanced Solution – Hydrotech Primary Filters (Control)



- Polymer dose is daily varying between 0 - 6 mg/L.
- With feedback control loop, the correct amount is dosed for desired setpoint and current effluent water quality
- Not sensitive to variations in influent wastewater chemical reactivity as in pure feed forward control

Avg effluent turbidity 50.6 NTU  
 Set point = 50.0 NTU.  
 PI feedback control works!

## Advanced Solution – Hydrotech Primary Filters

EASY OPERATION & MAINTENANCE



## Advanced Solution – Hydrotech Primary Filters (O&M)



- Panel & Nozzle Inspection/Replacement
- 1 BW Pump, 1 Drive per unit
- Durable & Convenient Design



## Advanced Solution – Hydrotech Primary Filters



Questions