

# Softening

Design of 4<sup>th</sup> Mega location Oasen

CT 5520

Drinkingwater Treatment 2



Floor van den Berg  
Udo Ouwerkerk

25 May 2007

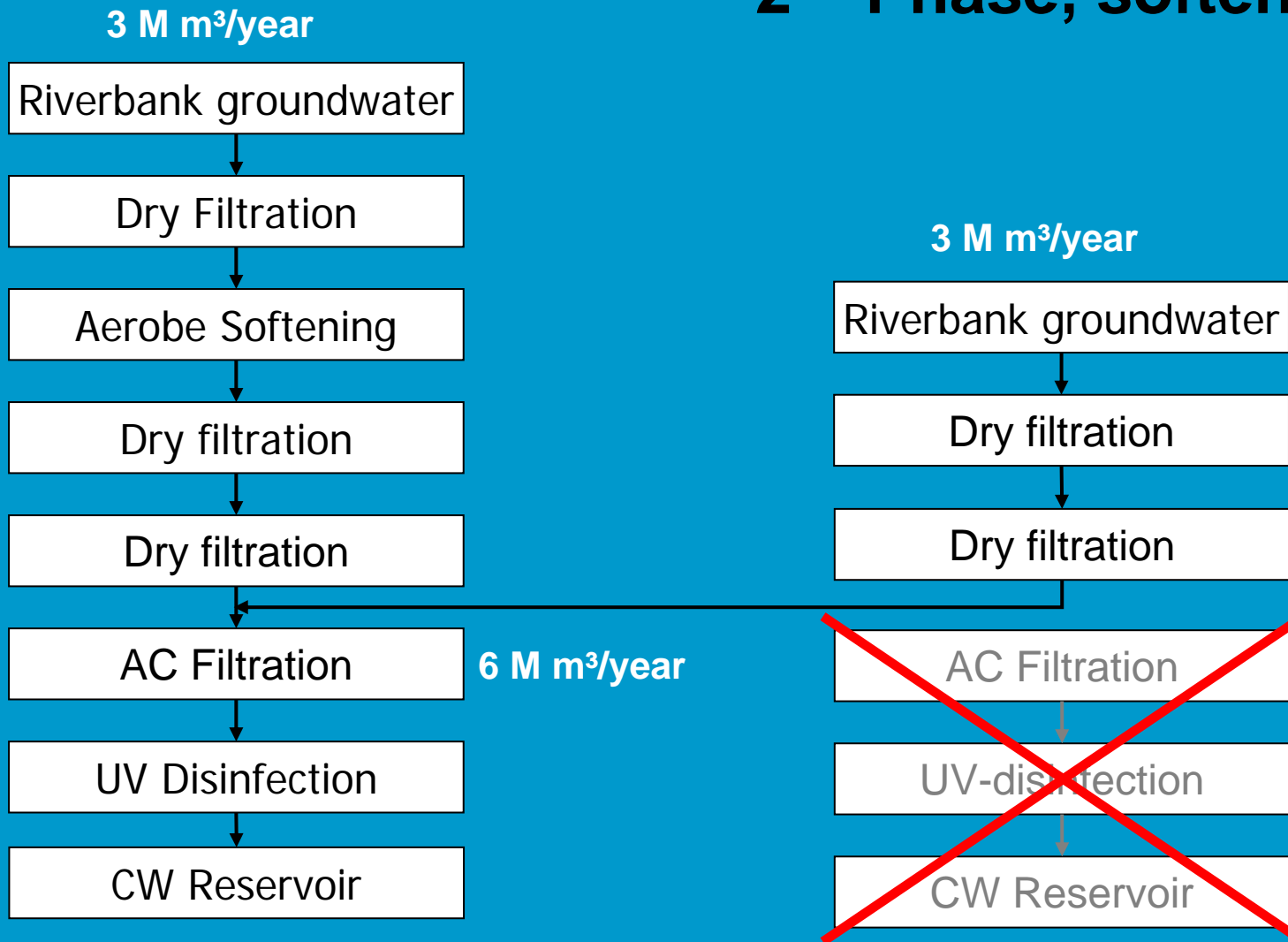
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# Contents

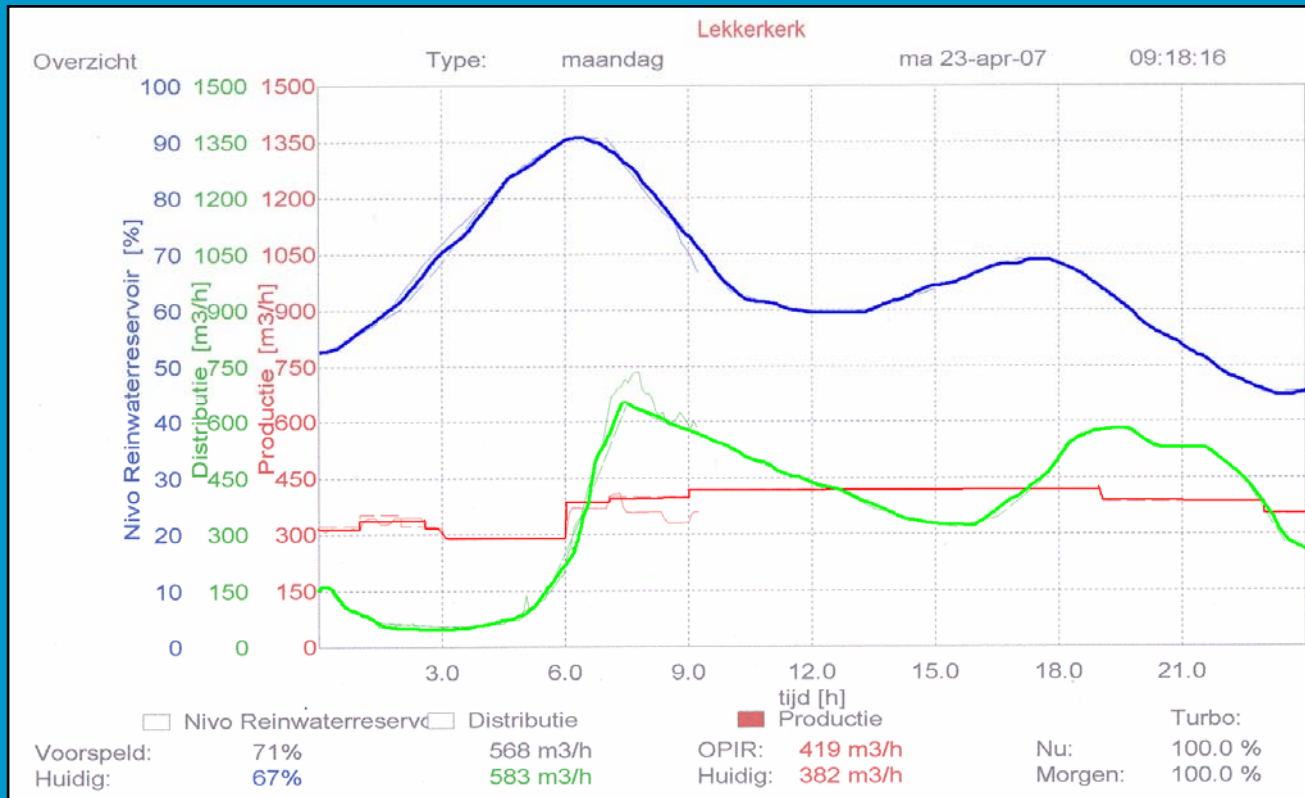
- 2<sup>nd</sup> Phase, Softening
- 3<sup>th</sup> Phase, Scaling up
- Water quality
- Pellet reactor
- Next step



# 2<sup>nd</sup> Phase, softening



# Production at zs Lekkerkerk



## Design capacity, 2<sup>nd</sup> phase

• License at Lekkerkerk: 4.0 M m<sup>3</sup>/year

Max day factor: 1.7

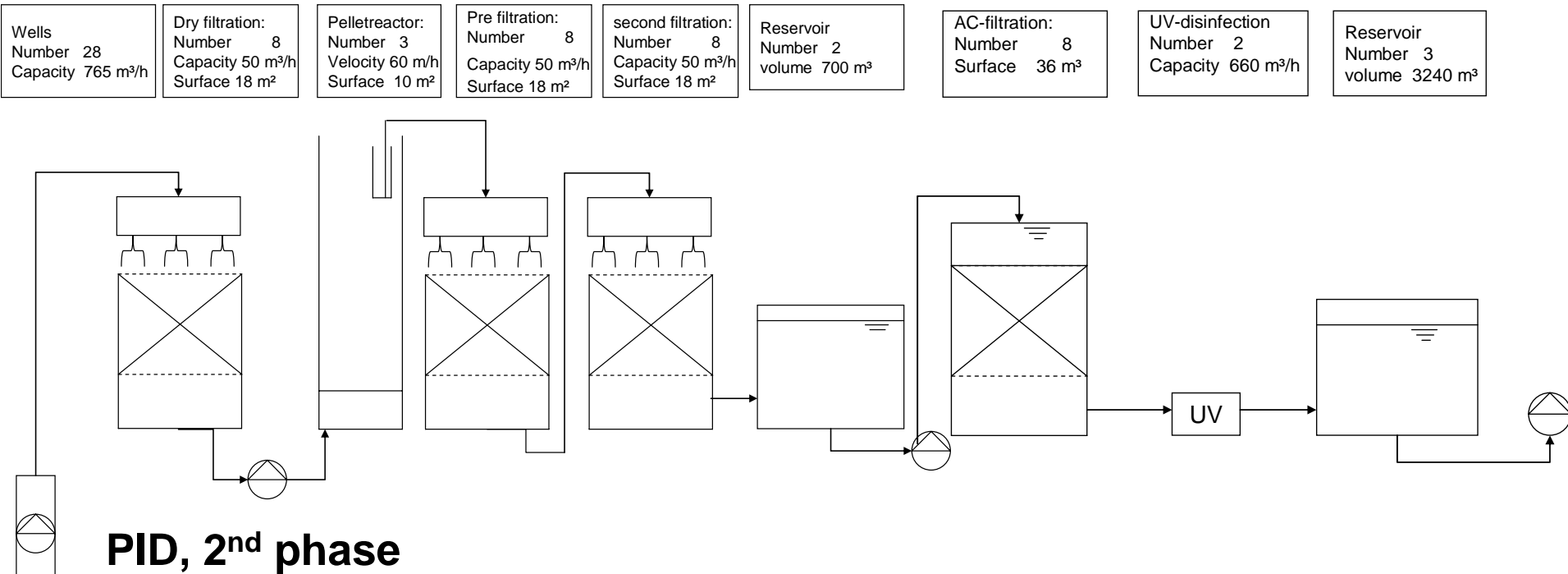
## Design capacity, 3<sup>th</sup> phase

• License at Lekkerkerk+de Put: 8.5 M m<sup>3</sup>/year

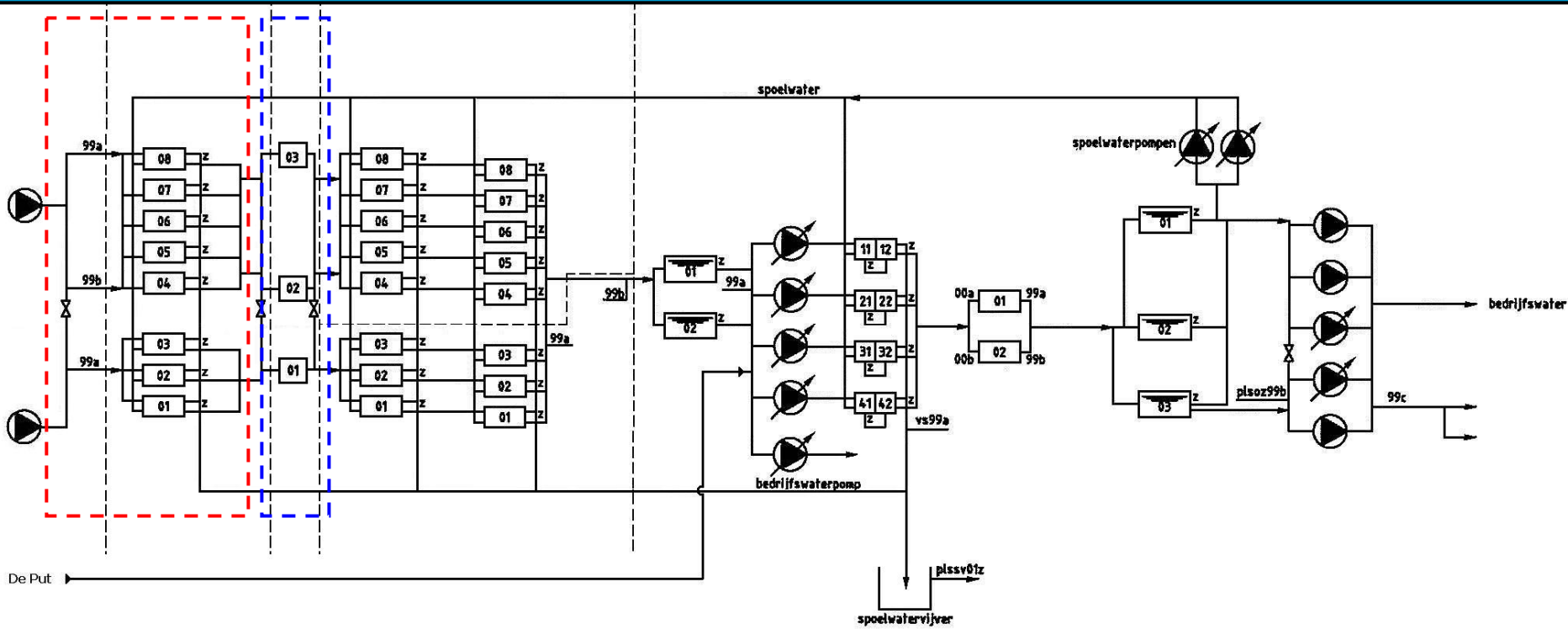
Min-Max year factor: 0.85-1.45

# Converge (after last filtration step) Beyond softening

- $Q_{\text{filters}} = 450 \text{ m}^3/\text{h} \rightarrow (450 \text{ m}^3/\text{h}) / (60 \text{ m/h}) = 7.5 \text{ m}^2$
- 3 pellet reactors
- Capacity AC-filtration and UV-disinfection should be sufficient
- Capacity =  $50 \cdot 60 \text{ m}^3/\text{D} = 2.2 \text{ m}$ ,  $H_{\text{inner}} = 7 \text{ m}$
- Clear water reservoir: 3240 m<sup>3</sup>, according to rule of thumb should be sufficient

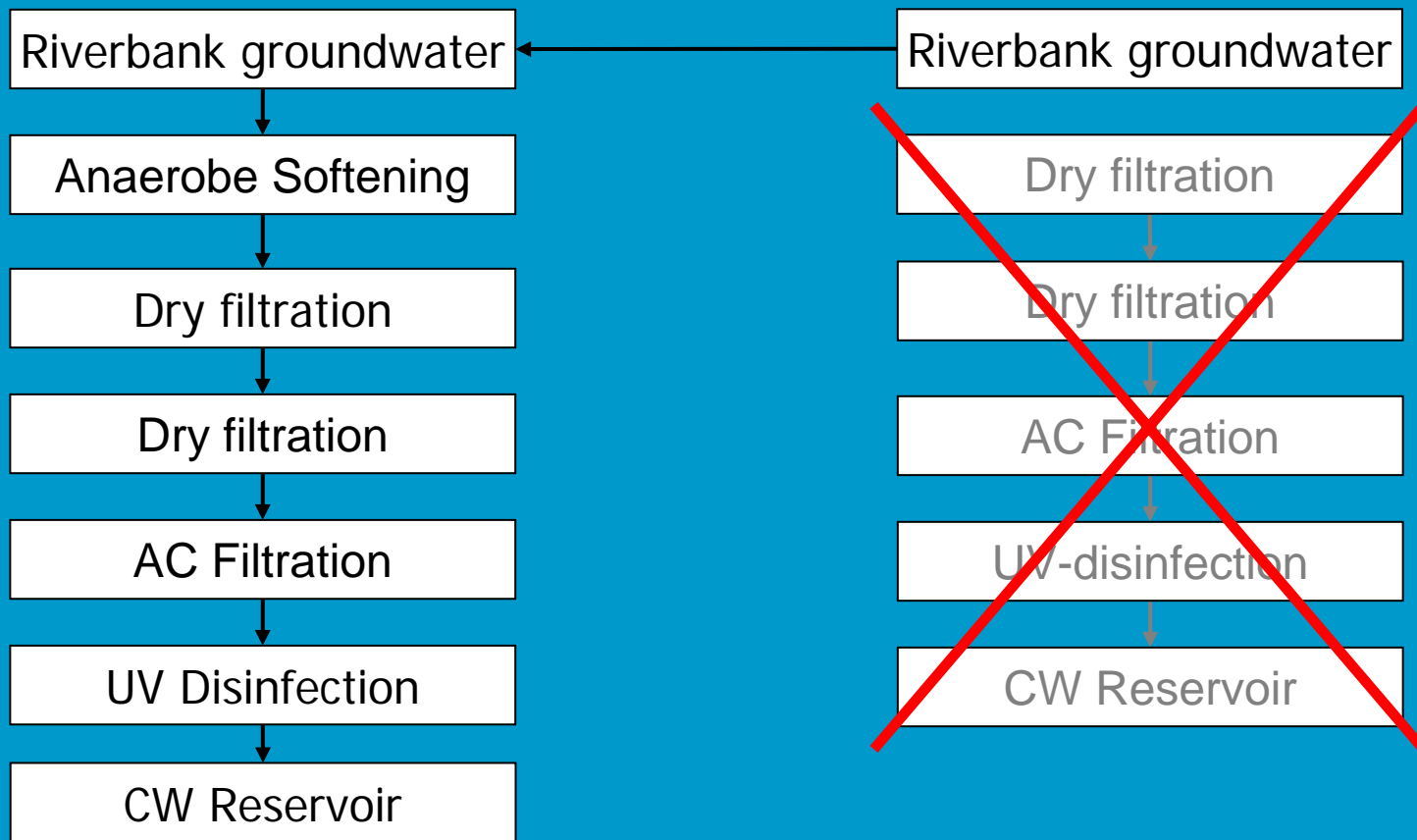


# Process scheme, split treatment



8.5 M m<sup>3</sup>/year

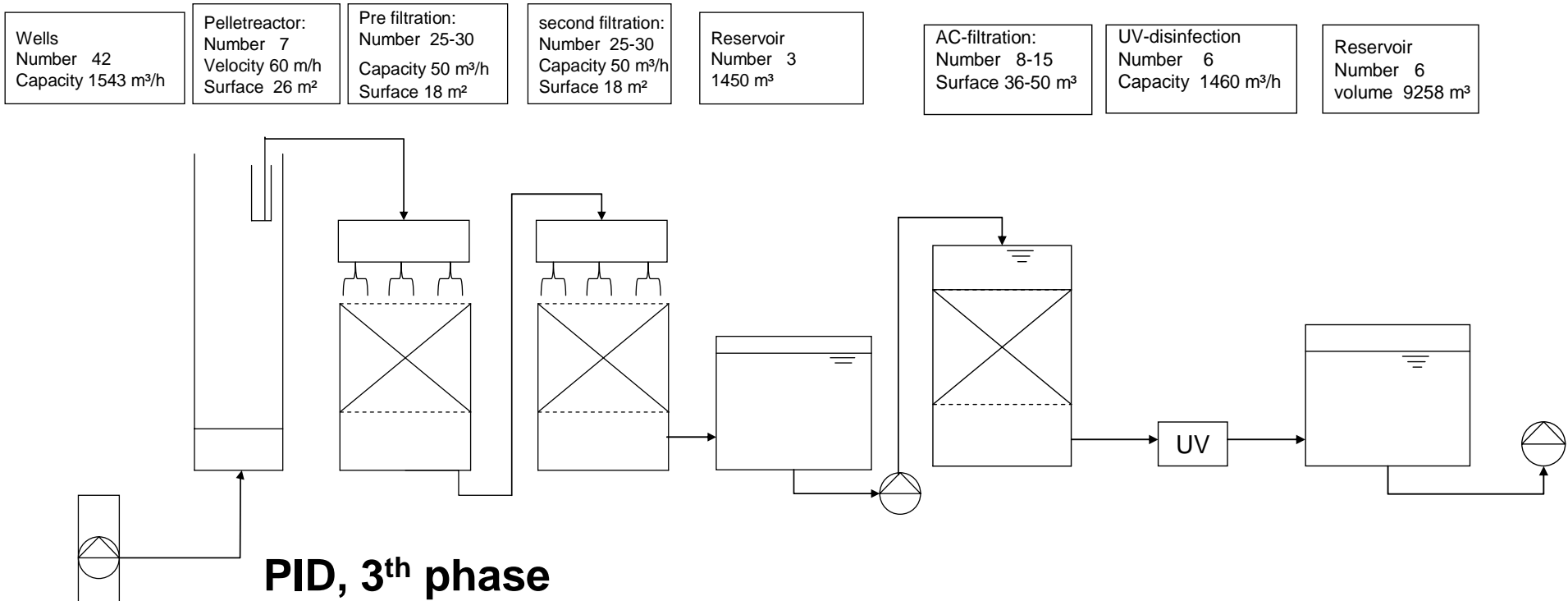
### 3<sup>th</sup> Phase, softening



- Dry filtration build in phase 2 can be used as extra needed filtration after the softening proces in phase 3 when scaling-up is being suplied

# AC Filtration

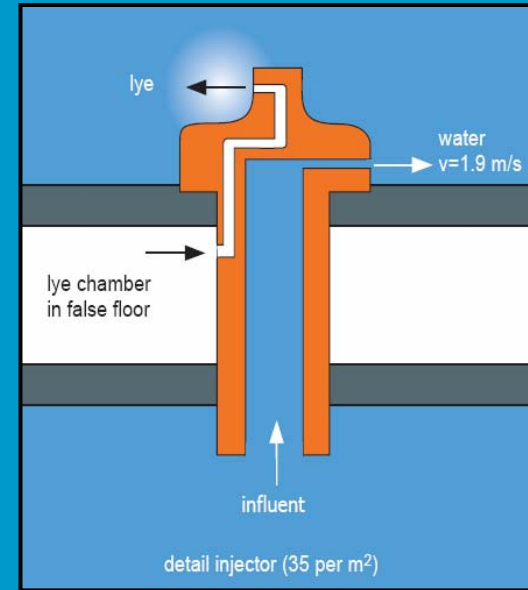
- 8 filters (for filtration) →  $2543 \text{ m}^3/\text{day}$  (1543 m<sup>3</sup>/dag) \* 1 day
- Flowing water velocity  $0.25 \text{ m/s}$  →  $2543 \text{ m}^3/\text{day}$  →  $26 \text{ m}^2$  1 day
- 7 pellet reactors,  $A_{\text{per reactor}} = 3.75 \text{ m}^2$ ,  $H = 7 \text{ m}$
- 2\*330 m<sup>3</sup>/h at Lekkerkerk → 660 m<sup>3</sup>/h + 4 à 5\*200 m<sup>3</sup>/h from De Put





## Water quality

Parameter	mmol/l	norms mmol/l
Ca <sup>2+</sup>	2.02	
Mg <sup>2+</sup>	0.45	
CO <sub>2</sub>	0.45	
Na <sup>+</sup>	2.40	< 6.5
NH <sub>4</sub> <sup>+</sup>	0.24	< 0.011
HCO <sub>3</sub> <sup>-</sup>	3.80	> 1



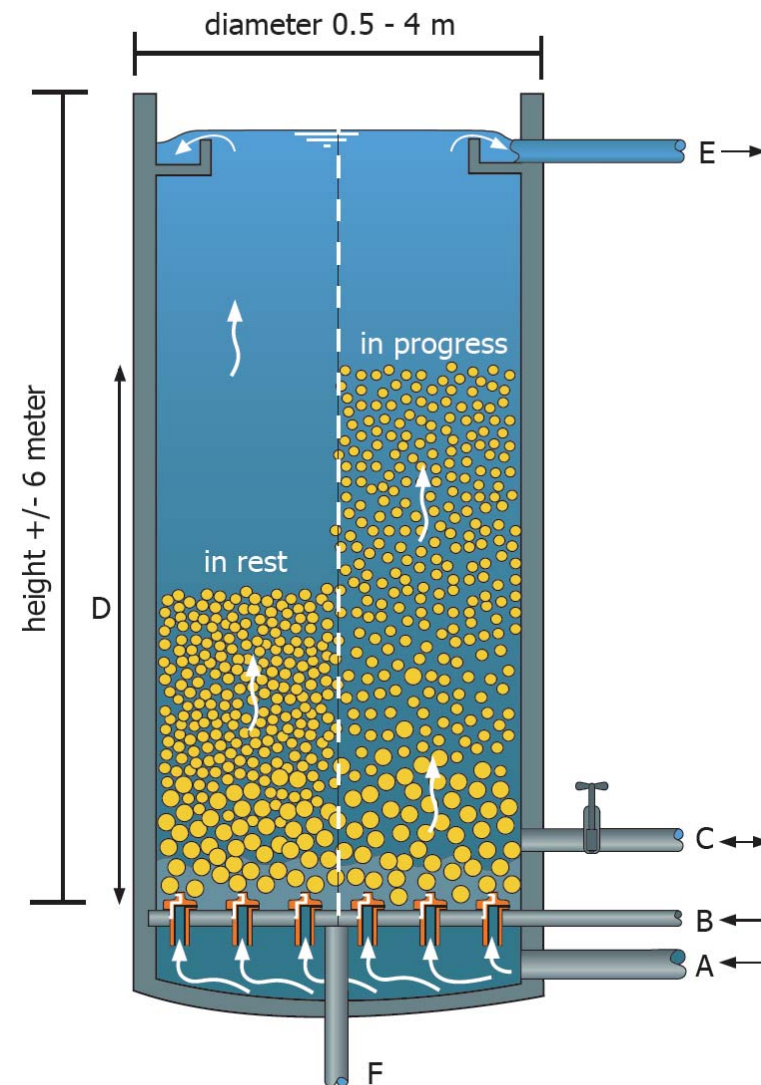
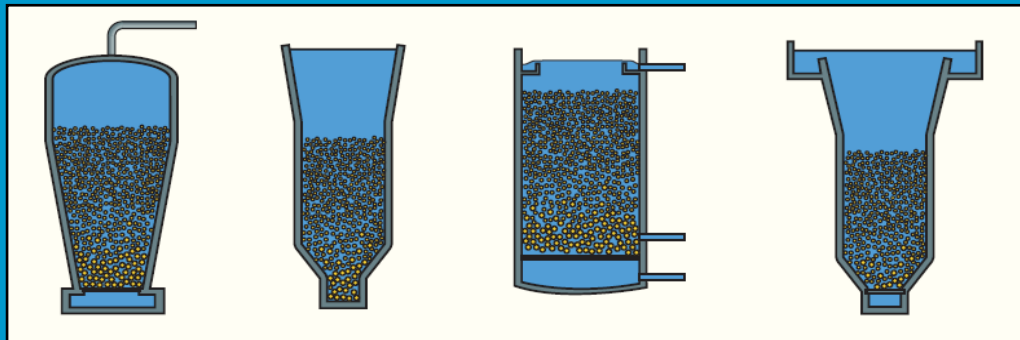
pH min. 7,0  
max. 9,5

## Water quality, chemical dose

Na(OH)	Na(OH) mg/l	Na+ mg/l	HCO <sub>3</sub> <sup>-</sup> mg/l
aerob, no split treatment	40	78,4	173
anearob, no split treatment	59,2	89,44	202,28
aerob, split treatment	81,6	102,32	109,56
anearob, split treatment	100,8	113,36	138,84
<b>Ca(OH)<sub>2</sub></b>			
Ca(OH) <sub>2</sub>	Ca(OH) <sub>2</sub> mg/l	Na+ mg/l	HCO <sub>3</sub> <sup>-</sup> mg/l
aerob, no split treatment	74	55,4	112
anearob, no split treatment	109,52	55,4	112
aerob, split treatment	186,48	55,4	-14,88
anearob, split treatment	142,82	55,4	57,1
<b>Na<sub>2</sub>CO<sub>3</sub></b>			
Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> CO <sub>3</sub> mg/l	Na+ mg/l	HCO <sub>3</sub> <sup>-</sup> mg/l
aerob, no split treatment	106	101,4	234
anearob, no split treatment	156,88	123,48	112
aerob, split treatment	216,24	149,24	234
anearob, split treatment	267,12	171,32	292,56

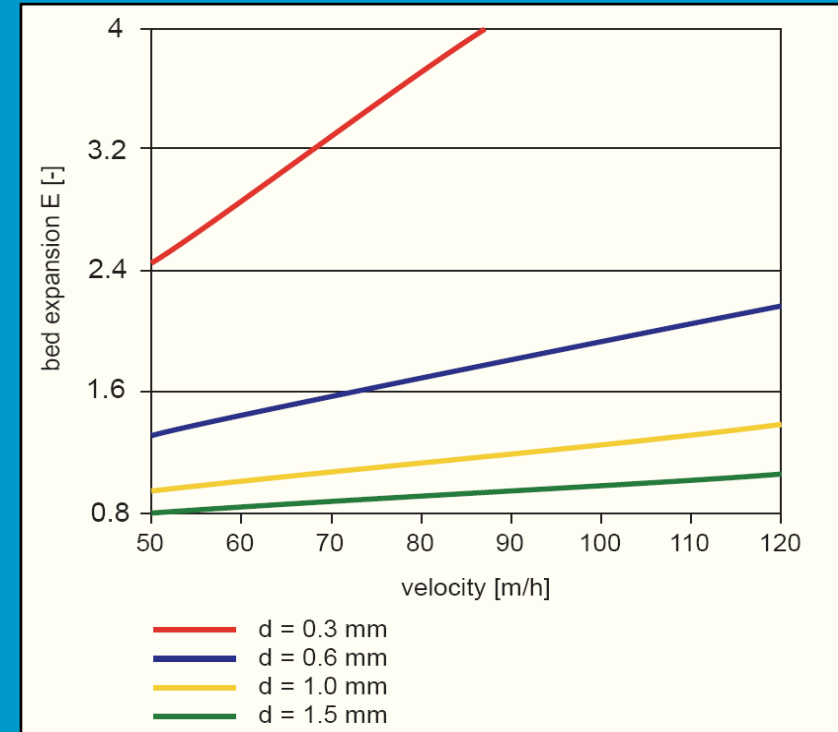
# Construction Alternatives

- Cylindrical reactor with flat bottom ( Amsterdam reactor)
- Cylindrical reactor with conical bottom part and tangential inlet.

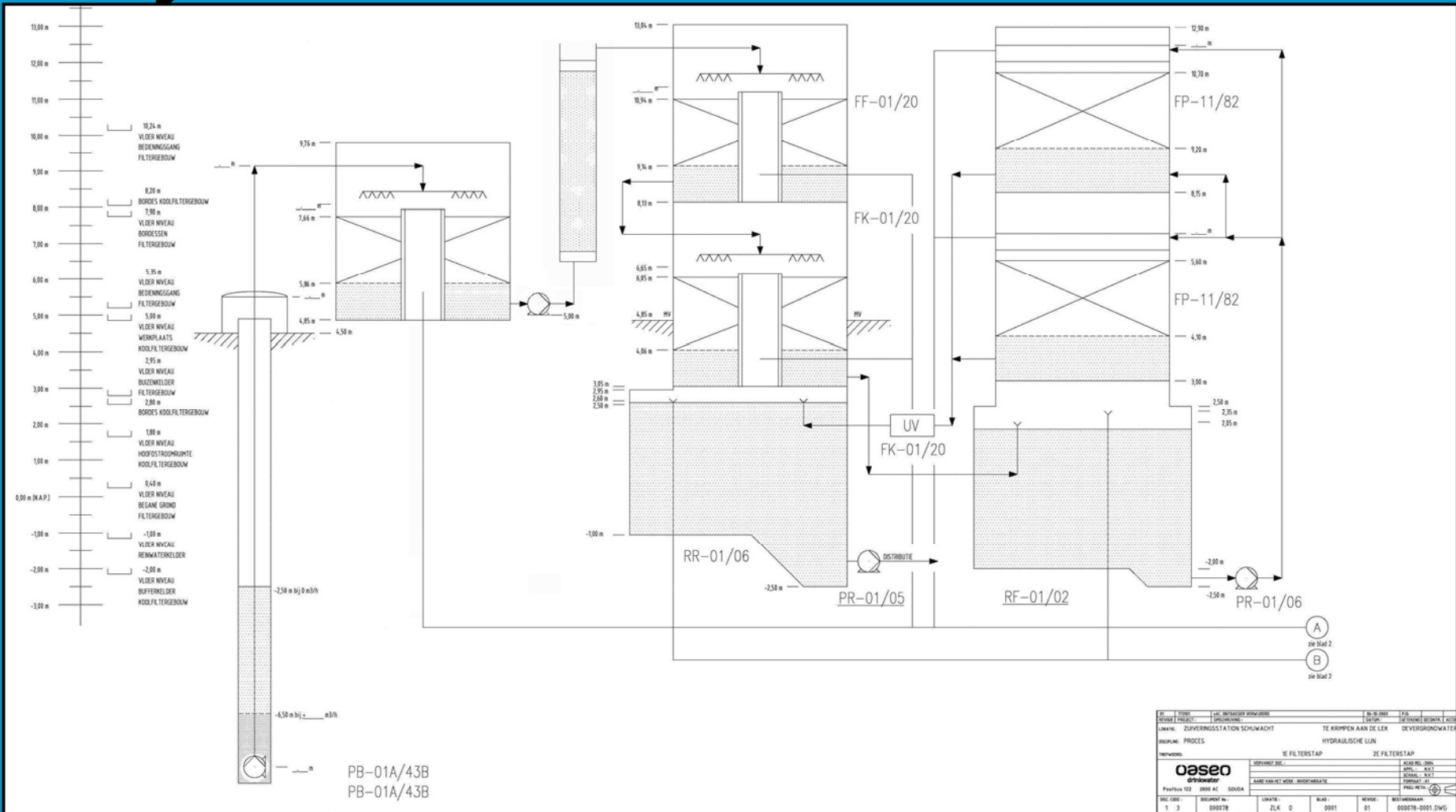


# Softening

- Height fixed bed (  $L_0$  )  $\pm$  2m
- Height expanded bed (  $L_e$  )  
 $L_e = E \cdot L_0 = 5.6$  m
- Diameter of seeding material (  $d_1$  ) 0.3 – 0.6 mm
- Diameter of pellets when removed (  $d_2$  ) 1.0 – 1.5 mm



# Hydraulic Line



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# Next step

- (Structural) Design drawings
- Finances
- Specific calculations (2<sup>nd</sup> + 3<sup>th</sup> Phase)
- .....last things



# Questions?



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