

# 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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**oaseo**

**TU**Delft

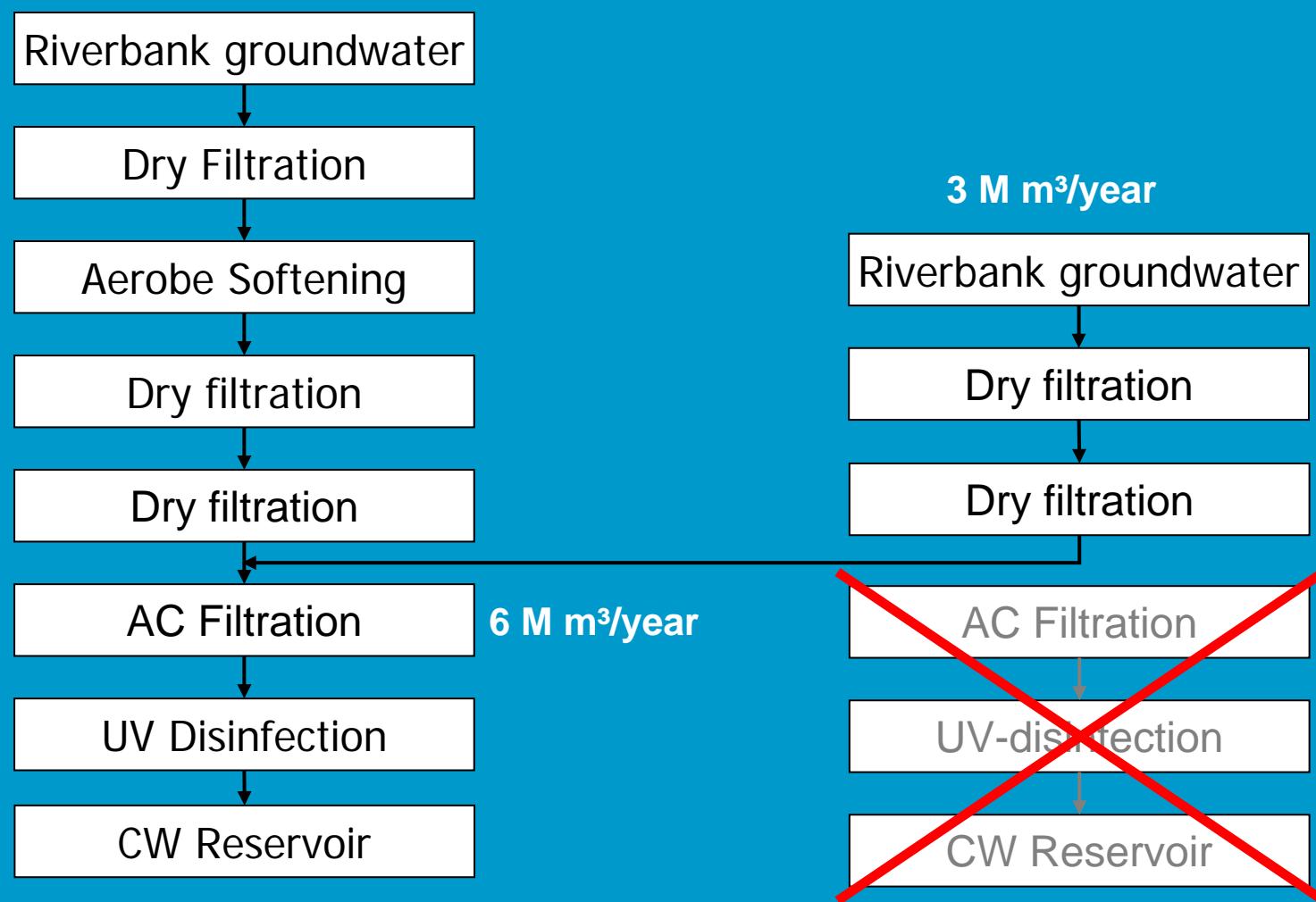
Delft University of Technology

# 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**

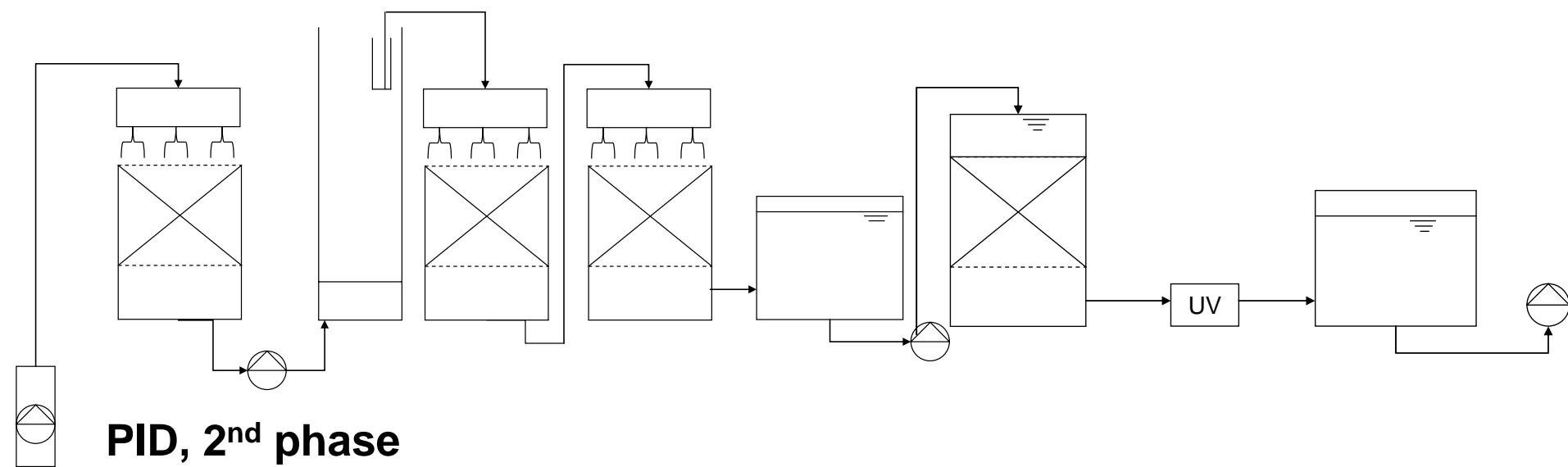
Min-Max year factor: 0.85-1.45

## Converge (after last filtrationstep)

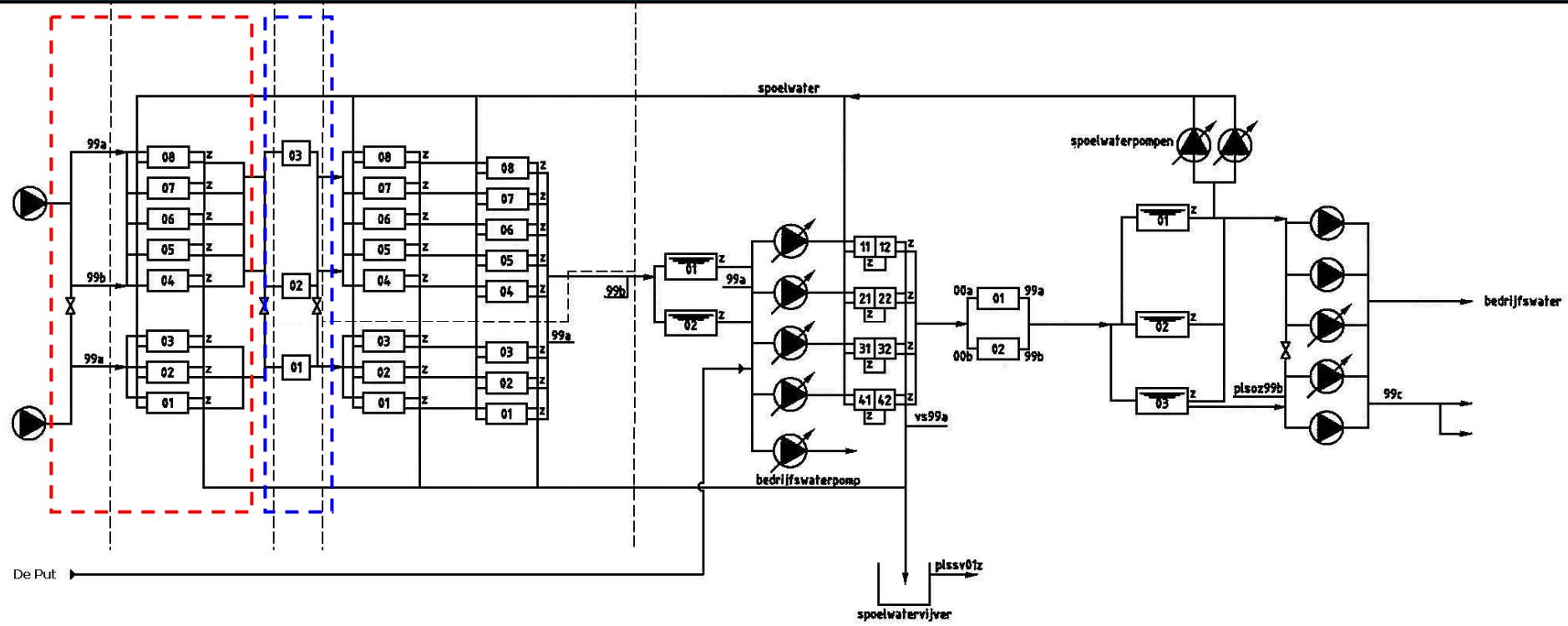
### Dry deaerating

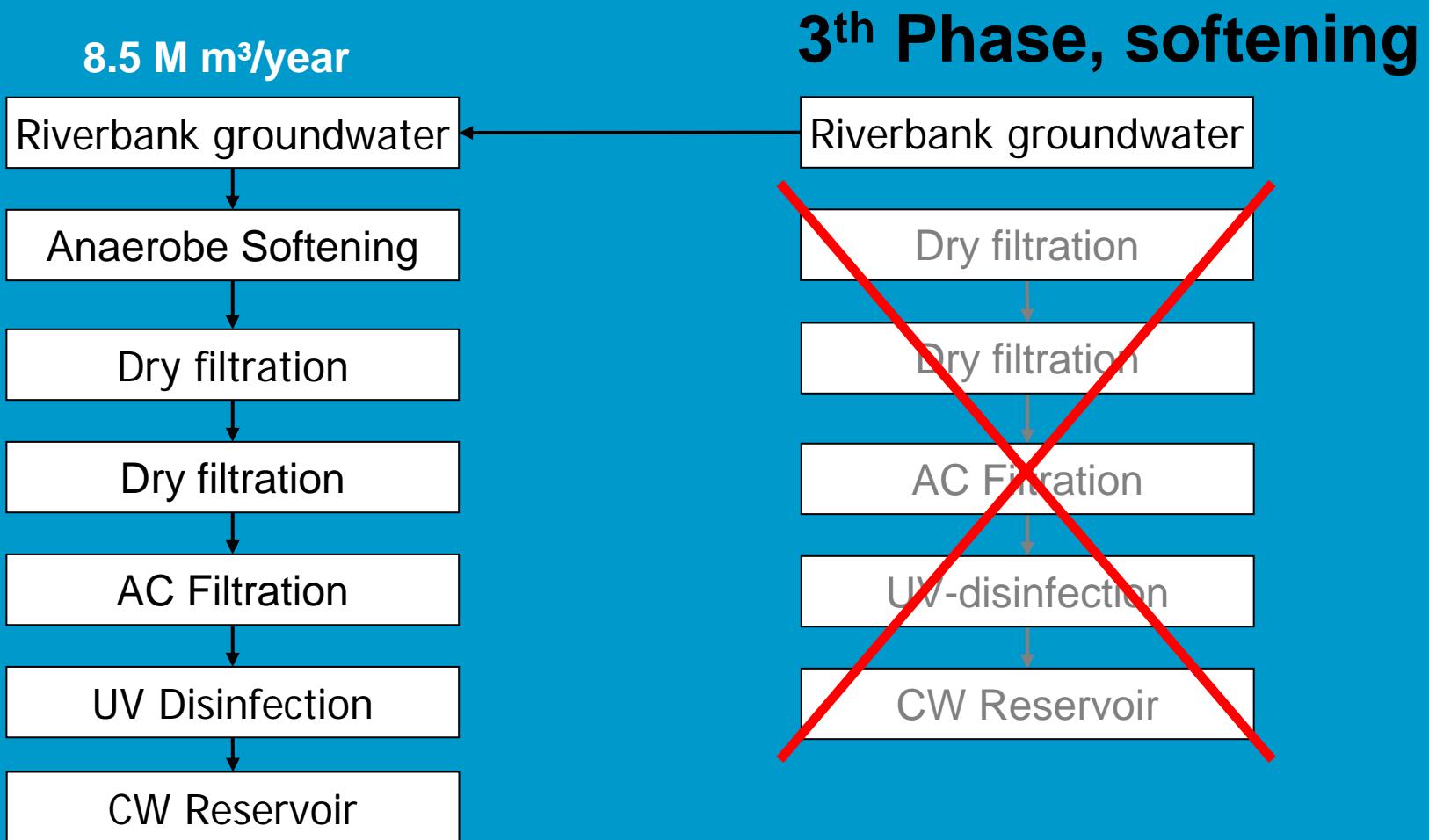
- $3.0 \text{ Mm}^3/\text{year} \rightarrow 4.9 \text{ Mm}^3/\text{h} / (30 \text{ m/h}) = 7.5 \text{ m}^2$
- 3 pellet reactor
- Capacity AC filtration and UV-disinfection should be sufficient
- $\text{Capacity per reactor} = 30 \text{ m}^3/\text{D} = 2.2 \text{ m}, H_{\text{inner}} = 7 \text{ m}$
- Clear water reservoir:  $3240 \text{ m}^3$ , according to rule of thumb should be sufficient

Wells Number 28 Capacity 765 m <sup>3</sup> /h	Dry filtration: Number 8 Capacity 50 m <sup>3</sup> /h Surface 18 m <sup>2</sup>	Pelletreactor: Number 3 Velocity 60 m/h Surface 10 m <sup>2</sup>	Pre filtration: Number 8 Capacity 50 m <sup>3</sup> /h Surface 18 m <sup>2</sup>	second filtration: Number 8 Capacity 50 m <sup>3</sup> /h Surface 18 m <sup>2</sup>	Reservoir Number 2 volume 700 m <sup>3</sup>	AC-filtration: Number 8 Surface 36 m <sup>3</sup>	UV-disinfection Number 2 Capacity 660 m <sup>3</sup> /h	Reservoir Number 3 volume 3240 m <sup>3</sup>
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# Process scheme, split treatment





- 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 supplied

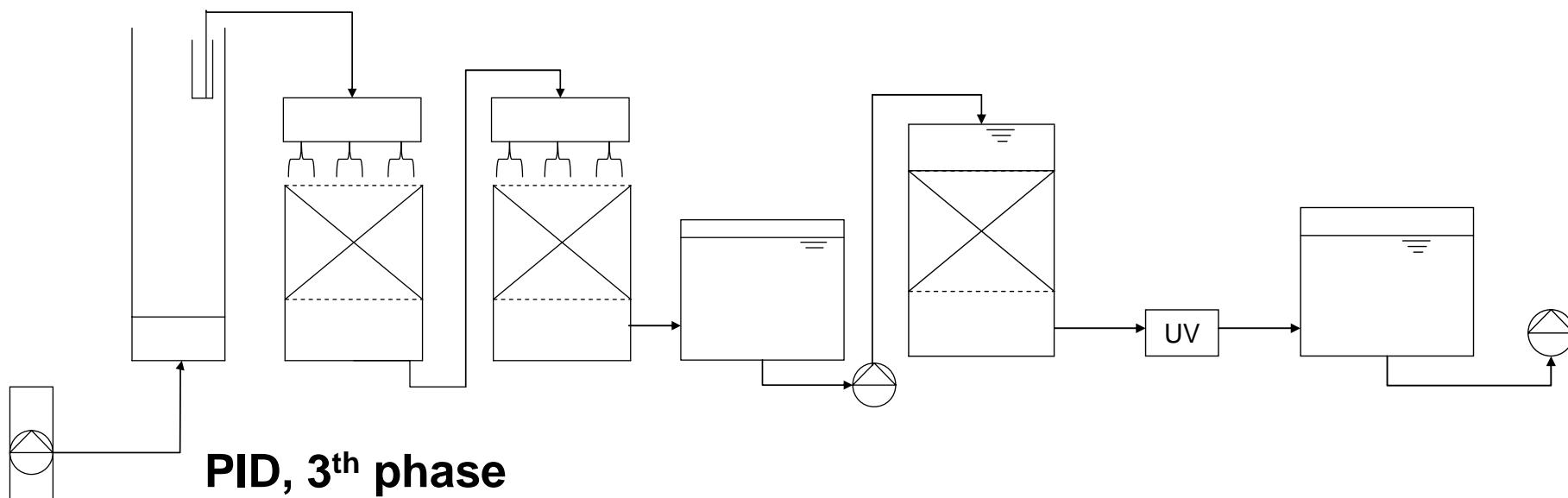
## AC Filtration, second (Filtration thumb)

- Collected water from 25 wells (1543 m<sup>3</sup>/h) \* 1 day

## UV Disinfection

- UV disinfection (1543 m<sup>3</sup>/h) \* 1 day
- UV disinfection (1543 m<sup>3</sup>/h) \* 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

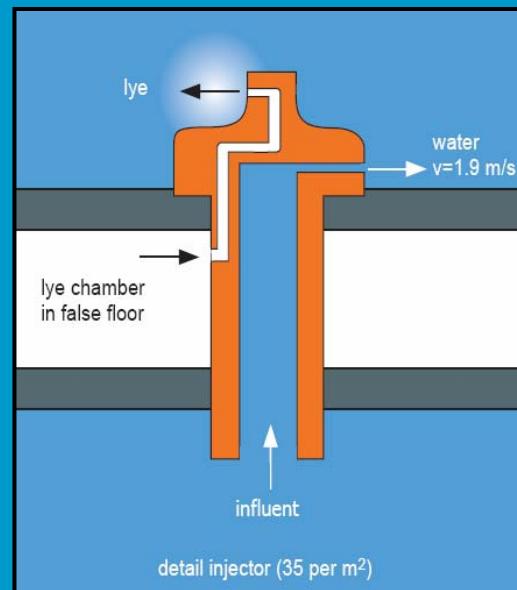
Wells Number 42 Capacity 1543 m <sup>3</sup> /h	Pelletreactor: Number 7 Velocity 60 m/h Surface 26 m <sup>2</sup>	Pre filtration: Number 25-30 Capacity 50 m <sup>3</sup> /h Surface 18 m <sup>2</sup>	second filtration: Number 25-30 Capacity 50 m <sup>3</sup> /h Surface 18 m <sup>2</sup>	Reservoir Number 3 1450 m <sup>3</sup>	AC-filtration: Number 8-15 Surface 36-50 m <sup>3</sup>	UV-disinfection Number 6 Capacity 1460 m <sup>3</sup> /h	Reservoir Number 6 volume 9258 m <sup>3</sup>
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## 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

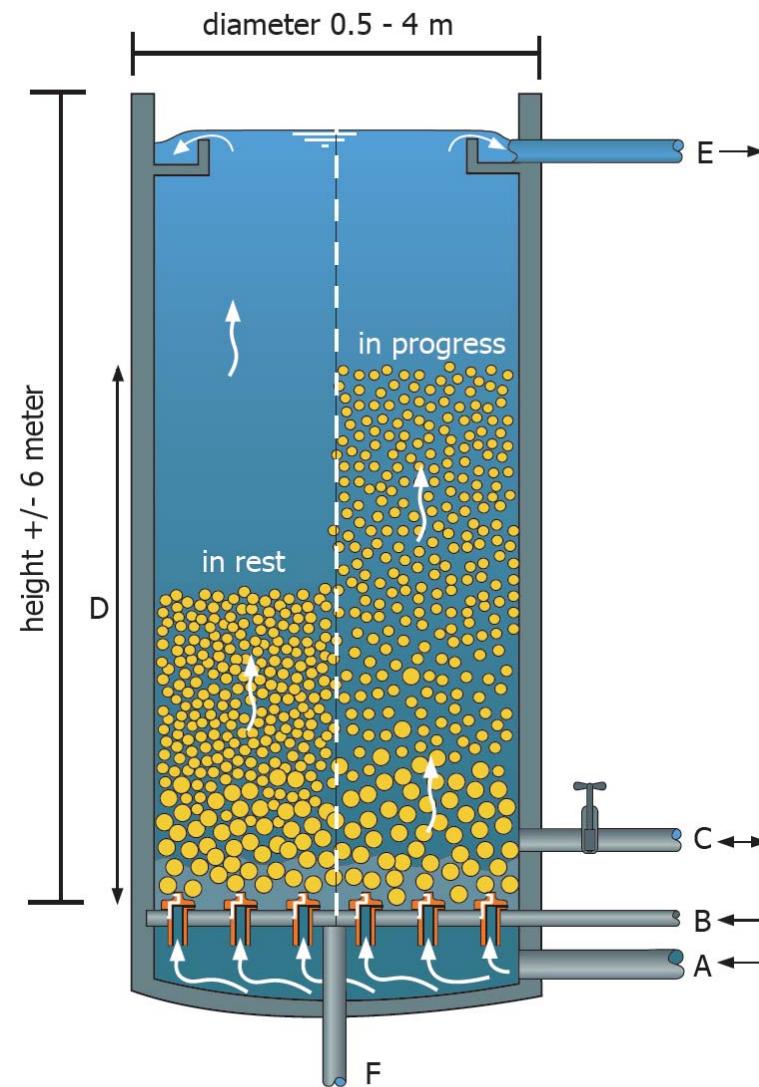
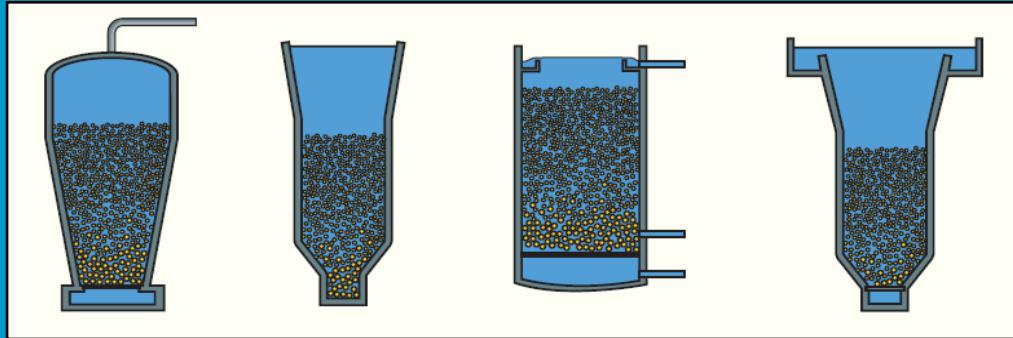


## Water quality, chemical dose

Na(OH)	Na(OH) mg/l	Na+ mg/l	HCO3- mg/l
aeroob, no split treatment	40	78,4	173
anearoob, no split treatment	59,2	89,44	202,28
aeroob, split treatment	81,6	102,32	109,56
anearoob, split treatment	100,8	113,36	138,84
Ca(OH)2	Ca(OH)2 mg/l	Na+ mg/l	HCO3- mg/l
aeroob, no split treatment	74	55,4	112
anearoob, no split treatment	109,52	55,4	112
aeroob, split treatment	186,48	55,4	-14,88
anearoob, split treatment	142,82	55,4	57,1
Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> CO <sub>3</sub> mg/l	Na+ mg/l	HCO3- mg/l
aeroob, no split treatment	106	101,4	234
anearoob, no split treatment	156,88	123,48	112
aeroob, split treatment	216,24	149,24	234
anearoob, split treatment	267,12	171,32	292,56

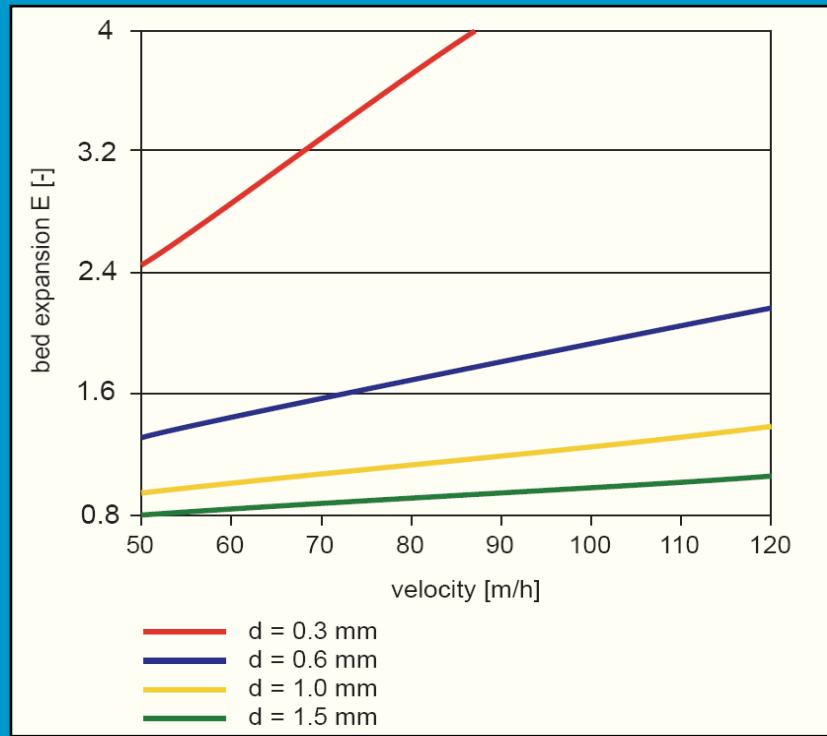
# Construction Alternatives

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

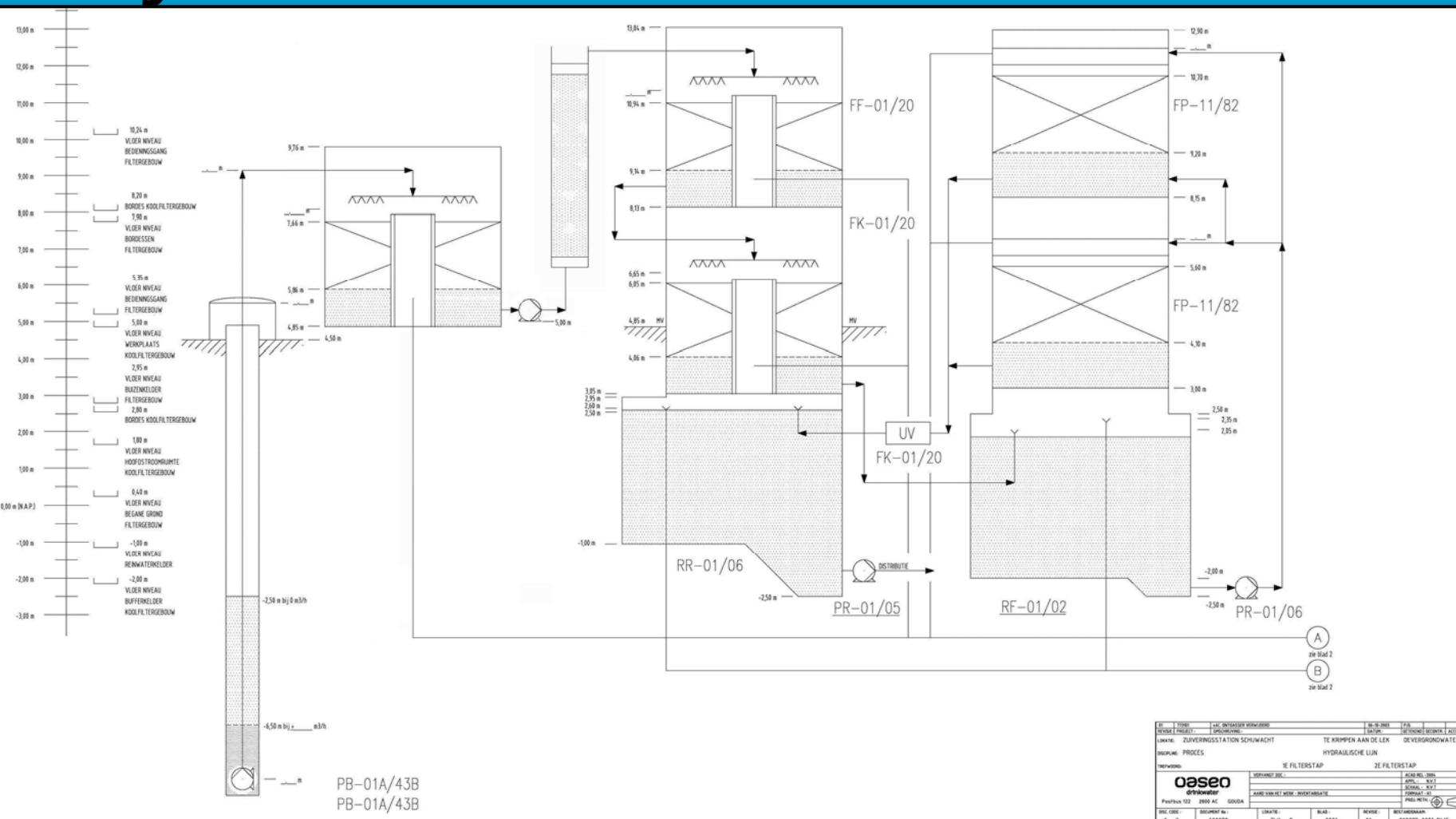


# Softening

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



# Hydraulic Line



E	TYPE	L&T IN GALLEY VERHOOG	St-10-2001	T-01
VERWIJZEND PROJ.	LEIDING	OPDRACHT	TE KRIJPPEN AAN DE LEK	ACHTERGRONDWAARDEN
LOCATIE:	ZUIVERINGSSTATION SCHIJNWICHT			
DISPLINE:	PROCES			
TERWOORD:	oaseo			
VERVANGEND SOC.	ACHTERGROND			
Projectnummer:	APR-N.V. 2			
AARD VAN HET WERK:	INVENTARISATIE			
BEG. GORE:	Document Nr.: 000078			
BLAD:	ZLK 0			
REVISE:	01			
MISCHIEDAAG:	000078-0001.DWG			

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# Next step

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



# Questions?

