

4e Megalocatie Lekkerkerk

 TU Delft


oaseo
drinkwater

Application of softening

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Objective

Oasen wants to realize 4th Megalocation

- Bigger scale treatment for BR-GW-treatment
- Combine De Put and Lekkerkerk
- Realize Softening

→ How implement this in the best way and what are the alternatives for softening?

Choice Alternatives

Pellet reactor – Ion exchange – Membrane filtration

- Innovative solution
- Easy implementation different phases
- Small installation



Ion exchange

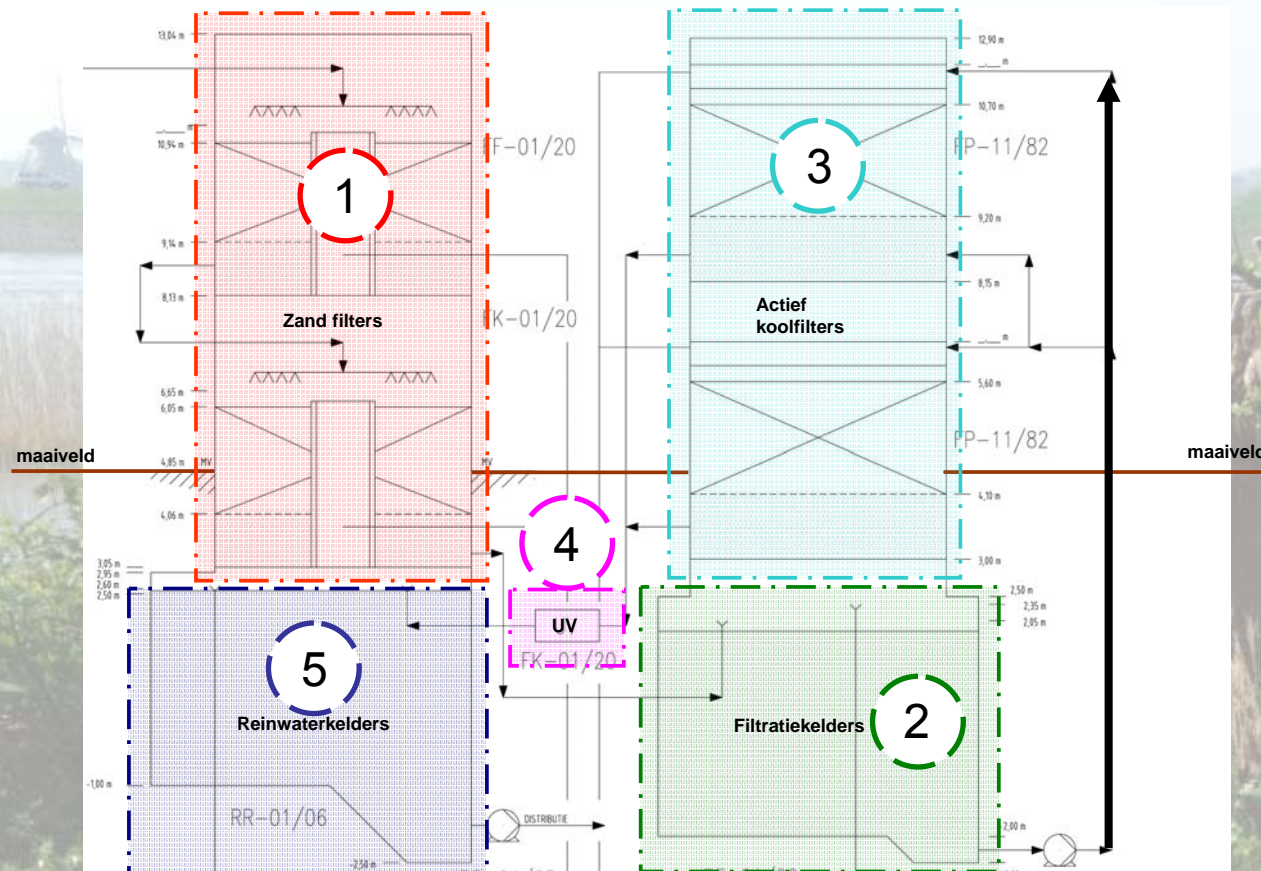
Used technique for:



- **Softening !** (often used industrial applications)
 - Heavy Metals
 - Nitrate Removal
 - DeColourising
 - NOM removal

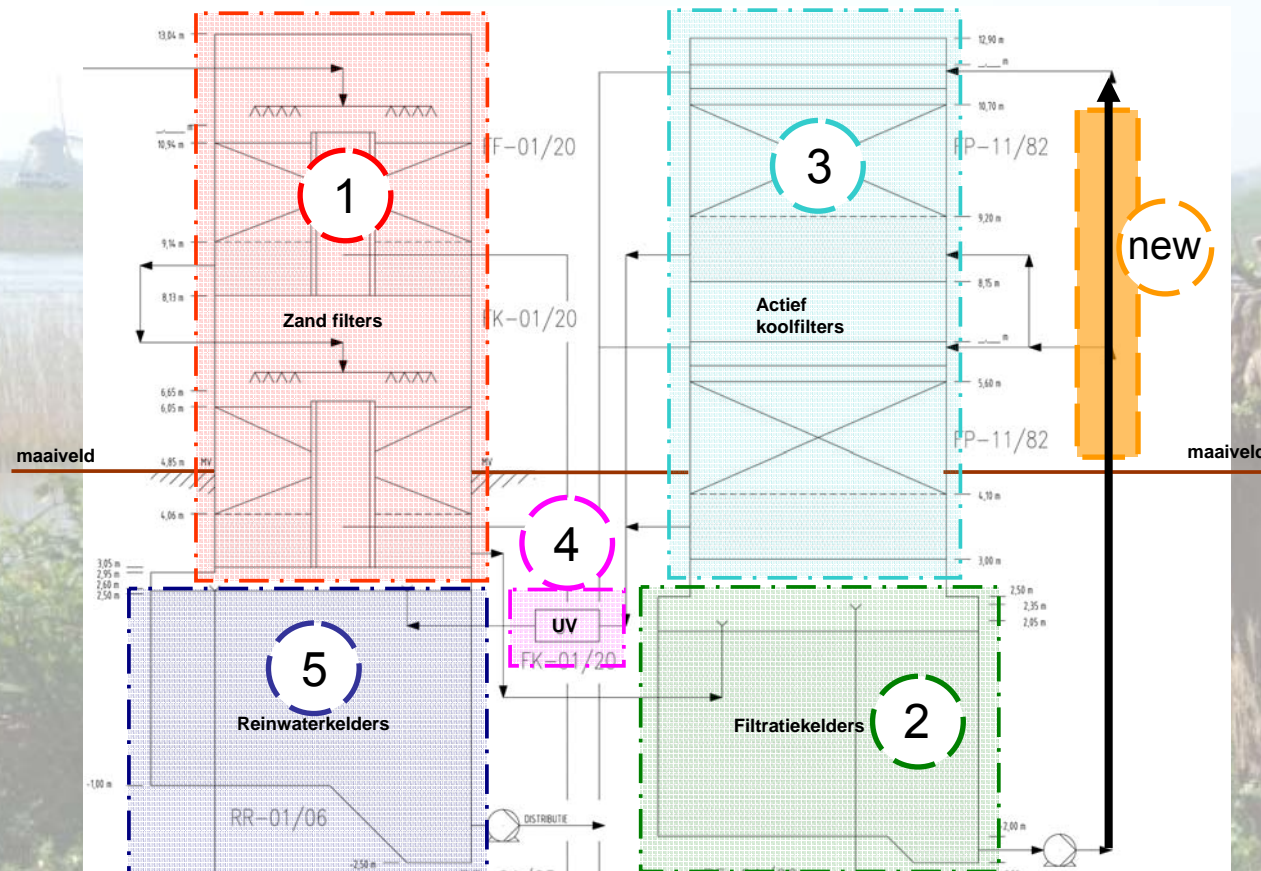
Insertion in treatment process

- Filtration → → Active carbon



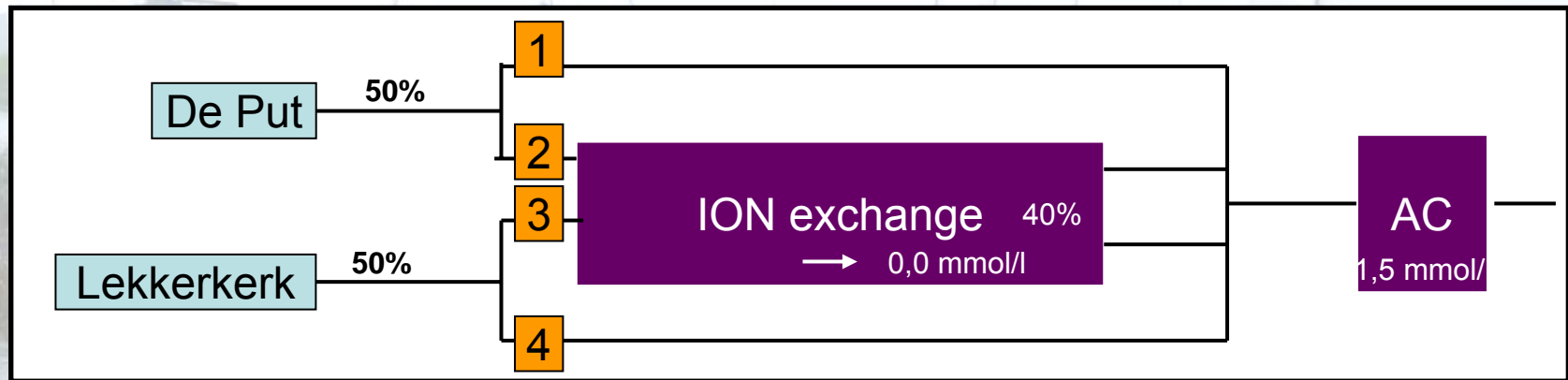
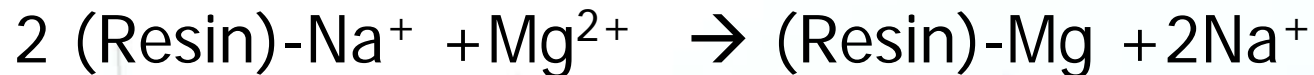
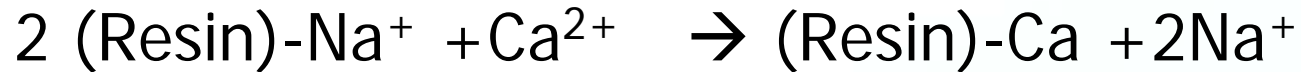
Insertion in treatment process

- Filtration → Ion exchange → Active carbon
- Expanded bed



Flexible design

Strongly acidic cation exchange

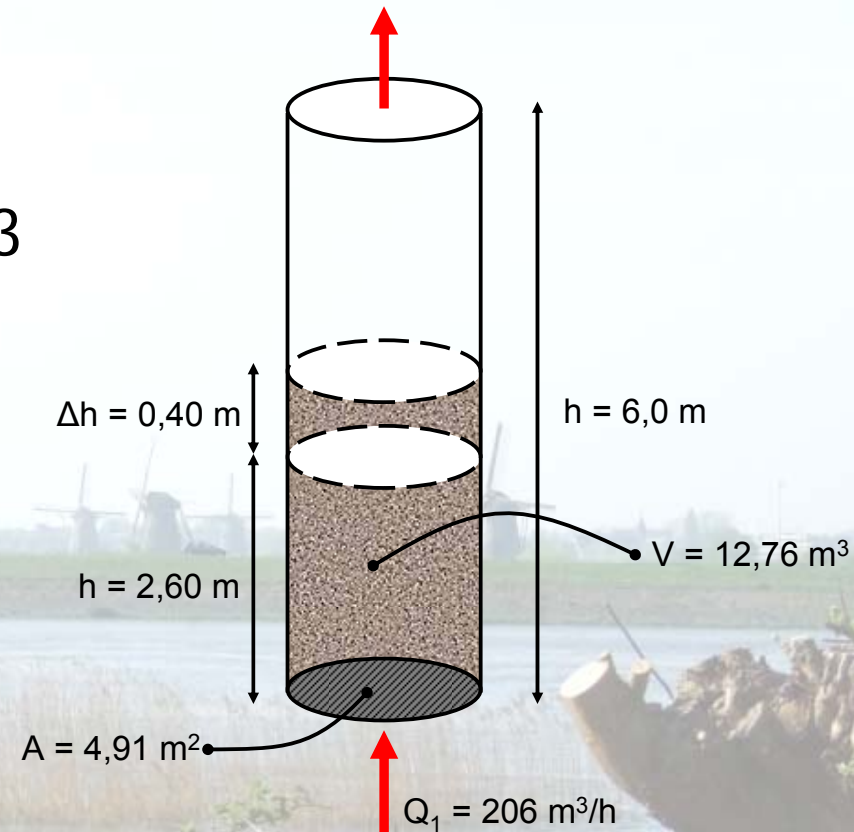


Softening: 2,5 mmol/l \rightarrow 0,0 mmol/l

Process: softening 40 % of total flow

Design

- Capacity – based on Phase 3
- 4 streets (3+1)
- Max. flow (1,45): 1543 m³/h
- Avg. flow (1,00): 1064 m³/h
- Min flow (0,85): 904 m³/h

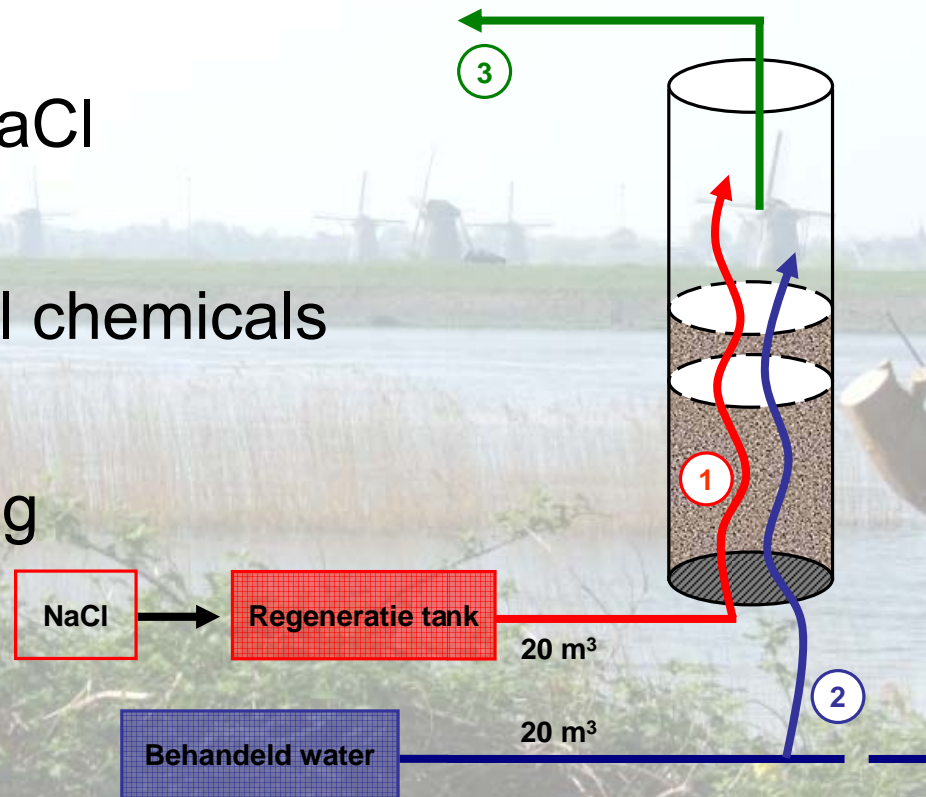


debiet m ³ /h	straten -	debiet/straat m ³ /h	bedbelasting BV/h	filtratiesnelheid m/h
618	3	206.00	16.14	41.97
425	2	212.50	16.65	43.29
362	2	181.00	14.18	36.87

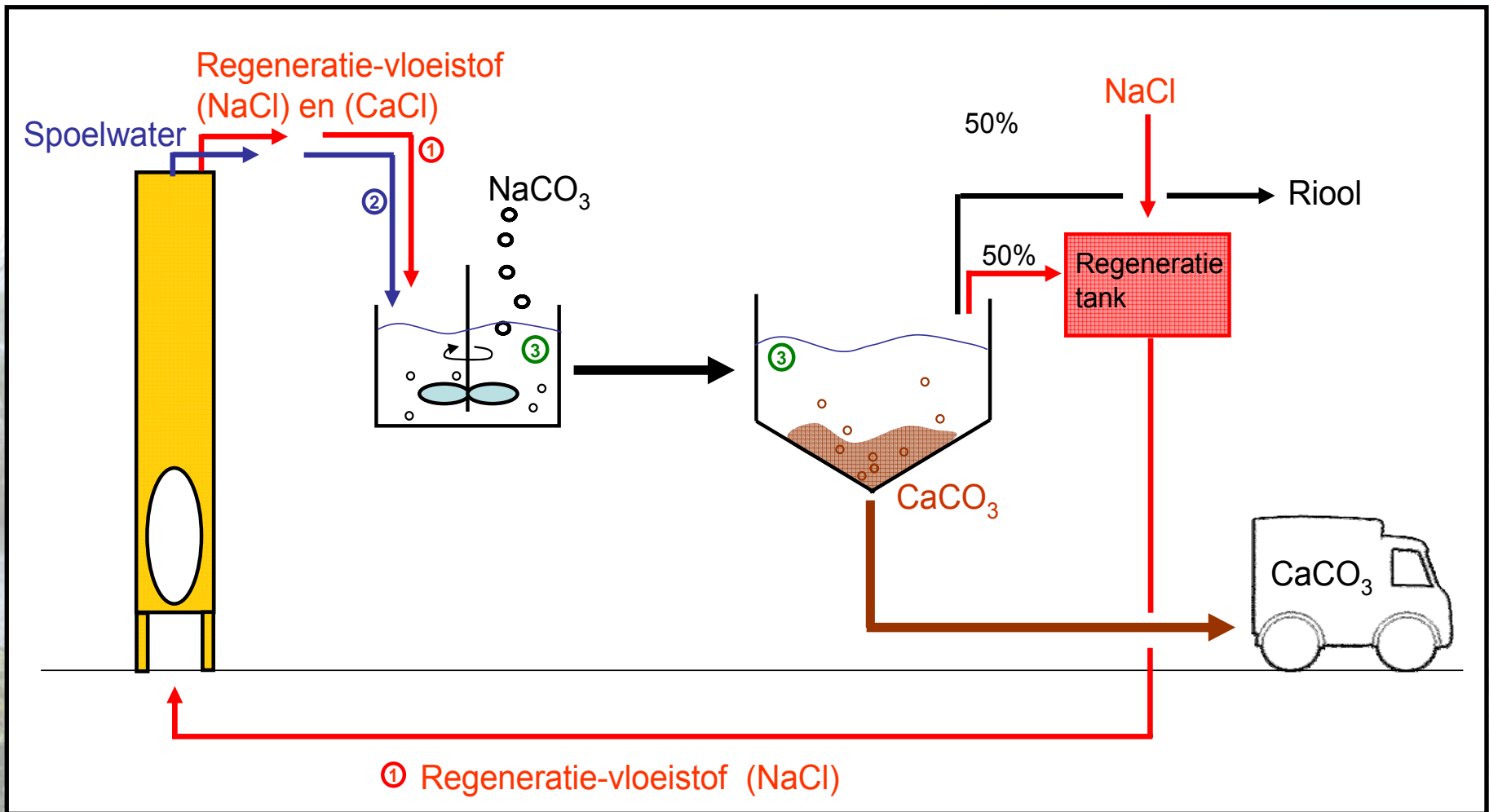
Regeneration (1)

Regeneration : every 12 hours

- ① – Step 1: Liquid NaCl
- ② – Step 2: Removal chemicals
- ③ – Step 3: Recycling



Regeneration (2)



Chemistry

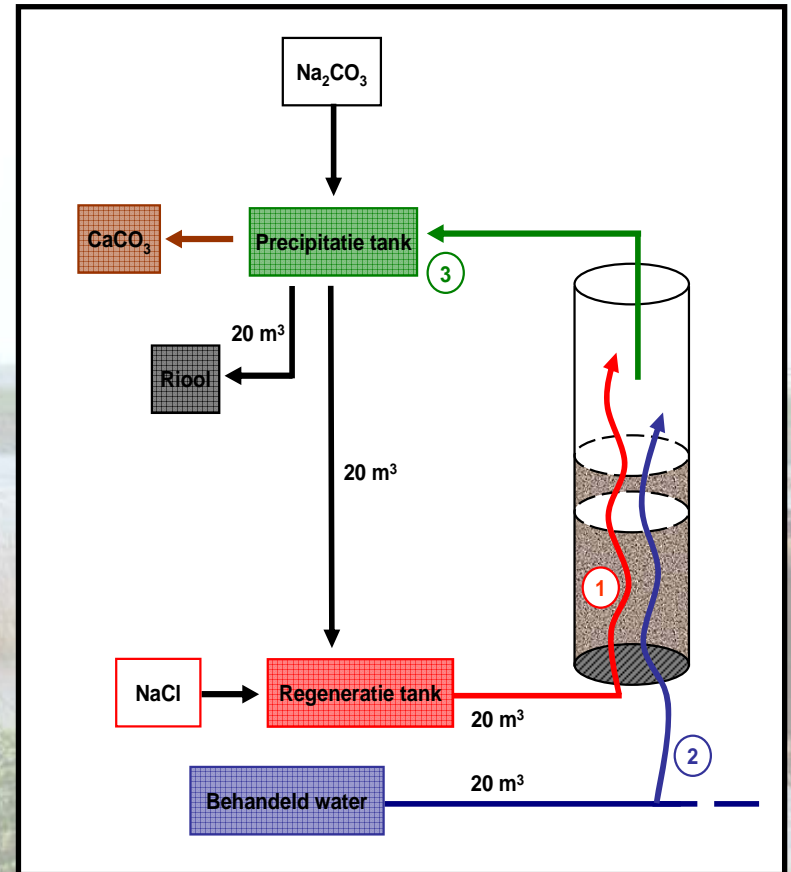
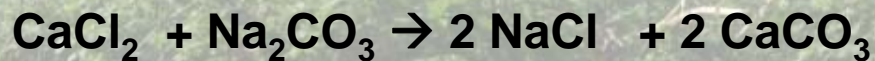
- Ion exchange



- Regeneration




- Precipitation




Consumption

	Chemicals	Without recycling m³/week	With recycling m³/week
In	NaCl	33.75	18
Out	CaCl ₂	19.85	0
In	NaCO ₃	0	18.9
Out	CaCO ₃	0	33.5



Costs: 350.000

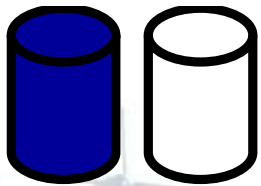


Costs: 150.000

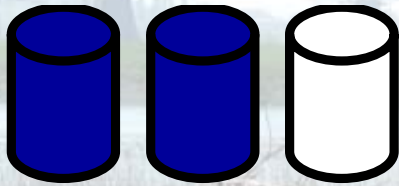
Costs

	aantal	eenheid	euro/aantal	euro	bron
Investing					
Gebouw + installaties + aanpassingen				60000	rapportage KIWA
Hars (levensduur circa 10 jaar)	50	m3	2000	100000	DHV Kostenstandaard
Totaal				700000	
Bedrijfsvoering (kosten per jaar)					
Controle & Regeling door operator	0,25	fte	40000	10000	rapportage KIWA
Onderhoud & Storingen	0,15	fte	40000	6000	rapportage KIWA
Onderhoudskosten				25000	schatting
Begeleiden transport (2,5 vrachtwagen per week)	0,1	fte	40000	4000	rapportage KIWA
Totaal				45000	
Chemicalien en andere verbruik					
Vervanging hars	2,5	m3/jaar	2000	5000	rapportage KIWA
NaCl	930	m3/jaar	150	139500	DHV Kostenstandaard
Na2CO3	1000	m3/jaar	-	-	DHV Kostenstandaard
afzet CaCO3	1750	m3/jaar	-	-	
Totaal				144500	

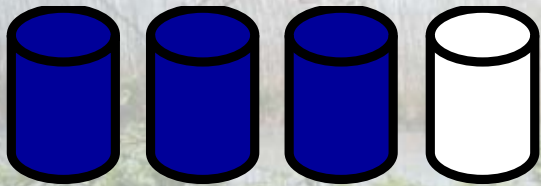
Implementing phases



Phase 1: 3 miljoen m³/year

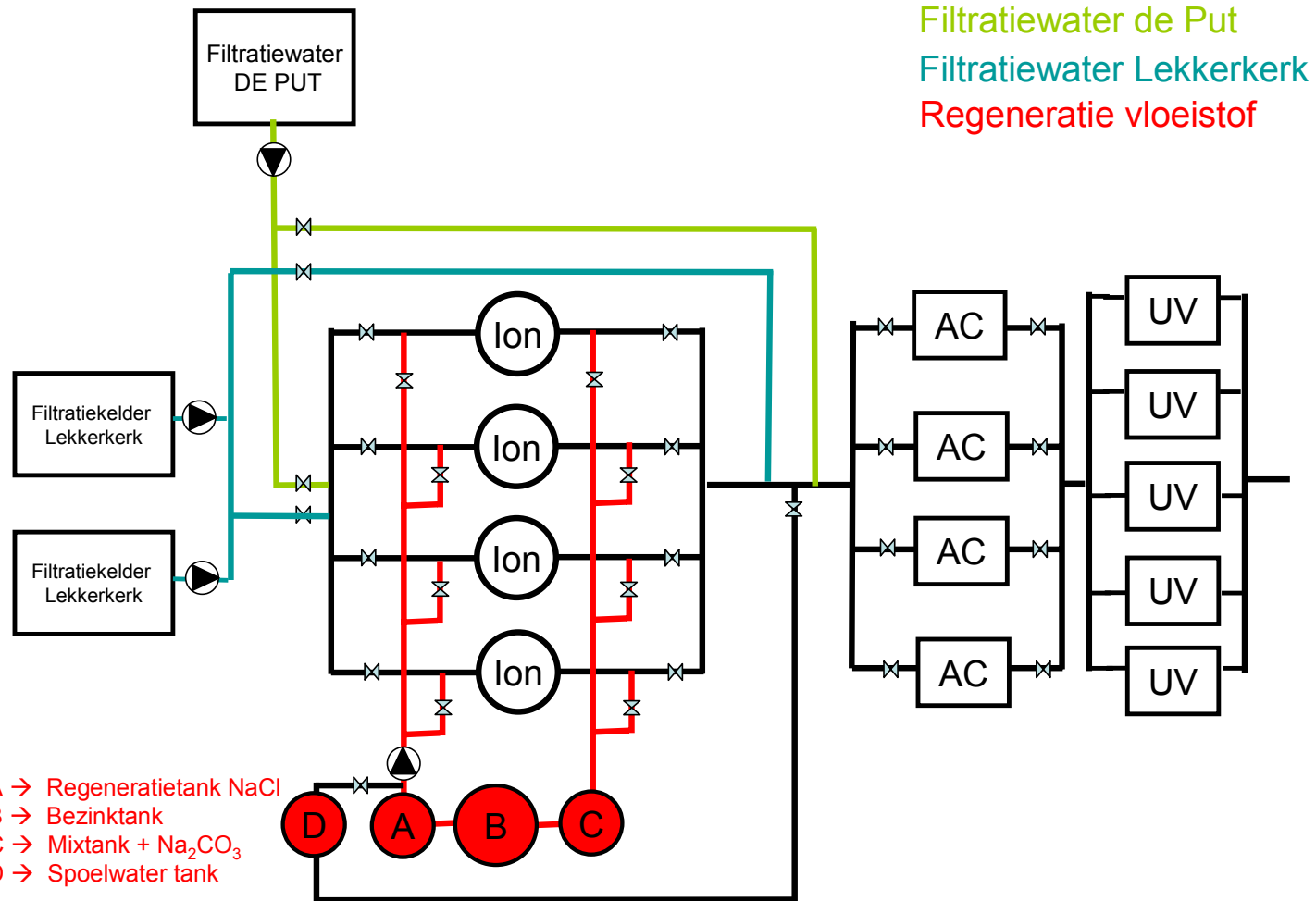


Phase 2: 6 miljoen m³/year

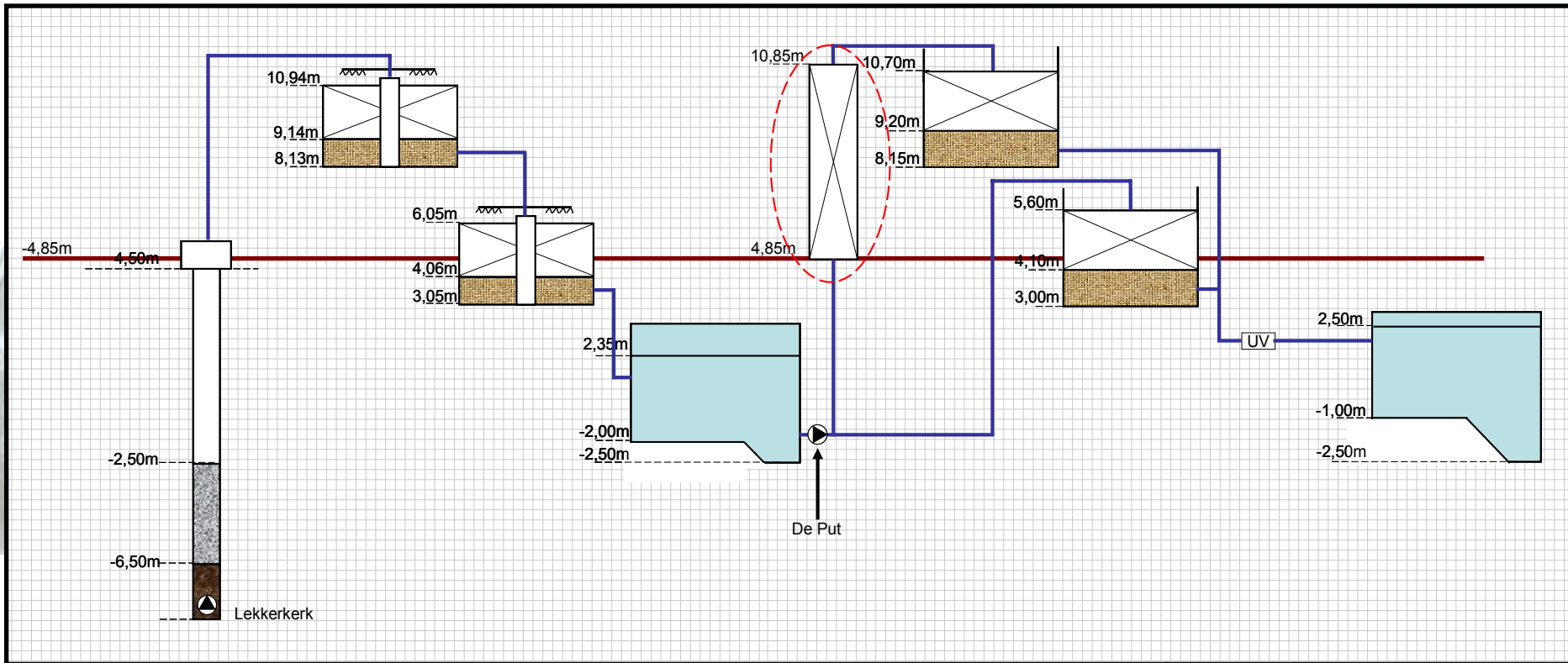


Phase 3: 8.5 miljoen m³/year

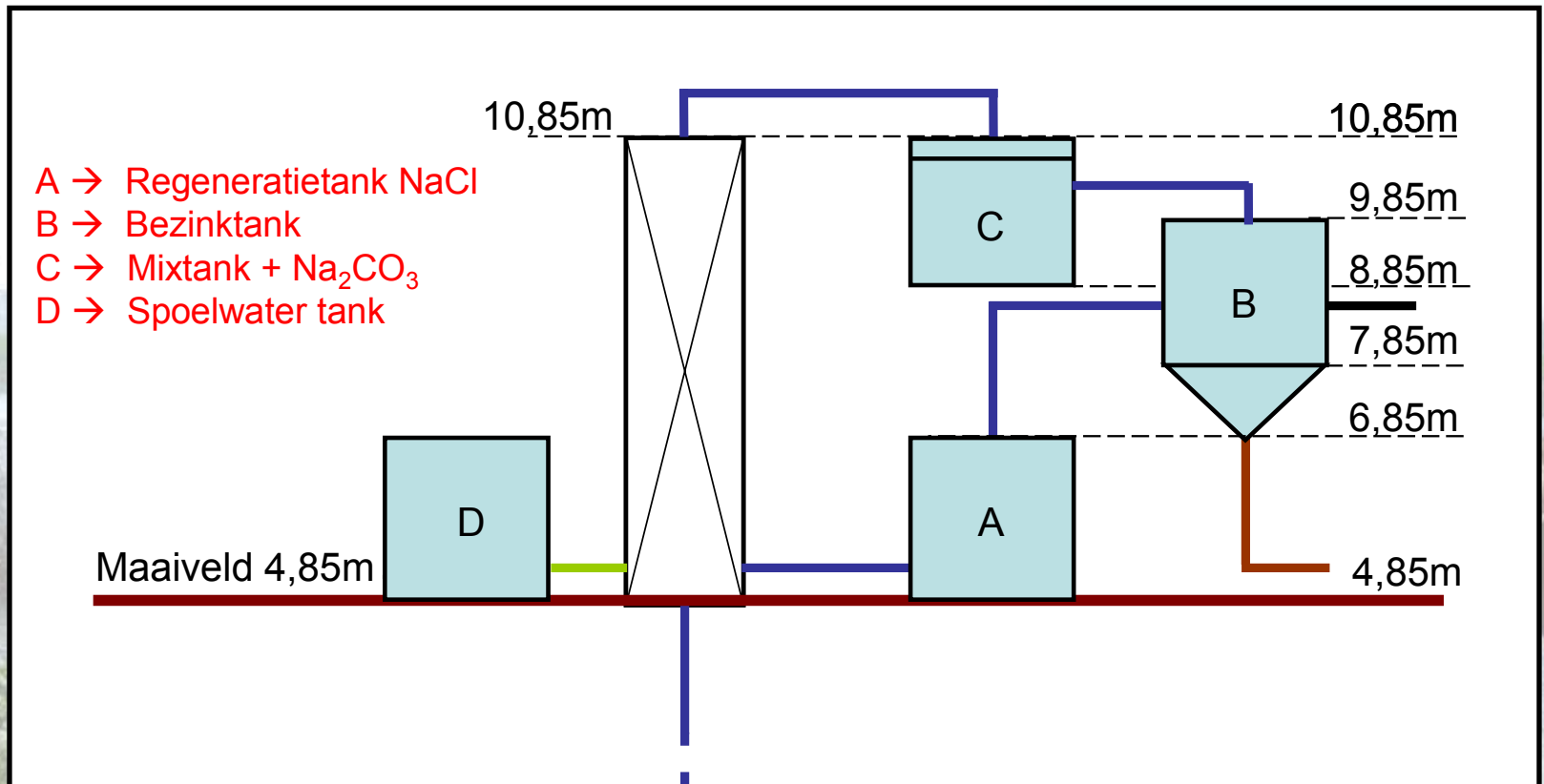
Process scheme



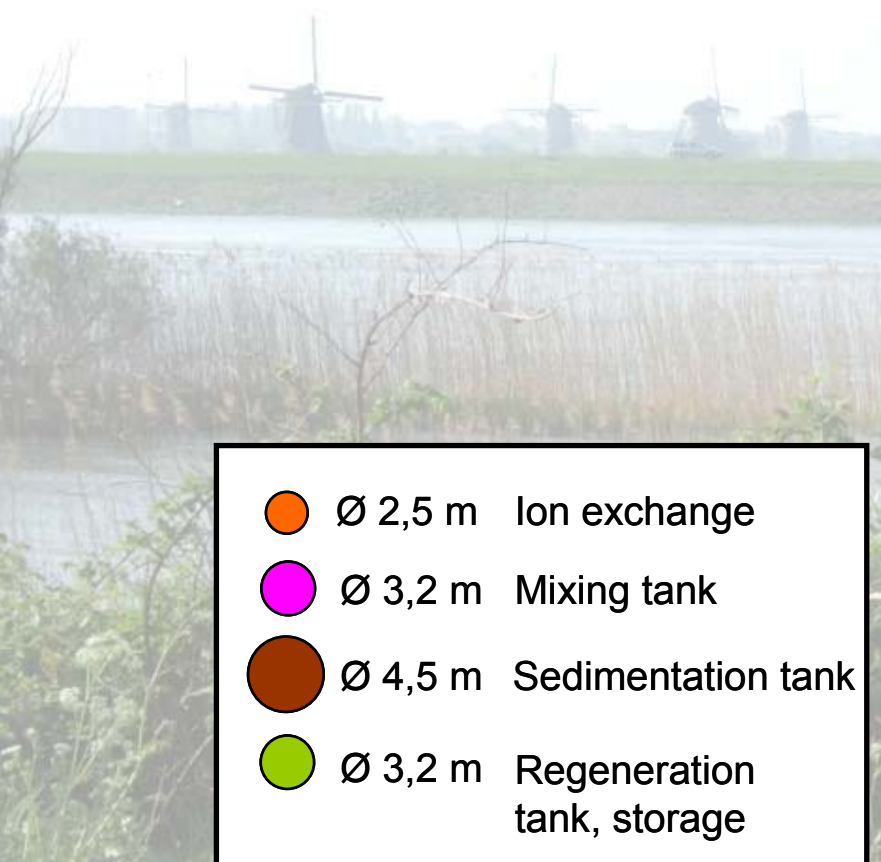
Hydraulic line (1)



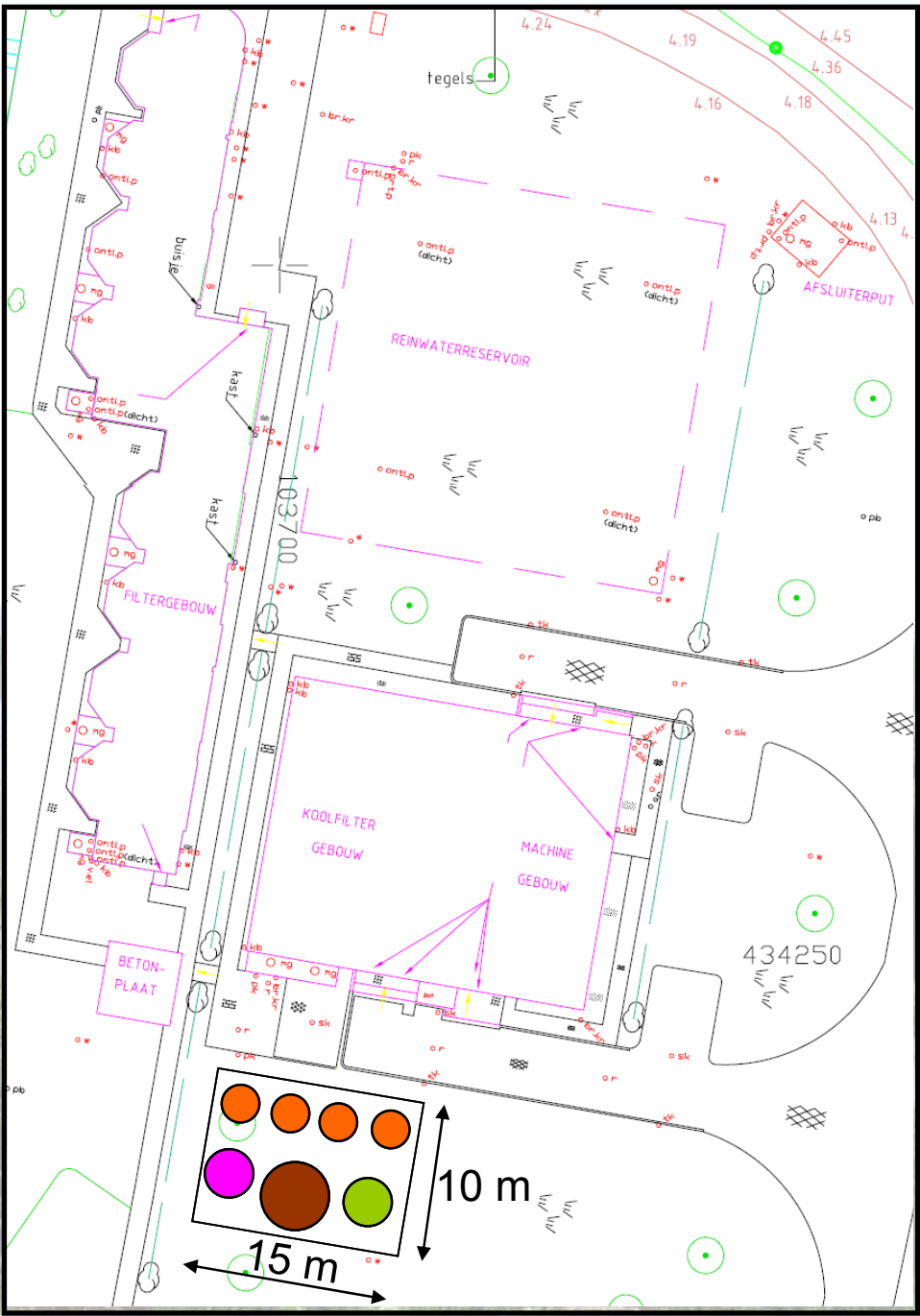
Hydraulic Line (2)



Map - Location



- Ø 2,5 m Ion exchange
- Ø 3,2 m Mixing tank
- Ø 4,5 m Sedimentation tank
- Ø 3,2 m Regeneration tank, storage



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