Pumping station of Harderbroek

Improving iron removal

Chiara Di Silvestro Silvia Guerreschi

kiwa
Partner for progress

TU Delft

Vitens

Previous presentation

•Analysis of the alternatives

» cascade – **limestone filtration** – tower aeration – rapid sand filtration

Same structure but changes in the use of the existing filters

This presentation

•Calculations of the capacity of the treatment

•Hydraulic line

Cascades

- 4 cascades each one with 6 steps

- Lower reservoir

- The water enters a division gutter that feeds only one filter

- Maximum flow through one cascade 500 m^3/h

- Efficiency = 20%

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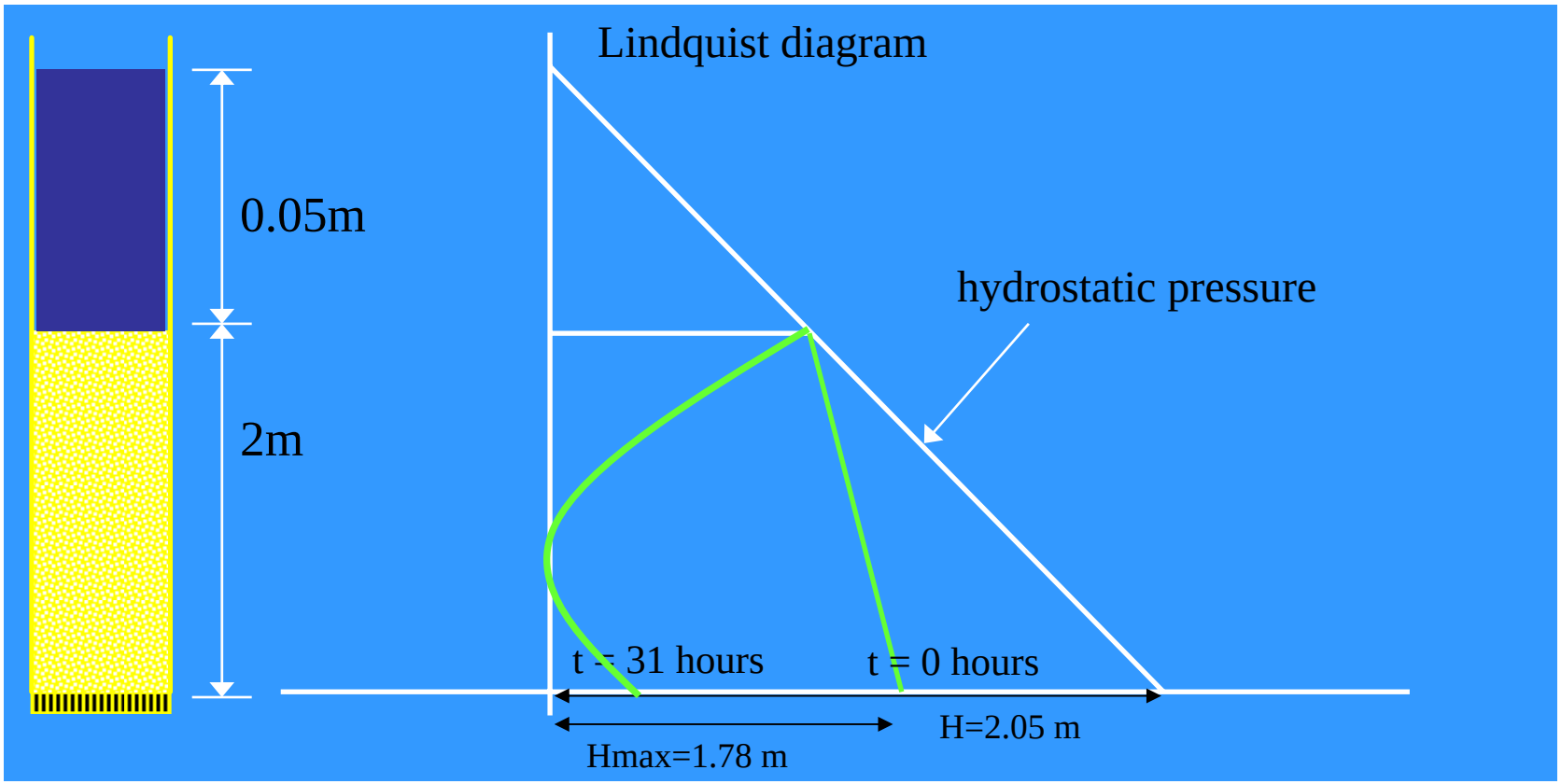
Crushed limestone filtration

- 4 filters ⟶ 2 lines

- Filter material ⟶ Jura Perle grains of limestone (1,1-1,8mm)
- Area = $24m^2$
- Max flux (Q) = $500m^3/h$
- Filtration rate (v) = Q/A = 20,8m/s
- Height of the bed (L) = 2m
- Height of the supernatant = 0,05m

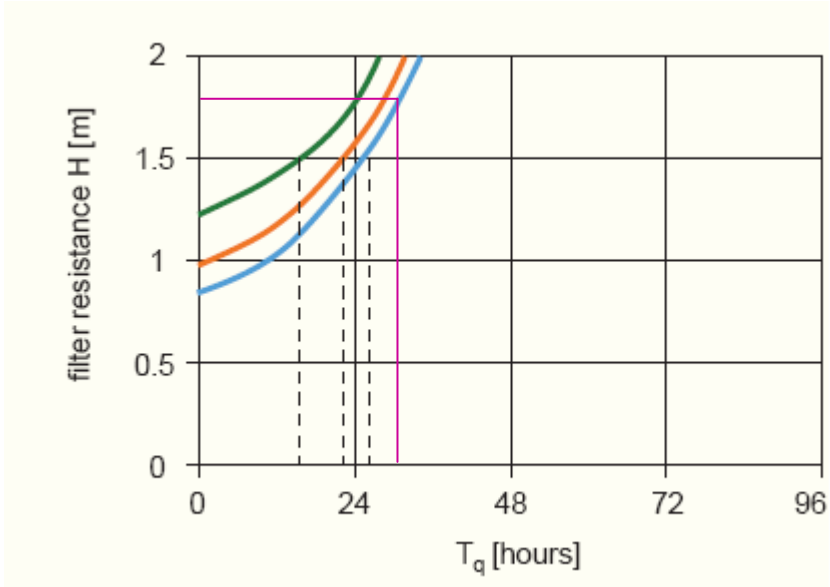
BACKWASH 1

- 8000m^3 at least 32 hours
- Clean bed resistance = $H_o = I_o \cdot L = 180 \cdot \frac{\nu}{g} \cdot \frac{(1-p_o)^2}{p_o^3} \cdot \frac{v}{d_o^2} \cdot L = 0.27$



BACKWASH 2

- H_{max} = 1.78 ⟶ 28 hours
- 8000m^3 ⟶ 14000m^3
- Backwash based on measure of pressure



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Tower aeration

- Aim: decrease CO_2 and increase of O_2
- Three towers
- Surface of 6.06 m^2
- Bed load = 50 m^3/m^2*h
- Bed height = 2m

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Rapid sand filtration

- 4 filters ⟶ 2 lines

- Filter material ⟶ **sand (0.6-1mm)**
- Area = 24m^2
- Max flux (Q) = 500m^3/h
- Filtration rate (v) = Q/A = 20,8m/s
- Height of the bed (L) = 2m
- Height of the supernatant = 0,05m
- **Higher efficiency but more tests are necessary to calculate the improvement in the suspended solids removal**

pH calculation

CASCADES:

- The pH is raised because of the CO_2 removal
- The pH is lowered because of the flocks formation
- The value remains of 7.46

CRUSHED LIMESTONE FILTRATION:

- pH = 8 $\longrightarrow$ 1:50 = CO_2:HCO_3^-
- Removal of all the CO_2 (5,5mg/l)

CO_2 = 0.125 mmol/l HCO_3^- = 1.34 mmol/l

$CaCO_3 + CO_2 + H_20 \longrightarrow Ca + 2HCO_3^-$

Q(m^3/h) $\longrightarrow$ mg CO2/h $\longrightarrow$ mg $CaCO_3$/h

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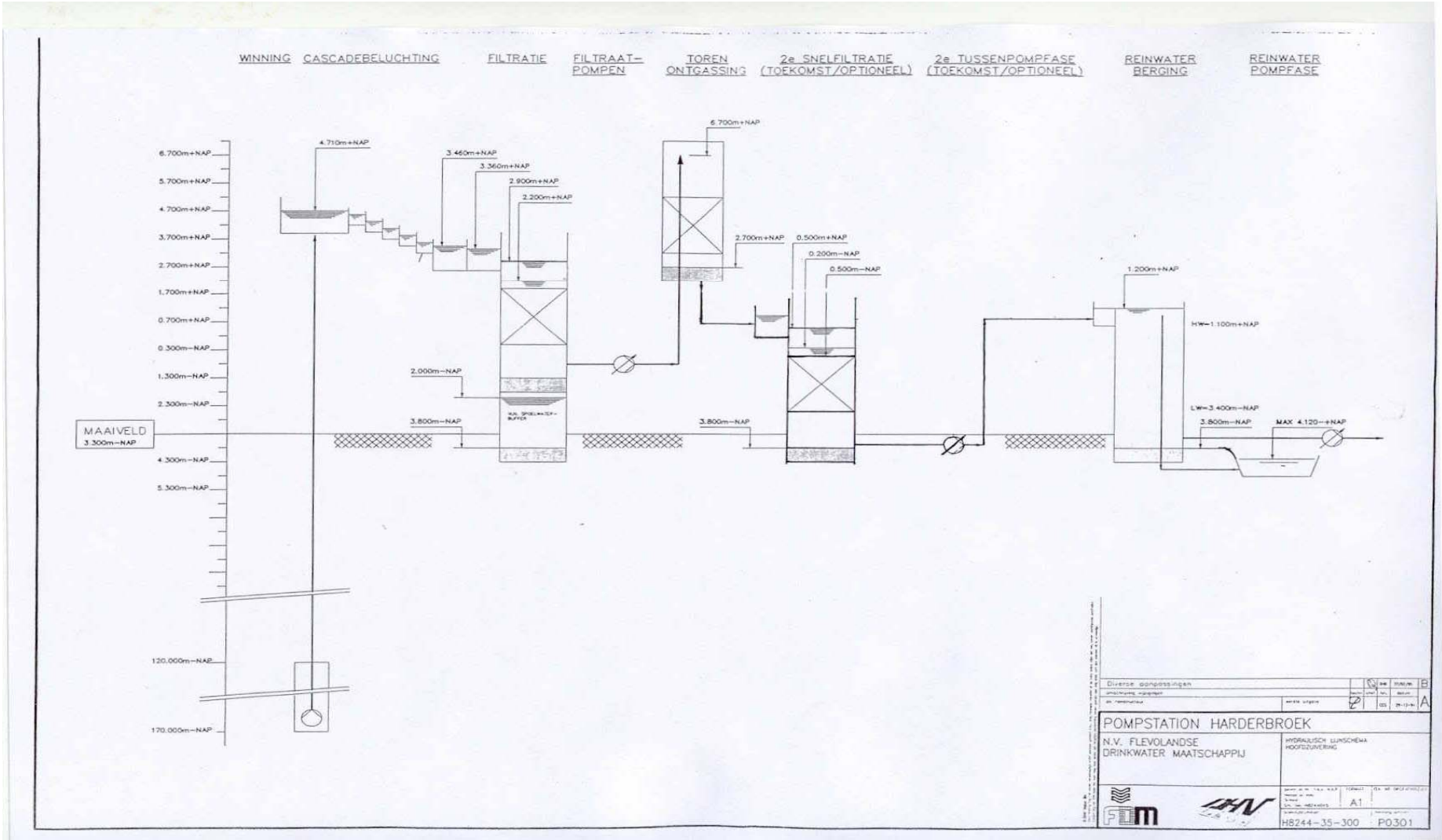
Fe concentration

- The pH is high so the oxydation of Fe(II) is faster
- The flocks are removed through the filtrations
- **GOAL concentration of 0.02 mg/l 90% time**

Hydraulic line scheme



Thanks for your attention

Questions???