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PHREEQc in process control

Operational implementation of PHREEQc in the process control of a surface water treatment

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water van waarde

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Water Laboratory North
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Center for water quality and water technology
Analyses of all types of water and advises on water treatment
Monitoring and improving water quality by chemical, biological and technological research and consultancy

Surface water treatment plant De Punt

- 2012 renovated
- 7.1 Mm^3/y

+ 4.0 Mm^3/y ground water

- Design cap 840 m^3/h

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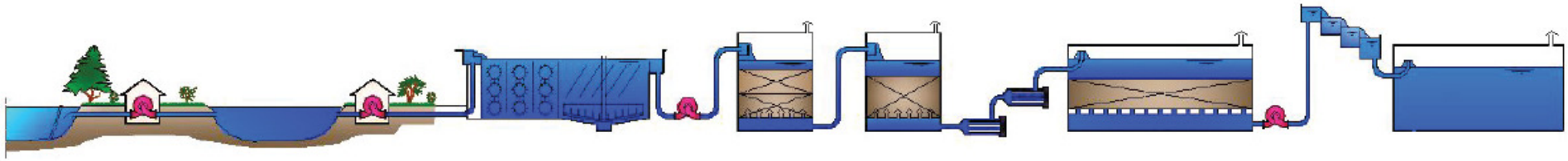
Surface water treatment plant De Punt



Drentsche Aa | Retention basin | Coagulation sedimentation | Rapid SF | ACF | UV disinfection | Slow SF | Cascade aeration | Clear water

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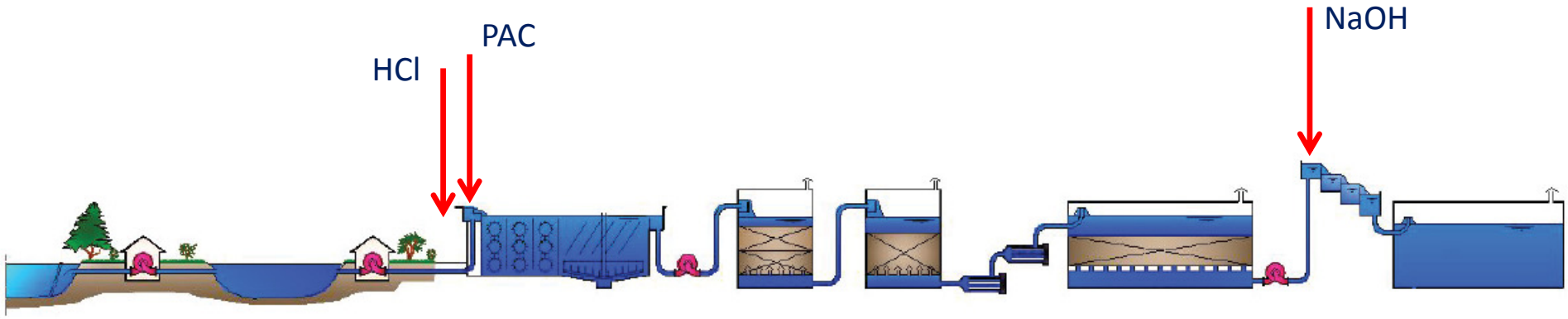
Surface water treatment plant De Punt



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Cascade aeration

- Increasing the pH
- Controlling the saturation-index (by dosing NaOH)
- Increasing amount of oxygen (O_2)

Saturation index

- Degree of over- or undersaturation of calcium carbonate
- $SI = \log \left(\frac{[Ca^{2+}][CO_3^{2-}]}{Ks} \right) = pH - pHs$

- SI > 0: limestone precipitation
- SI < 0: limestone aggressive

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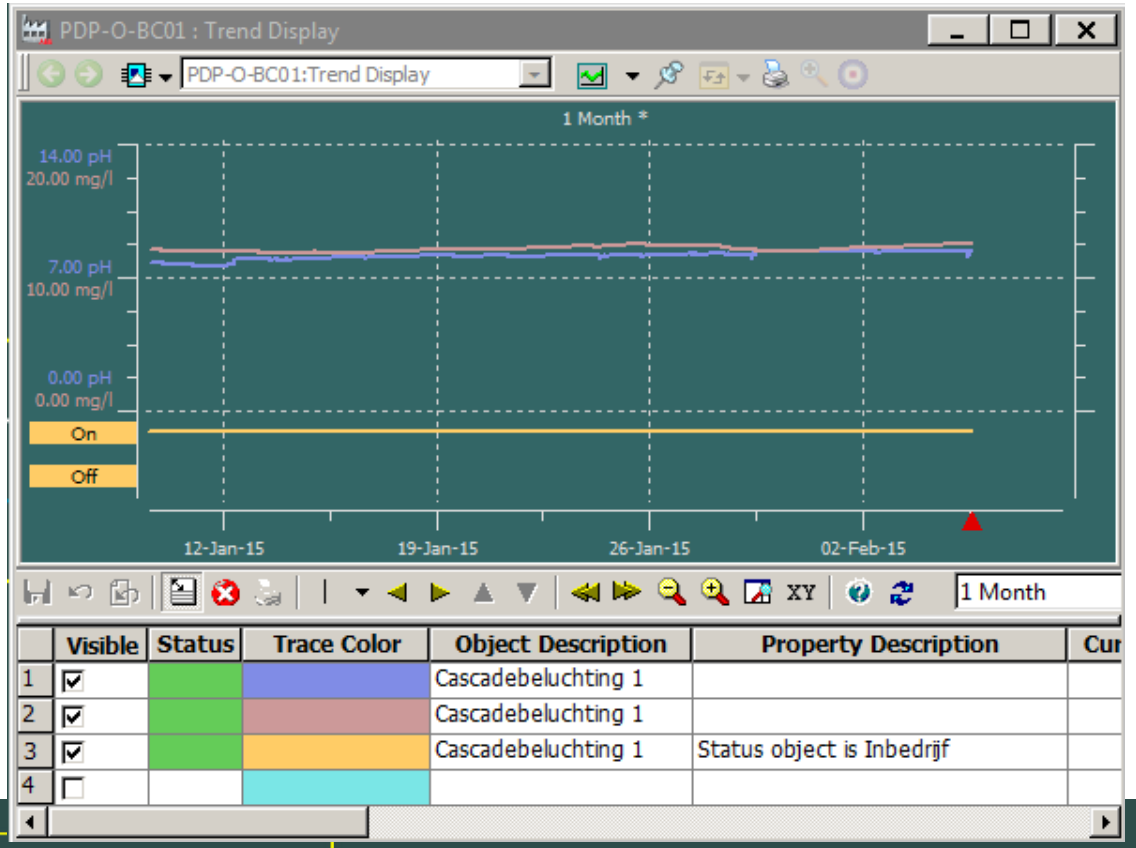
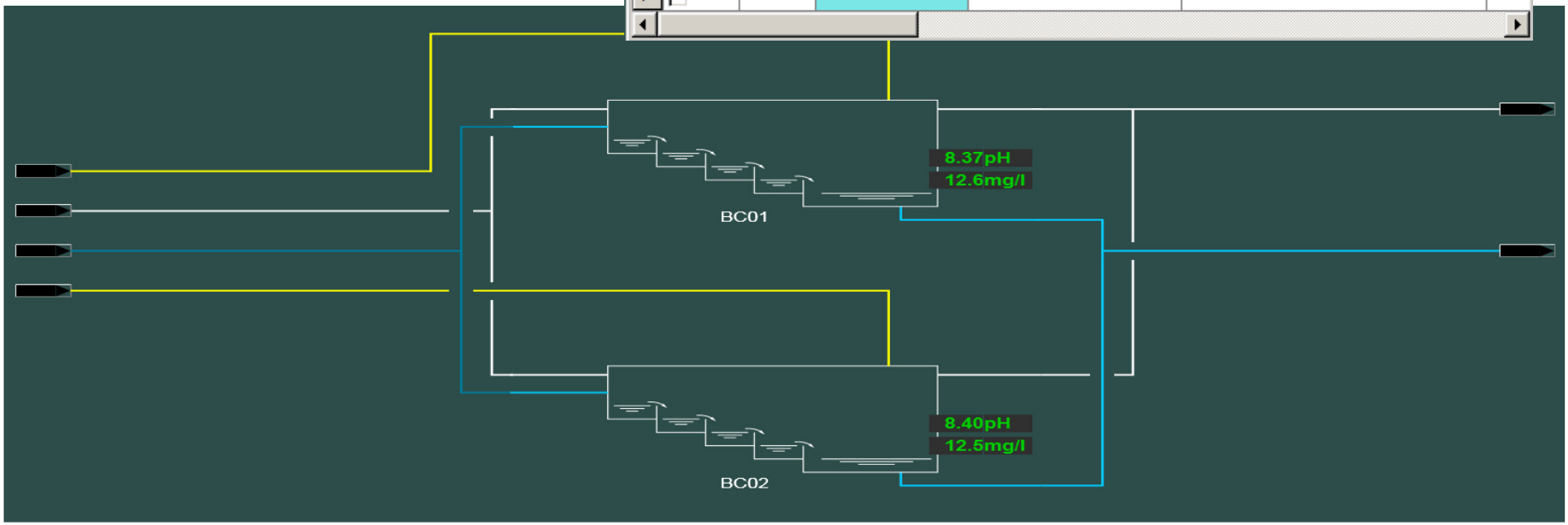
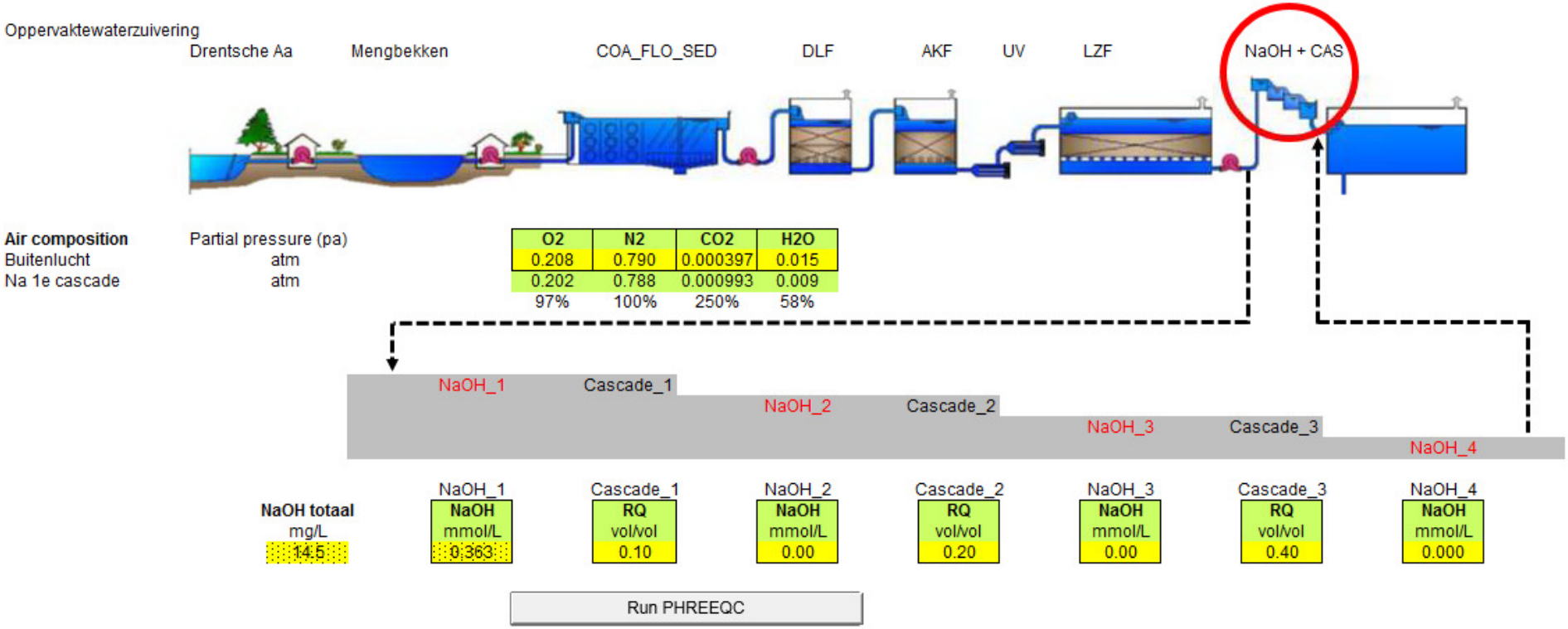
pH control


PDP-O-BC01 : Trend Display
PDP-O-BC01:Trend Display
1 Month *
14.00 pH
20.00 mg/l
7.00 pH
10.00 mg/l
0.00 pH
0.00 mg/l
On
Off
12-Jan-15
19-Jan-15
26-Jan-15
02-Feb-15
1 Month
Visible
Status
Trace Color
Object Description
Property Description
Cur
1 Cascadebeluchting 1
2 Cascadebeluchting 1
3 Cascadebeluchting 1 Status object is Inbedrijf
4


8.37pH
12.6mg/l
BC01
8.40pH
12.5mg/l
BC02

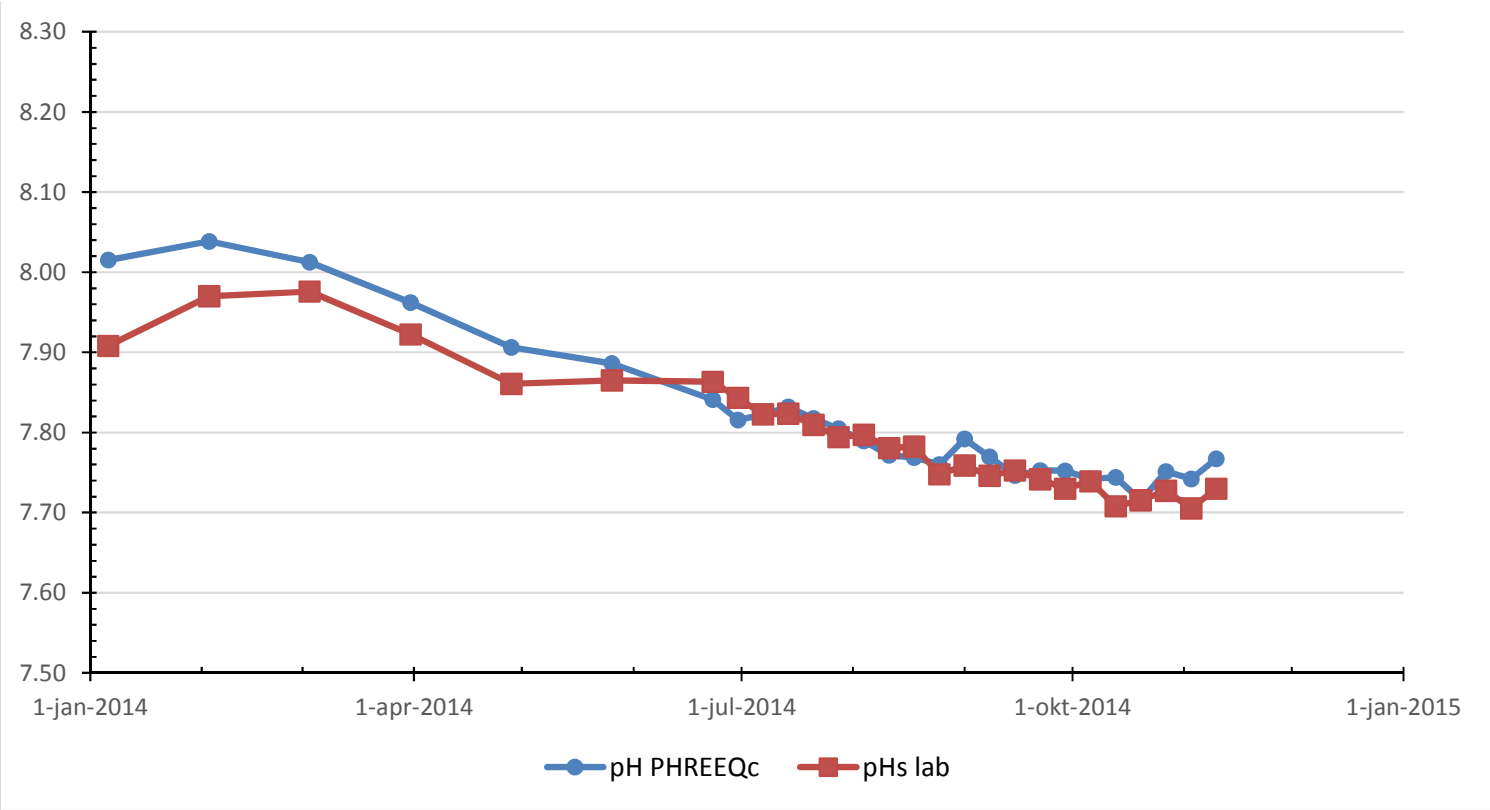
Calculation of pHs with PHREEQc

Input is the raw water, dosing of the chemicals, water flow



Calculation of pHs with PHREEQc

- Historical water quality analysis
- Calibration and validation of the model



Results modelling

- Water quality fluctuates with seasonal influence, but week-to-week limited
- pHs well predicted, but NaOH concentration not accurately

Next step: implementation of the model in operational process control

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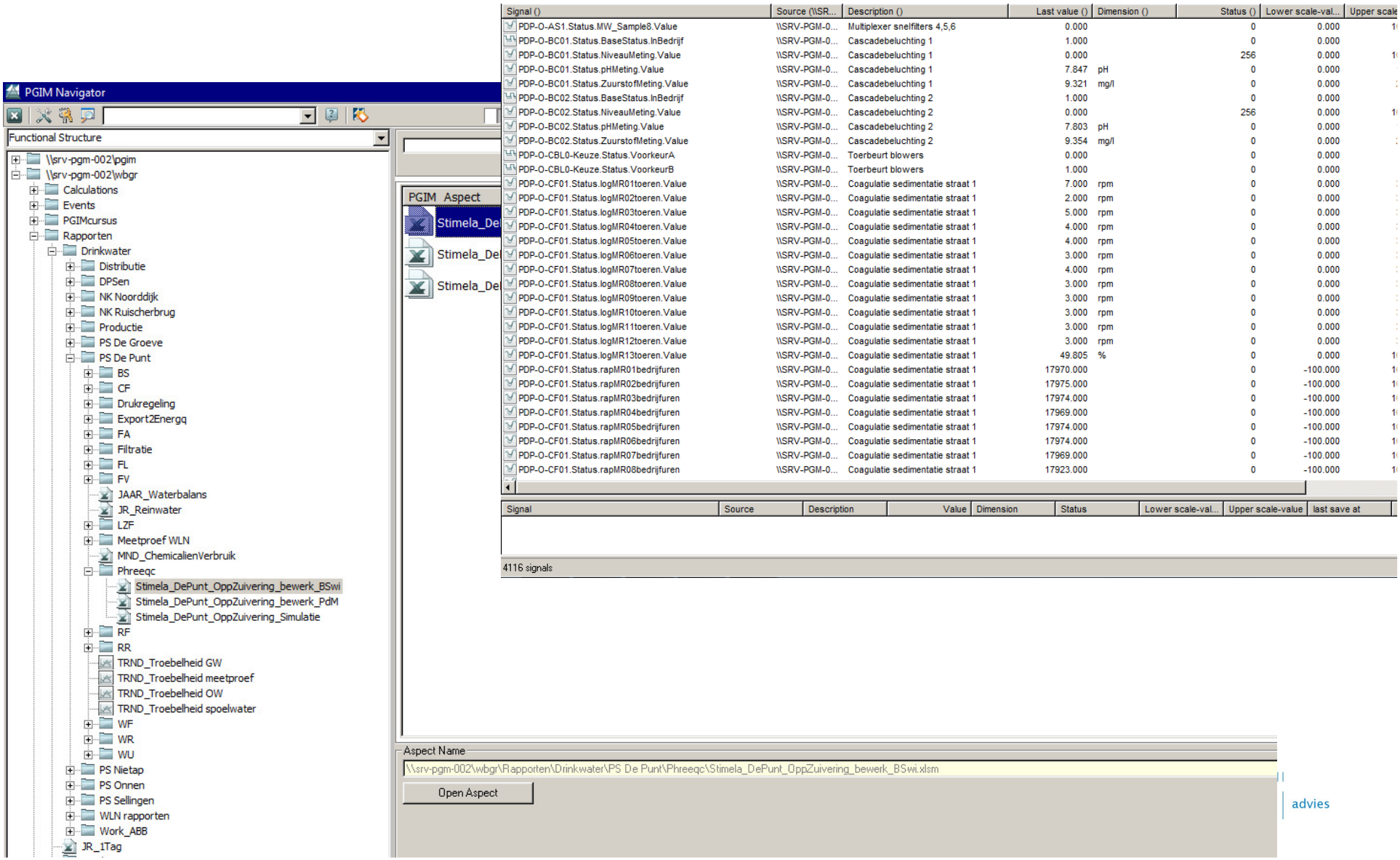
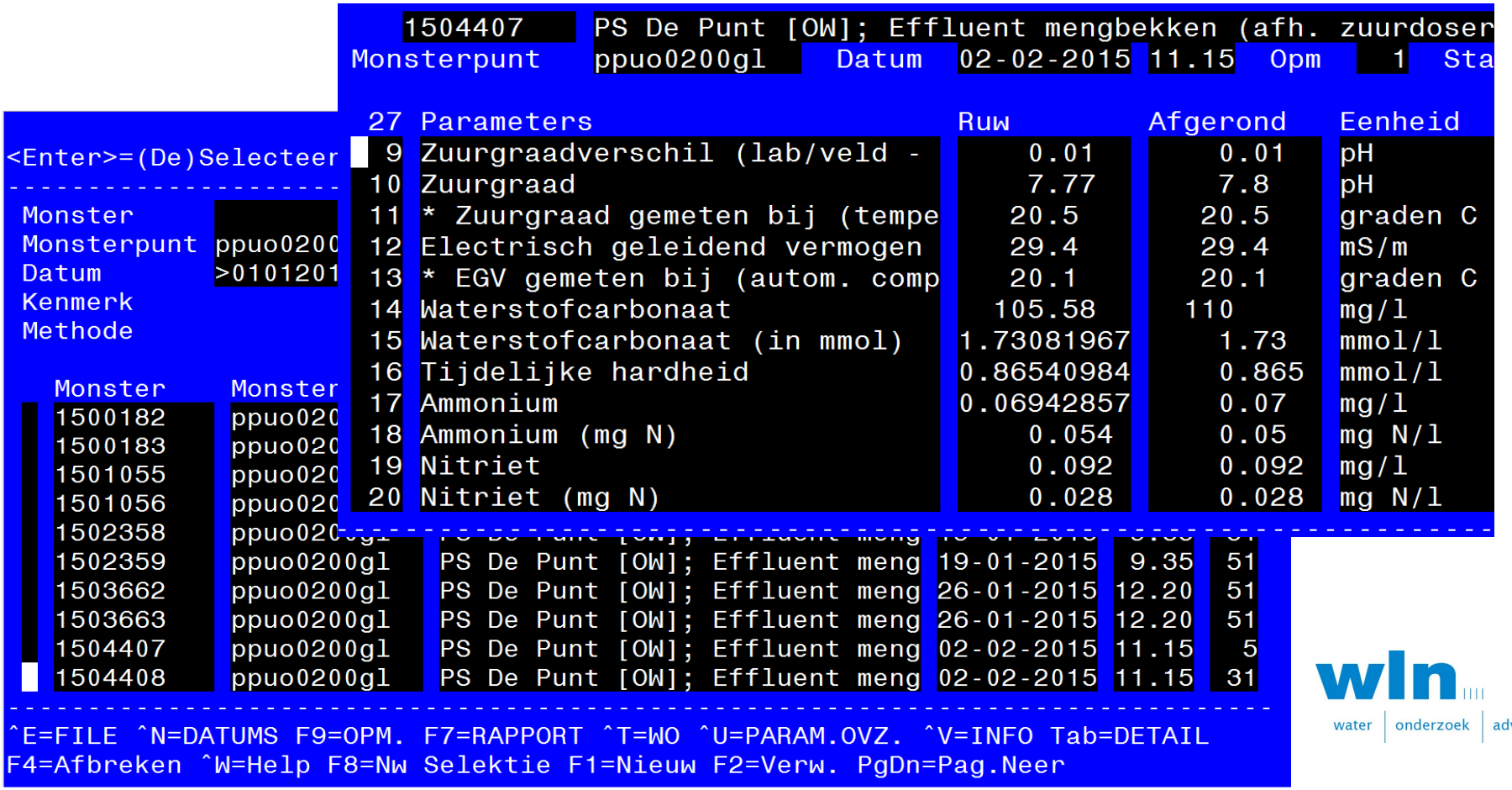
Power Generation Information Manager (PGIM)



Laboratory Information Management System (LIMS)



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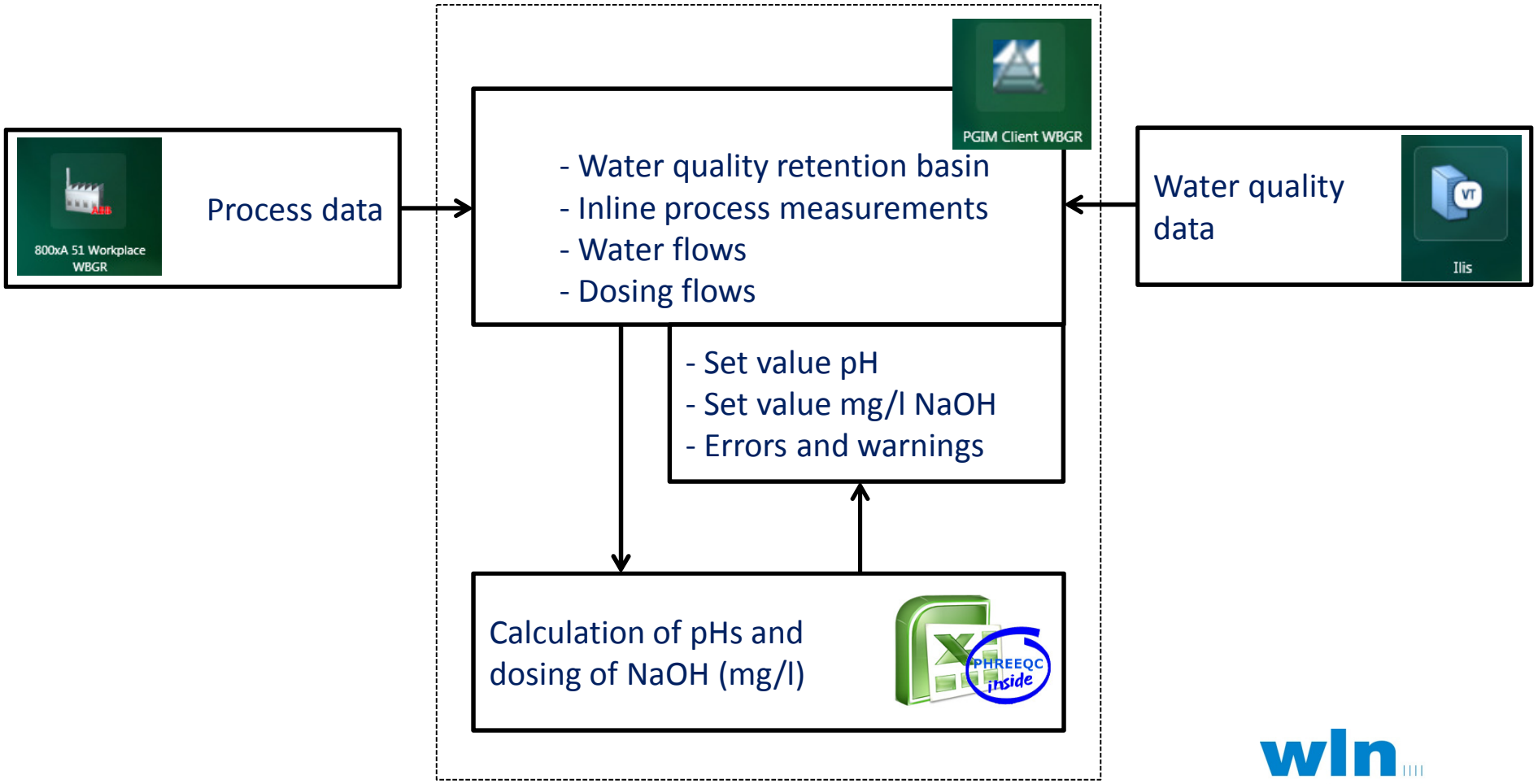
Dataflow



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Operational implementation

- Dashboard for the operators with input for the NaOH dosing
- Errors and warnings if calculated value is not within expected value
- Use model to evaluate entire treatment process
- Learning module for the operators

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Questions??

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