



FrieslandCampina
nourishing by nature

Towards sustainable water management @ FrieslandCampina

Chris Dotremont | 30th June 2022 | Het Nationale Watersymposium

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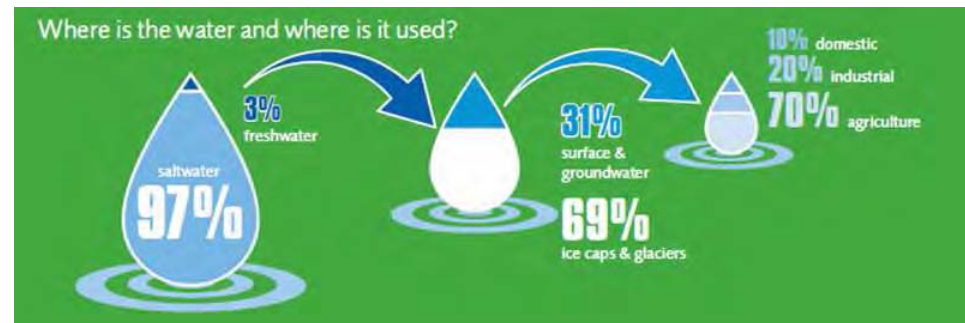
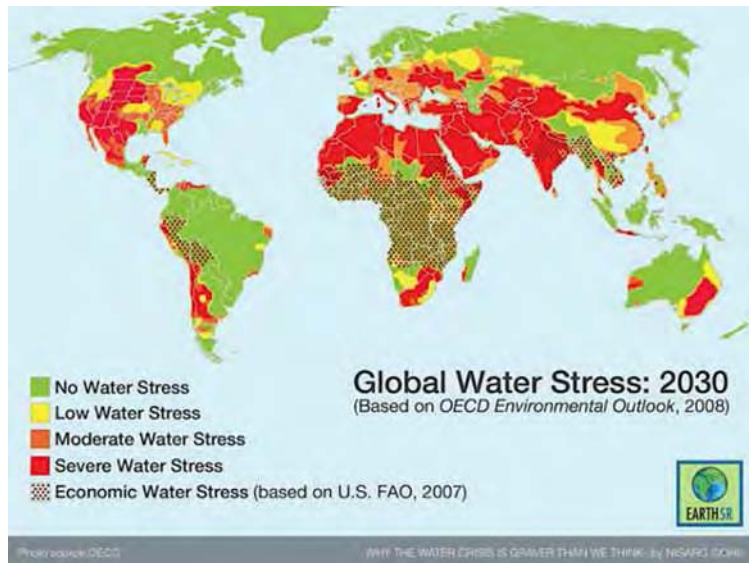
Outline



- A growing sense of urgency for water recycling and re-use
- Legal boundaries
- Minimization of water consumption
- Making water fit for use
- Case Waterballet
- R&D initiatives @ RFC
- Conclusions

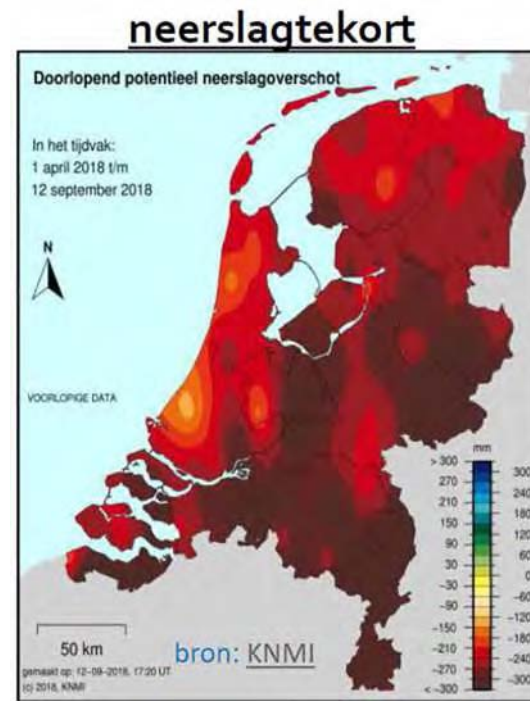
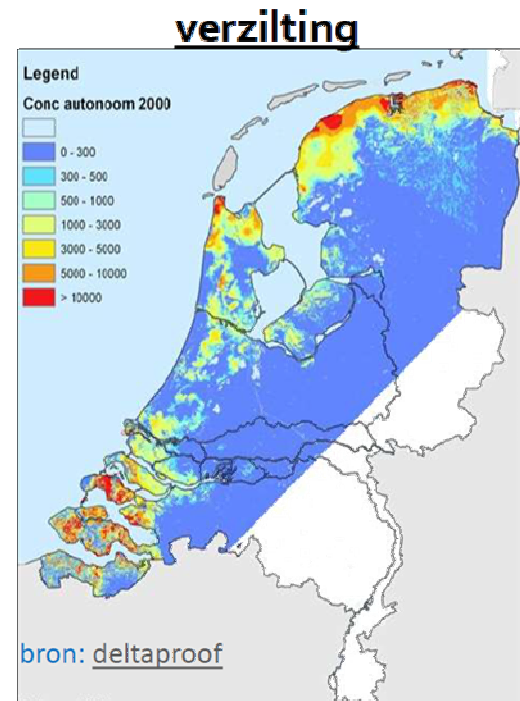
Water: An increasingly scarce resource

- Climate change, population growth, industrialization → great stress on the world's water resources!



Water: An increasingly scarce resource

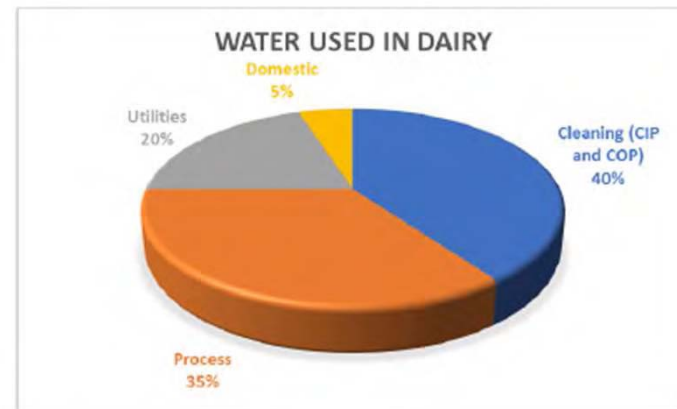
- Also the Netherlands is affected by water scarcity!



Water demand and use in Dairy Industry

- Dairy has a large water footprint → > 30% of the water usage in the food industry

Product	Wastewater discharge flow (m ³ /ton of processed raw material)*
Processed milk	0.32 - 5.07
Cheese	0.78 - 6.20
Powder (e.g. milk, whey)	1.21 - 2.95



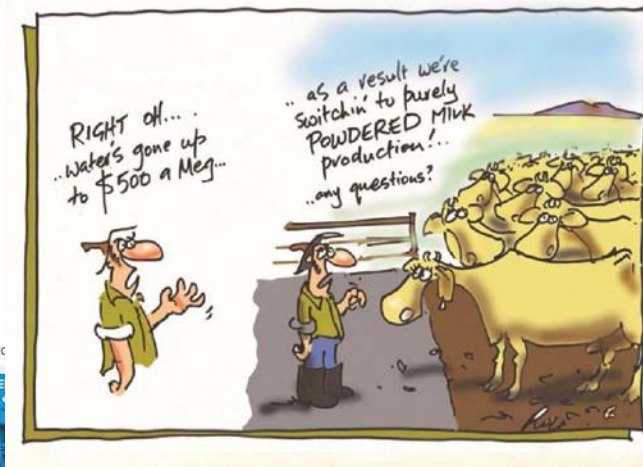
Incentives for water reuse at FrieslandCampina

- License to operate

Tabel 1. De verdringingsreeks (art. 2.1 Waterbesluit).

Categorie 1	Categorie 2	Categorie 3	Categorie 4
- waarborgen veiligheid tegen overstroming - voorkomen onomkeerbare schade	nutsvoorzieningen	Kleinschalig hoogwaardig gebruik	Overige behoeften
1. De stabiliteit van waterkeringen 2. Het voorkomen van klink en zettingen 3. Natuur (voorkomen onomkeerbare schade, anders cat. 4)	1. Drinkwatervoorziening (alleen bij gevaar voor leveringszekerheid, anders cat. 4) 2. Energievoorziening (alleen bij gevaar voor leveringszekerheid, anders cat. 4)	- tijdelijke beregening van kapitaalintensieve gewassen - verwerken van industrieel proceswater	- scheepvaart - landbouw - natuur (geen onomkeerbare schade) - industrie - waterrecreatie - binnenvisserij - overige belangen

- Cost reduction → cost of water ~ 3-4 €/m3



- Reduced ecosystem impact

Our Purpose, Our Plan

nourishing by nature

Better nutrition for the world, a good living for our farmers, now and for generati

Strategic pillars and values:

- Win with nutrition
- Serve the 24/7 consumer & customer
- Lead with sustainability
- Accelerate innovation
- Focus spend
- Unlock supply chain
- Drive digital
- Build winning programs, talent & culture
- Lead people, partners & impact

Compass code of conduct, Safety & Quality
FrieslandCampina mindset & behaviours



Legal boundaries

- Drinking Water Directive (98/83/EC) and Directive on the hygiene of food (852/2004/EC)

Council Directive 98/83/EC (98/83/EC, EU drink water legislation) concerns the quality of water that is intended for human consumption. This directive applies for:

- water in distribution systems serving more than 50 people
- water from tankers
- water from bottles and containers
- water used in the *food industry*

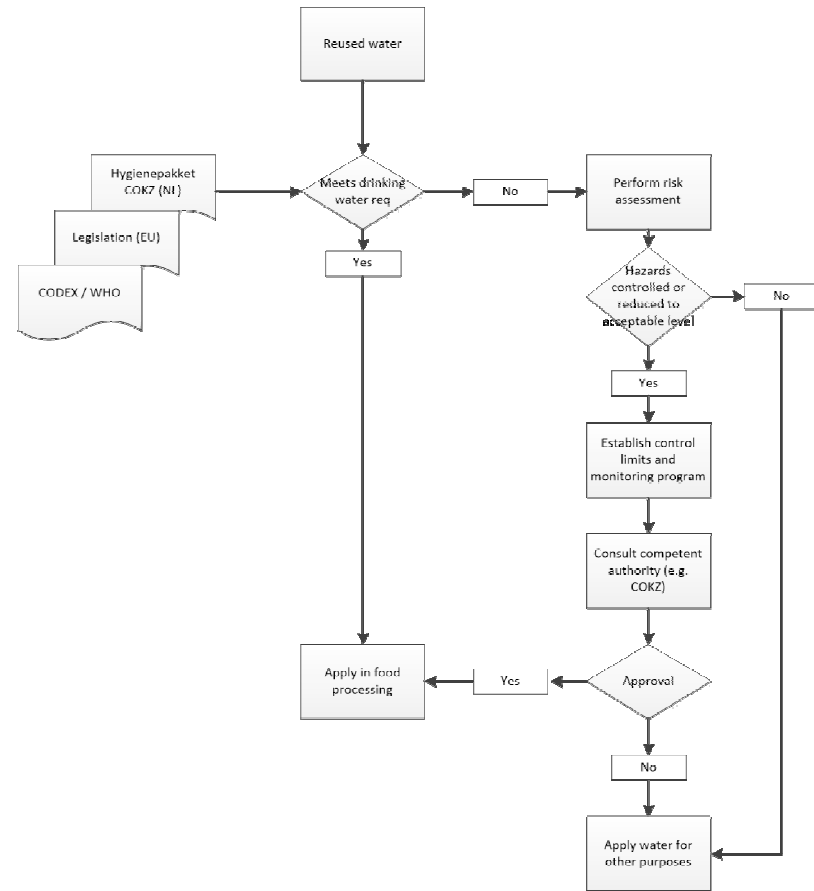
Regarding the last application it is also stated that: “*Water for human consumption*’ shall mean: all water used in any food-production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption *unless the competent national authorities are satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form*”. – a similar remark is mentioned in council directive 852/2004/EC (Regulation No. 852/2004/EC, 2004).

Council directive 852/2004/EC (852/2004/EC) lays down general rules for food production operators on the hygiene of food. In chapter VII of this directive, it is stated that:

“*Recycled water used in processing or as an ingredient is not to present a risk of contamination. It is to be of the same standard as potable water, unless the competent authority is satisfied that the quality of the water cannot affect the wholesomeness of the food in its finished form*”

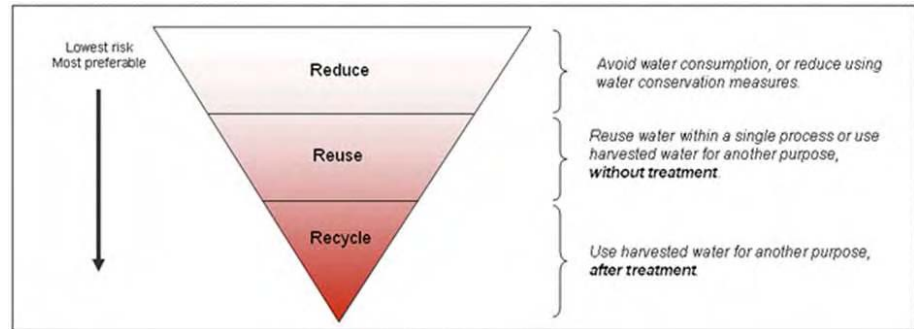
Decision tree

- Water quality meets the drinking water directive?
- Perform risk assessment
- Consult local authorities and seek for approval



Minimization of water consumption

- Step 1:** Develop unit operations that use less water
- Step 2:** Assess water flows in and out, and their quality per unit operation
- Step 3:** Optimize the water circuit
- Step 4:** Direct reuse
- Step 5:** Recycling after reconditioning



Types of water available for reuse/recycling

- Types of water available for reuse/recycling:

- Steam condensate
- Brüden condensate
- RO-permeate
- Permeate polisher



- Secondary treated effluent

Table 1 Composition of milk and related products condensates.

Parameters	Unity	Mean	Range of variation
pH	pH unity	6.6	[5.5-8.1]
Temperature	°C	49.0	[31.2-59.8]
Conductivity	µS/cm	9.8	[4.0-21]
Turbidity	NFU	0.6	[0.1-1.2]
TSS	mg/L	<2	/
Kjeldahl nitrogen	mg/L	0.74	[<0.50-1.7]
COD	mgO ₂ /L	25.3	[5.80-63.0]
BOD ₅	mgO ₂ /L	12.2	[2.10-37.0]
TOC	mg/L	9.9	[4.2-23]
Ammonium (NH ₄ ⁺)	mg/L	0.50	[0.21-0.77]

Table 2 Composition of whey condensates.

Parameters	Unity	Mean	Range of variation
pH	pH unity	7.4	[5.5-9.1]
Temperature	°C	41.3	[18.7-60.5]
Conductivity	µS/cm	22.8	[6.00-33.0]
Turbidity	NFU	0.36	[0.2-0.8]
TSS	mg/L	<2	/
Kjeldahl nitrogen	mg/L	3.1	[<2-5.2]
COD	mgO ₂ /L	56.5	[17.0-98.0]
BOD ₅	mgO ₂ /L	25.5	[1.3-80]
TOC	mg/L	14.4	[5.20-27.0]
Ammonium (NH ₄ ⁺)	mg/L	2.9	[0.38-5.3]

Making water fit for use

- Mature technology
 - Chemical conservation
 - Membrane filtration
 - UV
 - Biofilter
 -



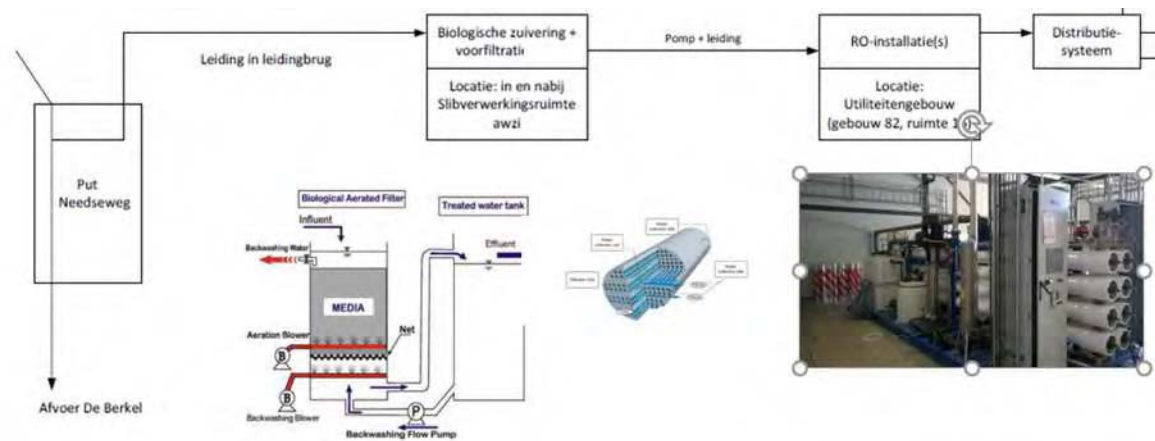
	Ultra filtration	Chlorine	ClO ₂	Ozone	UV
Disinfection capacity	Strongest	Medium	Strong	Strongest	Medium
pH-dependency	None	High	None	Low	None
Depot effect	None	Hours	Days	Minutes	None
Disinfection By Products	None	AOX – THM – HAA + other organic halides	Chlorite	Evt. Bromate	Evt. Nitrite
Resources	Electric energy	Hypo-chlorite	HCl & NaClO ₂	Electric energy, air or O ₂	Electric energy

Making water fit for use

- Shelf life for water storage without any preservation

Water Source	Available carbon (mg/l)	Nitrogen (mg/l)	Phosphorous (mg/l)	Trace components (Potassium) (mg/l)	Max. advised shelf life	Max. advised cleaning interval
Drinking water/ Well water	~0,02	<0,5	~0,05	~5	1 day	0,5 y
Brüden condensate	~20	~1-5	~0,05	<1	3 h	Strongly depends on quality
RO permeate	~20	~50	<0,001	<0,001	3 h	Strongly depends on quality
Polished RO permeate	~10	~20	<0,001	<0,001	1 day	0,5 w

Water reuse and recycling @ Borculo: Project Waterballet



Water reuse and recycling @ Borculo: Project Waterballet



The Biologically Aerated Filter (BAF), outside in 'waste water' area'



Ceramic Microfiltration In 'waste water area'



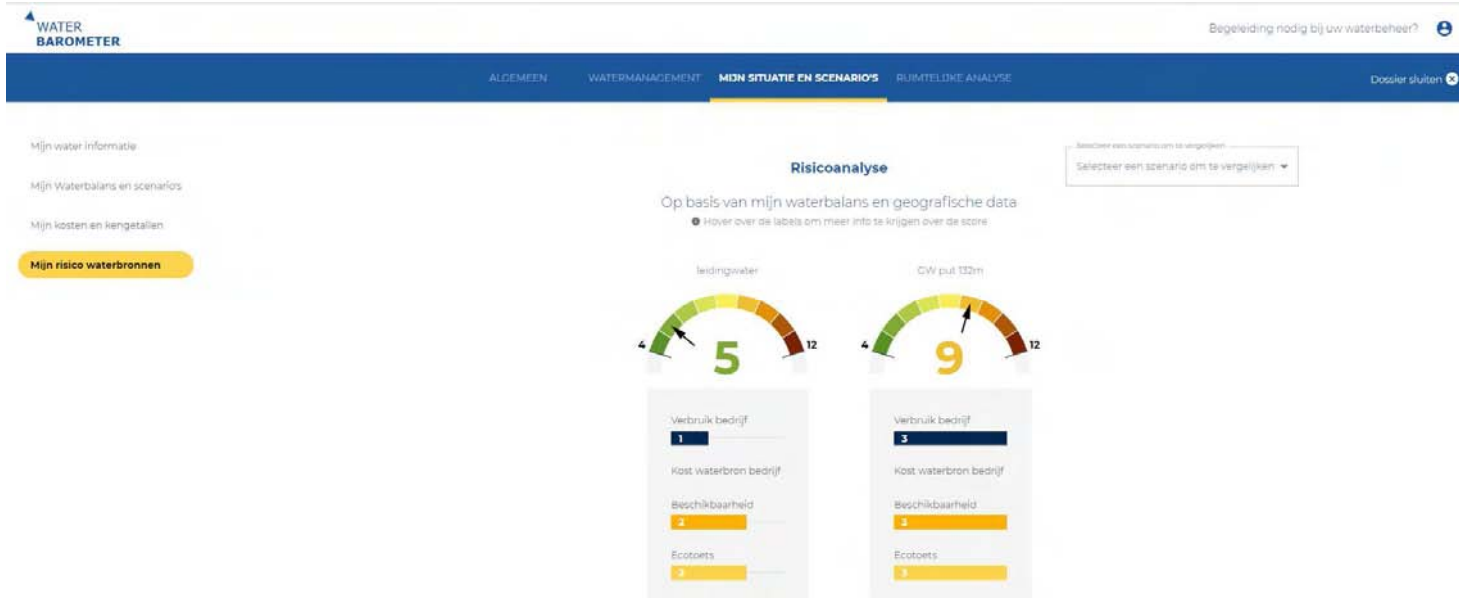
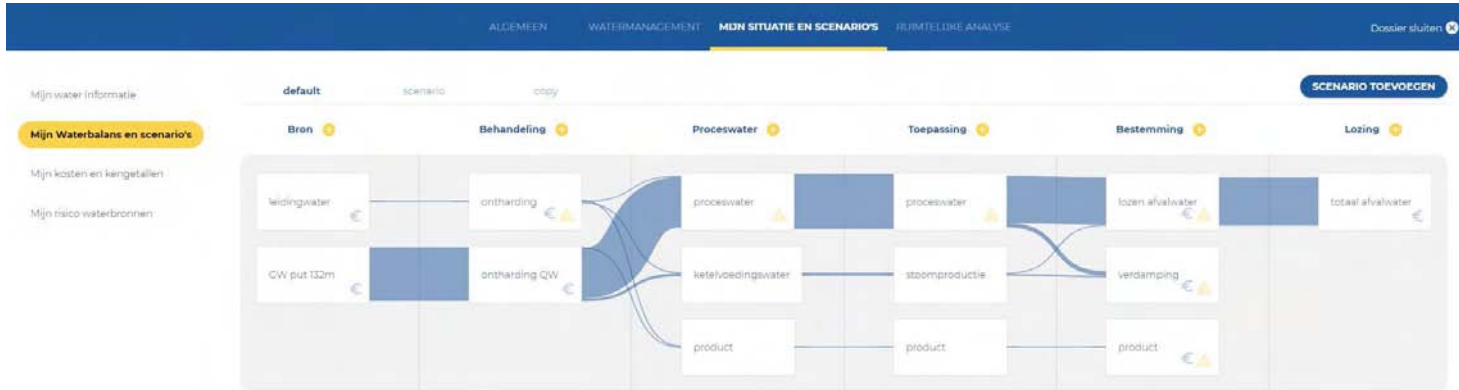
RO installation in 'Drinking water area'. At borders feed and permeate tanks. IBC tanks for chemical cleaning.

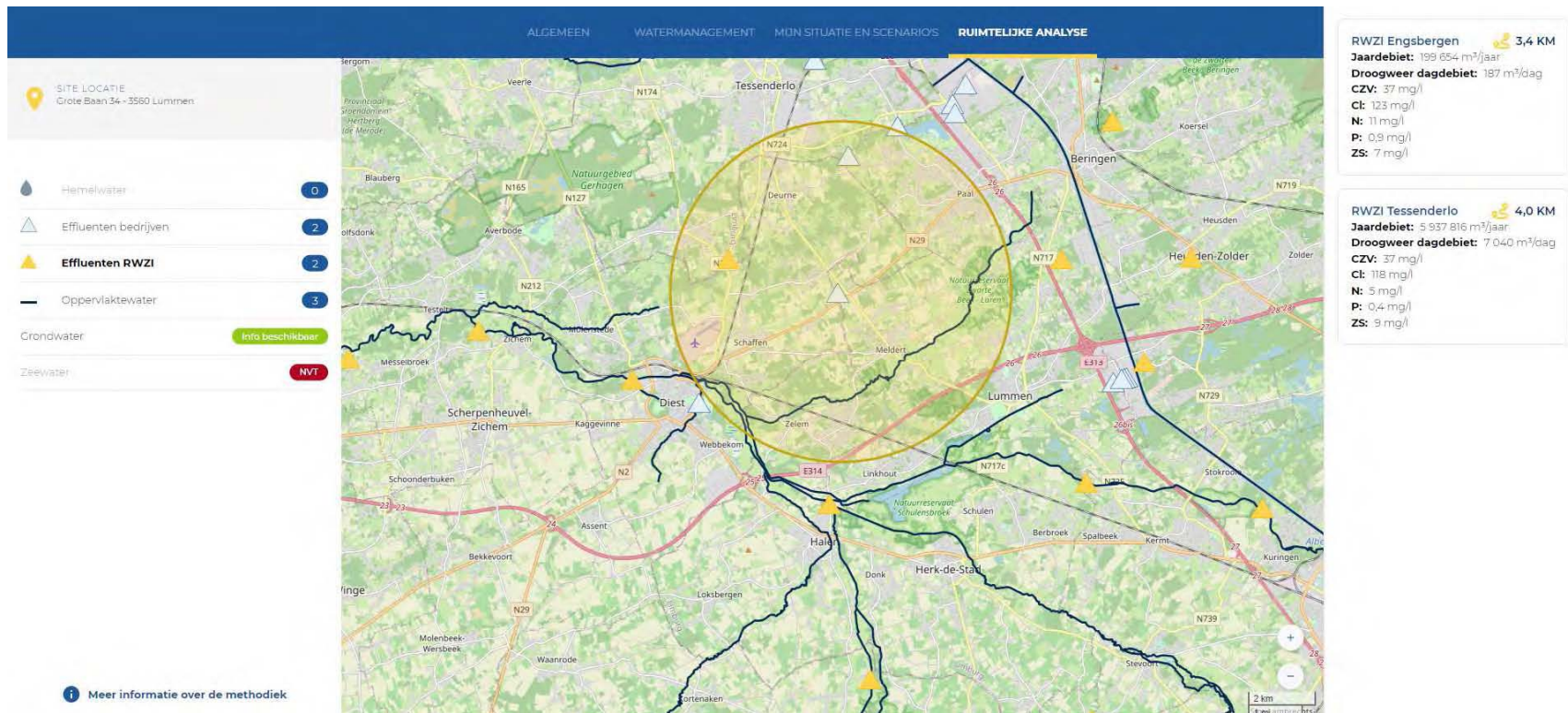


One destination line on the piping bridge

R&D project 1: Smart Water Re-Use

- Initiator
- R&D partner
- Goal:
 - develop
 - oppo
 - eval
 - over





R&D project 2: Water Re-Use from Dairy Industry to Farmers

- WiCE-project:

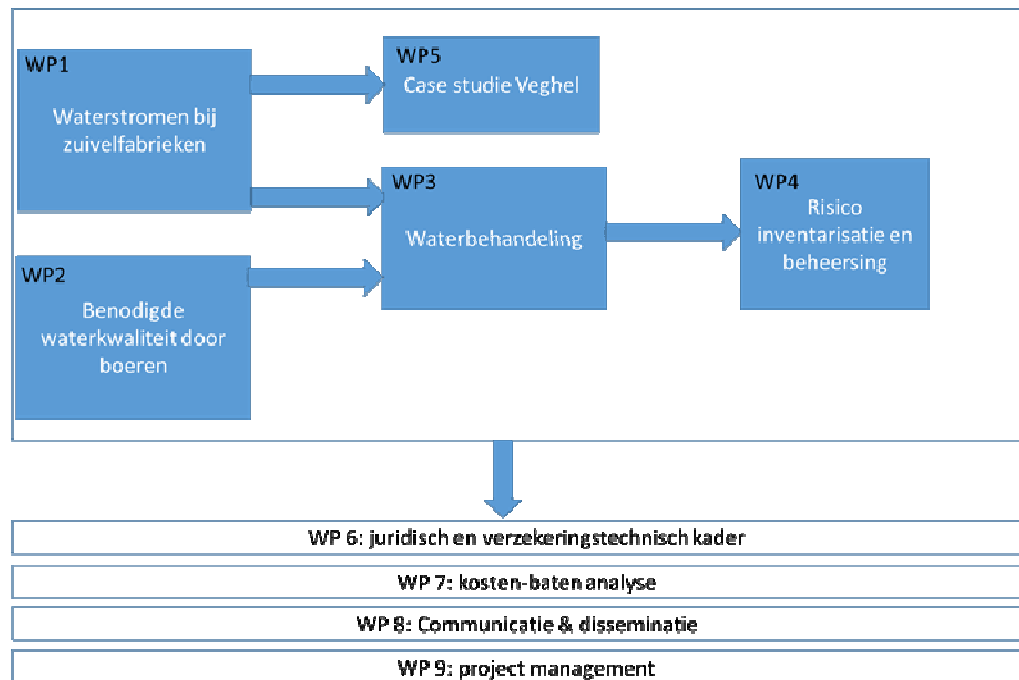
<i>Naam project:</i> Vermindering druk grondwater door waterhergebruik van zuivel naar landbouw	
<i>WiCE onderzoeksthema</i> Zuinig met Zoet	
<i>Hoofdaanvrager</i> KWR Water BV	<i>Contactpersoon hoofdaanvrager</i> Nienke Koeman
<i>E-mail hoofdaanvrager</i> nienke.koeman@kwrwater.nl	<i>Telefoonnummer hoofdaanvrager</i>
<i>Opdrachtgever</i> Kerngroep WiCE	<i>Contactpersoon opdrachtgever</i> Joep van den Broeke
<i>Partners</i> Waterbedrijven binnen WiCE (Vitens, WML, Waterbedrijf Groningen, Brabant Water,) Waterschap Aa en Maas, ZLTO, Provincie Brabant, FrieslandCampina	

R&D project 2: Water Re-Use from Dairy Industry to Farmers

- Doel: water afkomstig van zuivelfabrieken beschikbaar maken voor de agrarische sector → stap richting kringlooplandbouw!
- Impact: alle ontbrekende elementen aanleveren om de waterkringloop veilig en economisch te sluiten, met name:
 - kwaliteit van industrieel afvalwater in de zuivel
 - benodigde kwaliteit van water in de landbouw
 - BBT voor hergebruik van afvalwater in de zuivel
 - gevolgen voor het milieu (watersystemen)
 - pathogene routes van door water overdraagbare ziekten in de route koe - zuivel - afvalwater - voedergewassen – koeien
 - juridische en verzekeringstechnische risico's
 - kosten-batenanalyse van de voorgestelde oplossing

R&D project 2: Water Re-Use from Dairy Industry to Farmers

- Plan van aanpak:



Conclusions

- Water is an increasingly scarce source
- Dairy sector has a large footprint
- Council Directives 98/83/EC and 852/2004/EC are relevant for water quality in food industry and provide the possibility for the reuse of water
- Minimization of water consumption is based on R³ principle (Reduce – Reuse – Recycle)
- HACCP plans for water reuse & recycling should be in place and approved by local authorities
- Treatment technologies for water recycling are matured
- Increasingly number of show cases (Borculo, Aalter, Workum, Gerkesklooster, Lutjewinkel)
- R&D initiatives to guide us in reducing our water footprint!

Sustainability in our heart and mind!

Questions?

