Interreg North Sea

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Source-Separated Systems in Practice

Learning from the Super Local Demo Site

waterschap limburg

November 26 2025

Kerkrade

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gemeente amsterdam

KWR

Stockholms stad

NSVA
NORDVÄSTRA SKÅNES VATTEN OCH AVLOPP

SOURCE-SEPARATED SYSTEMS IN PRACTICE

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Let’s hoist the sails!

Welcome

Henk-Jan van Alphen

SOURCE-SEPARATED SYSTEMS IN PRACTICE

AGENDA

- 10:00 Opening remarks
  Arnold Jansen, Board member, *Waterschap Limburg*
- 10:15 Lessons learned from the Super Local demo site
  Ad de Man, *Waterschap Limburg,* Geraldine Minten, *WML and* Roberta Hofman-Caris, *KWR*
- 11:00 Panel
  Rethinking the City: New Perspectives on Circular Urban Planning
- 12:00 Networking lunch & guided site tour of Super Local
- 14:00 End

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ANCHOR

- By employing a **unique EU demo network** in Belgium, the Netherlands, Germany and Sweden with **source separation technology**, and expanding it with **new pilots**
- By mapping the impacts of **decentralized water systems** in urban areas
- By closely **engaging with stakeholders**
- By delivering **practical tools and transition knowledge**

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SOURCE-SEPARATED SYSTEMS IN PRACTICE

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Let's hoist the sails!

Opening remarks

By Arnold Jansen
Board member

waterschap limburg

DEMO CASE

SUPERLOCAL

Kerkrade

Ad de Man, Waterschap Limburg
Geraldine Minten, WML
Roberta Hofman-Caris, KWR

ANCHOR KICKS OFF

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HEEMWONEN

gemeente kerkrade

waterschap limburg

met de omgeving, voor de omgeving

wml Limburgs drinkwater

De Watergroep

Topics

- Arguments
- The concept
- Timeline
- Rainwater treatment
- In house systems
- Black water treatment
- Grey water treatment
- Key issues
- Lessons learned
- Program 2026 and 2027

Why ?

CIRCULAIR GREEN NEIGHBORHOOD

Climate change
Extreme rain events and droughts

Circular economy
Reuse of water
Reuse of nutrients and organic matter

Well-being
- Social cohesion
- More water and environmental awareness

How ?

Gain :

practical experience with the closed water cycle

Information to make transitions possible

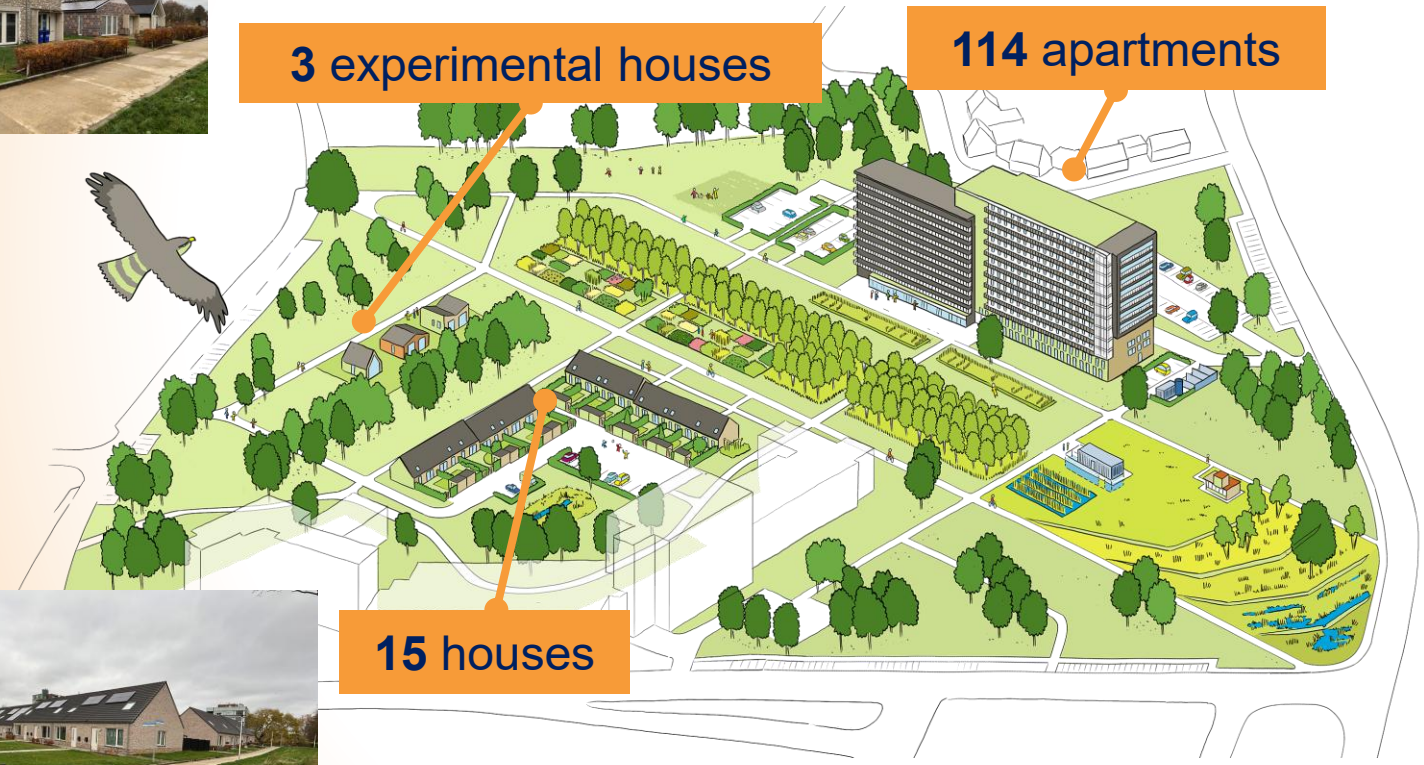
Determine :

the benefits/values of this concept in comparison with the conventional waterchain

social acceptance

The role of the stakeholders in this project/future projects

Total area : 1,5 ha
Paved area : 11.500 m²
Roof apartment building: 1.100 m²



250 residents
(tenants)

TIMELINE

Expectation

2012 -2013
District of Tomorrow

2014-2015
Promoting 0-water concept

2016
Pitch WL + WML at Superlocal Heemwonen

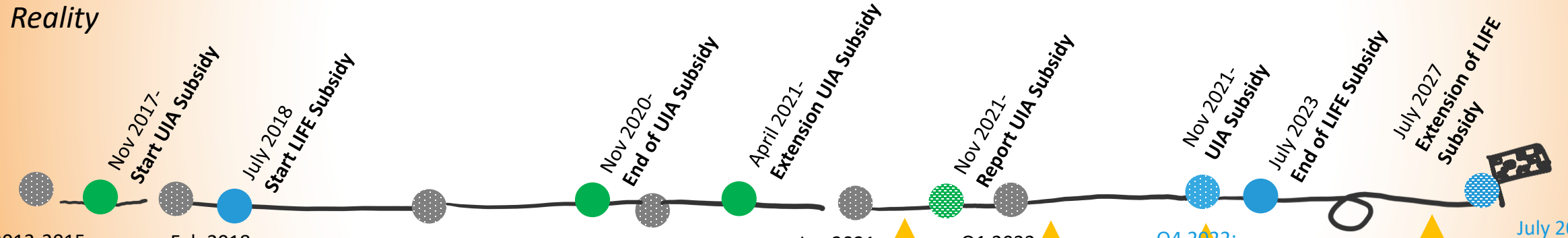
Public funding LIFE/UIA
Design buildings &
Closed watercycle

2017-2018
Partnership Heemwonen, Municipality, WL and WML

Nov 2020:
End of UIA subsidy
Monitoring closed watercycle UIA completed

July 2023 :
End of subsidy LIFE
Monitoring
Closed Watercycle LIFE completed

Reality



2012-2015
Wijk van morgen

Nov 2017-
Start UIA Subsidy

July 2018
Start LIFE Subsidy

Feb 2018:
Expo gebouw

Mid 2020:
experimental houses

Nov 2020-
End of UIA Subsidy

Q4 2020:
15 circular houses built

April 2021-
Extension UIA Subsidy

Jan 2021:
First inhabitants

Nov 2021-
Report UIA Subsidy

Q1 2022:
houses/apartment building inhabited

Nov 2021-
UIA Subsidy

July 2023
End of LIFE Subsidy

July 2027
Extension of LIFE Subsidy

Q4 2022:
Closed Water Cycle functional

July 2027:
Monitoring Closed Watercycle completed

In house watersaving system installed

Start monitoring grey water treatment

Start monitoring black water treatment

Start monitoring rain water treatment

Start post treatment grey water

LIFE LOCAL WATER ADAPT
LIFE 17 CCA/NL/000043

TIMELINE AREA DEVELOPMENT

May 2023

Rainwater treatment system being installed, helophyte filter installed and tested, construction apartment building in progress,

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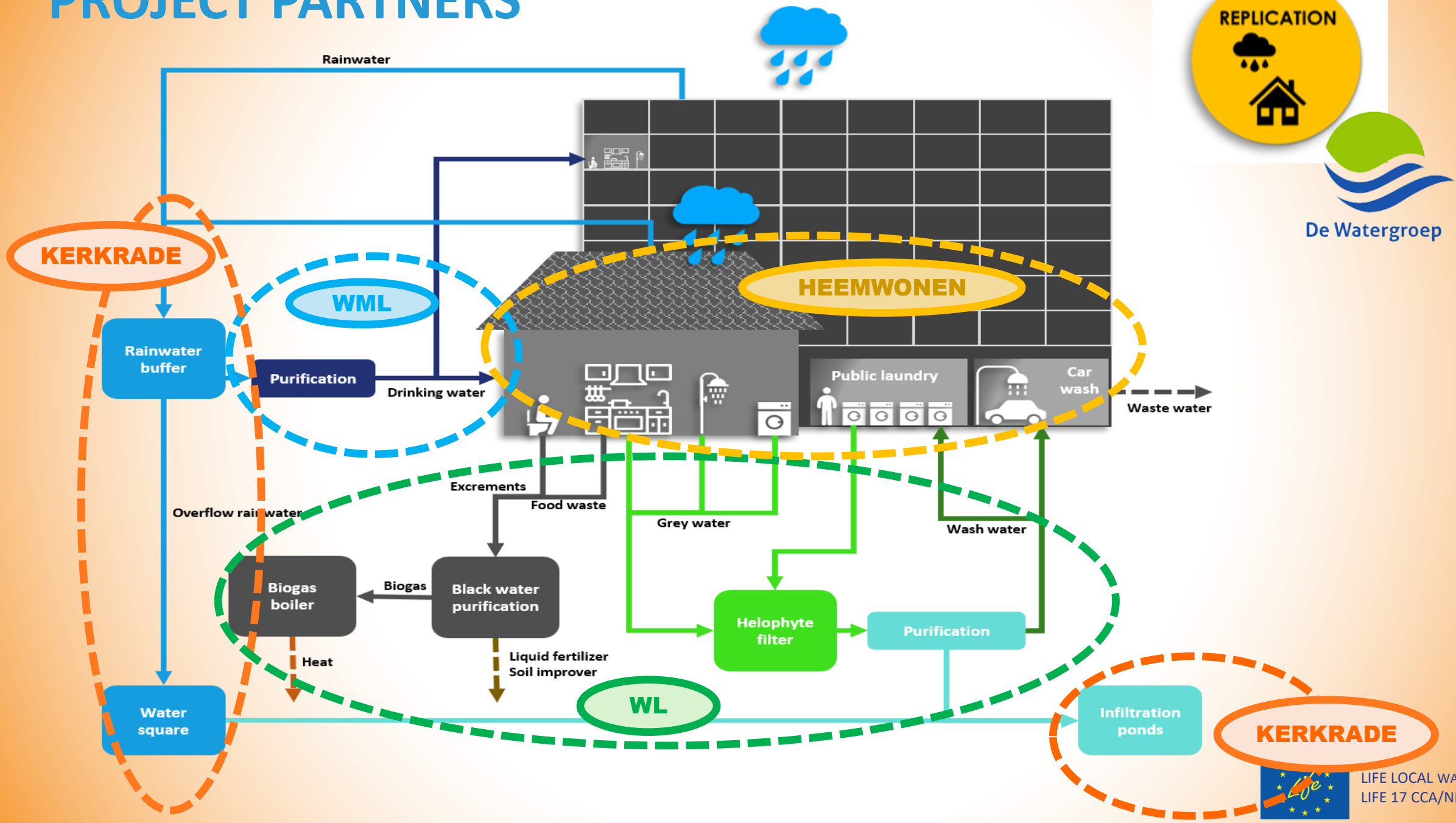
LIFE 17 CCA/NL/000043

PROJECT PARTNERS

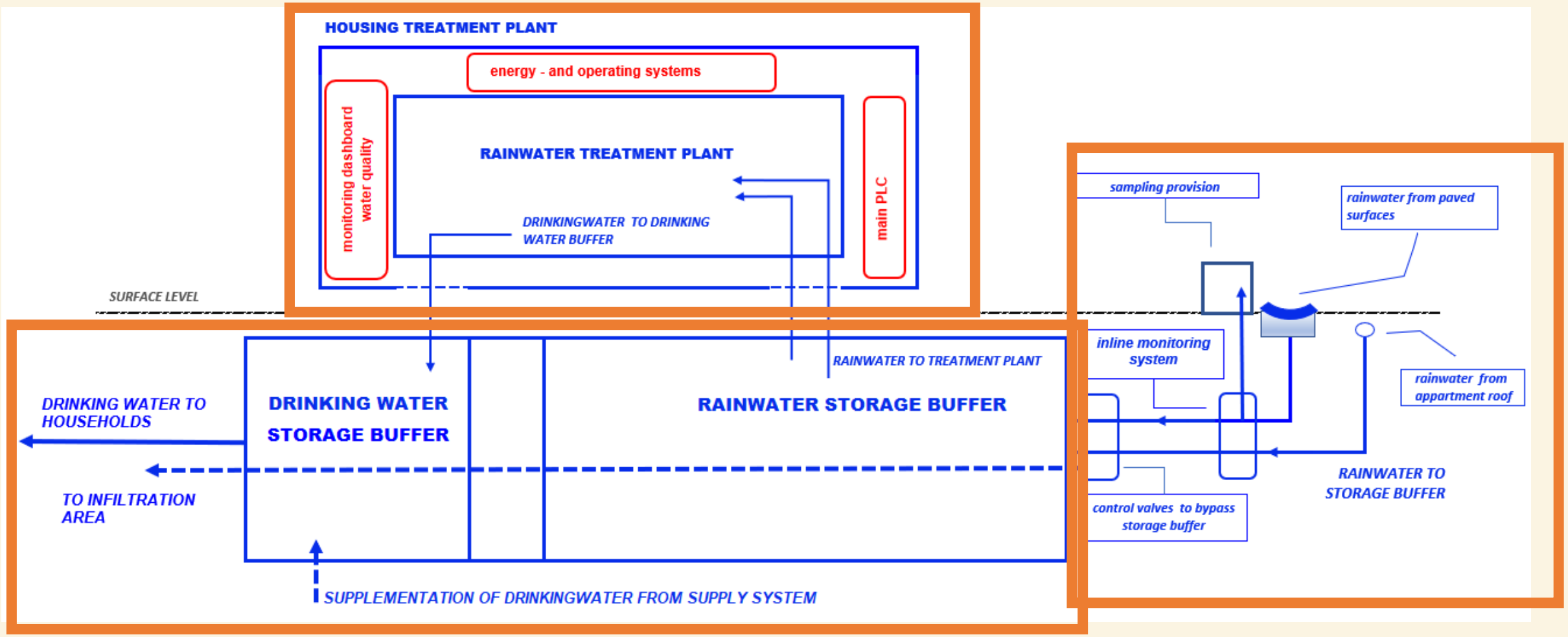


REPLICATION

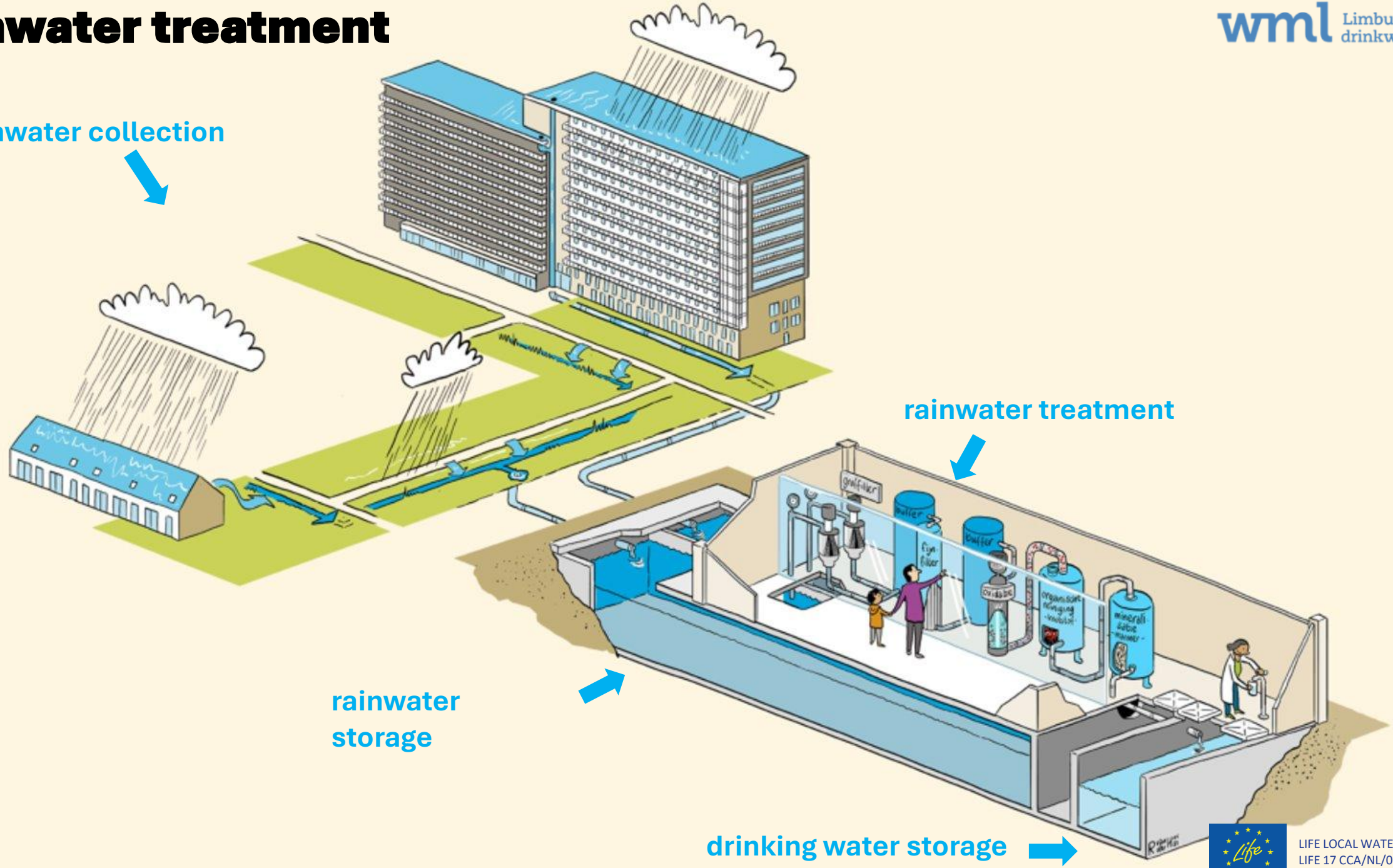
De Watergroep

Rainwater treatment

Schematic overview



Rainwater treatment



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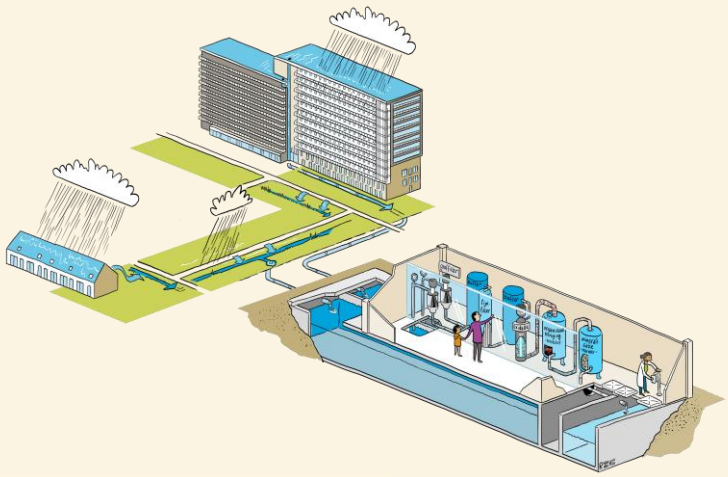
Rainwater treatment



1- 2,5 m^3/h

Source : rainwater of roof apartment building and concrete pathways

Rainwater quality

Determined by:

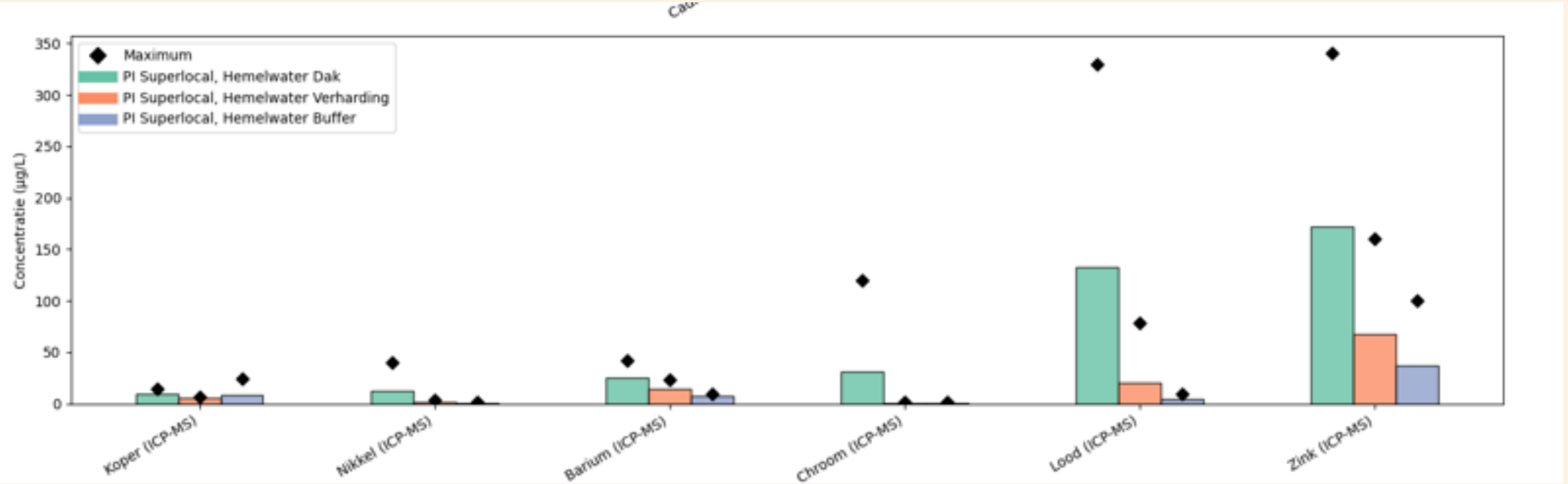
- Rain water (surroundings)
- Surface
- Collection system
- Number of dry days before harvesting

Surface:

- Composition
- Location in area
- Orientation and slope

Analysis data: roof versus hard surface

- Metals: roof collection system dak contains zinc and lead
- Dutch Drinking Water Decree: Pb 5 µg/L, Zn 3 mg/L



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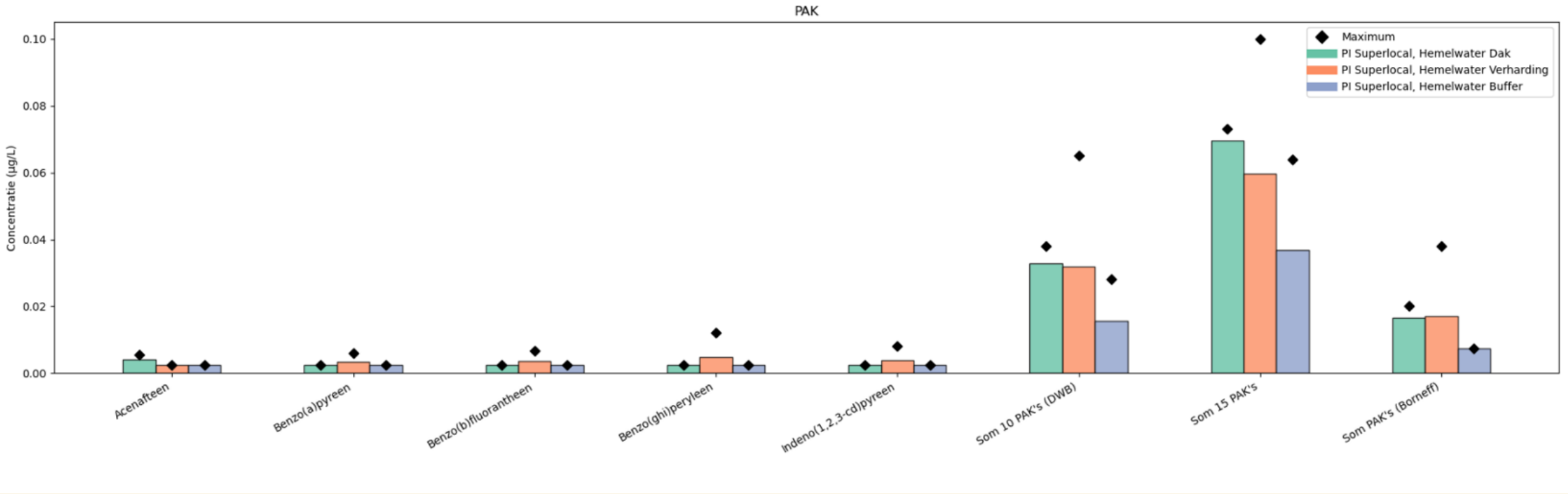
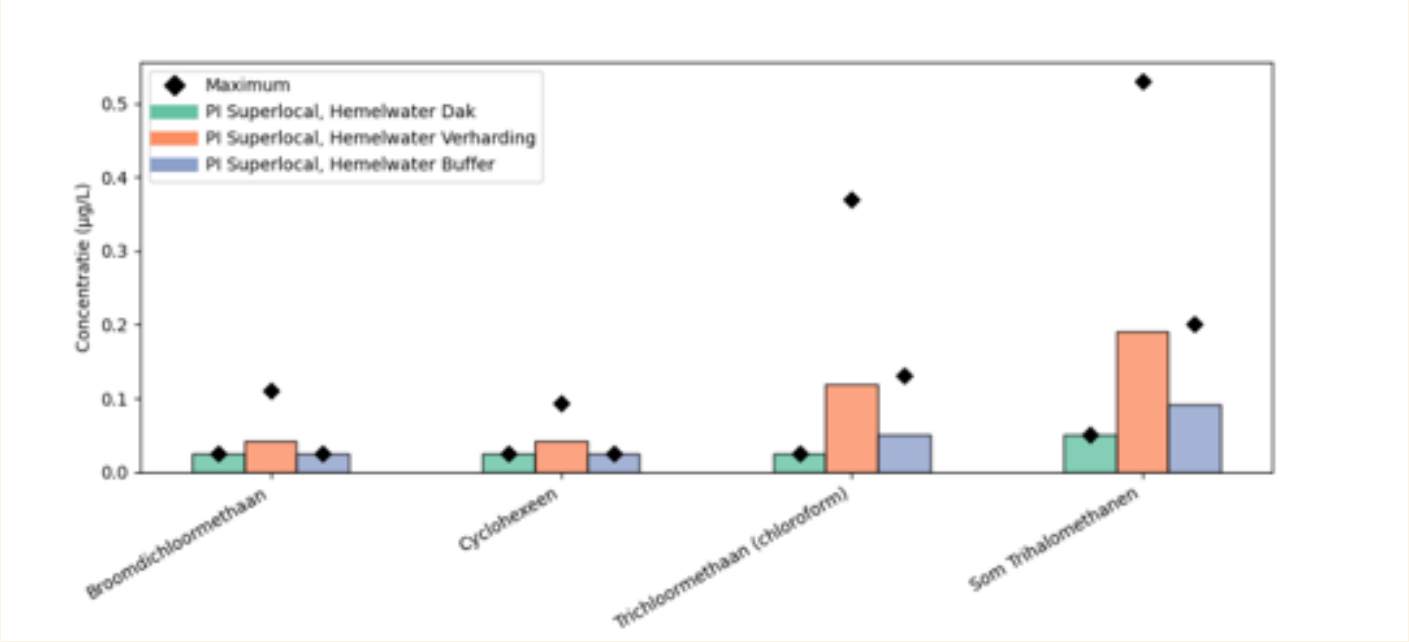
Analysis data: roof versus hard surface

- PAKs both from roof and hard surface



Analysis data: roof versus hard surface

- Halomethanes: cleaning using chlorine on hard surface?
- Dutch Drinking Water Decree: trihalomethanes < 1 µg/L



LIFE LOCAL WATER ADAPT
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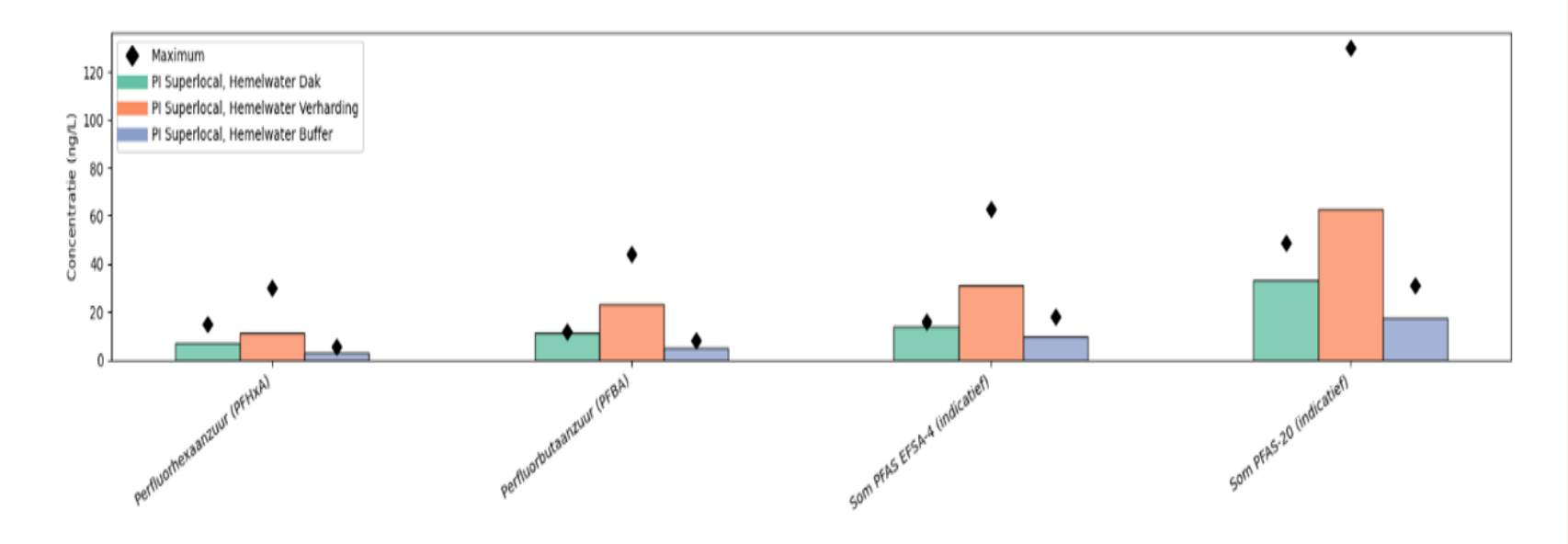
Analysis data: roof versus hard surface

- Sum 4 PFAS >> guideline value 4,4 ng/L!
- Sum 20 PFAS < 100 ng/L

- “It’s raining PFAS” (Cousins, 2022)



LIFE LOCAL WATER ADAPT
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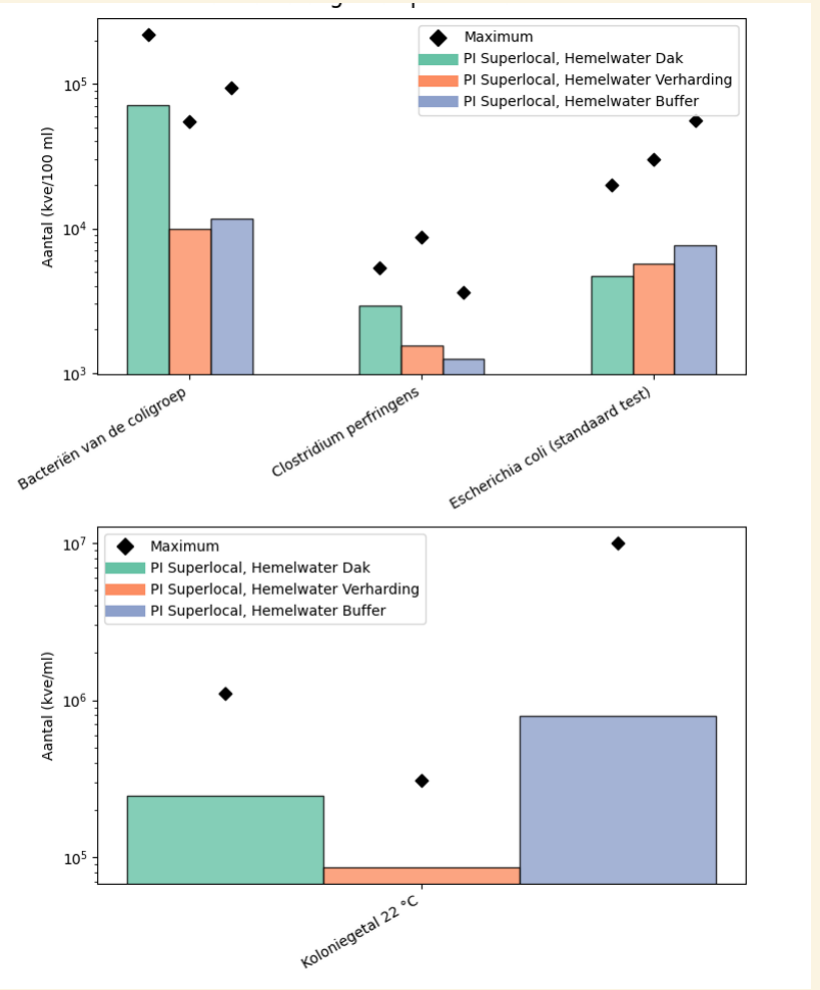
Analysis data: roof versus hard surface

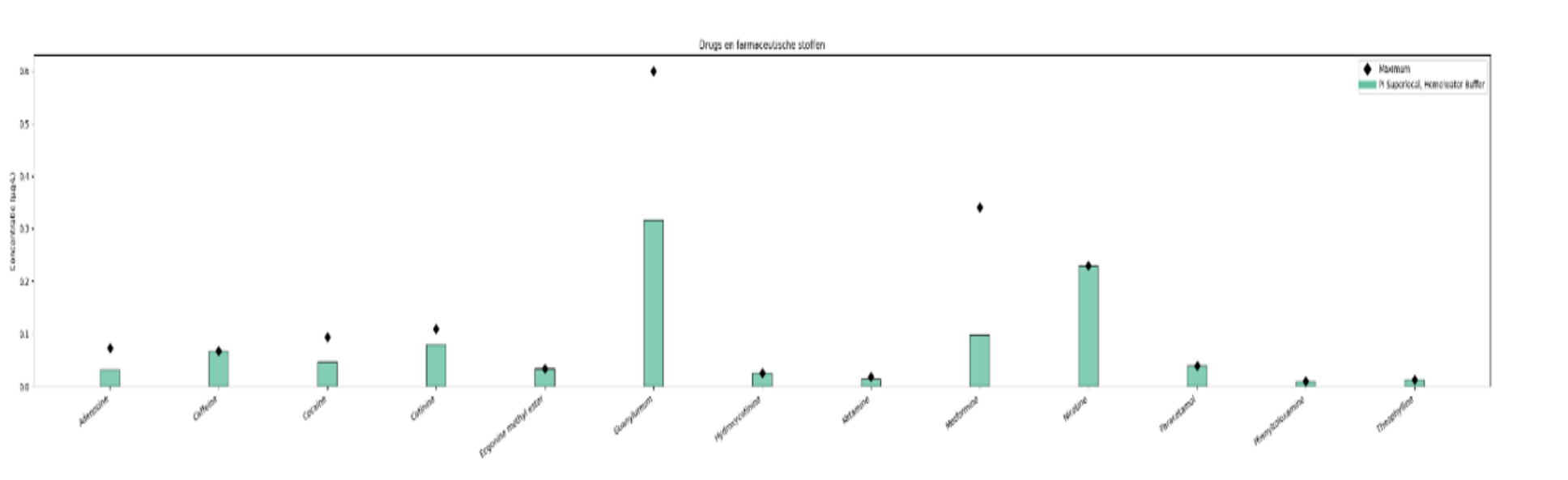
Microbiological parameters as expected (10^5-10^7)

Suficient disinfection required



Analysis data: observed in buffer

- Pharmaceuticals, especially guanylurea en metformin, caffeine points to human origin
- Dutch Drinking Water Decree: < 1 µg/L How did they turn up in the harvested rainwater?



Conclusions

Points of attention:

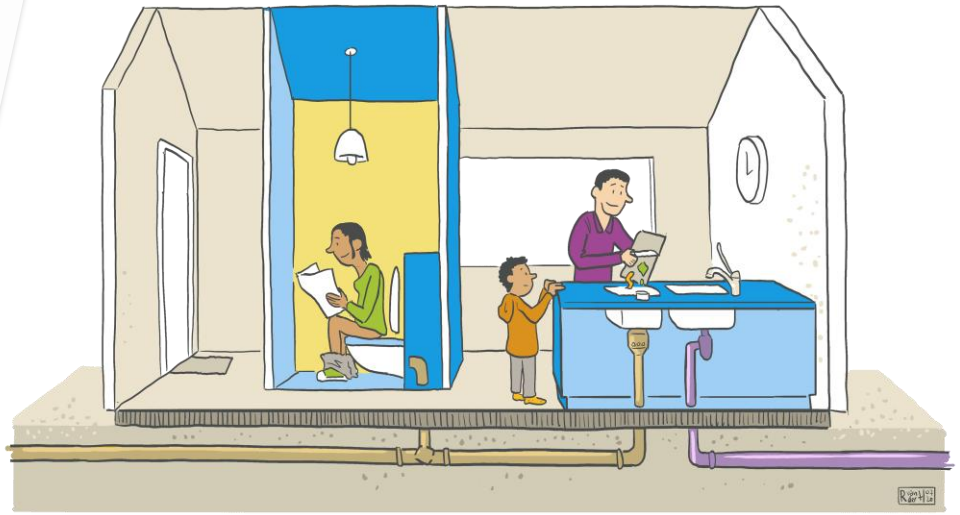
- Sufficient disinfection required
- Low SI causes dissolution of metals from roofs/collection systems
- PAKs both from roofs and hard surface
- Harvested rainwater contains significant concentrations of PFAS
- Harvested rainwater contains organochlorine compounds and trihalomethanes (cleaning?)
- Harvested rainwater contains low concentrations of pharmaceuticals. Origin?
- Quality rainwater harvested from roofs isn't better than from hard surfaces

In house systems

Black water

Water saving toilets (vacuum technology)

Food waste grinders (individual and collective)



Grey water

Shower & Sink

Washing machines (also collective)

Dishwasher

Recycle showers
in experimental houses

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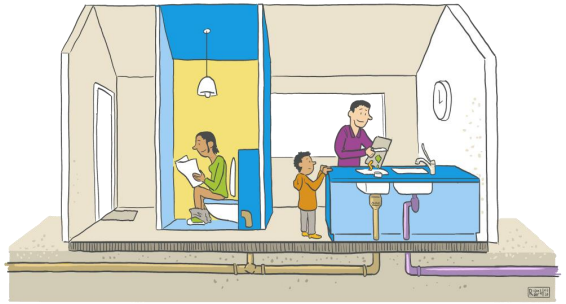
In house systems



Experiences

Communication :

1. **Selection** of sustainability-conscious tenants at the **intake of new residents**
2. Meetings and workshop : **support** for potential delays or maintenance
3. Keep **informing** the tenants about the do's and the don'ts
4. Keep informing about **progress** of project

Tenants : **positive** about vacuumtoilets and individual food waste grinders

Collective food waste grinder :

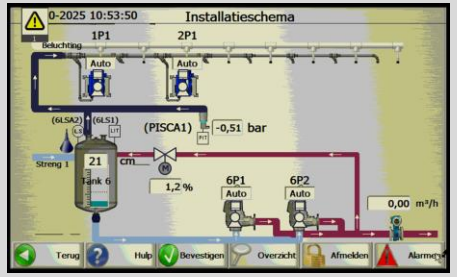
- not 100% correct use
- technology : is new and needs further optimization

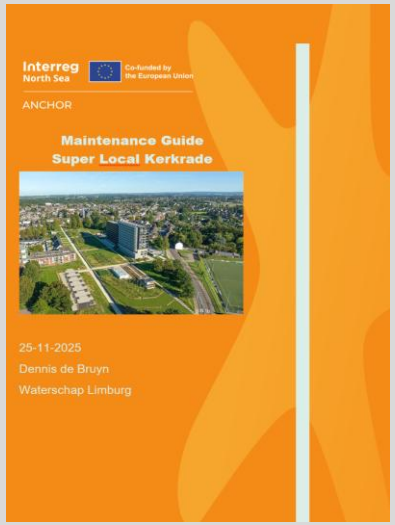
Vacuum station

Start : april 2021
Maintenance and operation

Vacuum station

- 2 Vacuum pumps
- Vacuum vessel (ca. 3 m^3)
- 2 Sludge pumps (cutting)
- 3-way valve
- Off gas treatment
- Flow, energy, pressure and level measurement





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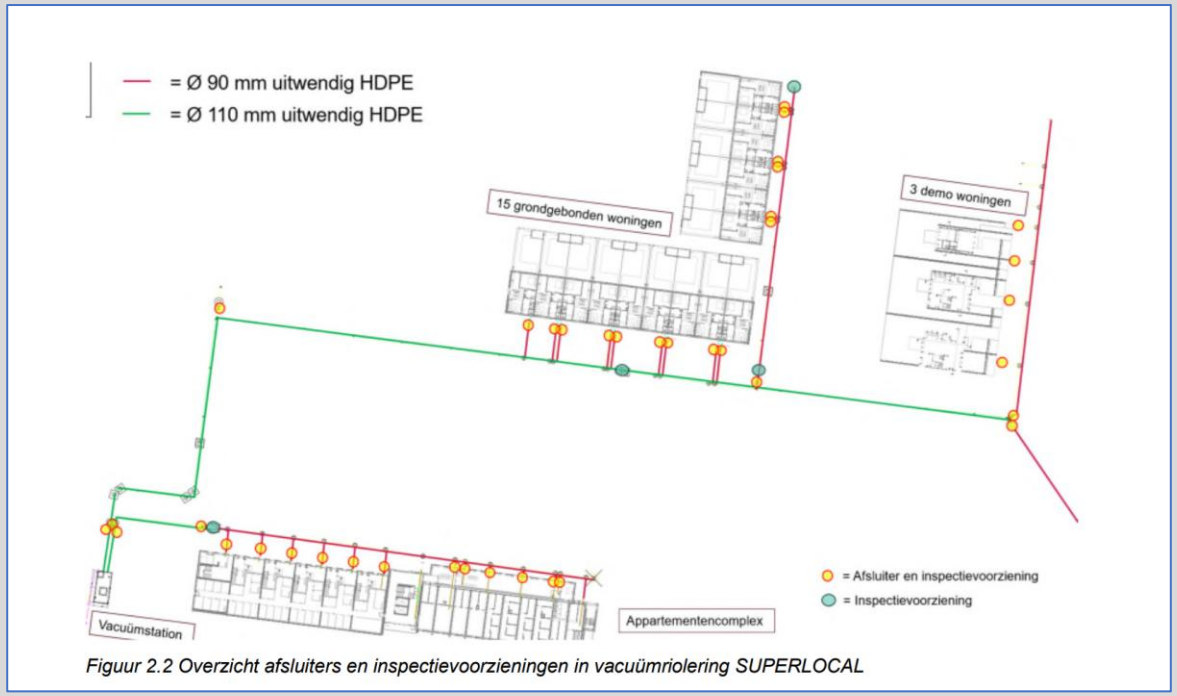
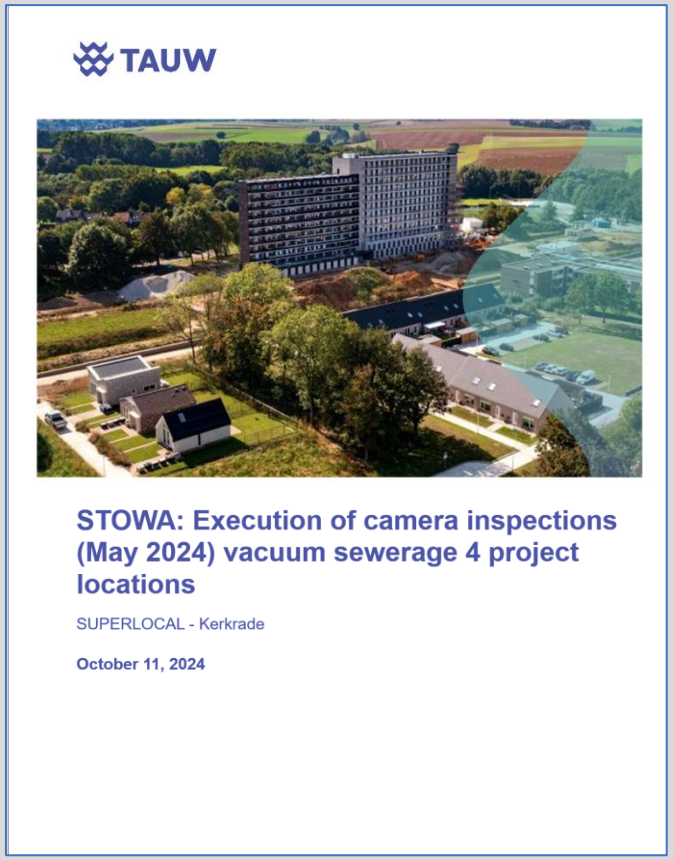
Black water transport and collection

Vacuum pipelines



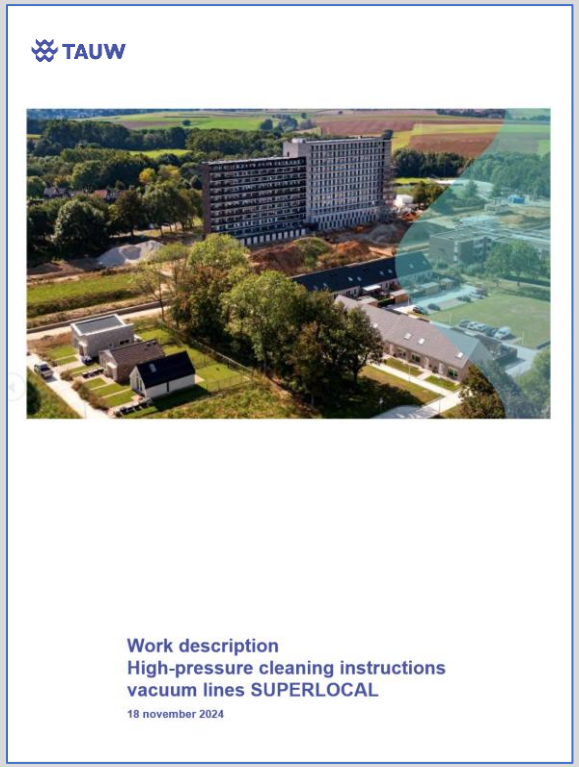
Figuur 2.2 Overzicht afsluiters en inspectievoorzieningen in vacuümriolering SUPERLOCAL



All inspected horizontal and vertical pipes have **moderate** to **severe** scaling, both indoor and in public areas

Black water transport and collection

Vacuum pipelines



September 2025
First test
Horizontal pipes

December 2025
First test
Vertical pipes
Apartment building

Q1 2026
Cleaning all pipes

Figuur 2.1 Vibrerende en roterende spuitkop zoals toegepast bij de hogedrukreiniging van de vacuümleidingen in het openbaar gebied in Sneek

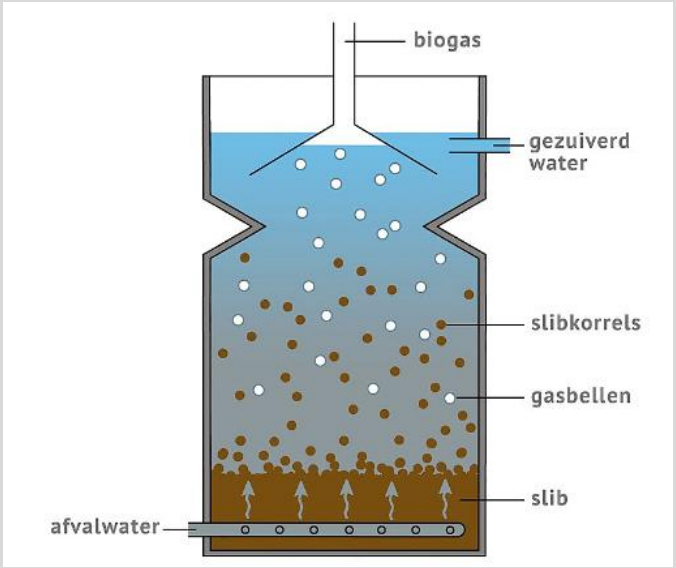
Rotating and vibrating high pressure water cleaning

Black water digestion

Digester

- type UASB
- volume : 7 m^3
- Load : ca. 1 – 1,5 m^3/d
- 35°C

Adjusted to black water treatment*



Hygiënization
- 1 uur en 70°C

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Black water digestion

First startup : juni 2022 – september 2022

influent : black water + collective food waste grinder

- clogged inlet pipes
- to high pressures inlet pipes
- loose pipes, leakage and odor and noice nuisance

Several adjustments : pipe connections, mixing facilities, level switches etc.

Second startup : april 2023 – october 2023

influent : only black water and in september + collective food waste

- same problems

Technical study 2024 :
- extensive additional adjustments are necessary,
- but no guarantee for stable operation

Decision : june 2025

Stop digester at Superlocal.

2026 : Continuous test with black water of Superlocal in Sneek

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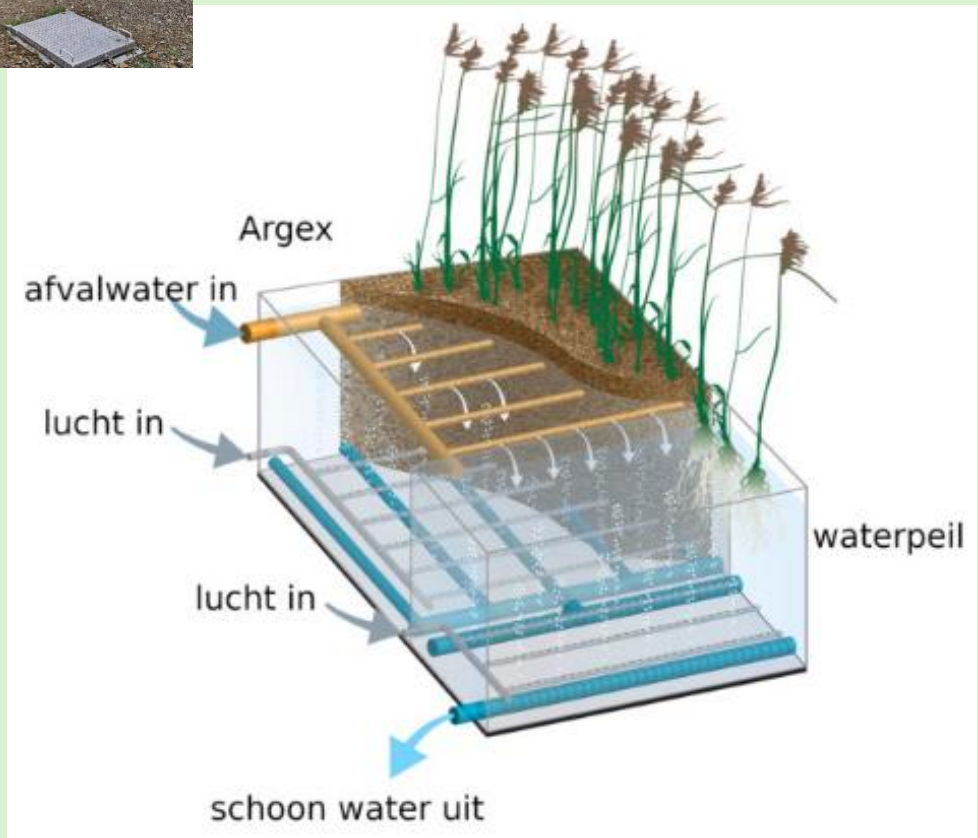
Grey water treatment

Vertical flow

Expanded clay granulas

Aerated at the bottom

Fe-pro



94 m^3 / 86 m^2

L x B x H = 10,7 x 8 x 1,1 m

10 m^3

Influent Buffer tank

20 m^3

Pump tank

4,5 m^3

Effluent Buffer tank

Sewer
or
future reuse
surface water

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Grey water treatment

+/- 7 m^3/day

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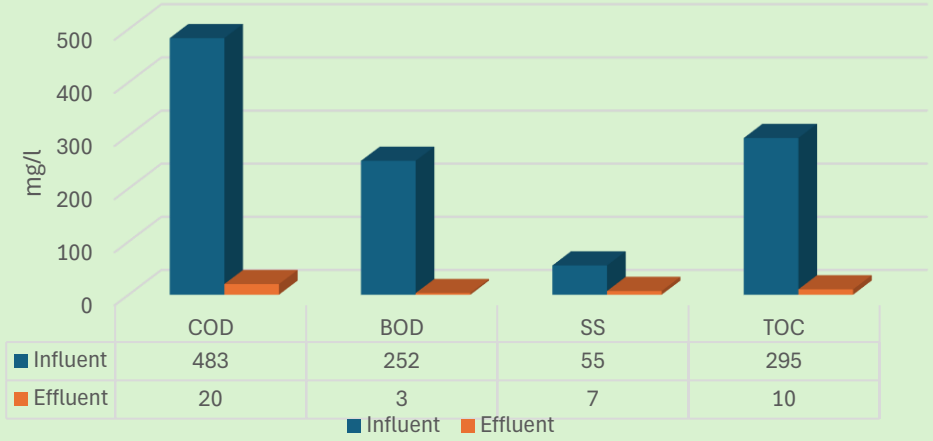
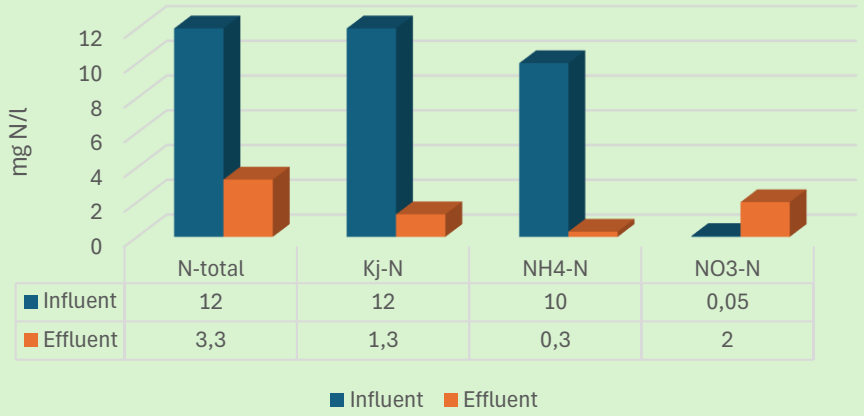
met de omgeving, voor de omgeving

COD, BOD, SS and TOC Infl/effl helofyte filter Superlocal



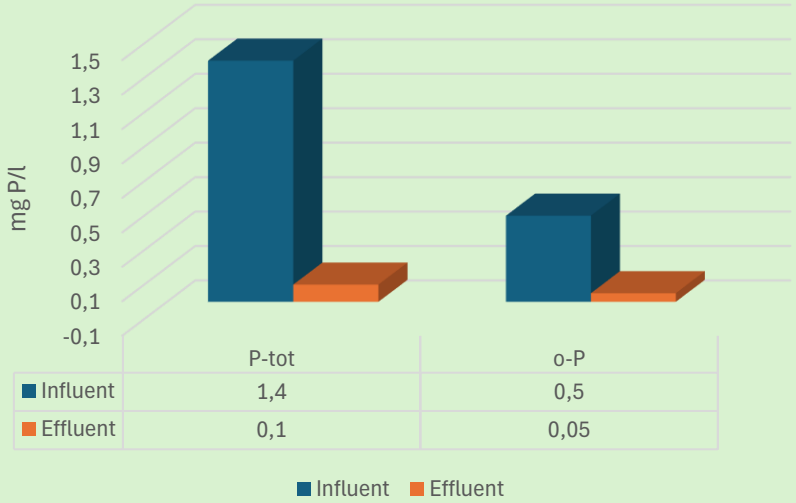
	COD	BOD	SS	TOC
Influent	483	252	55	295
Effluent	20	3	7	10

N Infl/effl helofyte filter Superlocal



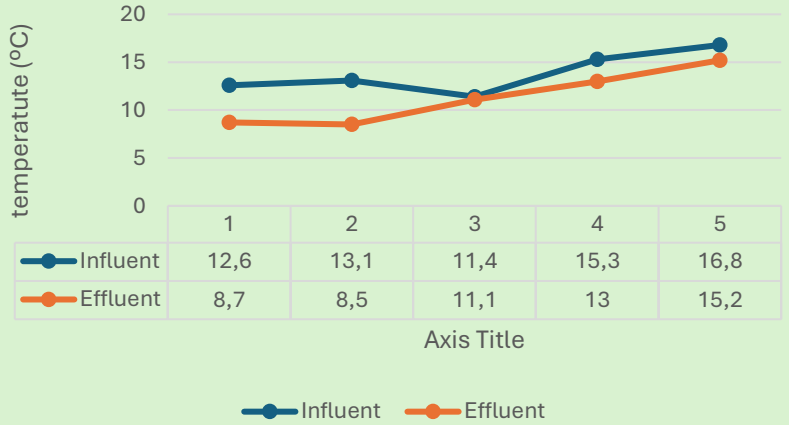
	N-total	Kj-N	NH4-N	NO3-N
Influent	12	12	10	0,05
Effluent	3,3	1,3	0,3	2

P Infl/effl helofyte filter Superlocal



	P-tot	o-P
Influent	1,4	0,5
Effluent	0,1	0,05

Temperature infl./ effl. helofyte filter Superlocal



	1	2	3	4	5
Influent	12,6	13,1	11,4	15,3	16,8
Effluent	8,7	8,5	11,1	13	15,2

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Grey water treatment

	Influent	Effluent	Removal
	ug/l	ug/l	`%
1,2,3-benztriazool	3	0,7	77
Som 4- en 5-methyl-1H-benzotriazool	0,07	0,03	57
Citalopram	0,043	0,01	77
Diclofenac	2	1,3	35
Metropolol	0,1	0,06	40

Amisulpride
Azitromycine
Candesartan
Claritromycine
Furosemide
Gabapentine
Hydrochloorthiazide
Irbesartan
Propanolol
Sotalol
Sulfamethoxazol
Trimethoprim
Venlafaxine
Carbamazepine

< detection limit

	Influent	Effluent	Removal
	ug/l	ug/l	`%
Aluminium	825	50	94
Barium	16	9,7	39
Calcium	24300	21750	10
Chroom	3,4	3	12
Kalium	7750	7675	1
Koper	18	8,1	55
Lood	1,5	1	33
Magnesium	3500	3325	5
Mangaan	15	15	0
Natrium	59250	56520	5
Strontium	43	37	14
Tin	2,5	1	60
Zink	90	5,2	94
Zwavel	11750	10325	12
Arseen	1	1,2	-20
IJzer	153	1875	-1125
Molybdeen	2	5,9	-195
Nikkel	4,1	24	-485
Antimoon	1	2,4	-140

Berylium
Cadmium
Kwik
Telluur
Thallium
Uranium
Vanadium
Wolfraam
Zilver
Kobalt

< detection limit

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met de omgeving, voor de omgeving

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Key issues Superlocal (1)

Location + **partners** found who are positive about the concept and the philosophy

Scale Super local is limited and defined and **risk** is limited (back-up)

Questions and transitions are **jointly formulated** (technology, legislation, acceptance and finance)

Every partner is represented by an **ambassadeur/promotor** at project level and at management and board level in the phase of:

(1) idea generation

(2) planning

(3) Preparation ; (4) Realization;

(5) Operation en (6) Monitoring

(7) Evaluation

Key issues Superlocal (2)

Knowledge exchange decentralized projects – other demo projects (ANCHOR), experts (Tauw), Stowa, KWR.

Communication – informing and involvement of residents

Initiate various actions to change **legislation** (use of rainwater as a source of drinkingwater and use digester sludge as fertilizer and reuse of grey water

DISCUSSION en LESSONS LEARNED (1)

Less flexibel in market targeting due to funding conditions

There are relatively few suppliers of specific installations

Long term track : Idea – choice – realization – operation – monitoring : > 5 – 10 years

Maintenance, operation and monitoring requires more time than foreseen

Maintenance, operation and monitoring requires specific skills

Knowledge sharing between experts from decentralized projects is essential

Knowledge building within installation companies is necessary

DISCUSSION en LESSONS LEARNED (2)

Within the organizations : ensure good coordination + staff deployment and reporting

Between the partners : good coordination and focuss on public interest

Activities in one “ Water Cycle Company” in stead of divided amongst 4 partners

Residents are positive about the new techniques

Keep informing the residents on do’s and don’ts

The black water vacuum lines must be cleaned every 3 - 4 years

To do : 2026 + 2027

1. Testing and monitoring

- ❑ Intensified testing rain water treatment
- ❑ Pilot test digestion black water SuperLocal at Sneek
- ❑ Testing post treatment of effluent helofytfilter -> household water

2. Evaluation of (parts of) of the concept

- Performance
- Maintenance and operation
- Costs and values : minimal scale
- Social acceptance and behavourial change

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PANEL DISCUSSION

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PANEL DISCUSSION

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Moderator

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⚓ Hamse Kjerstadius
NSVA (SE)

⚓ Sybren Gerbens
Wetterskip Fryslan (NL)

⚓ Ad de Man
Waterschap Limburg (NL)

⚓ Peter De Smet
DuCoop (BE)

WETTERSKIP FRYSLÂN

SPOORDOK LEEUWARDEN

A CIRCULAR URBAN WATERCYCLE

Sybren Gerbens
Wetterskip Fryslân
Anchor meeting Kerkrade,November 26, 2025

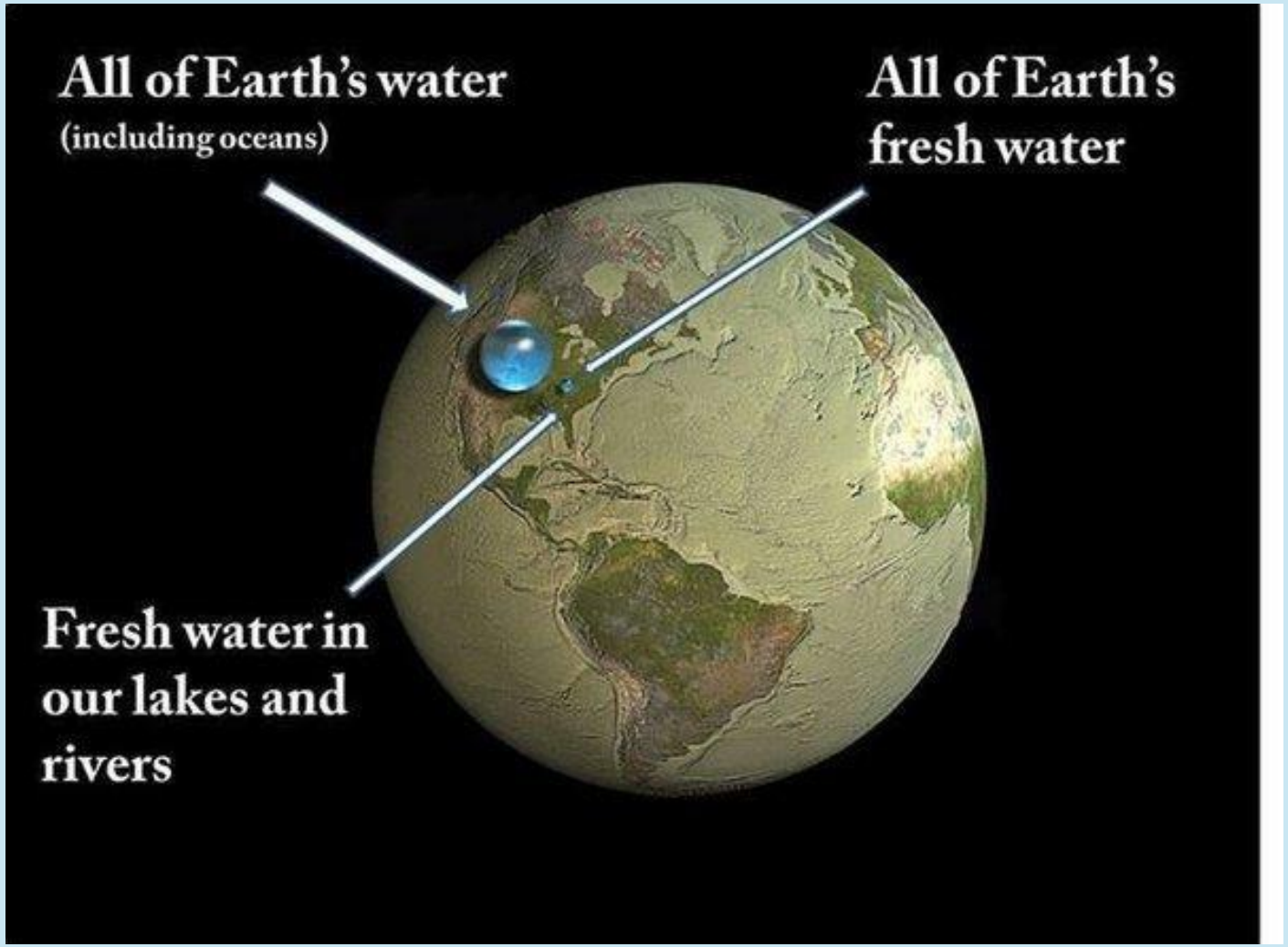
WETTERSKIP FRYSLÂN IN BRIEF

TASKS

1) We clean water
2) We keep water out
3) We manage water levels

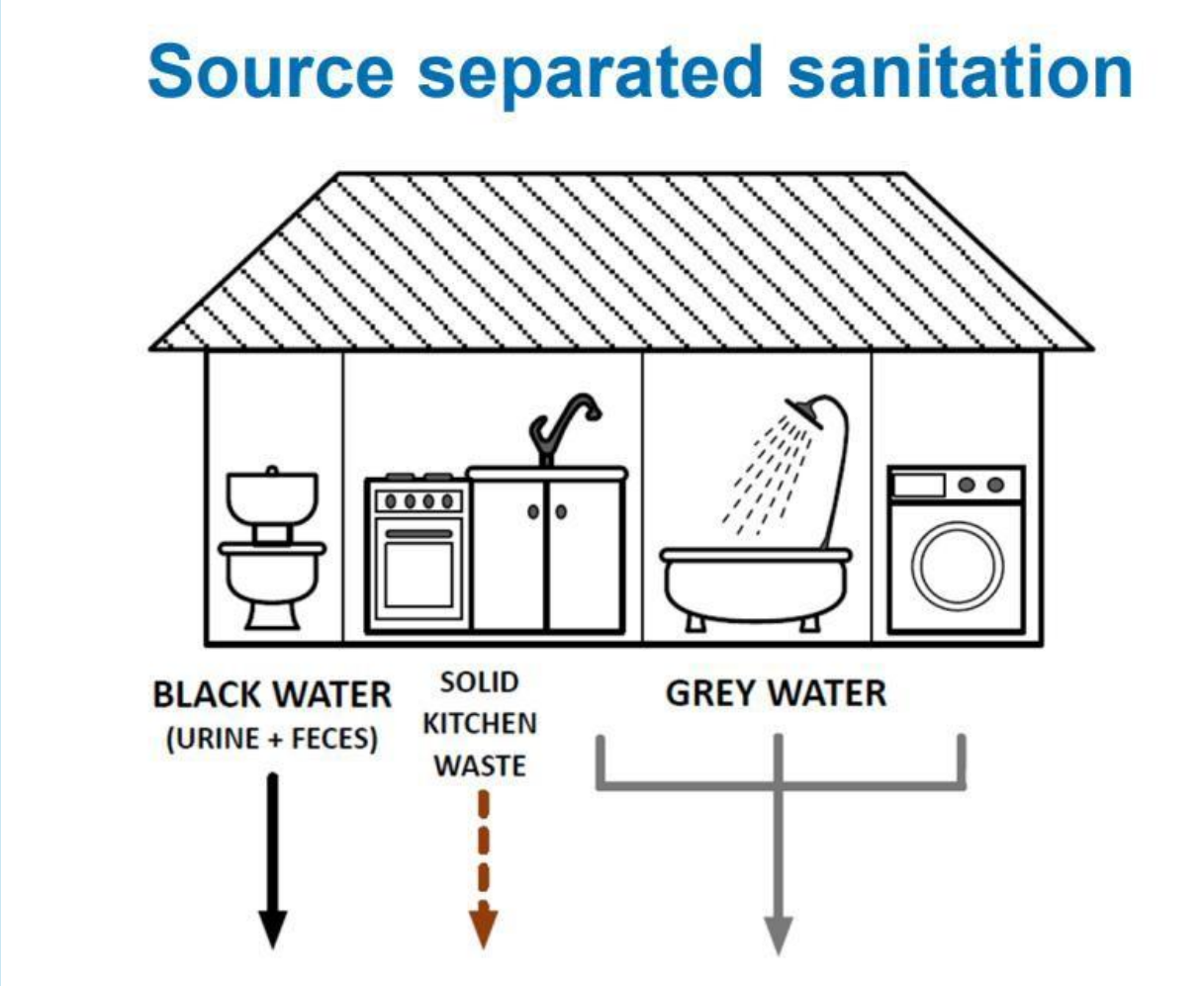
WETTERSKIP FRYSLÂN

WATER IS PRECIOUS



Water is precious and essential for life and more scarce then we think…

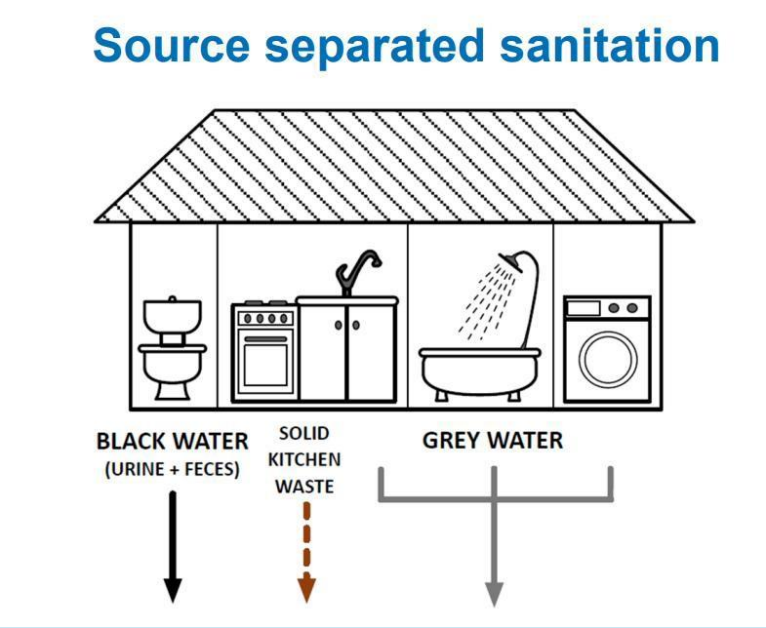
SOURCE SEPARATED SANITATION



Research Waterschoon showed:

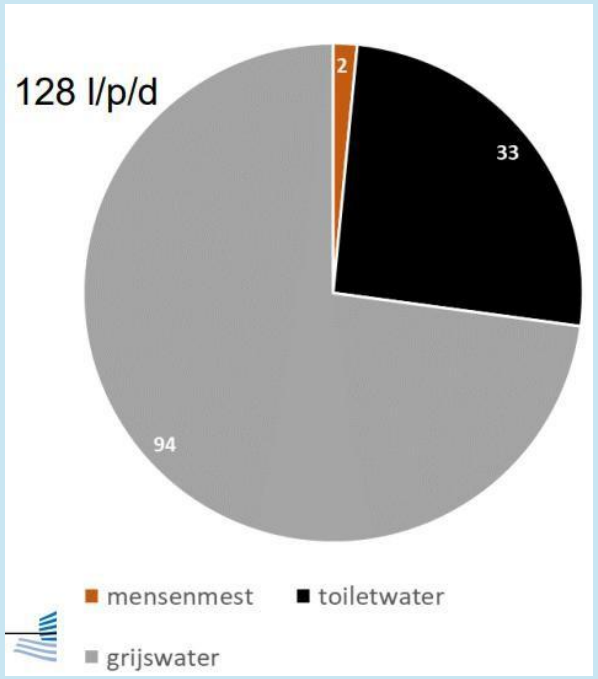
- Source separated sanitation has better po in reuse of nutrients
- 20% water savings by vacuum toilet
- Potential of 80% reuse of drinking water by greywater recycling

VACUUM TOILETS

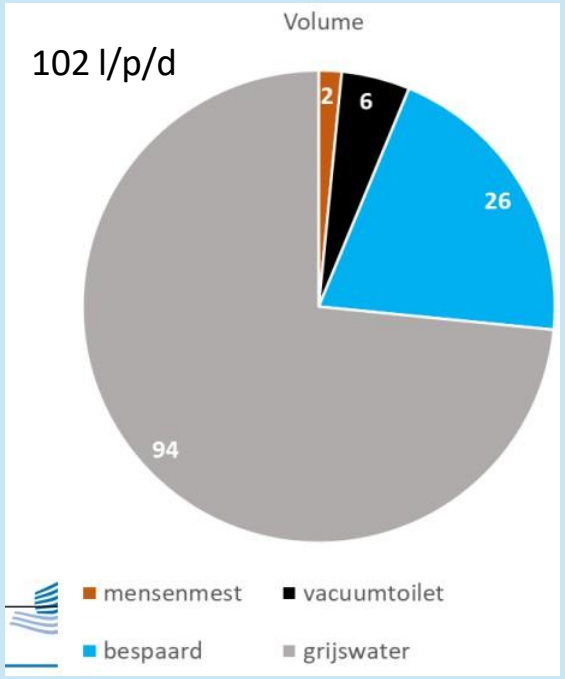


20% water savings by vacuum sewer!

Traditional

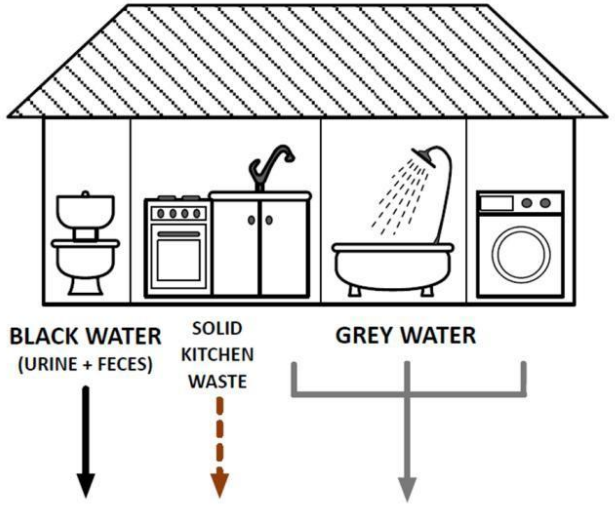


Source Separated Sanitation



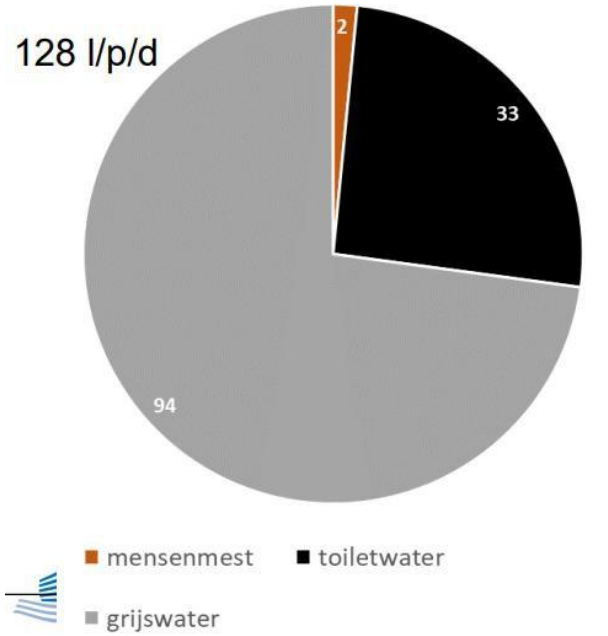
VACUUM TOILETS

Source separated sanitation

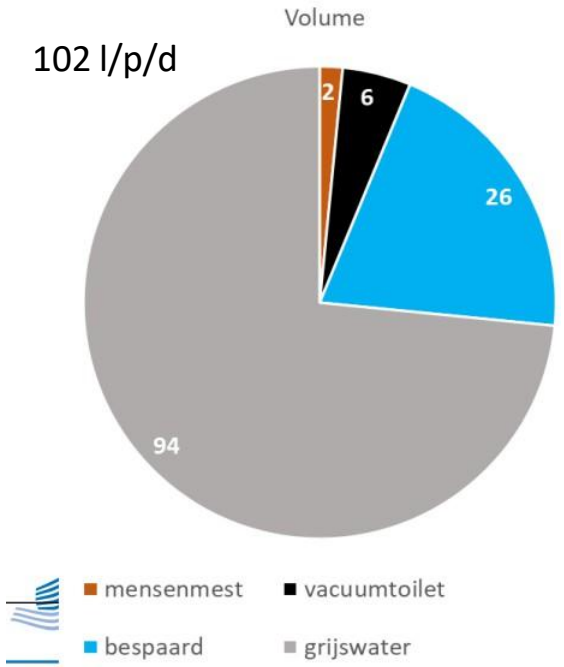


20% water savings by vacuum sewer!

Traditional

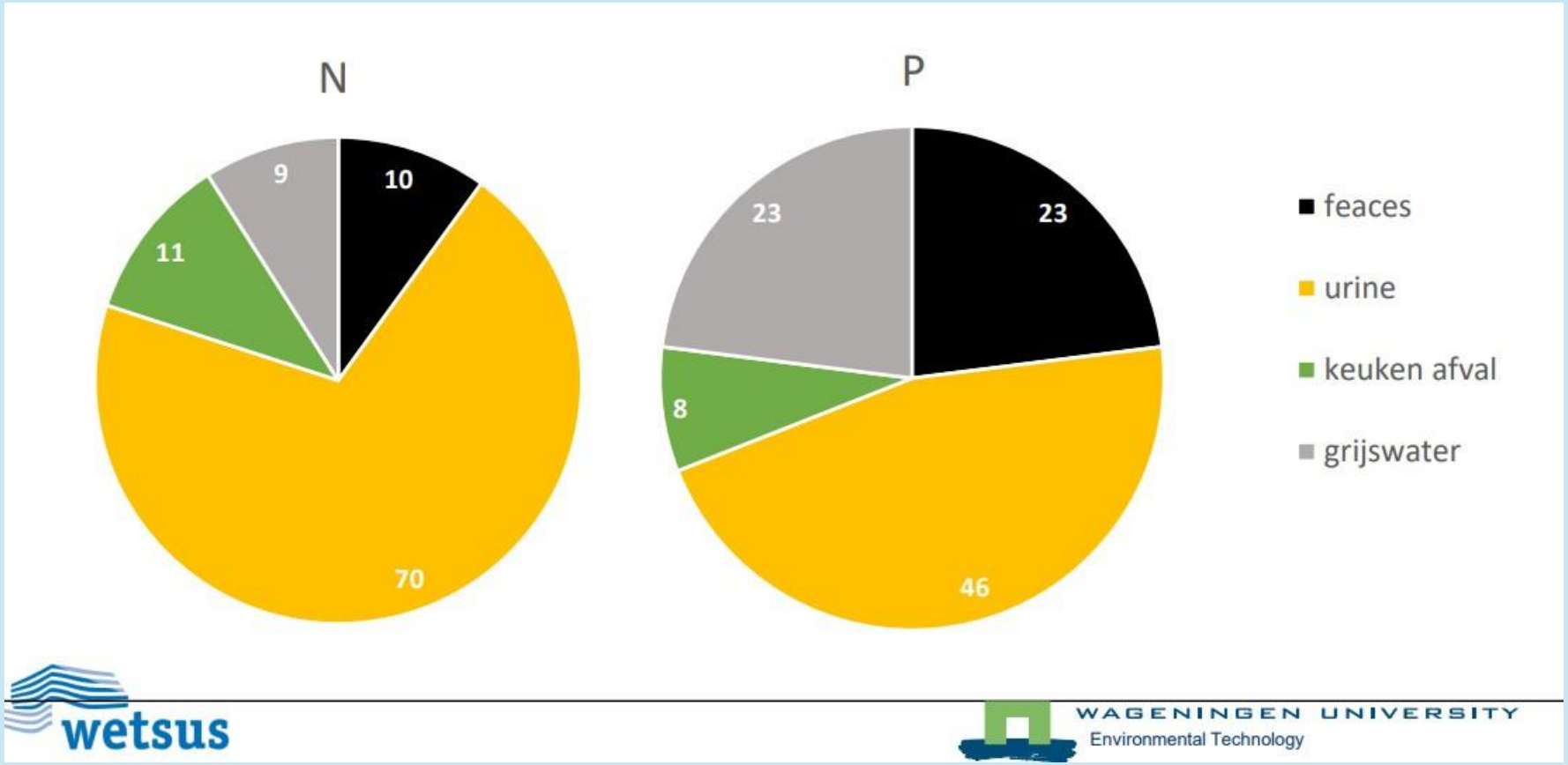


Source Separated Sanitation

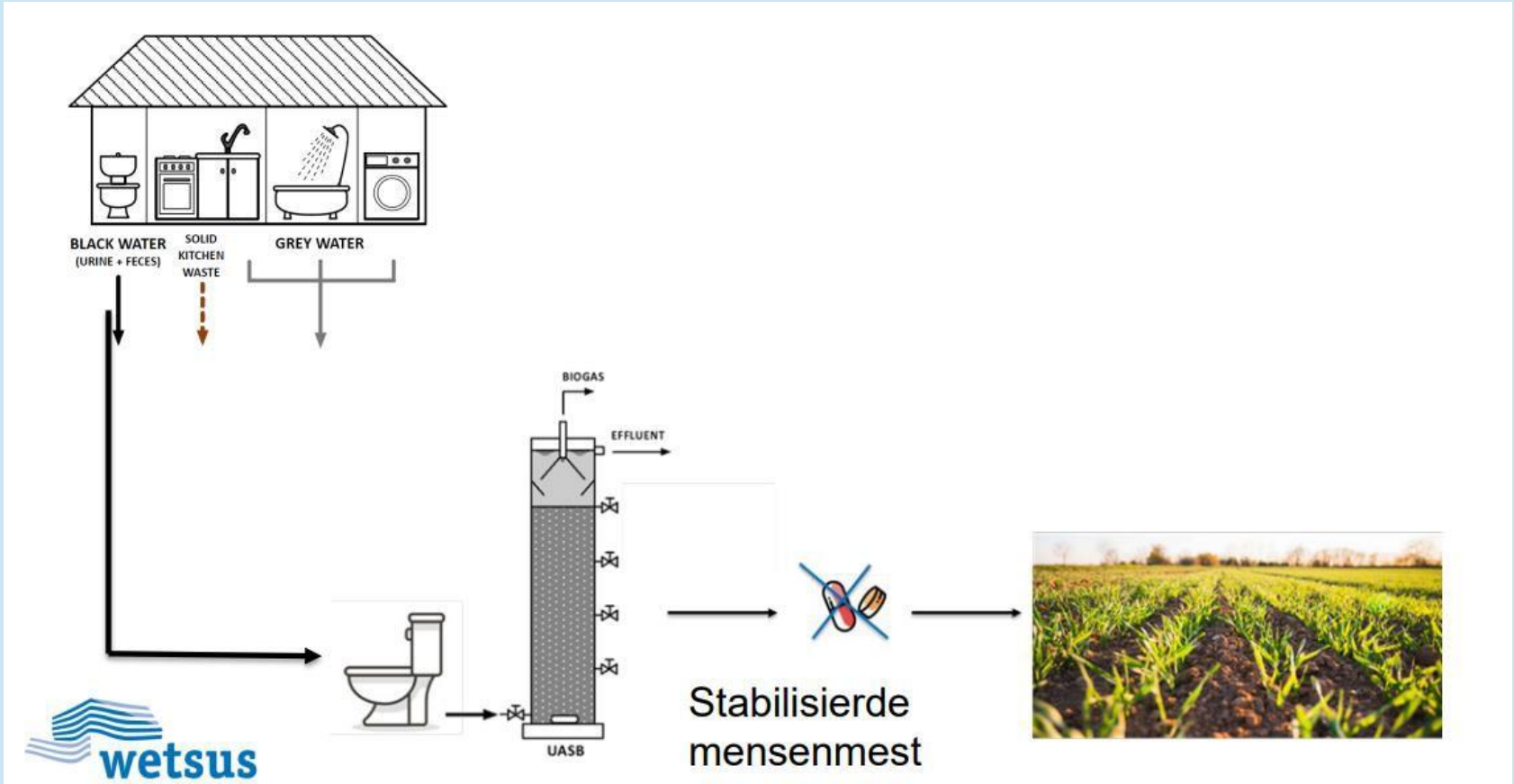


BLACK WATER

Most (>91% N and >77% P) of the nutrients are in the toiletwater and kitchen waste



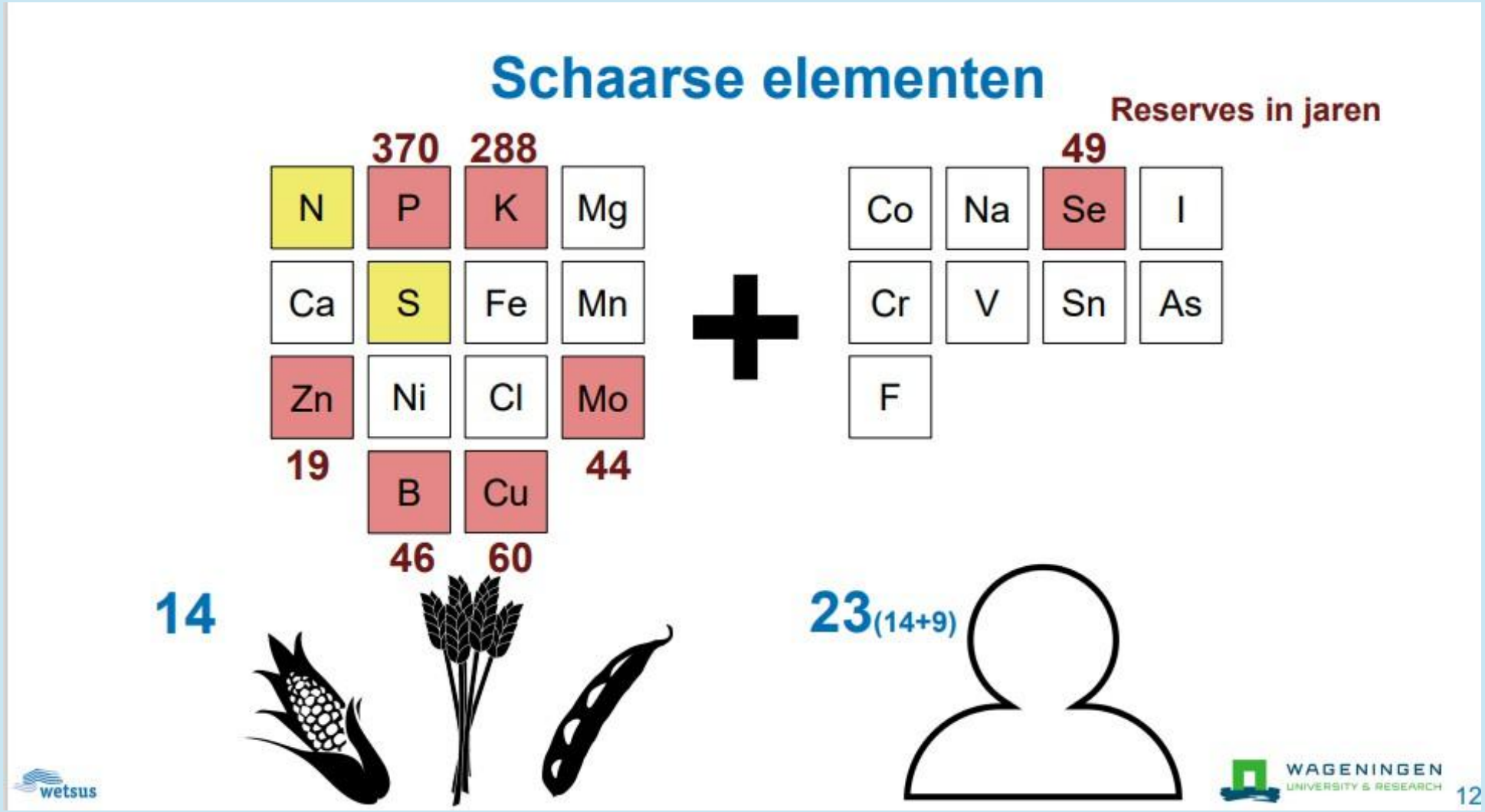
RECYCLING OF HUMAN MANURE



- Cleaning chemicals and microplastic predominant in greywater, which are kept apart from blackwater and treated seperately

- Blackwater is less polluted, but still contains medicines. These medicines in blackwater can be removed by composting

THE URGENCY FOR RESOURCE RECOVERY



SPOORDOK LEEUWARDEN

Renovation of the city district Spoordok in Leeuwarden:

- 19 hectare
- 2000 houses
- +/- 4000 people

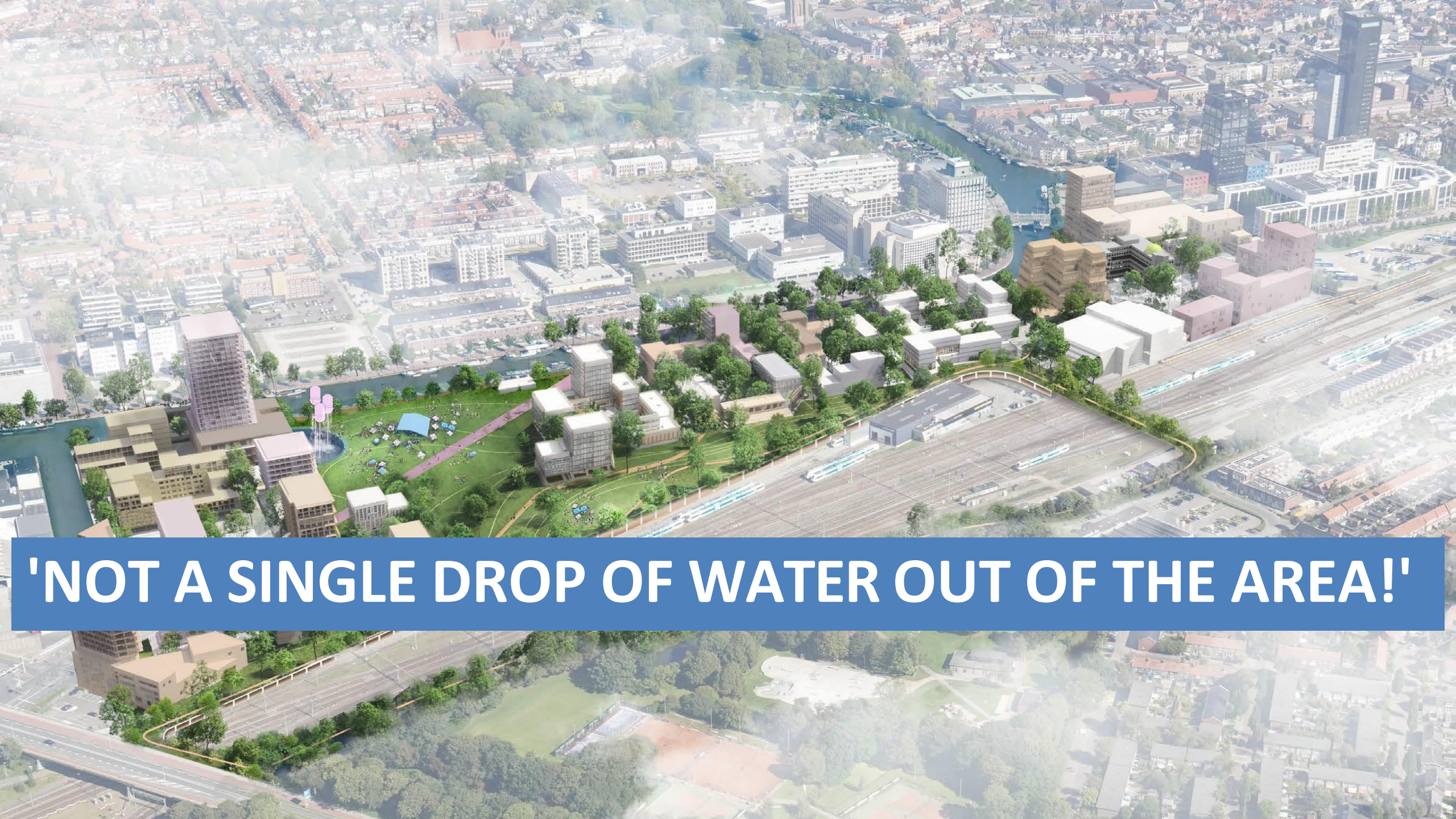
HIGH AMBITION

Ambition

Wetterskip Fryslân
- Climate neutral in 2030
- 100% circular in 2050

Municipality of Leeuwarden
- Climate adaptive in 2035
- Spoordok; water-, energy- and resource neutral

Figuur 2.1 Schetsontwerp visuele weergave Spoordok



'NOT A SINGLE DROP OF WATER OUT OF THE AREA!'

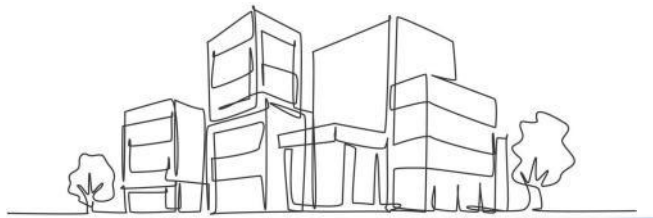
De Watermakerij; Water exhibition center

WETTERSKIP FRYSLÂN

Gemeente Leeuwarden

STEDENBOUW KUNDIGE RANDVOOR WAARDEN

PLANOLOGIE



2021

2022

RUIMTELIJKE IMPLICATIES WATERKETEN VARIANTEN

2024

VARIANTEN STUDIE WATERKETEN

2025

2026

2027

WETTERSKIP FRYSLÂN

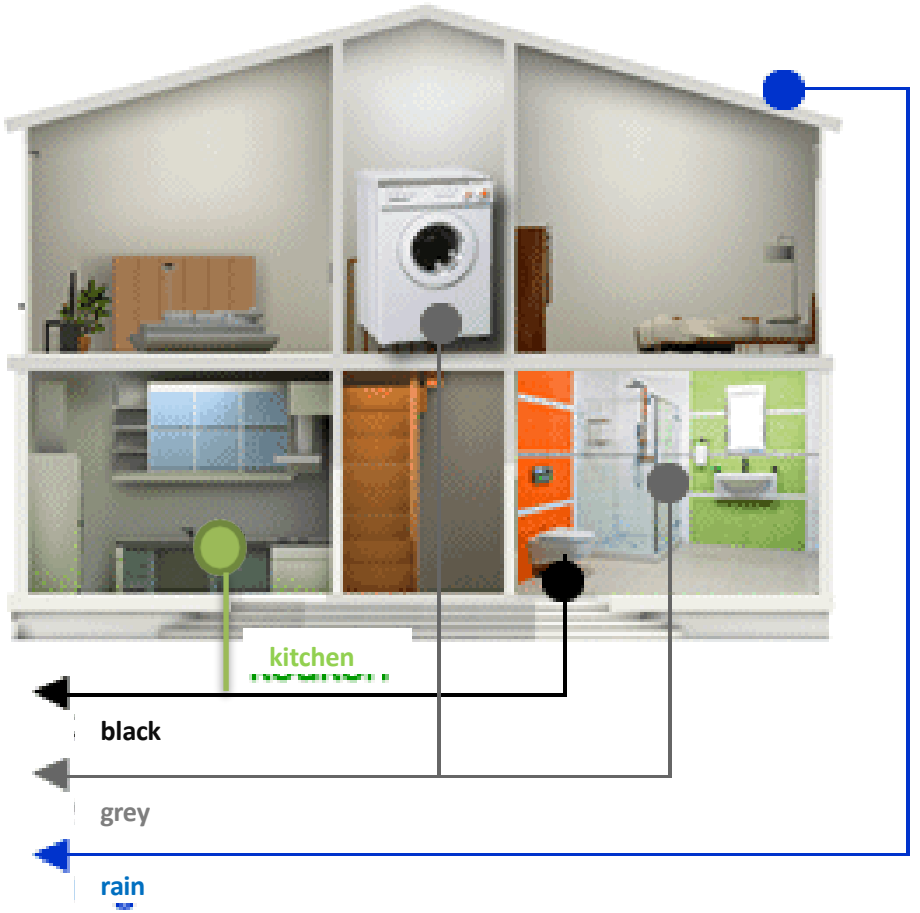
SMART WITH WATER

Climate adaptation in Spoordok:

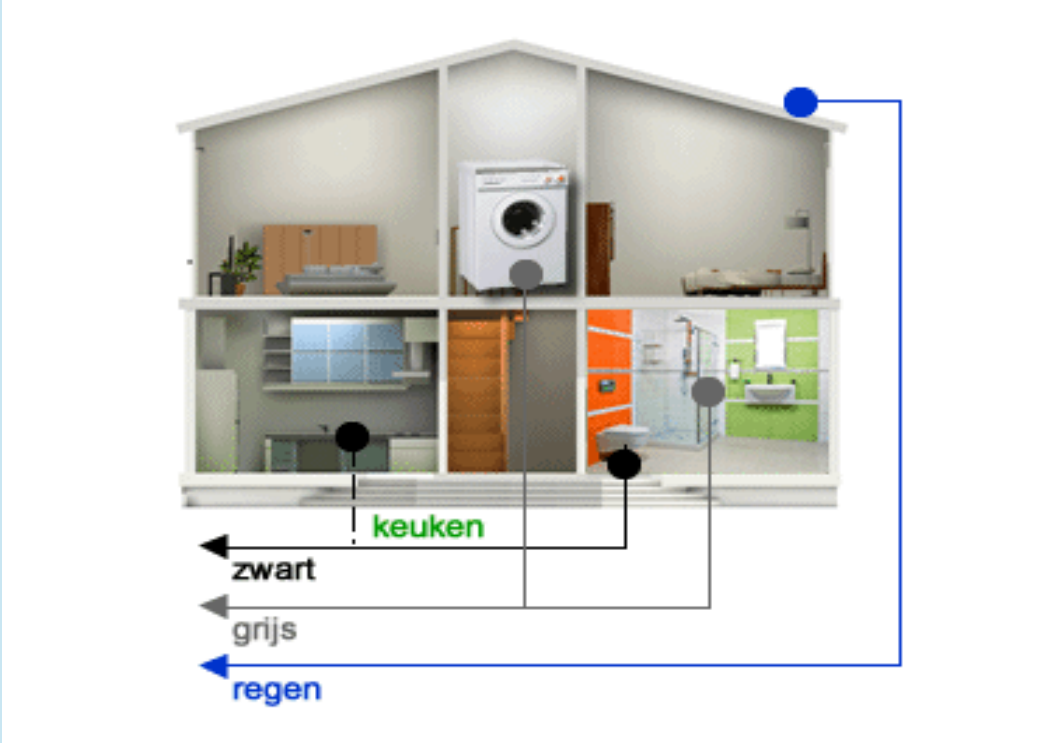
- smart rainwater storage
- avoiding heat stress

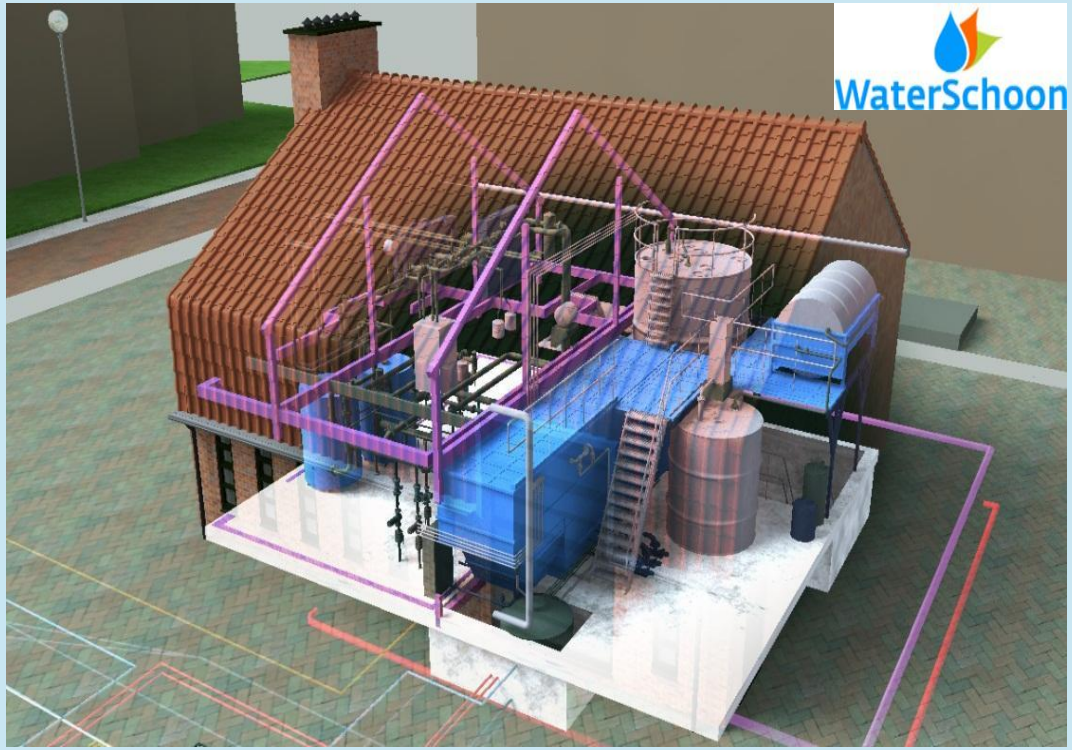
Apply source separated sanitation

- water saving (vacuum toilets)
- recover nutrients

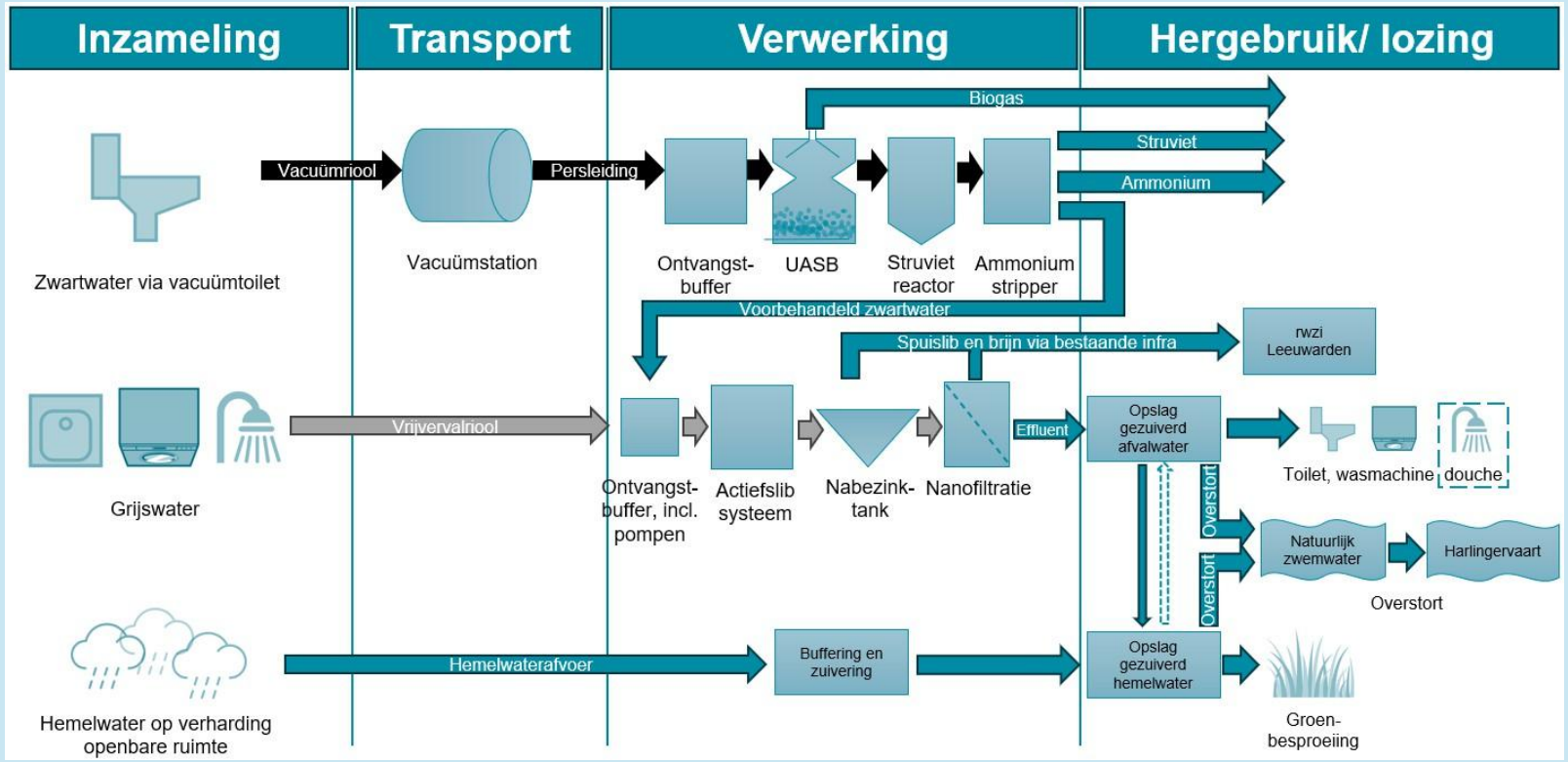


VARIANT 1: SOURCE SEPARATED SANITATION (= WATERSCHOON 3.0)





VARIANT 1
(=SOURCE SEPARATED SANITATION)



- Highest investment cost (>10 € million)
- Highest exploitation cost (€100k/yr)
- Lowest CO2 (160 ton/yr)
- Lowest drinking water consumption (29 lppd)

WETTERSKIP FRYSLÂN

Gemeente Leeuwarden

CONCLUSIONS

- Vacuum toilets can save 25% drinking water
- Variant 1 (new sanitation) scores highest in the MCA
- Circular urban water cycle will cost extra money
- Water and nutrients still yield too little for a solid BC
- "Lock in" with existing urban water cycle is an obstacle for source-separated sanitation

WETTERSKIP FRYSLÂN

EN WAT DOEN WE MORGEN MET WATER?

SOURCE-SEPARATED SYSTEMS IN PRACTICE

PANEL DISCUSSION

Interreg North Sea

Co-funded by the European Union

ANCHOR

Moderator

⚓ Henk-Jan van Alphen
KWR (NL)

⚓ Hamse Kjerstadius
NSVA (SE)

⚓ Sybren Gerbens
Wetterskip Fryslan (NL)

⚓ Ad de Man
Waterschap Limburg (NL)

⚓ Peter De Smet
DuCoop (BE)

Interreg North Sea

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ANCHOR

Join the ANCHOR community and innovate for water wise urban areas

Stay up to speed about the ANCHOR project

- News update 2/ year
- Invitation to online lunch talks 4/ year
- Sign up for the Community of Practice in your area

interregnorthsea.eu/anchor

SPECIAL THANKS

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provincie Oost-Vlaanderen

vito

DuCoop

HAMBURG WASSER

Bauhaus-Universität Weimar

waternet
waterschap amstel gooi en vecht
gemeente amsterdam

KWR

Stockholms stad

NSVA
NORDVÄSTRA SKÅNES VATTEN OCH AVLOPP

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SOURCE-SEPARATED SYSTEMS IN PRACTICE

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We leave for the site visit at 12.45 sharp

GUIDED TOUR SUPERLOCAL

Group 1

Group 2

Group 3

SOURCE-SEPARATED SYSTEMS IN PRACTICE

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NETWORKING LUNCH & GUIDED SITE TOUR OF SUPER LOCAL

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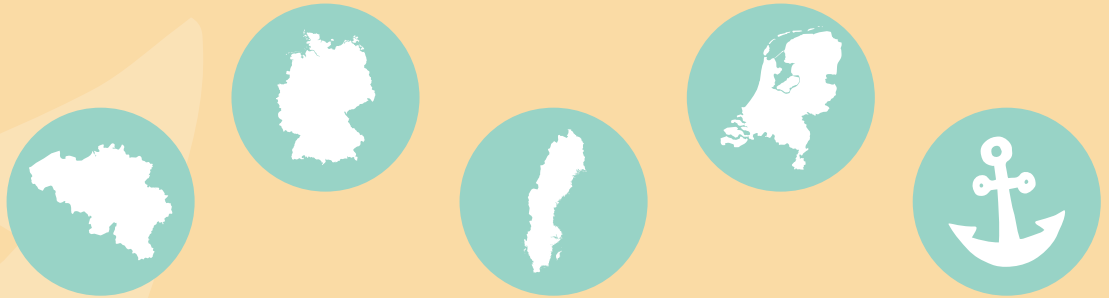
Thank you for attending!



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