Edible Cities Network

EDICITNET GLOBAL LUNCH TALKS :
URBAN FOOD INNOVATION

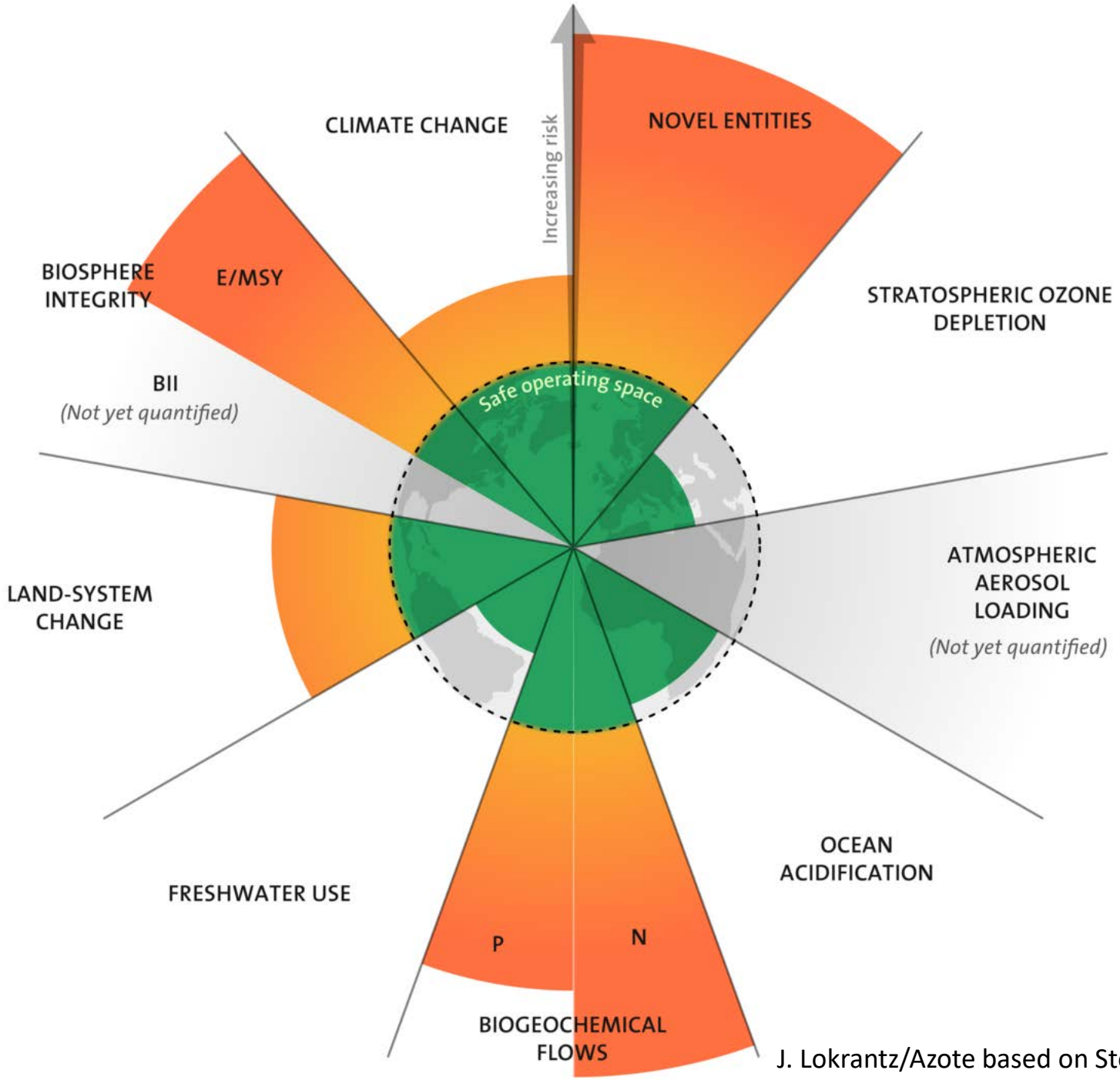
Closed-Loop Urban Farming: Recycling Water & Reclaiming Nutrients

With Erwin Nolde (Nolde & Partner | innovative water concepts) and Martin Regelsberger (Transition Network)

7th July 2022 | 12.00-13.00 CEST

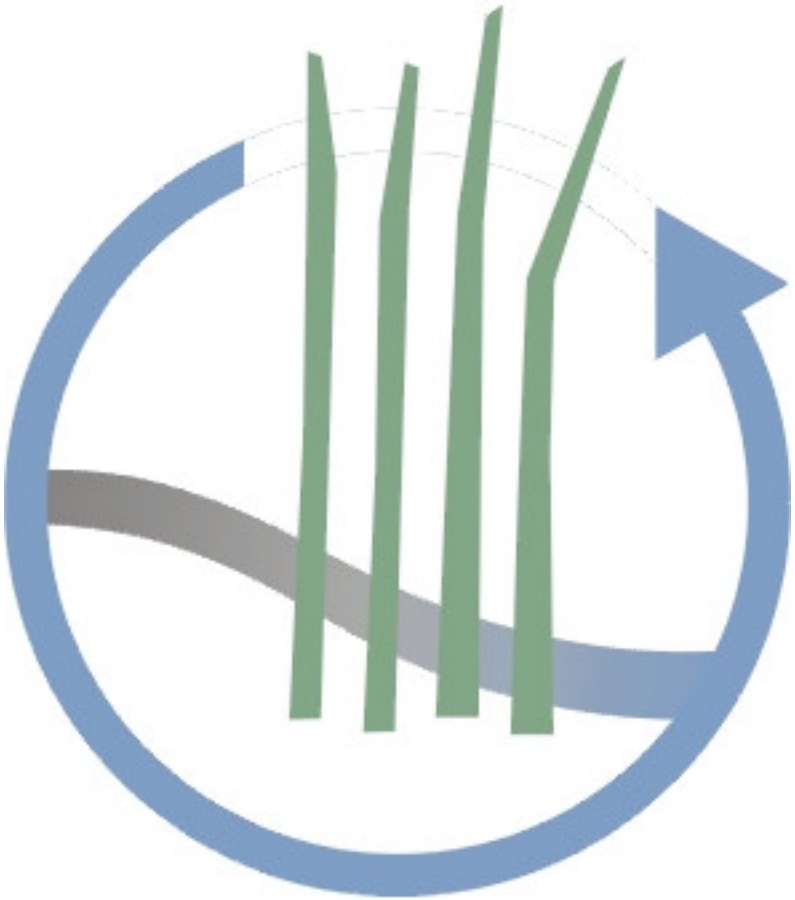
www.edicitnet.com

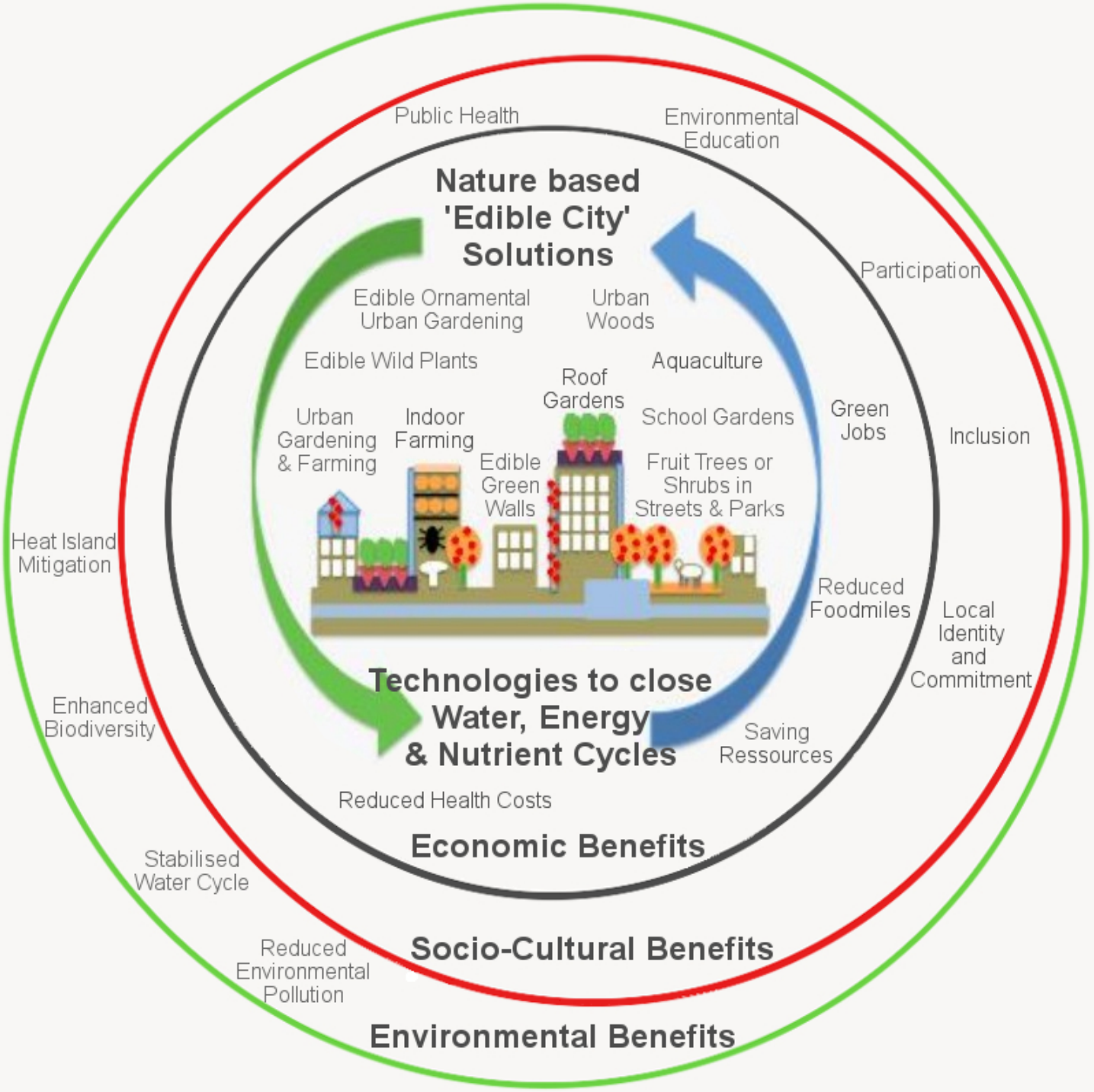
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776665

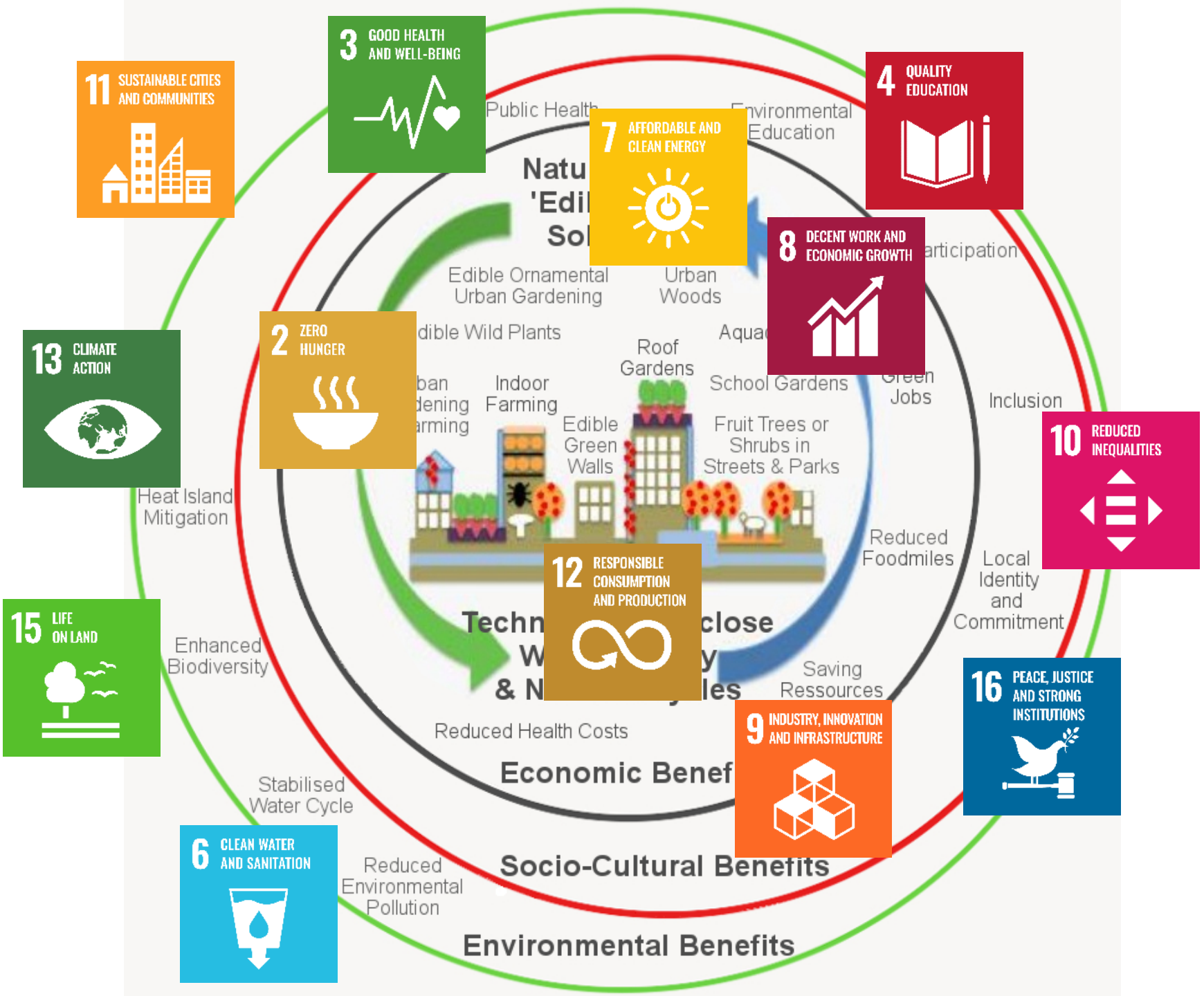


J. Lokrantz/Azote based on Steffen et al. 2015

Graphics by Jerker Lokrantz/Azote




Public Health
Environmental Education
Nature based 'Edible City' Solutions
Participation
Edible Ornamental Urban Gardening
Urban Woods
Edible Wild Plants
Aquaculture
Roof Gardens
Urban Gardening & Farming
Indoor Farming
School Gardens
Green Jobs
Inclusion
Edible Green Walls
Fruit Trees or Shrubs in Streets & Parks
Heat Island Mitigation
Reduced Foodmiles
Local Identity and Commitment
Technologies to close Water, Energy & Nutrient Cycles
Enhanced Biodiversity
Saving Ressources
Reduced Health Costs
Economic Benefits
Stabilised Water Cycle
Reduced Environmental Pollution
Socio-Cultural Benefits
Environmental Benefits


3 GOOD HEALTH AND WELL-BEING
11 SUSTAINABLE CITIES AND COMMUNITIES
4 QUALITY EDUCATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
2 ZERO HUNGER
13 CLIMATE ACTION
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15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
6 CLEAN WATER AND SANITATION
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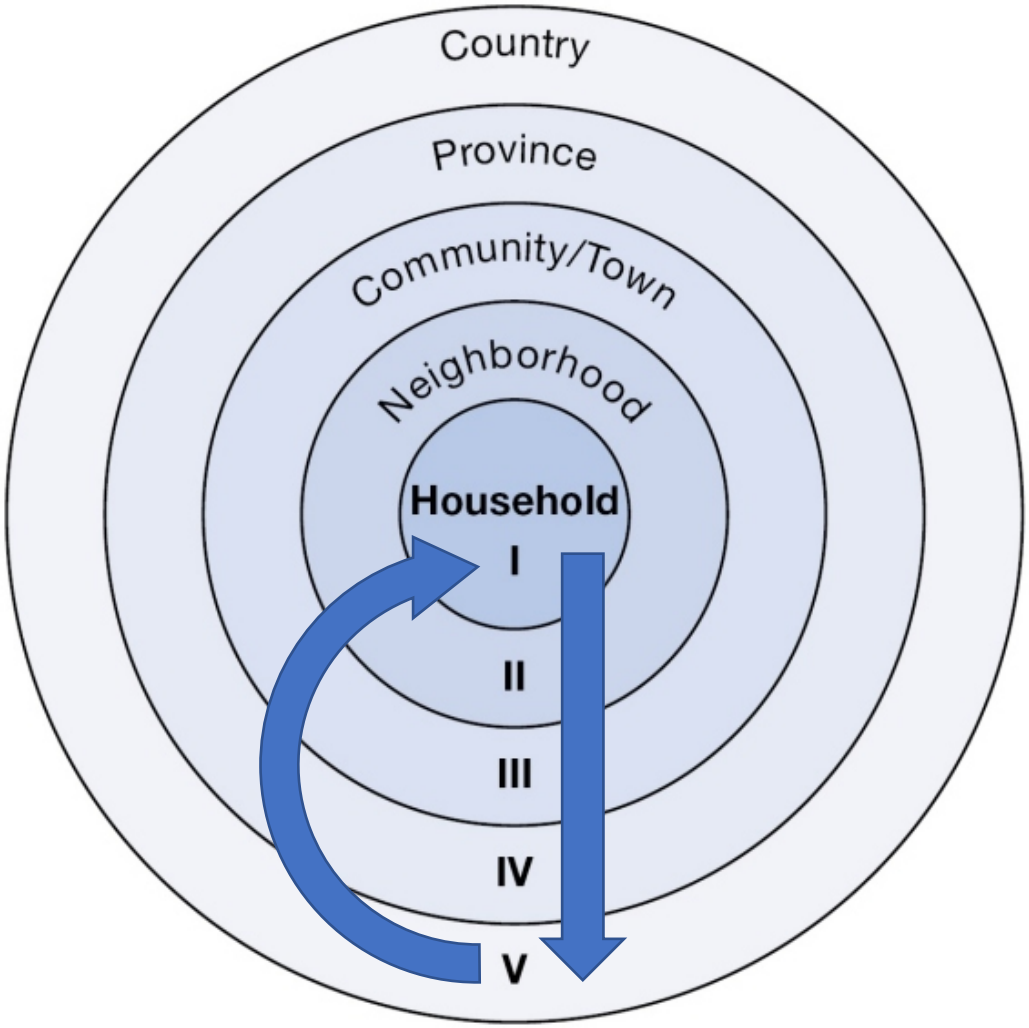
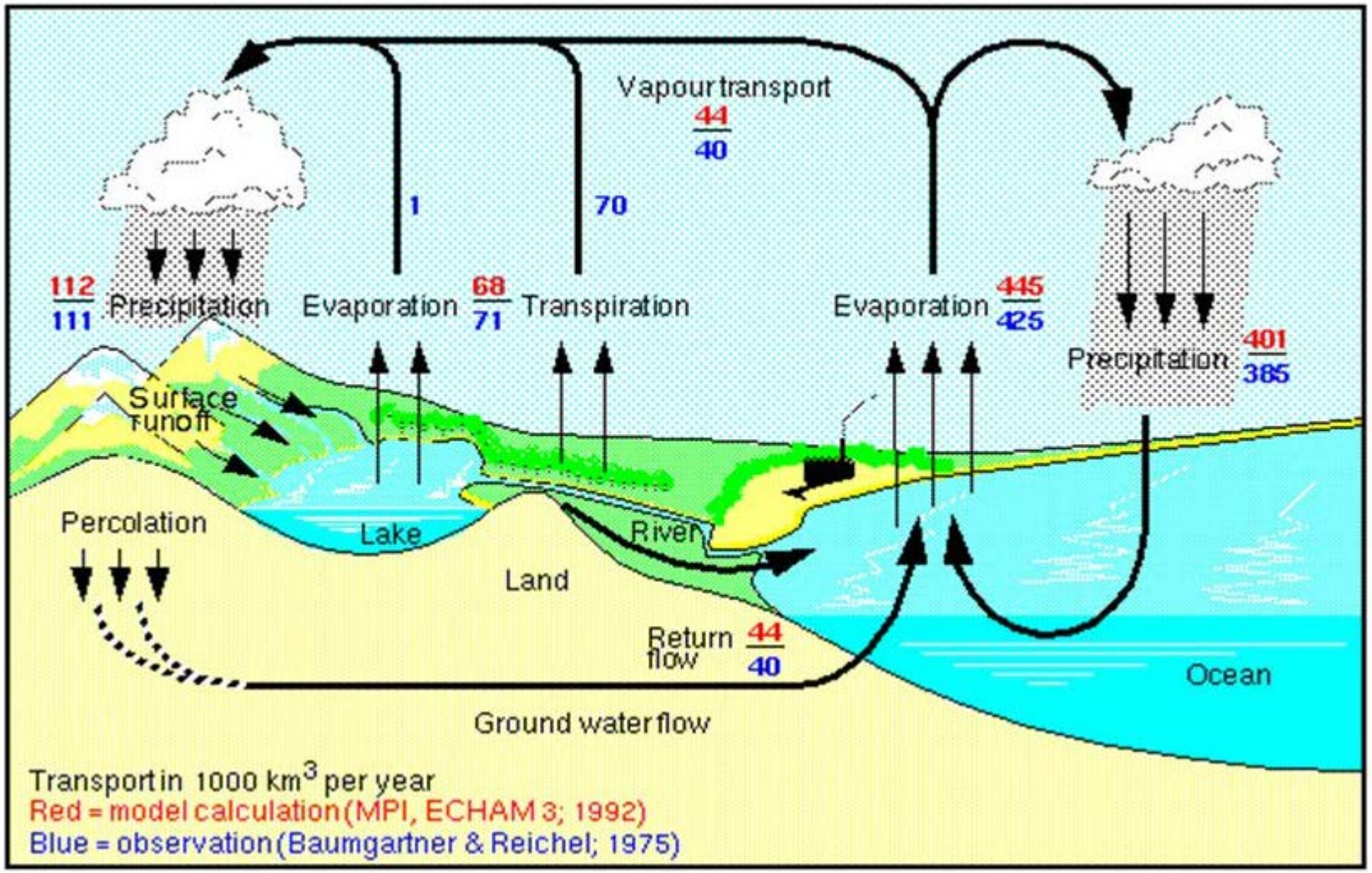


Trust = f(1/Distance)

The Water Cycle, Flows



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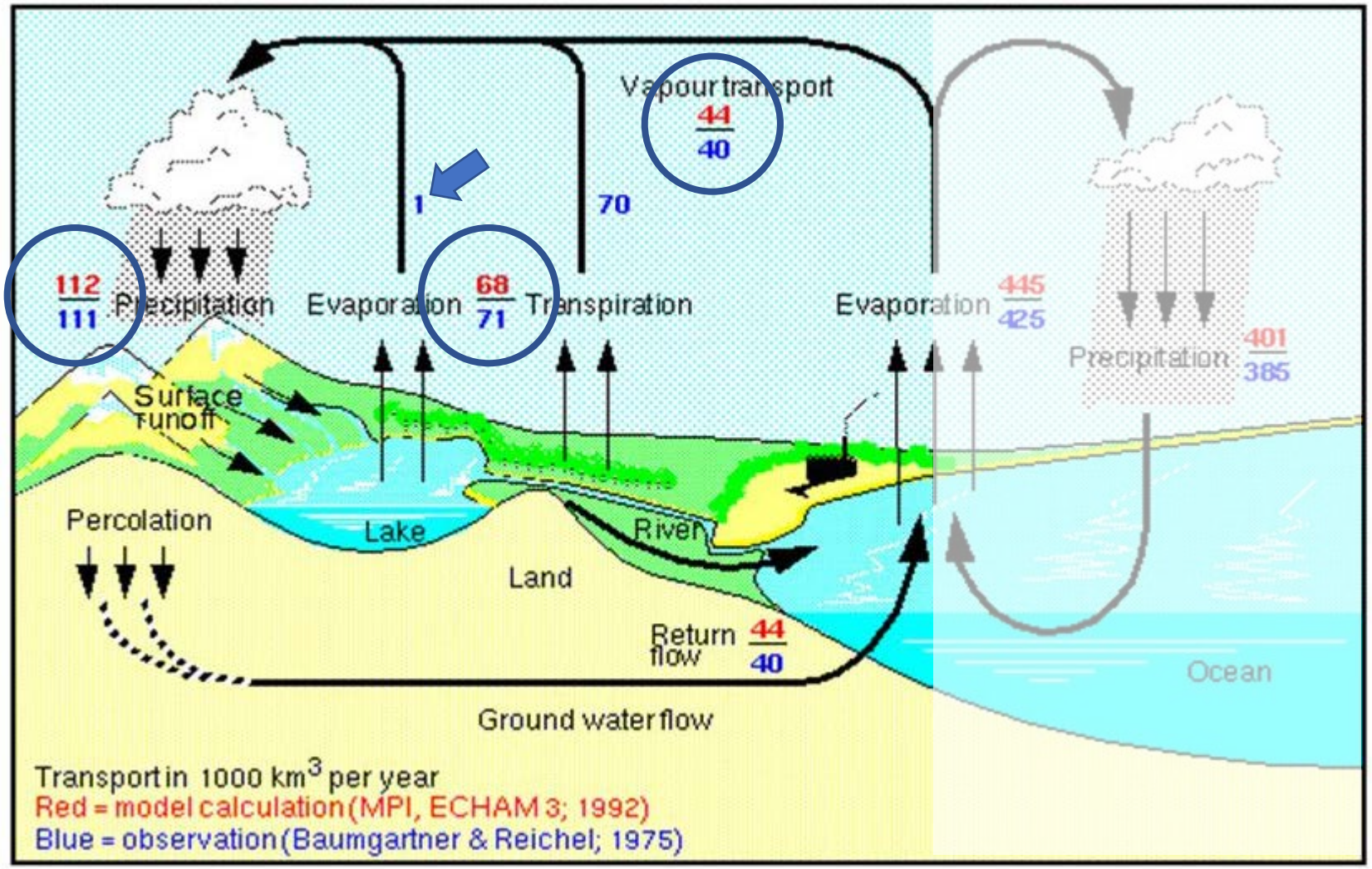
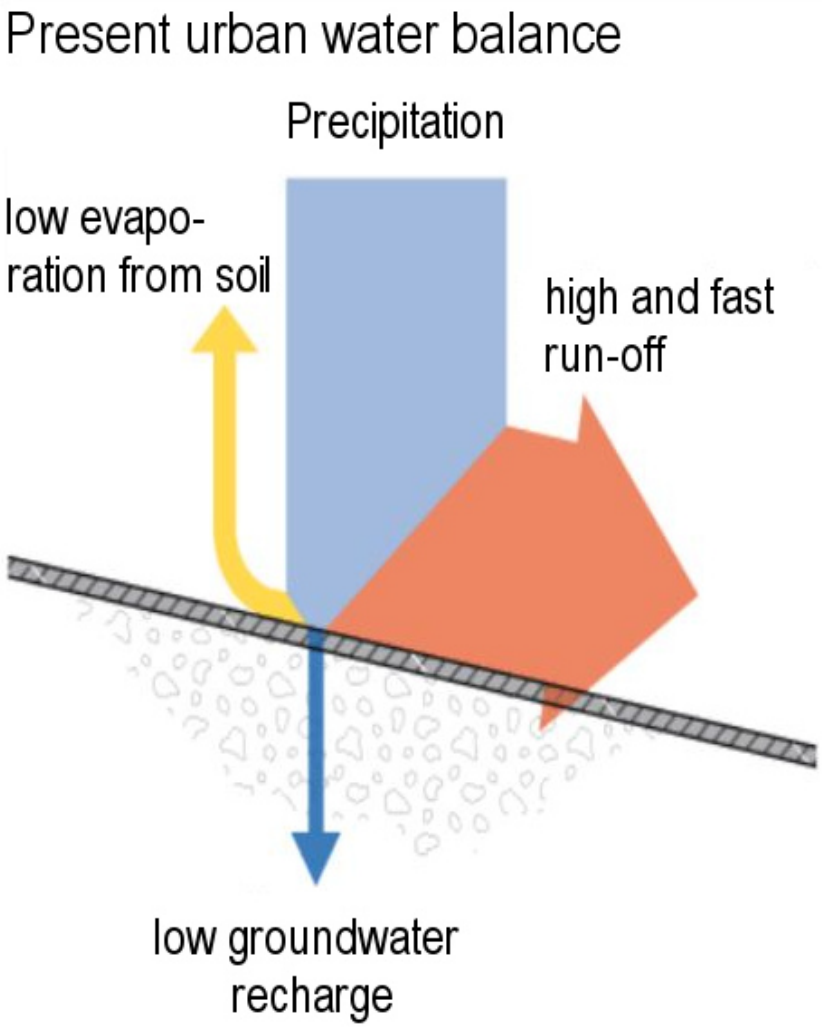
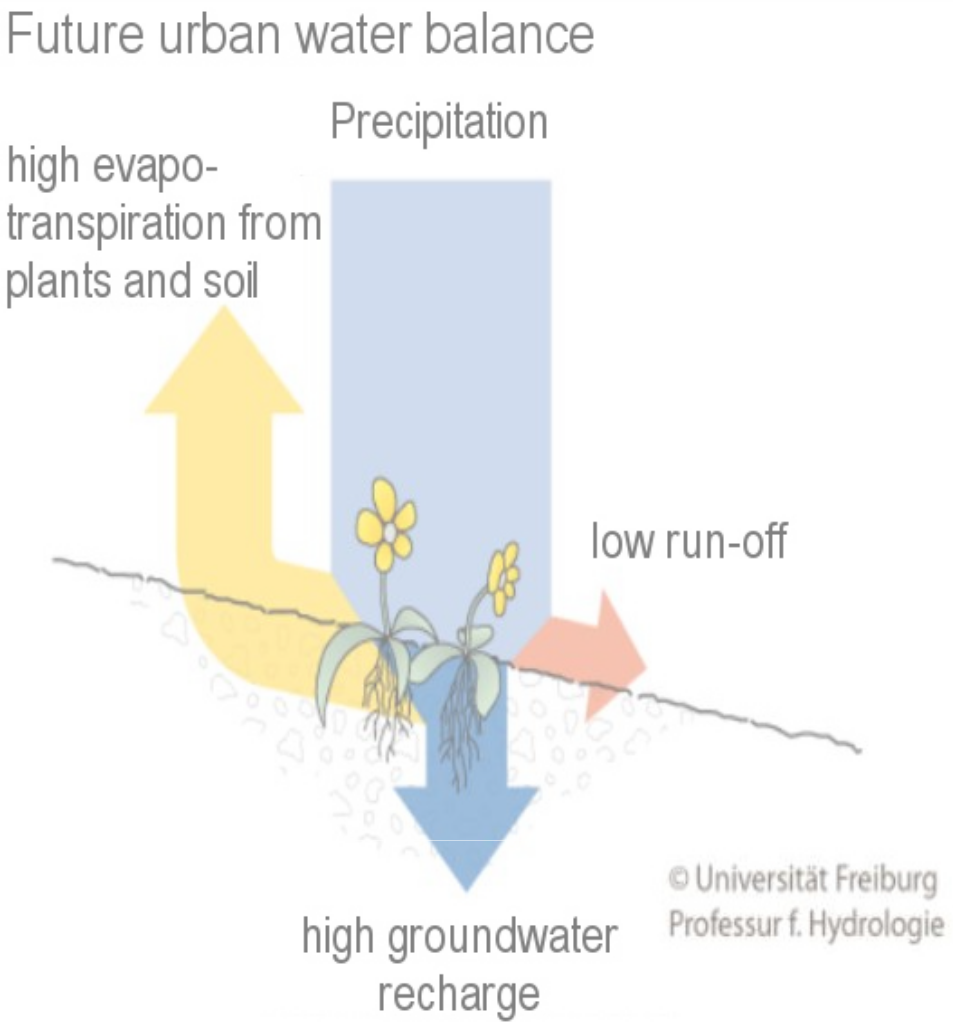
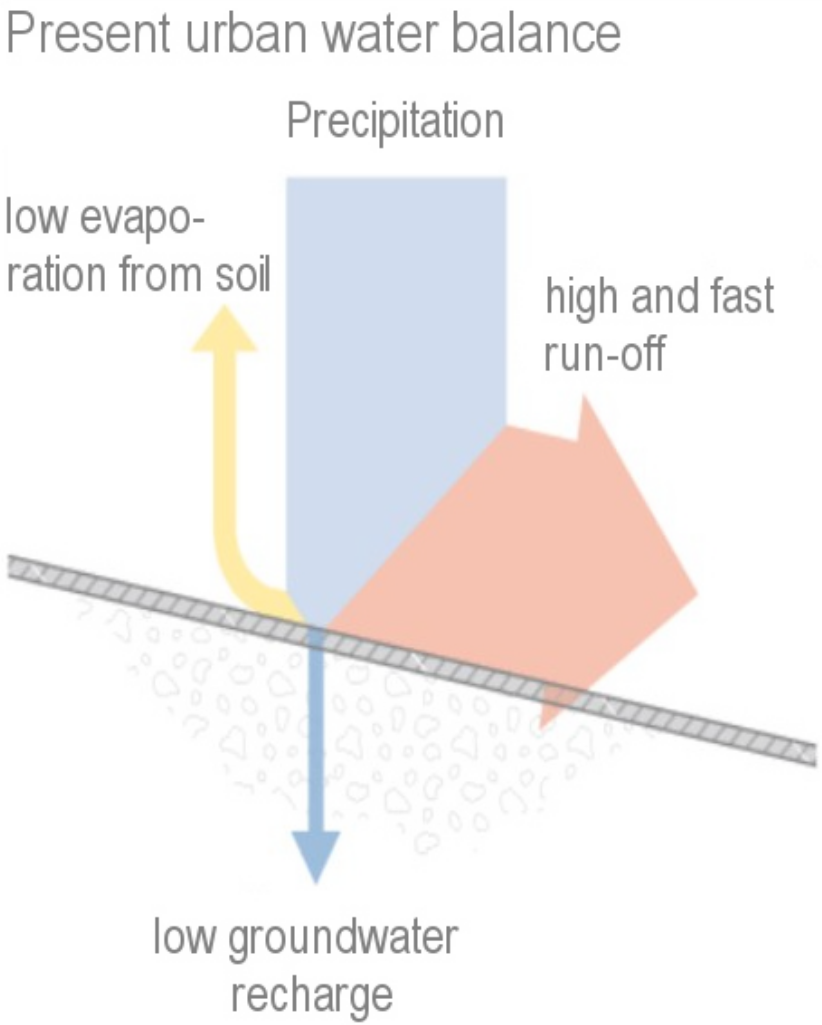


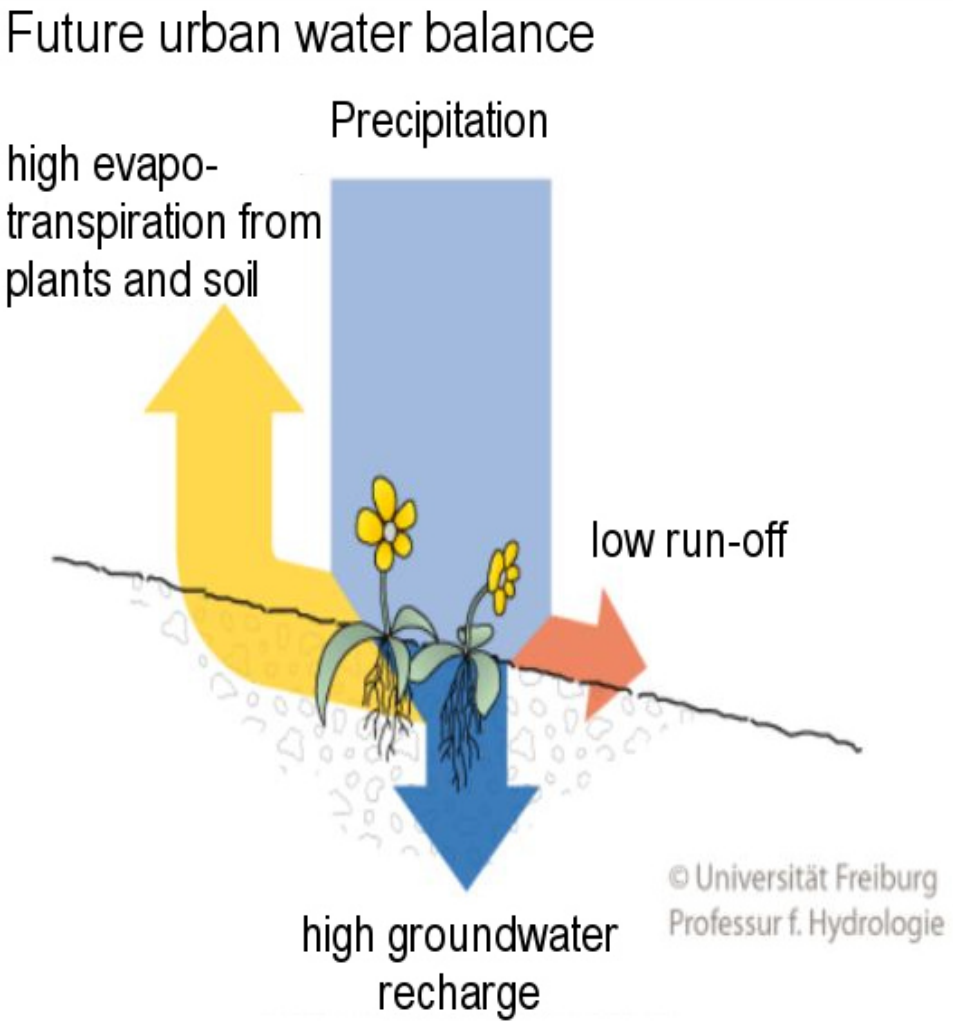
Urban Rainwater Balance



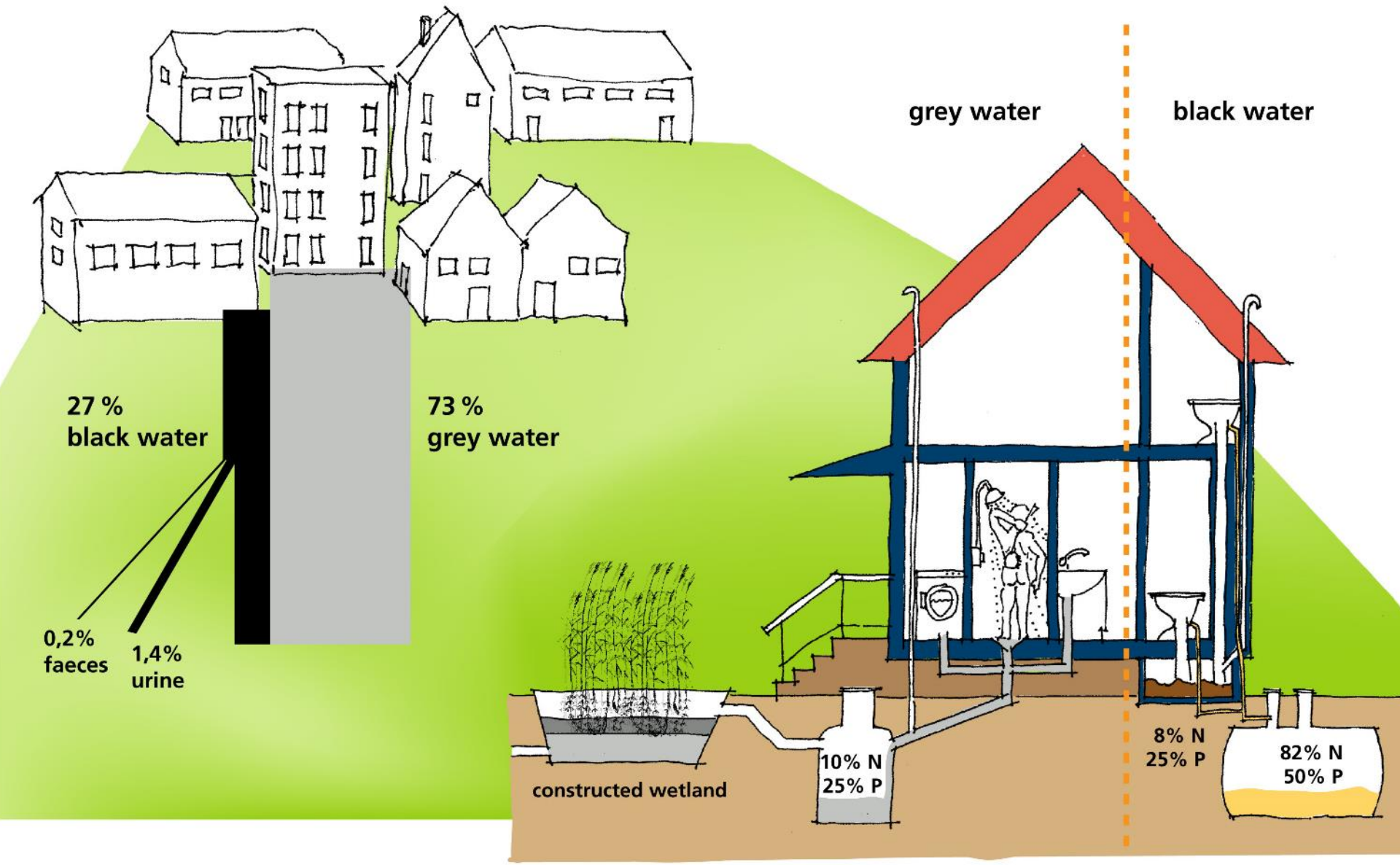


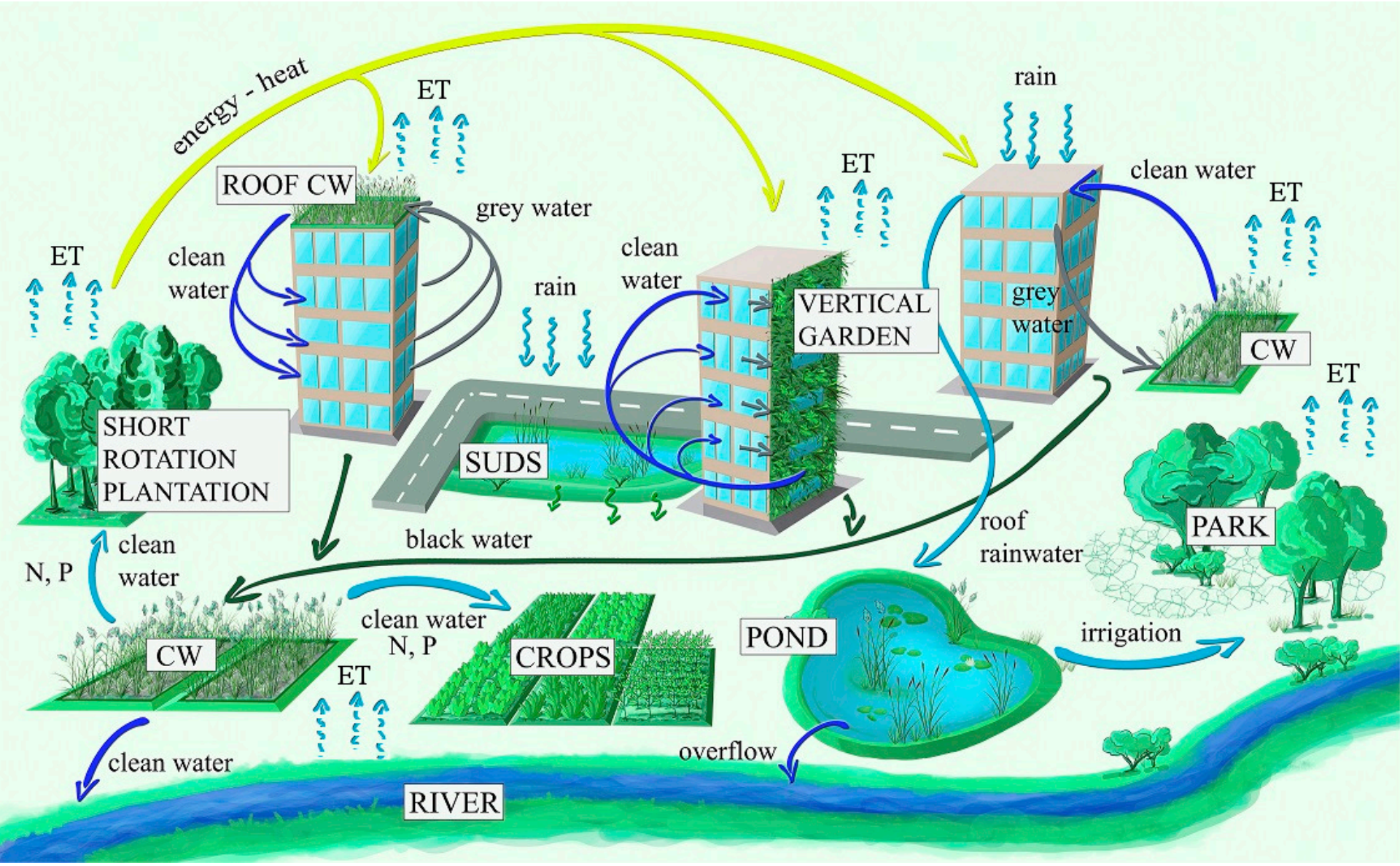
Urban Rainwater Balance





Percentage of sewage components of European households




energy - heat
ET
ROOF CW
grey water
clean water
ET
rain
clean water
VERTICAL GARDEN
rain
ET
clean water
grey water
ET
CW
ET
SHORT ROTATION PLANTATION
SUDS
black water
roof rainwater
PARK
N, P
clean water
clean water
N, P
CW
CROPS
ET
POND
irrigation
clean water
overflow
RIVER

Conventional wastewater management

The sewer:
A good rat breeding station

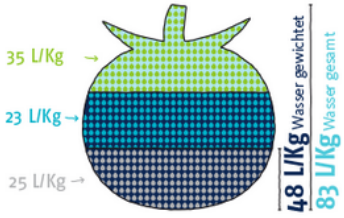
The treatment plant:
High electric energy demand
and wasted N-resources,
phosphorus and potassium

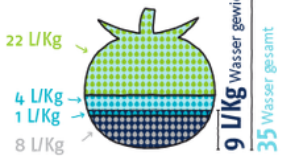
The output:
Hygienically unsafe;
not suitable for irrigation
and bathing

What do we need for urban farming?

Water

Spanien	Niederlande	Deutschland





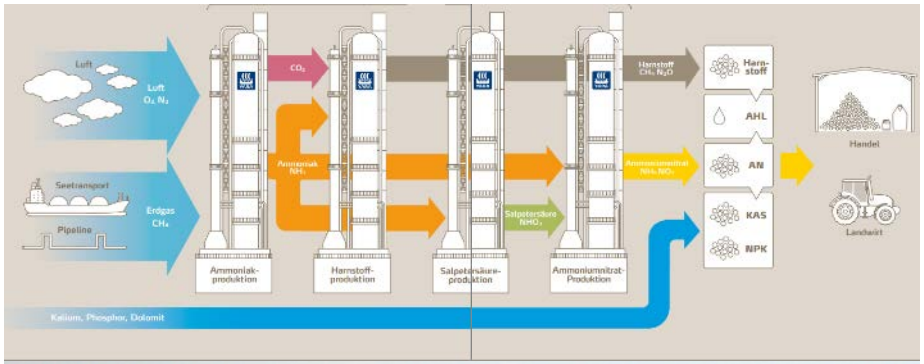
Energy

Sunlight: 1000 Watt/m²

LED light: 300 Watt/m²

Thermal energy

Nutrients - nitrogen, phosphorus, potassium



Production, transport and application of N-fertiliser is energy intensive

Phosphorus reserves are limited;
Peak phosphorus 2030

Potassium:
Salt water intrusion from mine dumping

For all of these nutrients there is no return back from the ocean!

CEphoto, Uwe Aranas | CC BY-SA 3.0

Wastewater: a resource for water, energy and nutrients

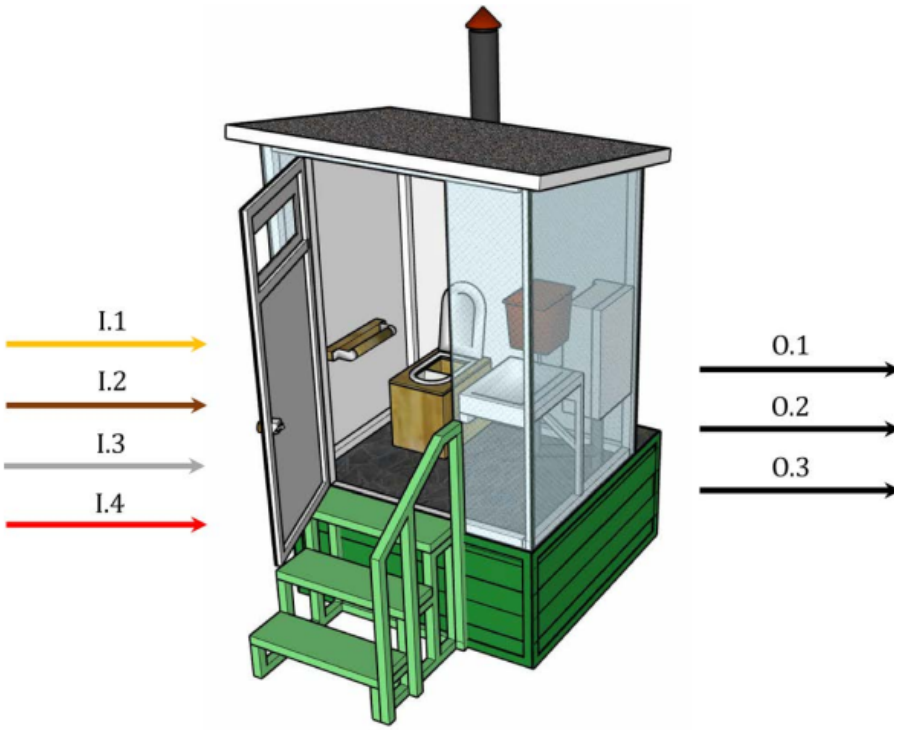
		blackwater		greywater		total
Quantity	l/p/d	35,0	31,3 %	77,0	68,7 %	112,0
COD	g/p/d	70,0	59,3 %	47,0	40,2 %	117,0
Nitrogen (N)	g/p/d	11,9	92,2 %	1,0	7,8 %	12,9
Phosphorus (P)	g/p/d	1,5	75,0 %	0,5	25,0 %	2,0
Potassium (K)	g/p/d	3,2	76,2 %	1,0	23,8 %	4,2
Sulphur (S)	g/p/d	0,9	23,7 %	2,9	76,3 %	3,8

energy review		greywater	total
warmth potential	Cooling in K	20	2
	Wh/p/d	**1768**	**243**
biogas	Wh/p/d		**118**

Decentralised energy recovery potential is 15-fold higher than with the centralised option.

Dilution is no solution

- Don‘t mix black and grey water
- Never put rainwater in the wastewater sewer
- Wastewater is a source of new water, nutrients and energy



Die Luxuriöse: Model Verena

Legend:

I. Material flows input

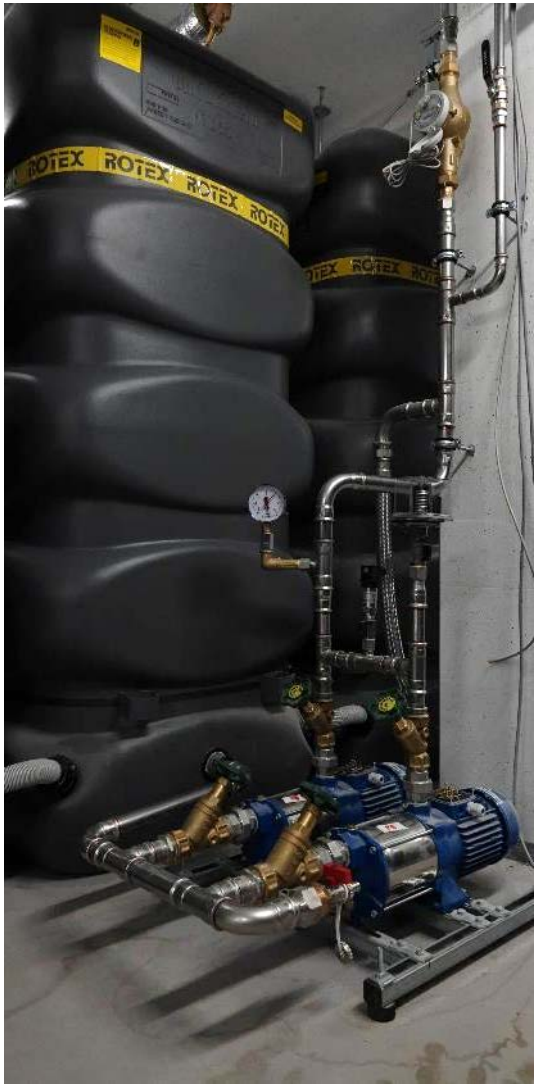
I.1 urine

I.2 faeces

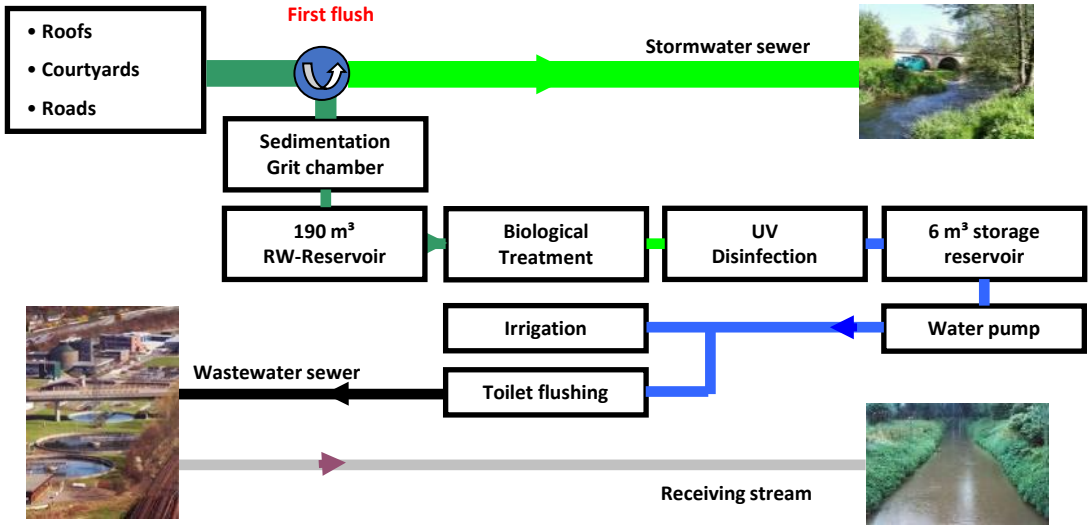
I.3 additives

I.3 contaminants

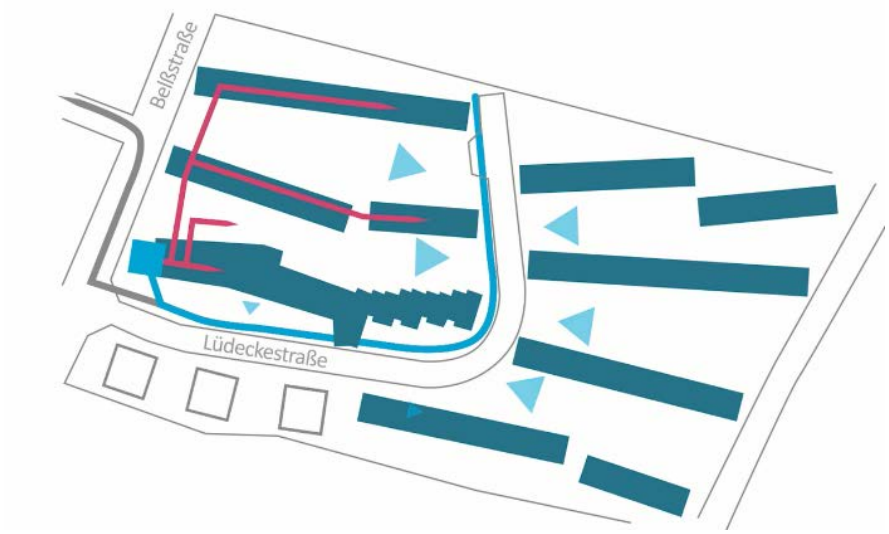
What have we done?



Rainwater with street runoff



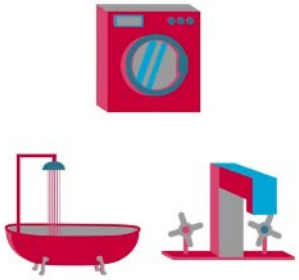
Belß-
/Lüdeckestraße



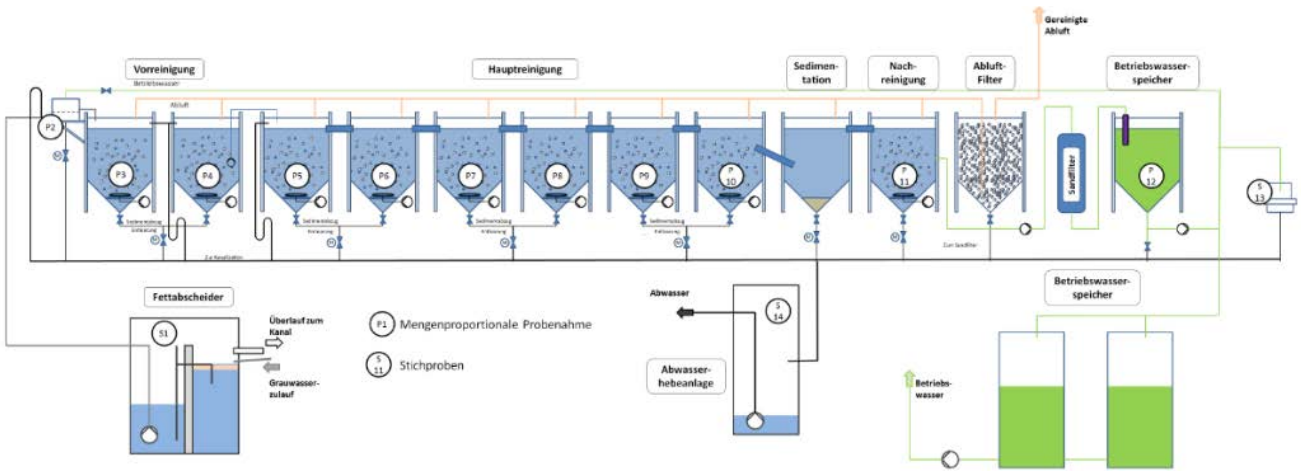
Service water

blackwater

greywater



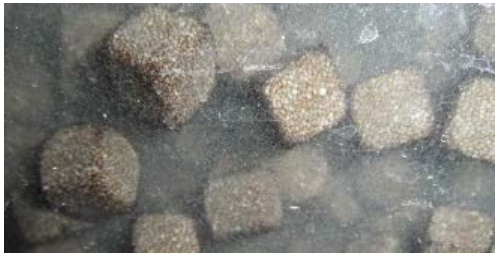
Greywater incl. kitchen water



Block 6

Service water

Grey water → Sedimentation and sieving → Biological treatment → Sedimentation, Filtration + UV disinfection → Service water



Blackwater for fertilizer

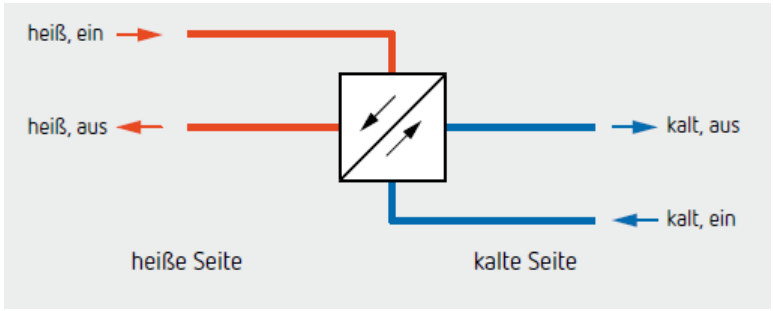
Block 6

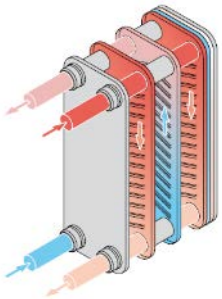
Nutrients

https://www.youtube.com/watch?v=0T-jKxExE3U&t=20s

Energy heating, electricity

Energy analysis		
Cooling down grey water 20 K	1,768	Wh/p/d
Cooling down waste water 2 K	243	Wh/p/d
Biogas	118	Wh/p/d





Greywater with heat recovery

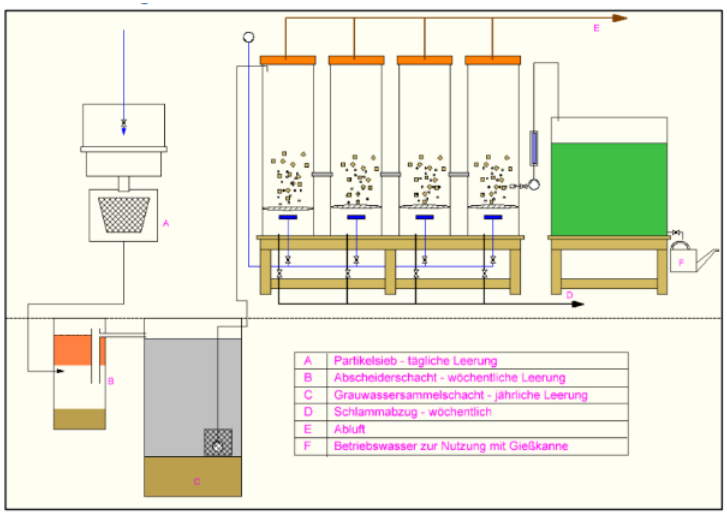
- 450 beds – 15 m³/d

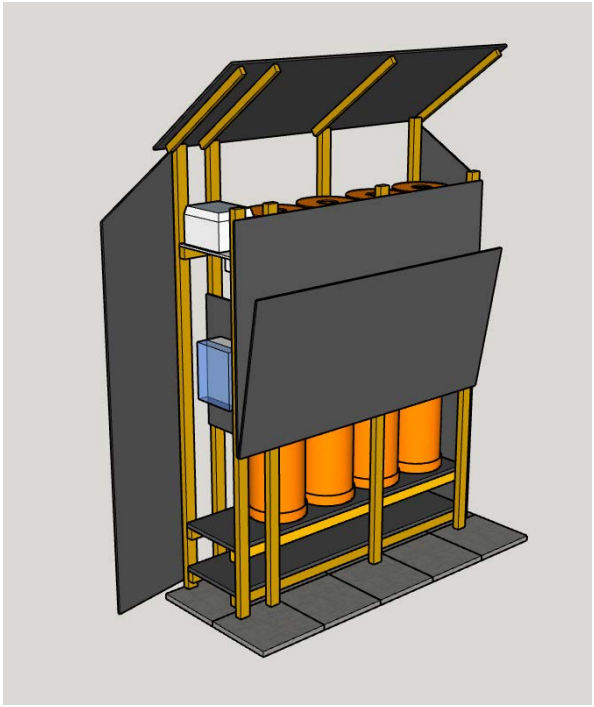
https://www.youtube.com/watch?v=XmOWOSikr_s

Greywater with heat recovery

- 39 flats
- Greenhouse
- Beehives

Greywater incl. kitchen





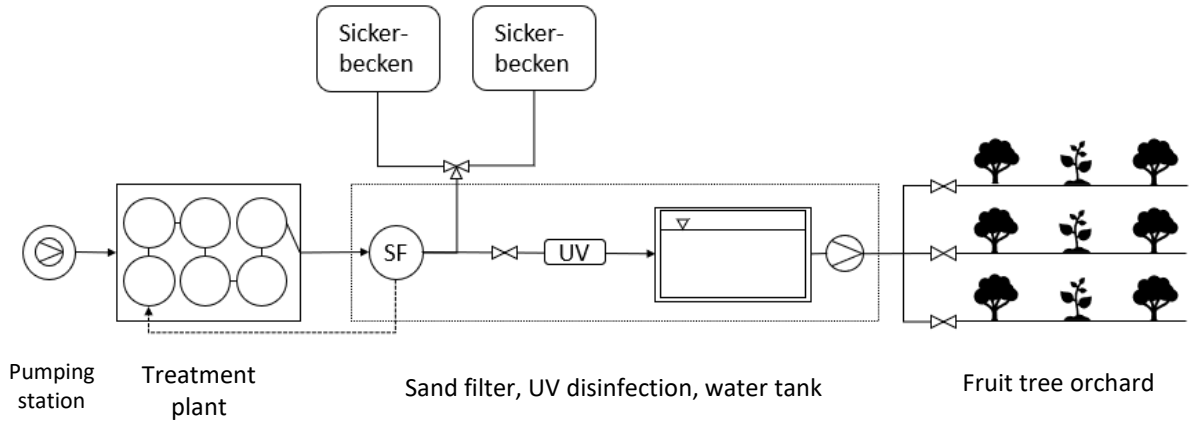
Hellersdorf

Greywater incl. kitchen


Hellersdorf

EdiCitNet: Gutsgarten, Berlin-Hellersdorf

Treated wastewater for irrigation



Guidelines

- EU Directive for Bathing Water 2006/7/EC (under revision)
- REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 May 2020 on minimum requirements for water reuse
- Onsite non-potable water systems: DIN EN 16941-2:2021 (greywater) and DIN EN 16941-1:2018 (rainwater)
- Protection against pollution of potable water installations and general requirements of devices to prevent pollution by backflow: DIN EN 1717:2011

- Berlin guidelines for service water use (1995)
- British Standards BS8525-1:2010 & BS 8525-2:2011 for greywater

Thank you for your attention!

"Knowing is not enough,
we must apply;
Willing is not enough,
we must do."

Johann Wolfgang von Goethe
(From: Wilhelm Meisters Wanderjahre)

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