

Introduction to Arctic Water Sanitation and Health (WASH)

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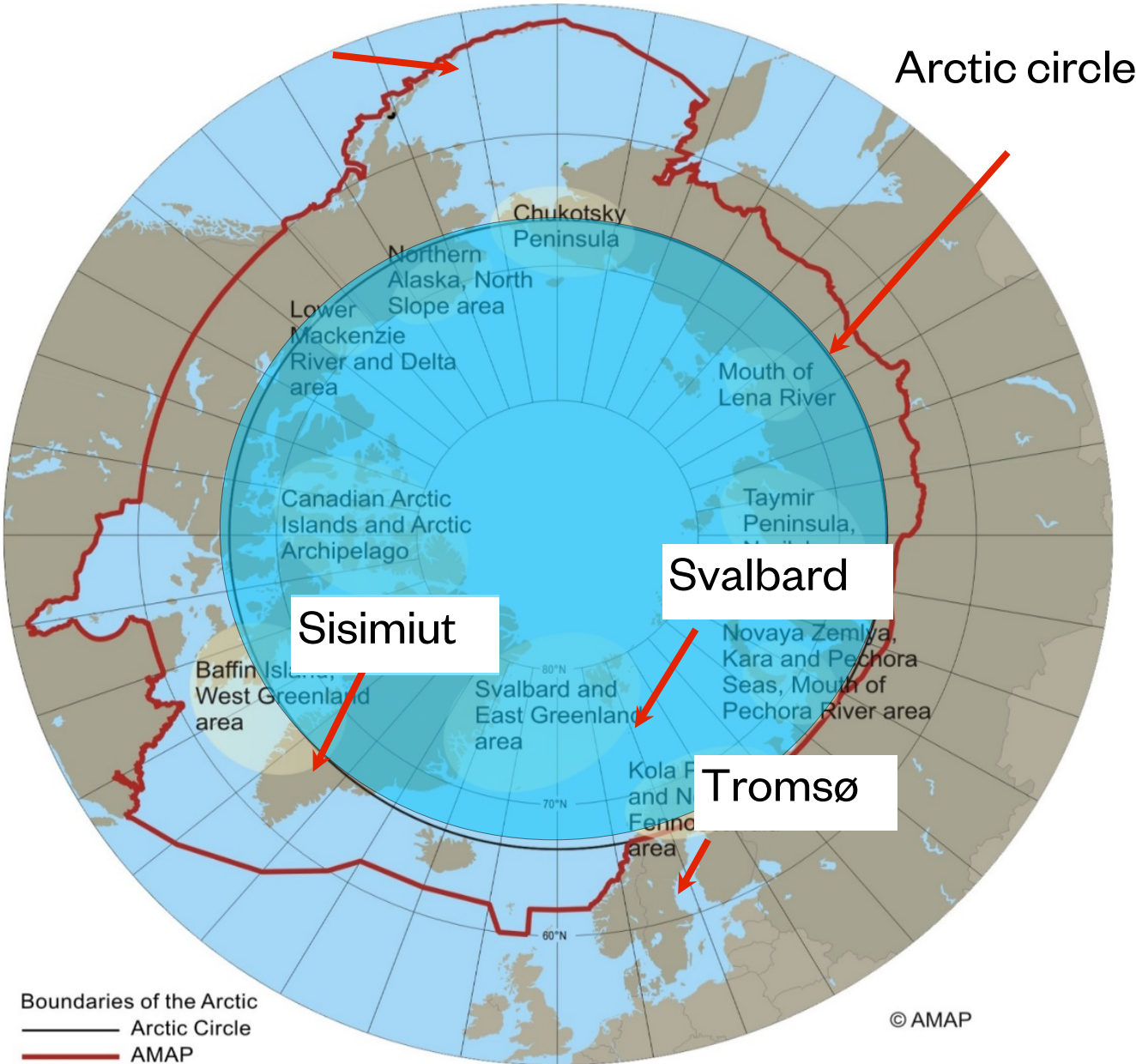
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AMAP - area

Arctic Monitoring and Assessment Programme



Extremely cold climate

Sisimiut Greenland 66° north



Extremely cold climate

Sisimiut Greenland 66° north



Low biological diversity

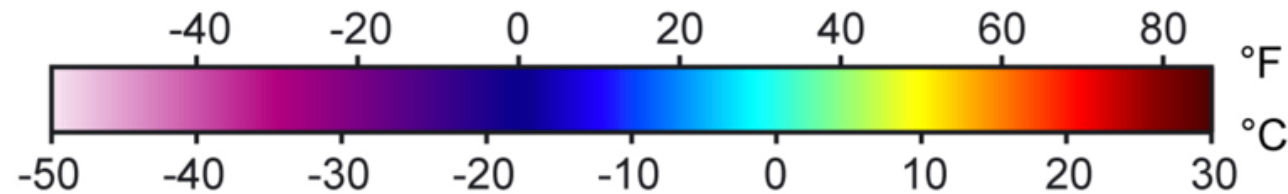
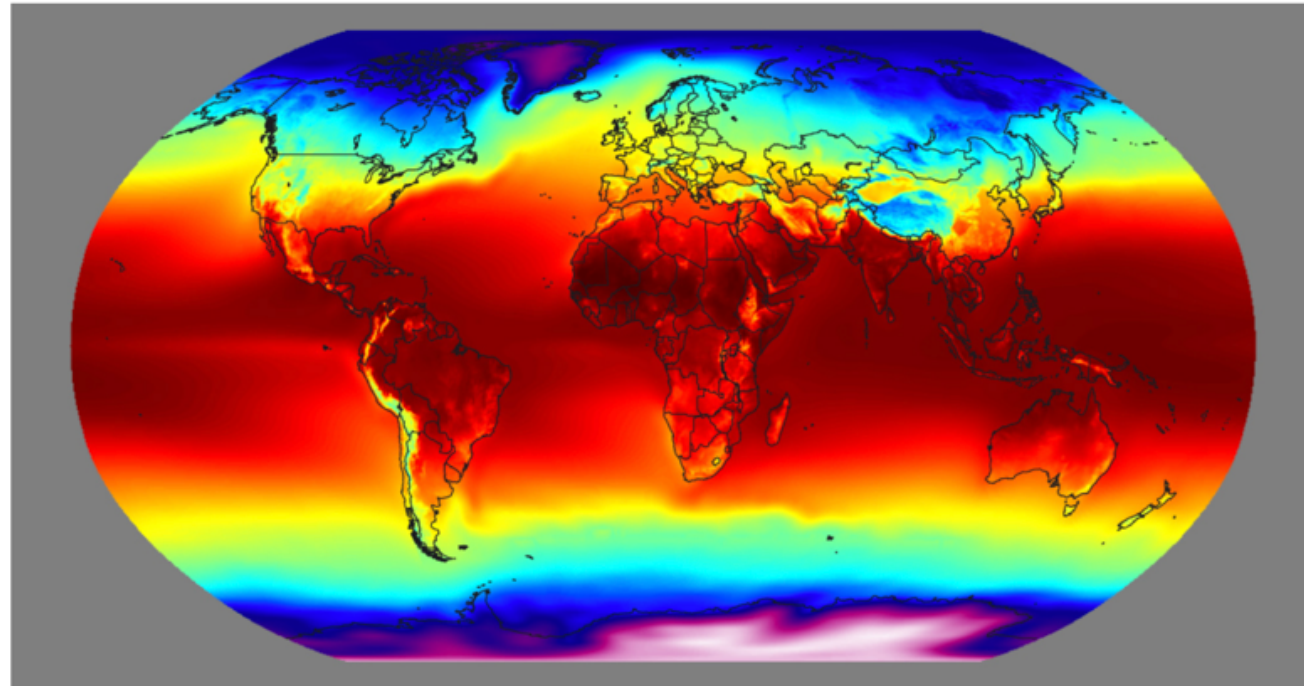


Lower reaction rates for chemical and biological processes



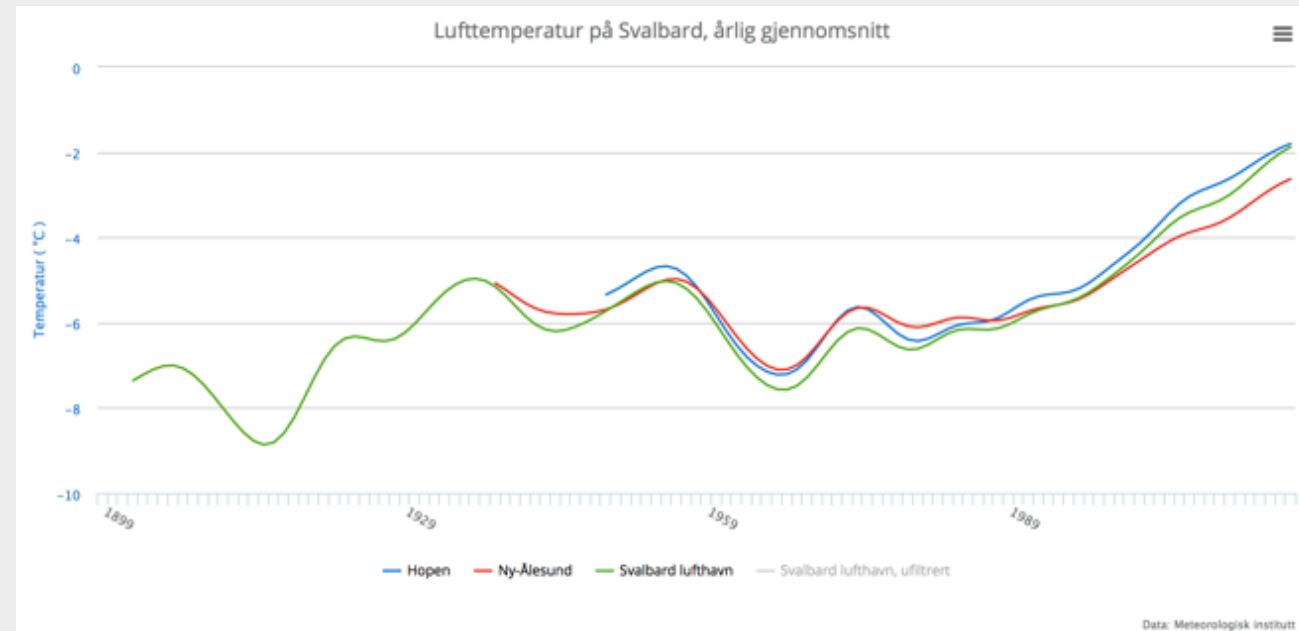
Mean annual temperatures

Global view

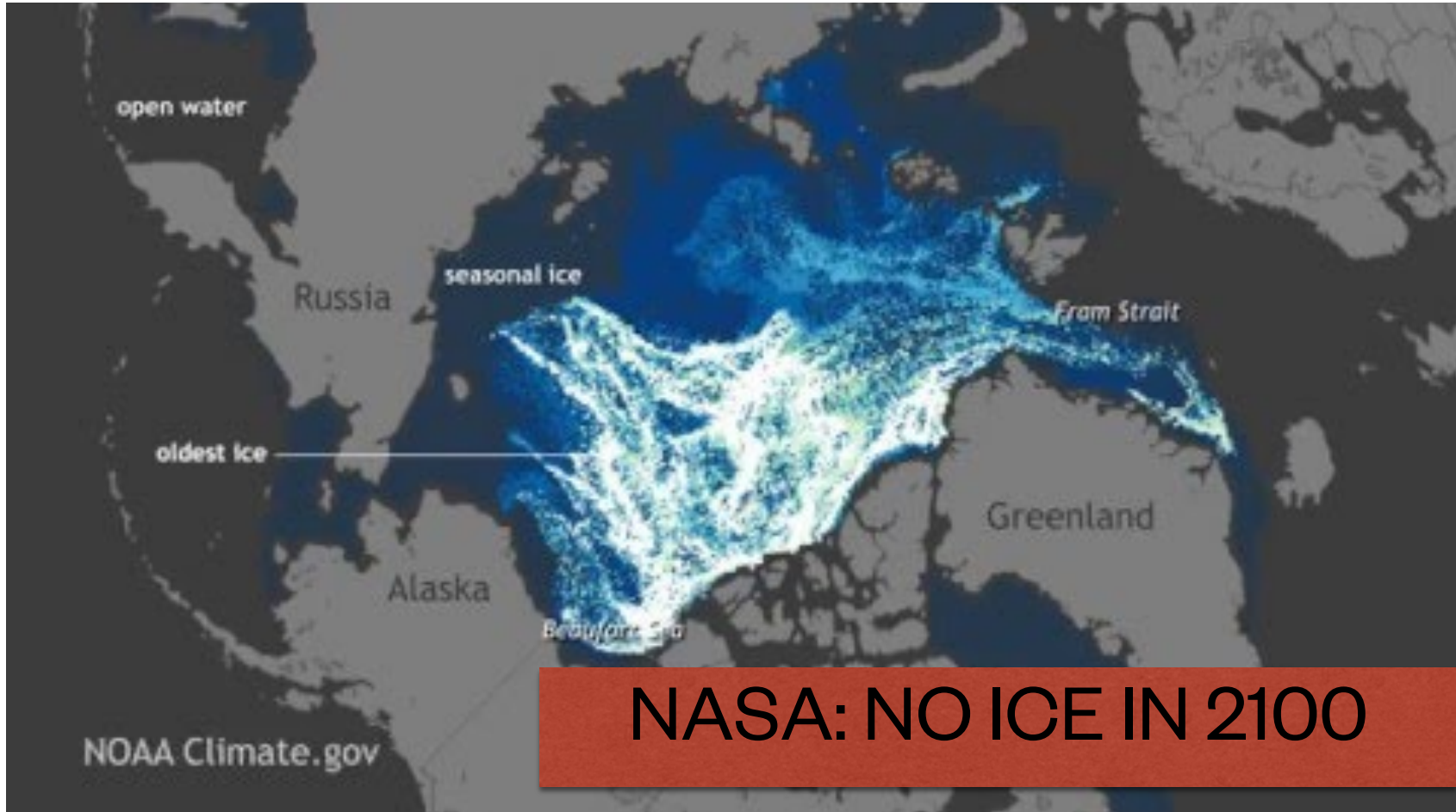


Mean annual temperatures

Global view



The arctic ice cap is decreasing



2050



Wastewater discharge to arctic ocean waters – problems?



Greenland



The world's biggest island



The ice free area 19%



Inhabitants: 55 000

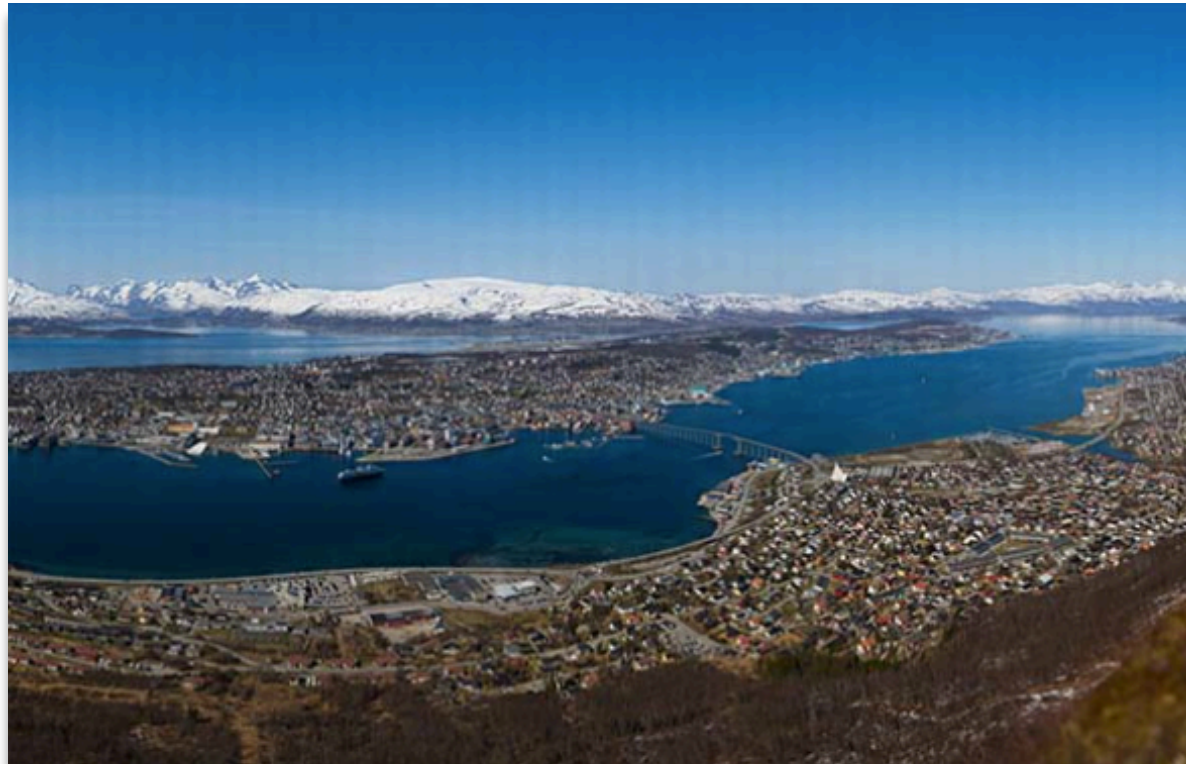


Climate differs from one locality to the other



Tromsø, Norway

75 000 people, 69° north





Wastewater discharge to arctic ocean waters – problems?

- ▲ Nutrients (nitrogen and phosphorus)?
- ▲ Organic matter?
- ▲ Particles (SS)?
- ▲ Microorganisms?
- ▲ Organic micropollutants as PPCPs?

Svolværpostei



Made from cod roe
and cod liver



Popular on sandwiches



Svolværpostei



Made from cod roe
and cod liver



Popular on sandwiches

Warning:
Not to be consumed by
pregnant women!





Organic micropollutants in polar mammals – alarming levels

Wastewater discharge to arctic waters – problems?

▲ Nutrients (nitrogen and phosphorus)?

▲ Organic matter?

▲ Particles (SS)?

▲ Microorganisms?

▲ Organic micropollutants as PPCPs?



Low income - poor communities



Low income – poor communities

Smell! Health risk! Dignity!



Greywater handling



Greywater outlet

Greywater handling



Frozen greywater

Greywater handling



Greywater discharge pipe

Low income – poor communities

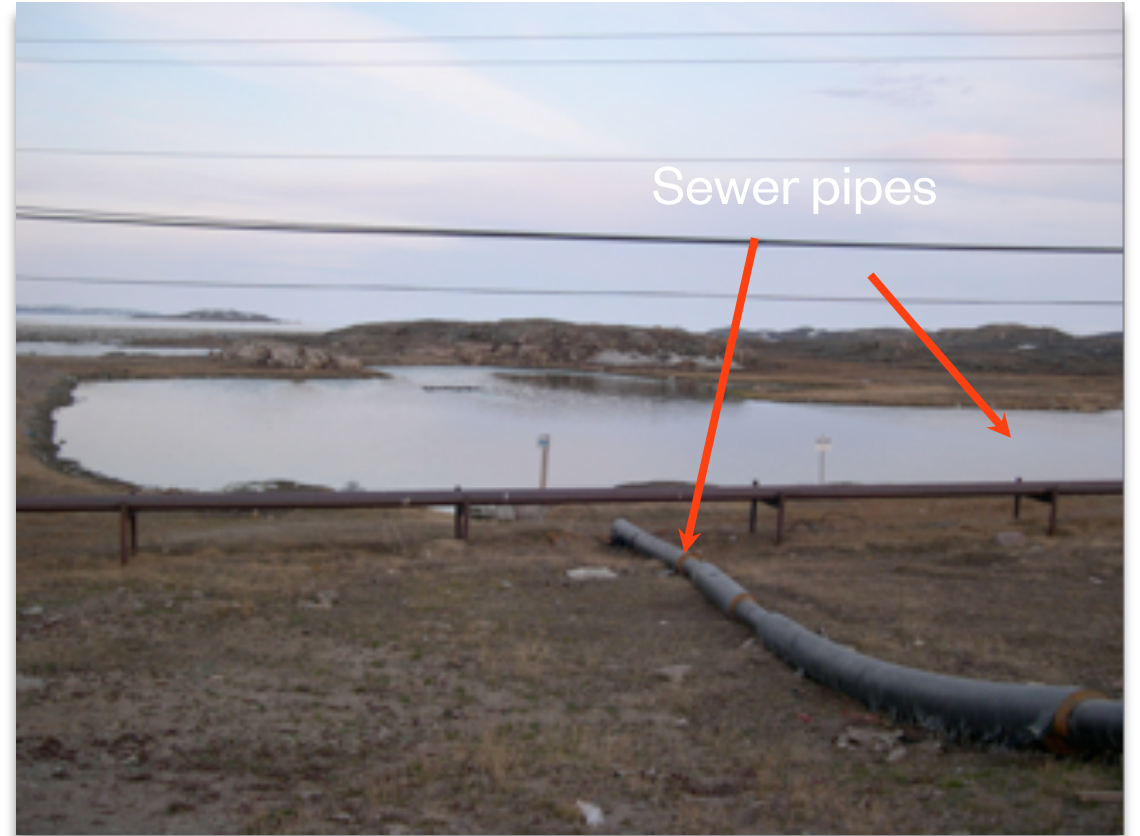
Lack of adequate water
and sanitation cause
health problems

(Hennesey et al. 2008)



Current wastewater handling - centralized systems

Iqaluit's Sewage Lagoon:
Baffin Island





Sisimiut Greenland – no treatment



Sisimiut Greenland – no treatment



Risk:

**Accumulation of unwanted
substances in the food chain!**

Current wastewater handling in Greenland – Towns

Smell! Health risk! Dignity!



Cost – centralized systems in the Arctic



Water and sewerage up to
160'000 USD/home
(Nelson 2016)

Cost – centralized systems

Water and sewer pipes up to
6000 CAD/meter
(Johnsen 2016)



Centralized systems



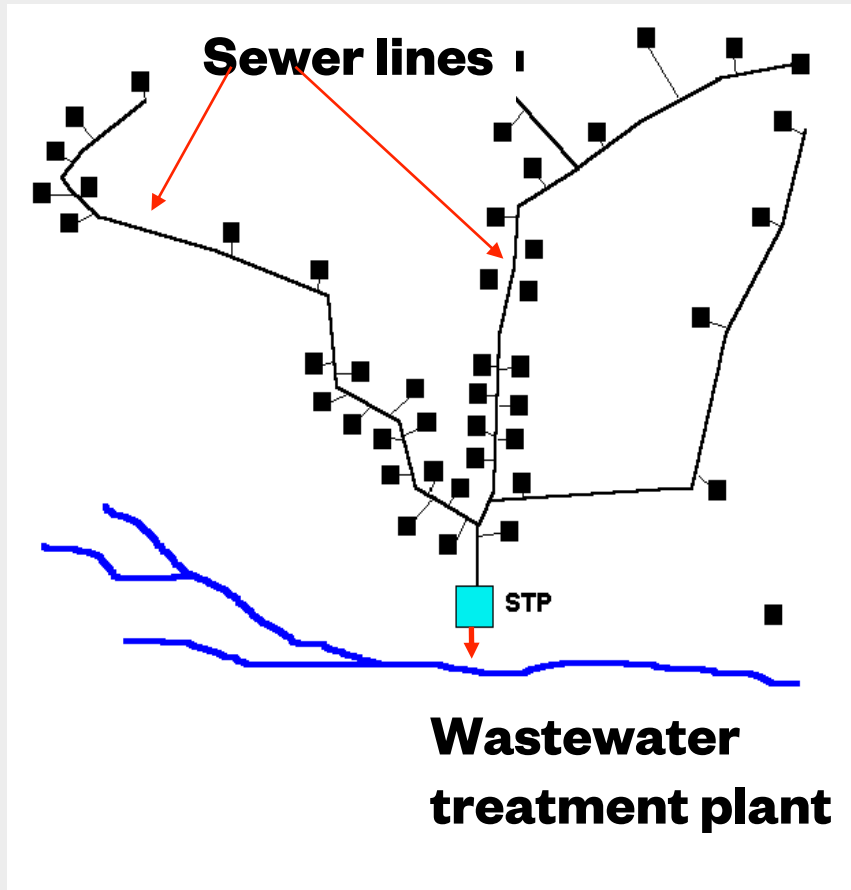
Water
pipe

Centralized systems



Wastewater pipes

Investment cost of centralized sewer systems



Collection system: 70 - 90%



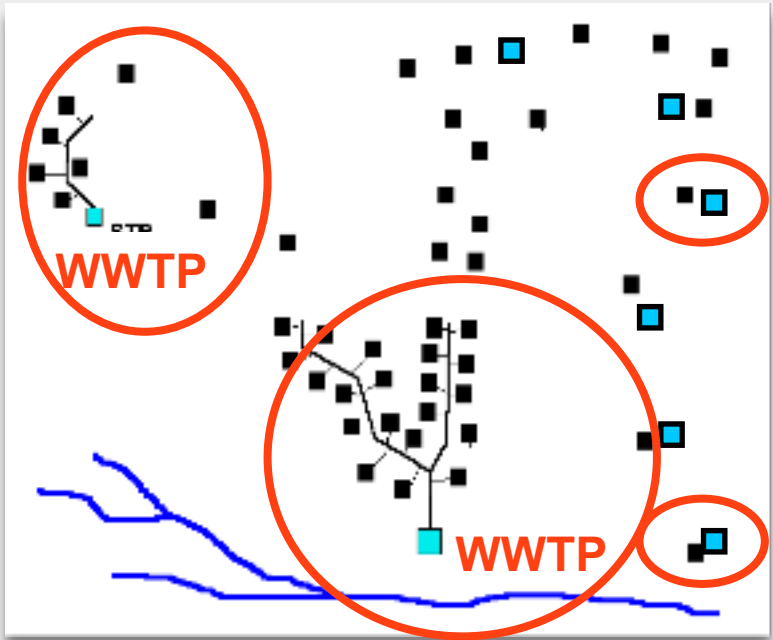
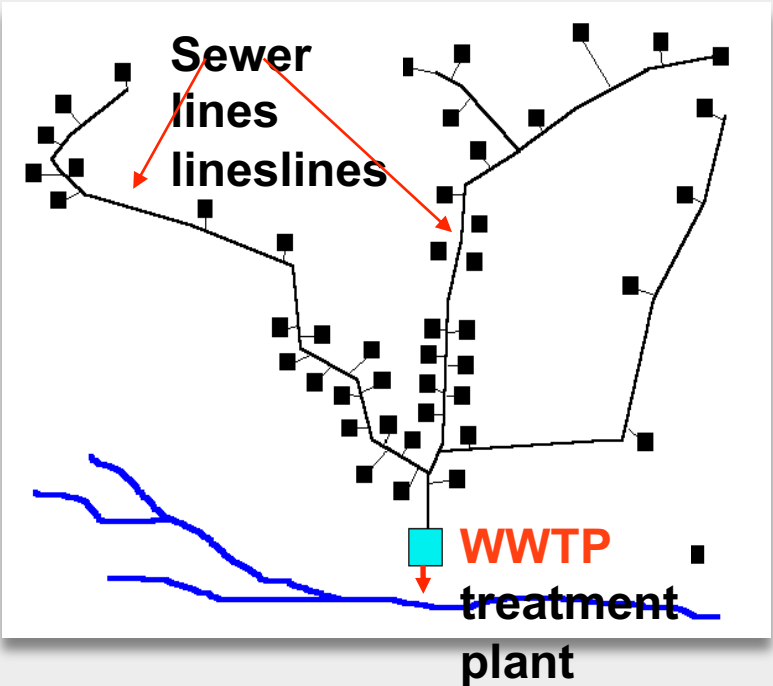
Treatment: 10 - 30%

Wastewater treatment

Centralized

or

Decentralized



■ Wastewater Treatment Plant - WWTP

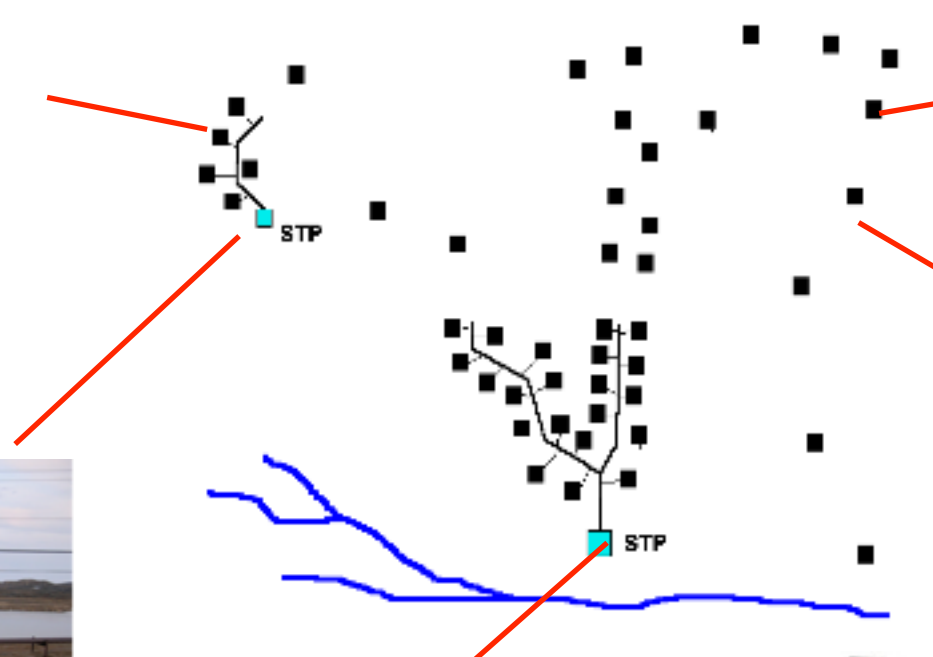
Wastewater treatment options



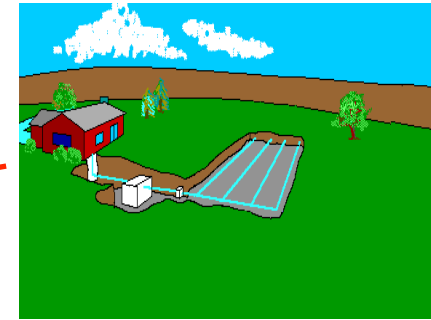
Source separation



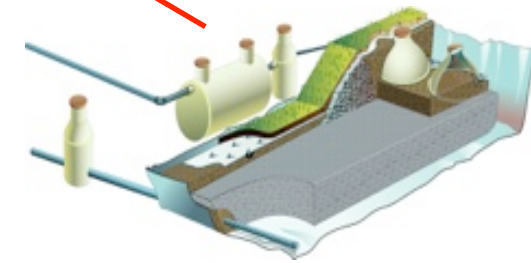
Ponds - lagoons



Conventional systems



Infiltration



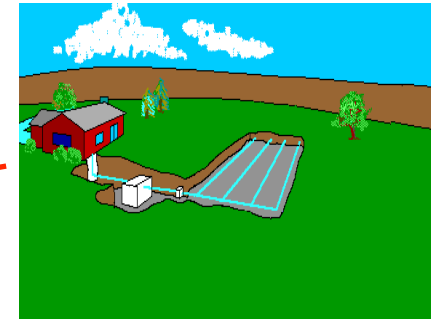
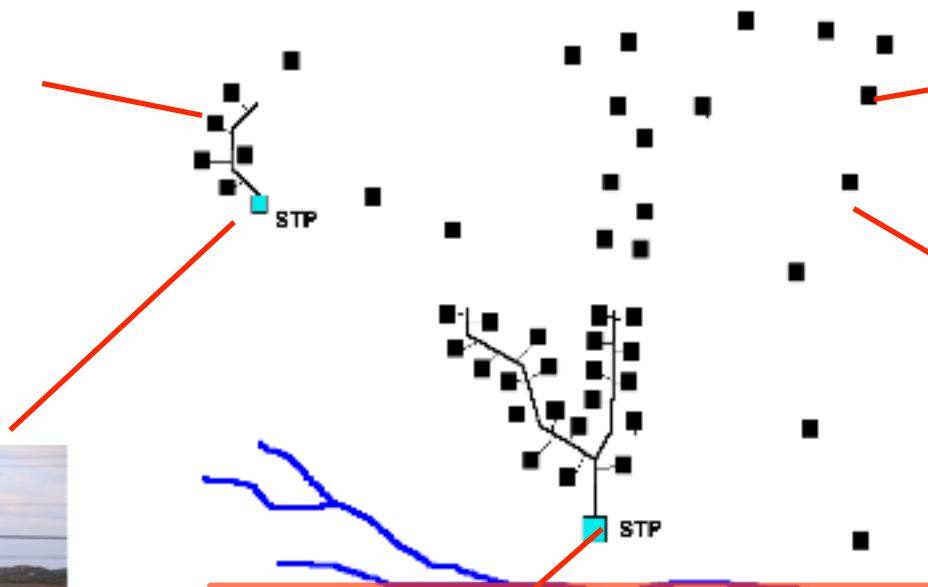
Constructed wetlands



Wastewater treatment options



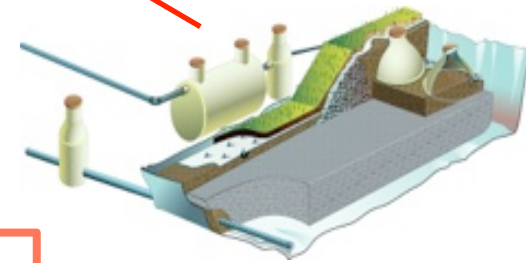
Source separation



Infiltration



Ponds - lagoons



Constructed wetlands

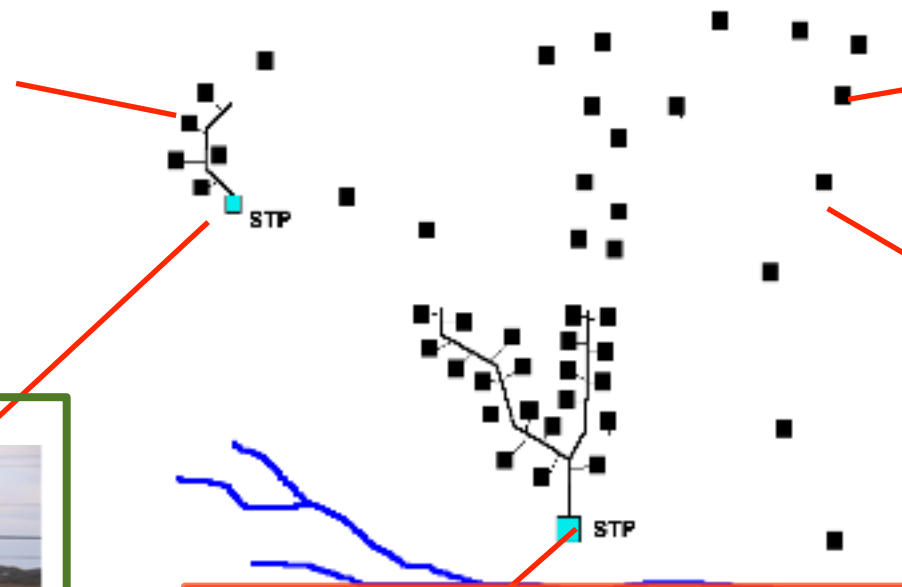


Conventional systems

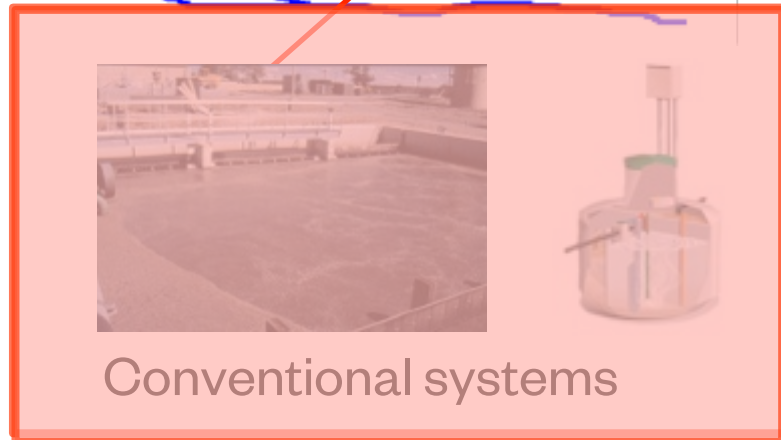
Wastewater treatment options



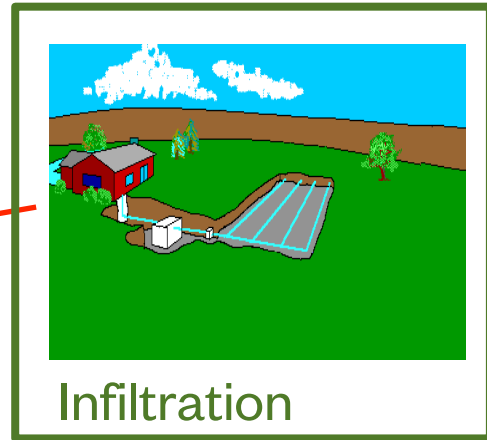
Source separation



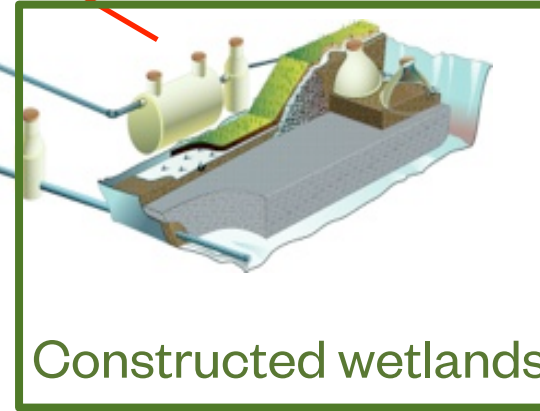
Ponds - lagoons



Conventional systems



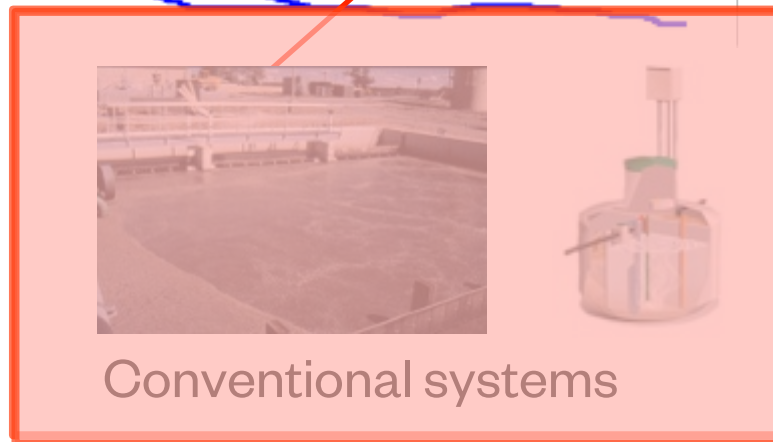
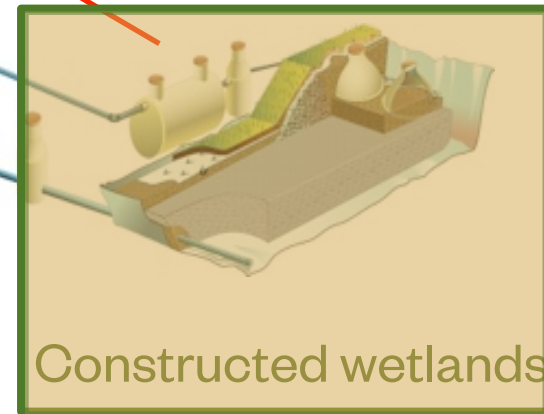
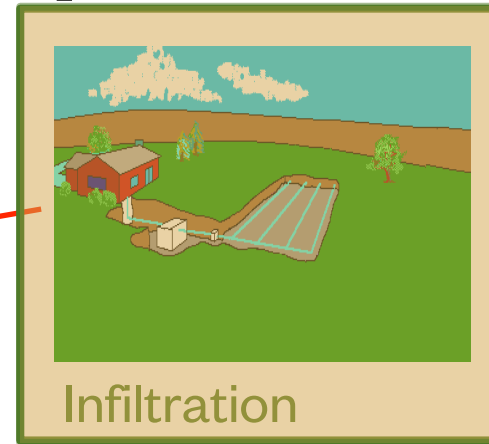
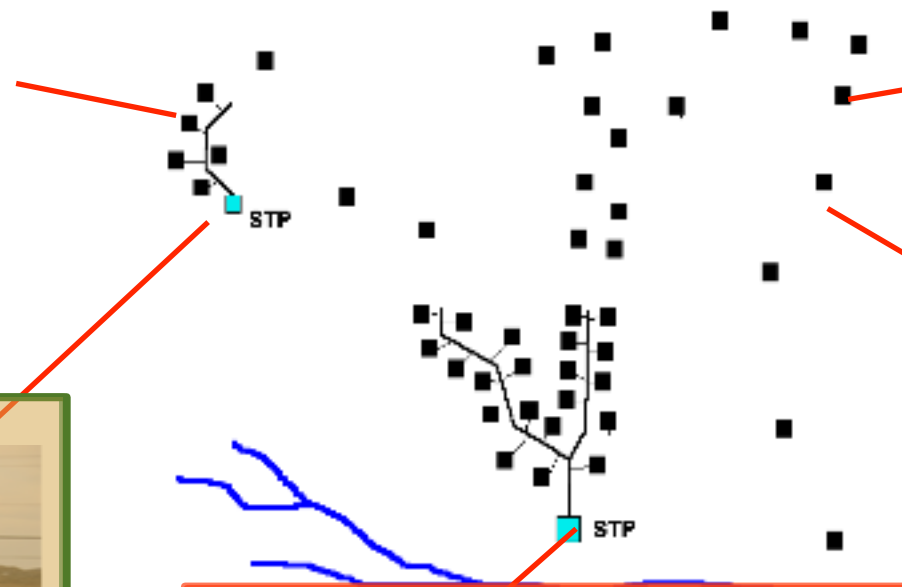
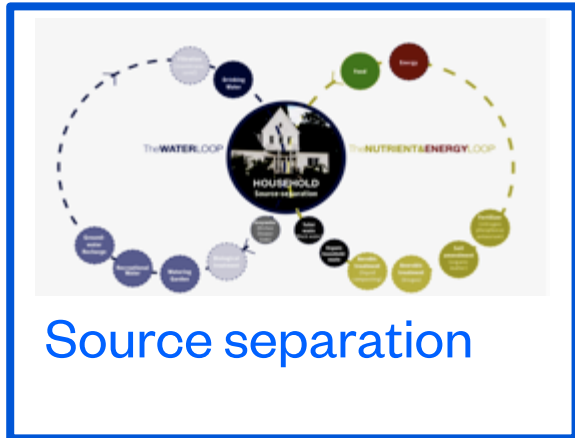
Infiltration



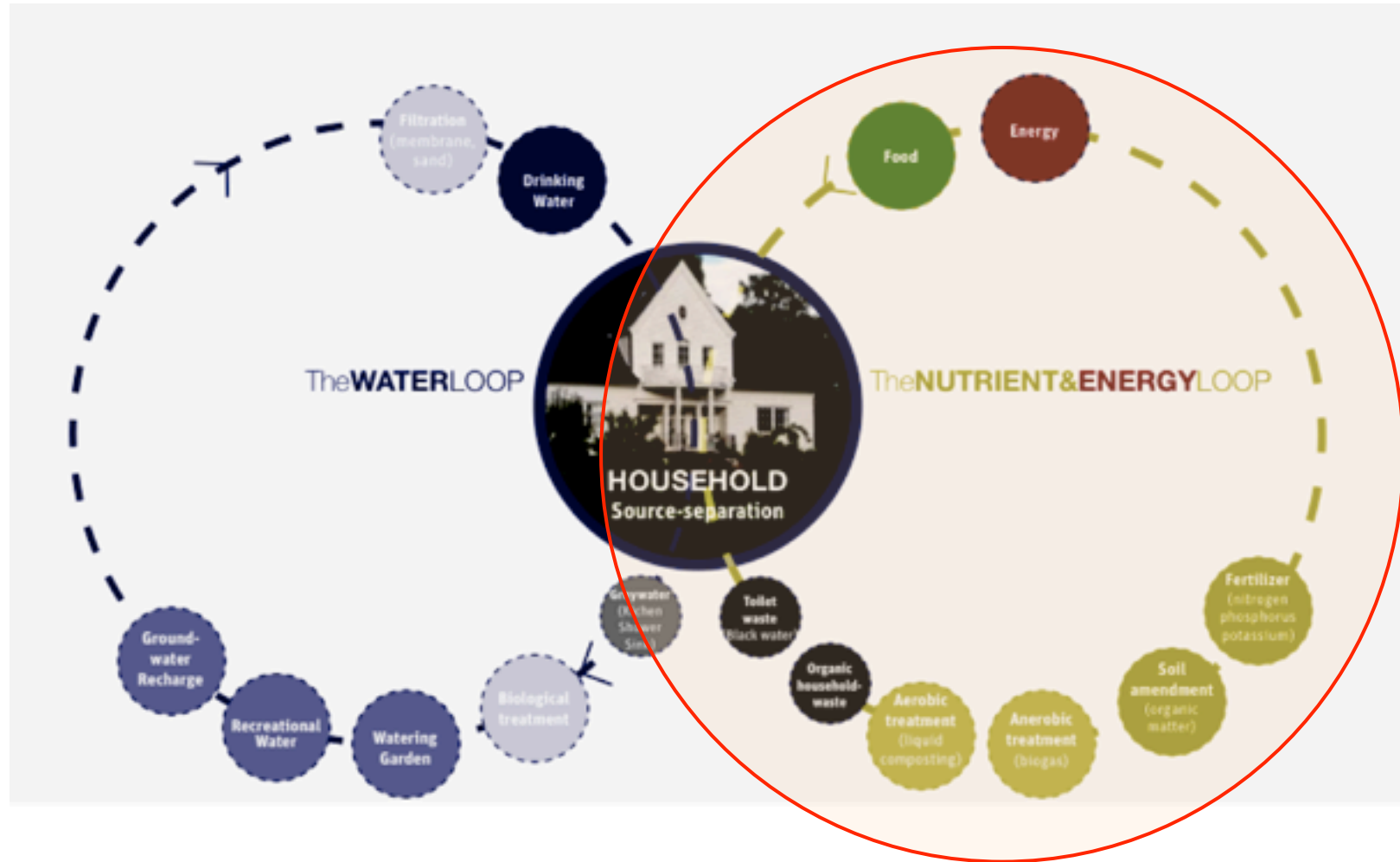
Constructed wetlands



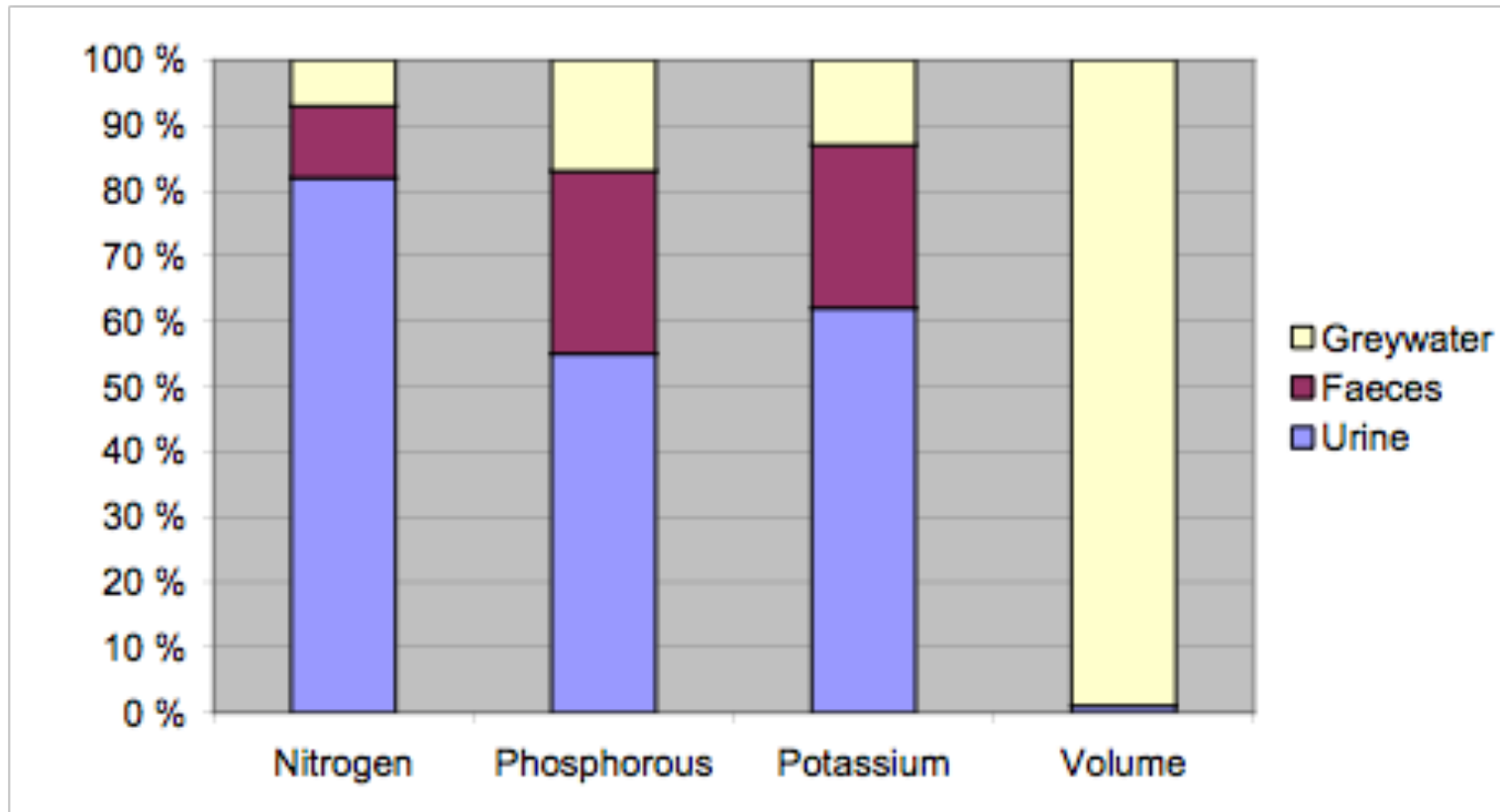
Wastewater treatment options



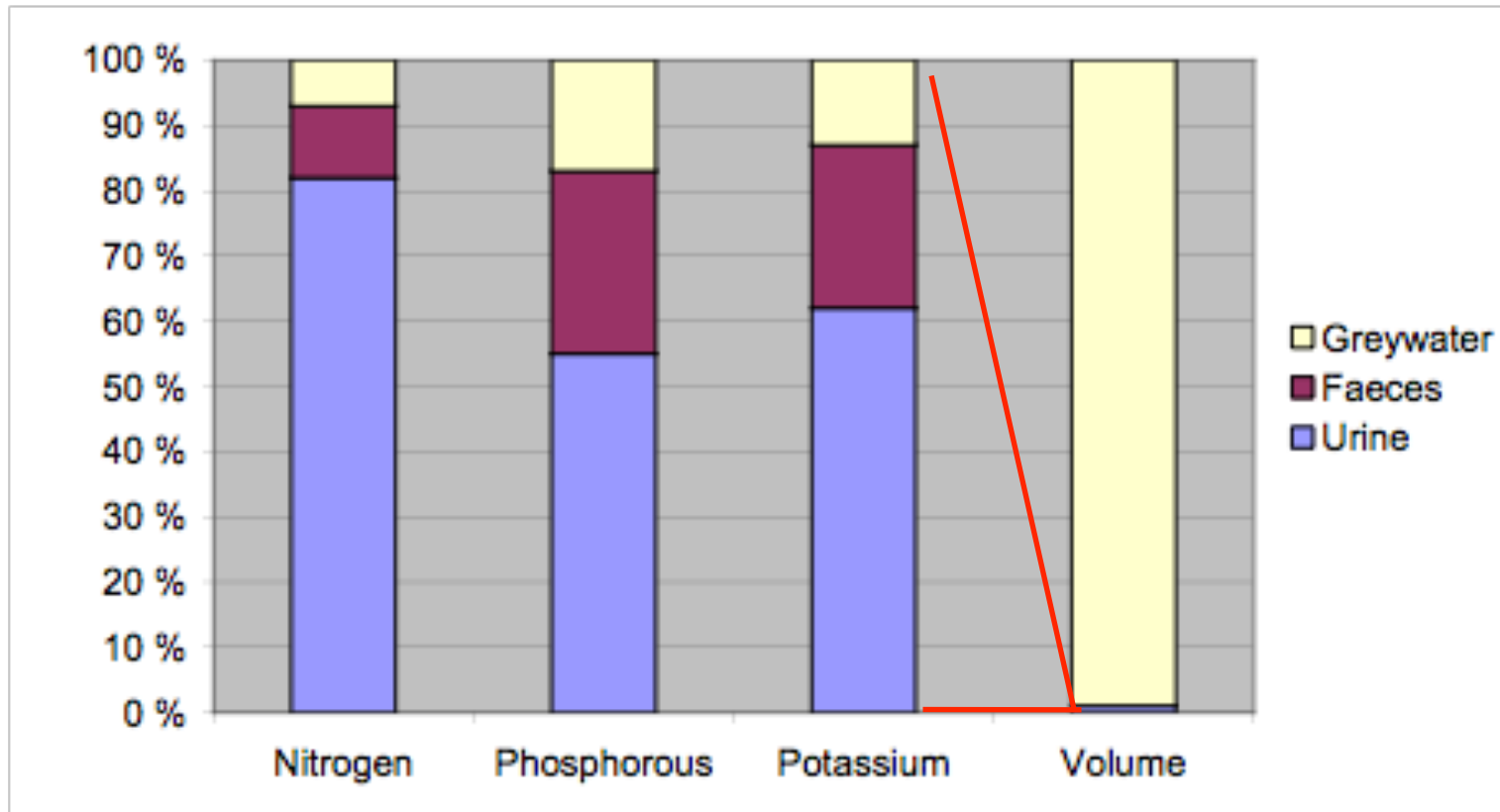
Source separation of wastewater



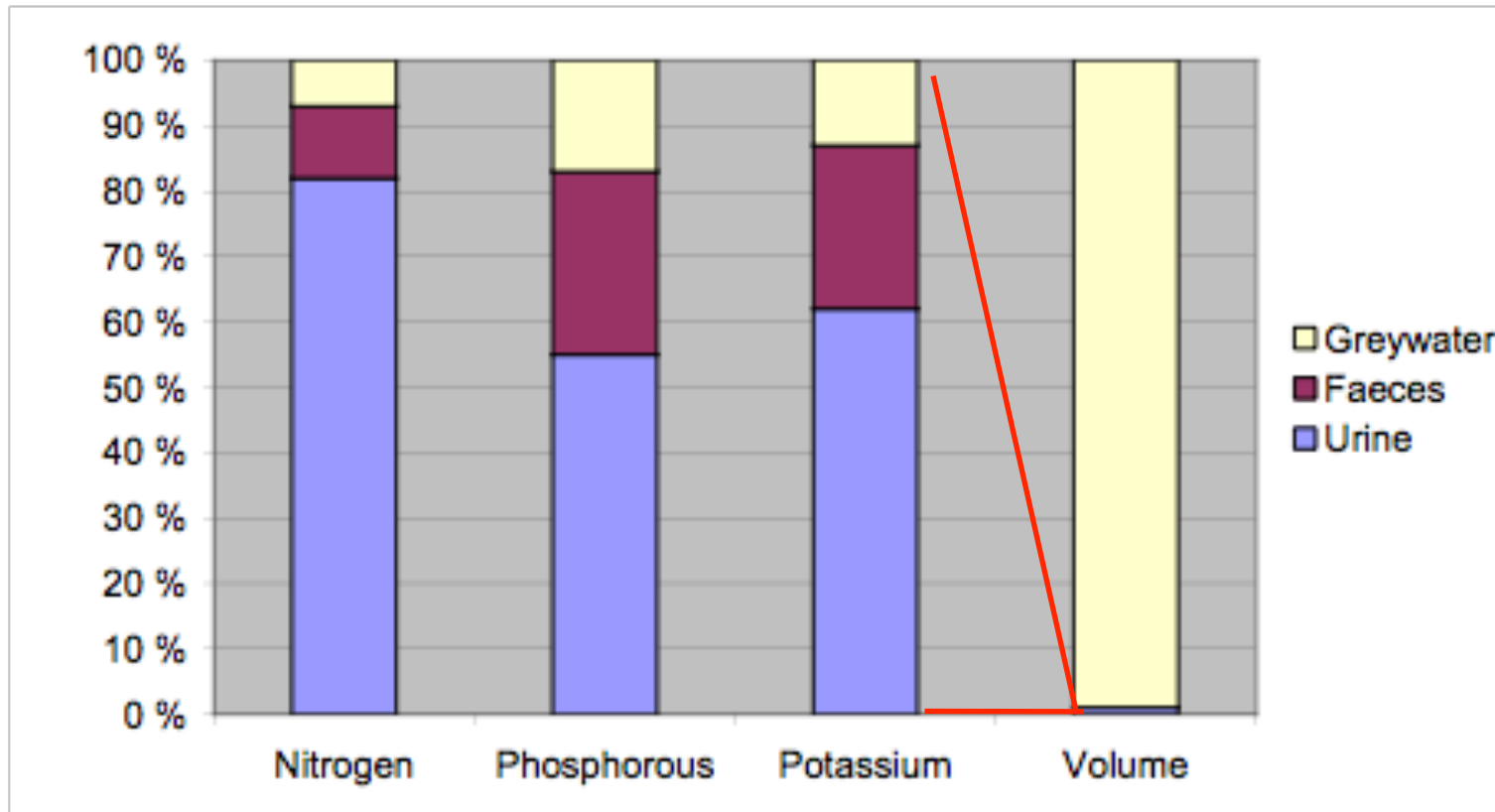
Nutrients and volume of domestic wastewater fractions



Nutrients and volume of domestic wastewater fractions

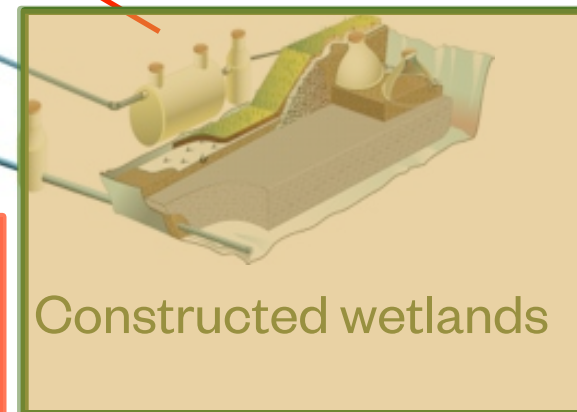
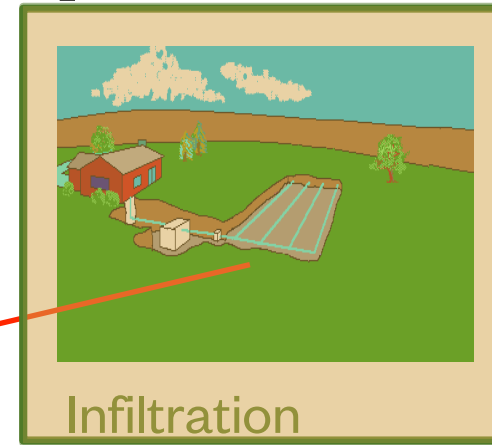
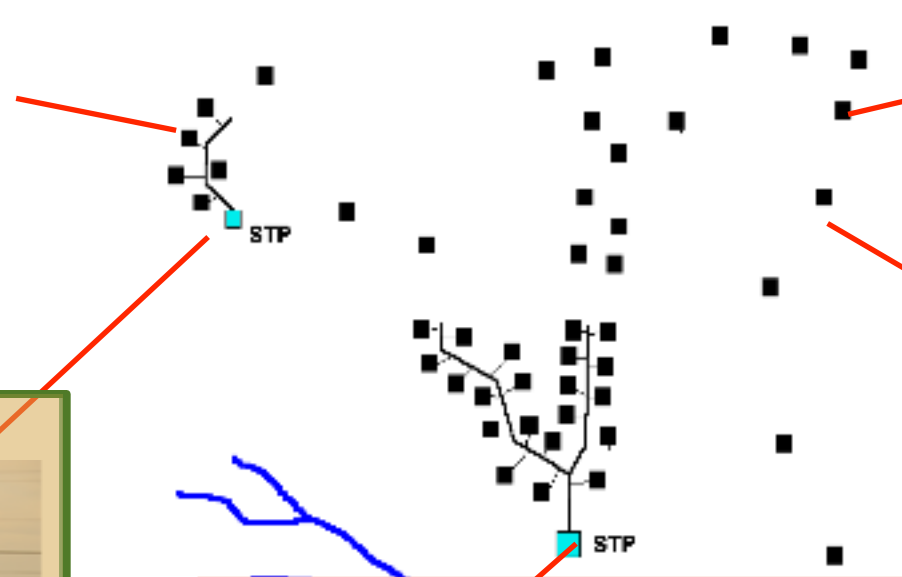
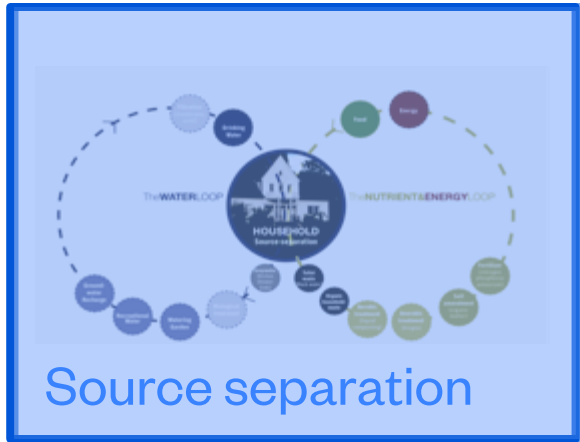


Nutrients and volume of domestic wastewater fractions



**1 % of the volume
contains:
> 80% of the
Resources**

Wastewater treatment options



Wastewater treatment options

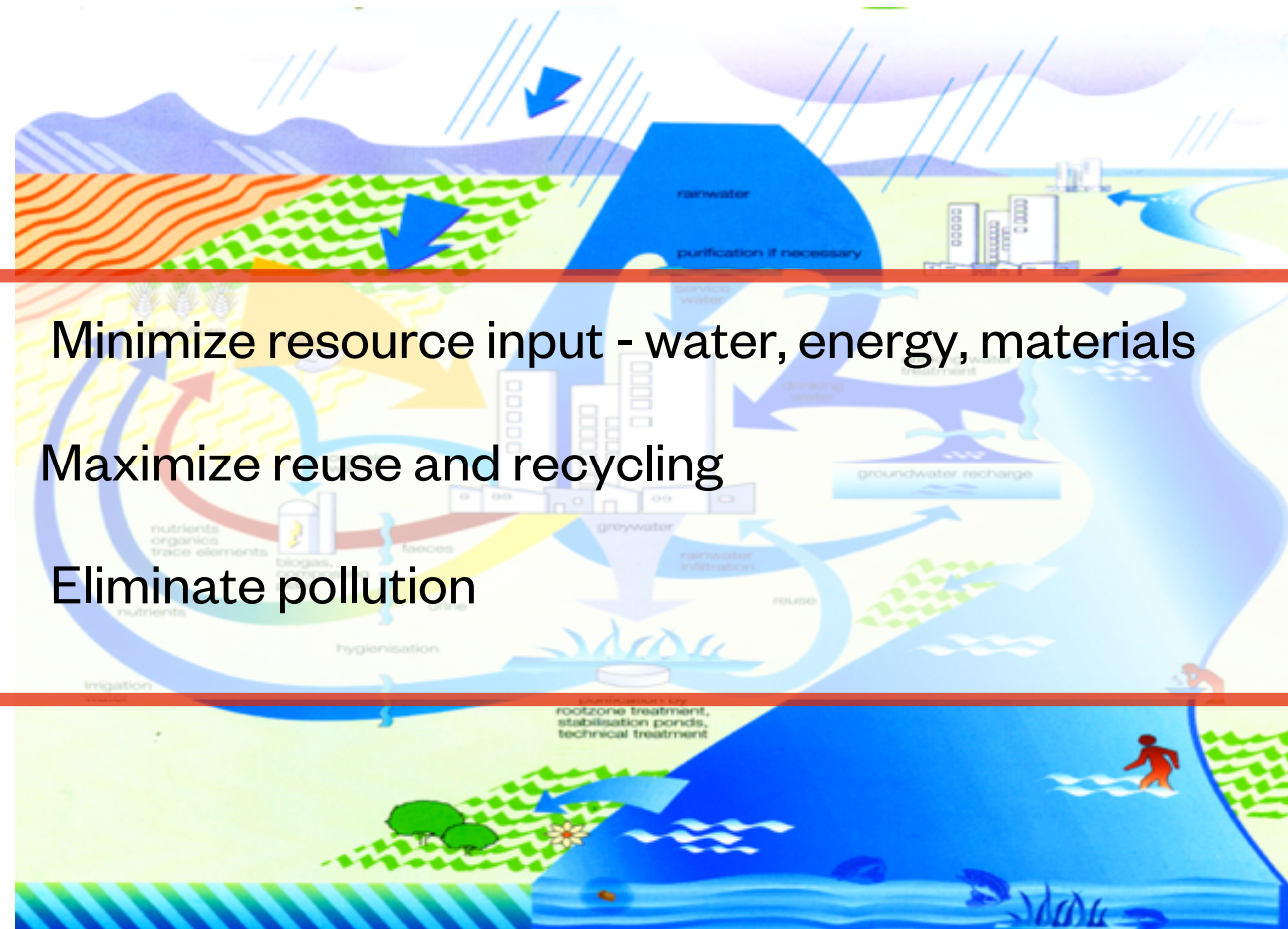
Cross cutting issues

Health and risk

Socio-cultural

Development, planning, economy

Sustainable water and sanitation – (in the Arctic)

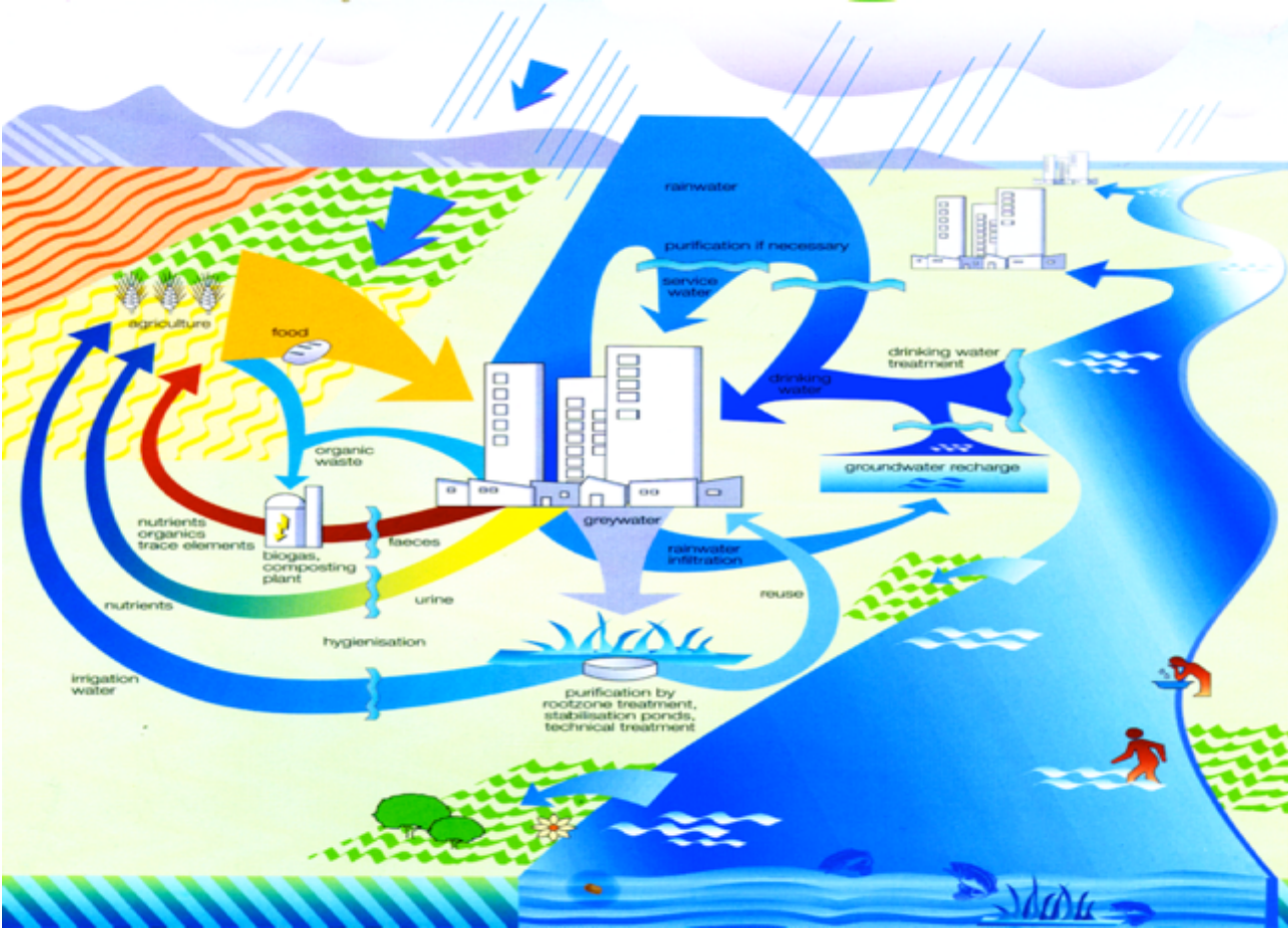


Minimize resource input - water, energy, materials

Maximize reuse and recycling

Eliminate pollution

Sustainable water and sanitation – (in the Arctic)



Module 4: Technology

WWT in cold Climate – Source separating Systems

<https://bit.ly/2YxZteY>

Thank you!



