Project Design

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Definition of a Project

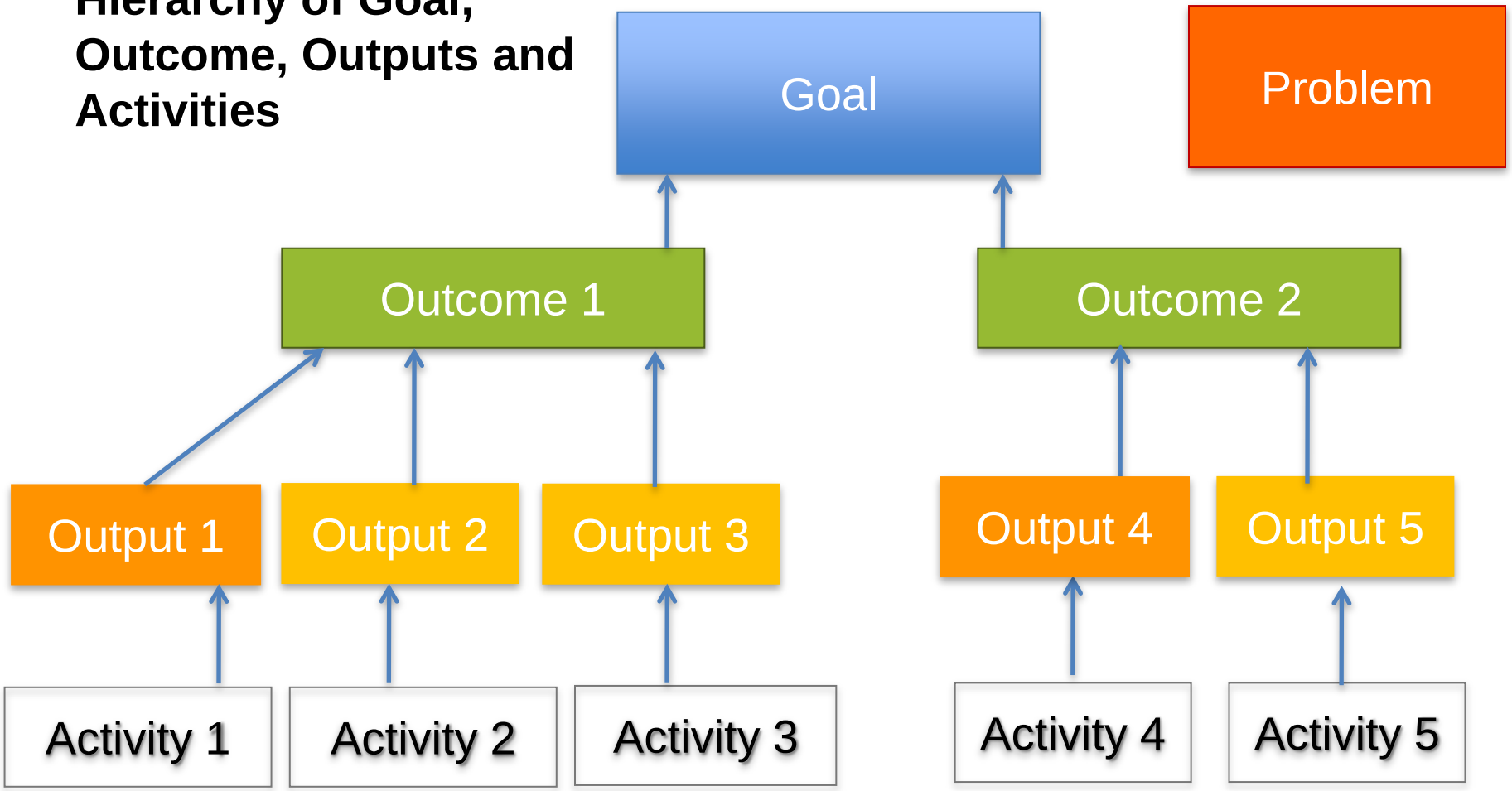
A project is:

- **a unique venture**
- **to produce a set of outputs**
- **with limited resources**
- **within a clearly specified time**

SOURCE: METHOD123 (2003): Project Management Guidebook. URL: www.method123.com. [Accessed: 20.05.2010]

Project Planning: Using the Project Tree

Hierarchy of Goal, Outcome, Outputs and Activities



SOURCE: NEBIU, B. (2002): Developing Skills of NGOs, Project Proposal Writing. Szentendre: The Regional Environmental Centre for Central and Eastern Europe.

Hierarchy of Objectives

Goal – *greater why*
The long-term impact of the project

Outcome – *what we achieve at the end of the project*
What we hope to achieve – the immediate effect of the project

Outputs – *what*
Specific results produced by activities. ToRs and Deliverables

Activities – *how*
Units of work undertaken to produce outputs

Definition of a Problem

A problem is a negative undesired situation

When formulating the problem, you should clearly specify:

- Place of the problem
- Reasons
- Consequences
- Magnitude (# or % of impacted persons)
- The impact of the problem on other problems

SOURCE: NEBIU, B. (2002): Developing Skills of NGOs, Project Proposal Writing. Szentendre: The Regional Environmental Centre for Central and Eastern Europe.

Goal of the Project

It is a long term goal that this particular project together with other projects contribute to its achievement

The goal is defined as "it contributes to …"

Example:

- improving the quality of life in the community Z

Goal of the Project (cont.)

Tips for Setting a Project Goal

1. There should be only **one goal** per project.

2. The goal should be connected to the **vision** for development.

3. It is difficult or **impossible to measure** the accomplishment of the goal using measurable indicators, but it should be possible to prove its merit and contribution to the vision.

SOURCE: NEBIU, B. (2002): Developing Skills of NGOs, Project Proposal Writing. Szentendre: The Regional Environmental Centre for Central and Eastern Europe.

Outcomes of the Project

What will be achieved ***as a direct result of the project***. Also called objectives or results.

A project will likely have multiple outcomes.

Characteristics:

- Specific
- Measurable
- Applicable
- Realistic
- Timely

SOURCE: NEBIU, B. (2002): Developing Skills of NGOs, Project Proposal Writing. Szentendre: The Regional Environmental Centre for Central and Eastern Europe.

Outcomes of the Project (cont.)

Requirements of drafting the project outcomes:

- percentages or figures
- place specified
- target group specified
- time-specific
- positive desired state

Example:

- Increased number of families from village Z in quantity X who live in a clean garbage-free environment within Y years.
- Improved water supply in quantity X and quality Y for the population of village Z in the next N years.

Outputs of the Project

Outputs describe the **services or products to be delivered** to the intended beneficiaries.

This is what the project team is promising to deliver.

The outputs are also called deliverables.

SOURCE: NEBIU, B. (2002): Developing Skills of NGOs, Project Proposal Writing. Szentendre: The Regional Environmental Centre for Central and Eastern Europe.

Outputs (cont.)

Examples:

- *A sanitation system composed of 6 community toilets with 10 toilet units, connected to a settler, an anaerobic baffle reactor and a soak pit.*
- *A water supply system providing minimum 24 m^3/d with a purification step and a total of 4 water points.*
- *A local-based management system to ensure the proper operation and maintenance.*
- *…..*

Activities of the Project

The tasks to be undertaken to achieve the aspired results.

Activities:

…are linked to specific outputs

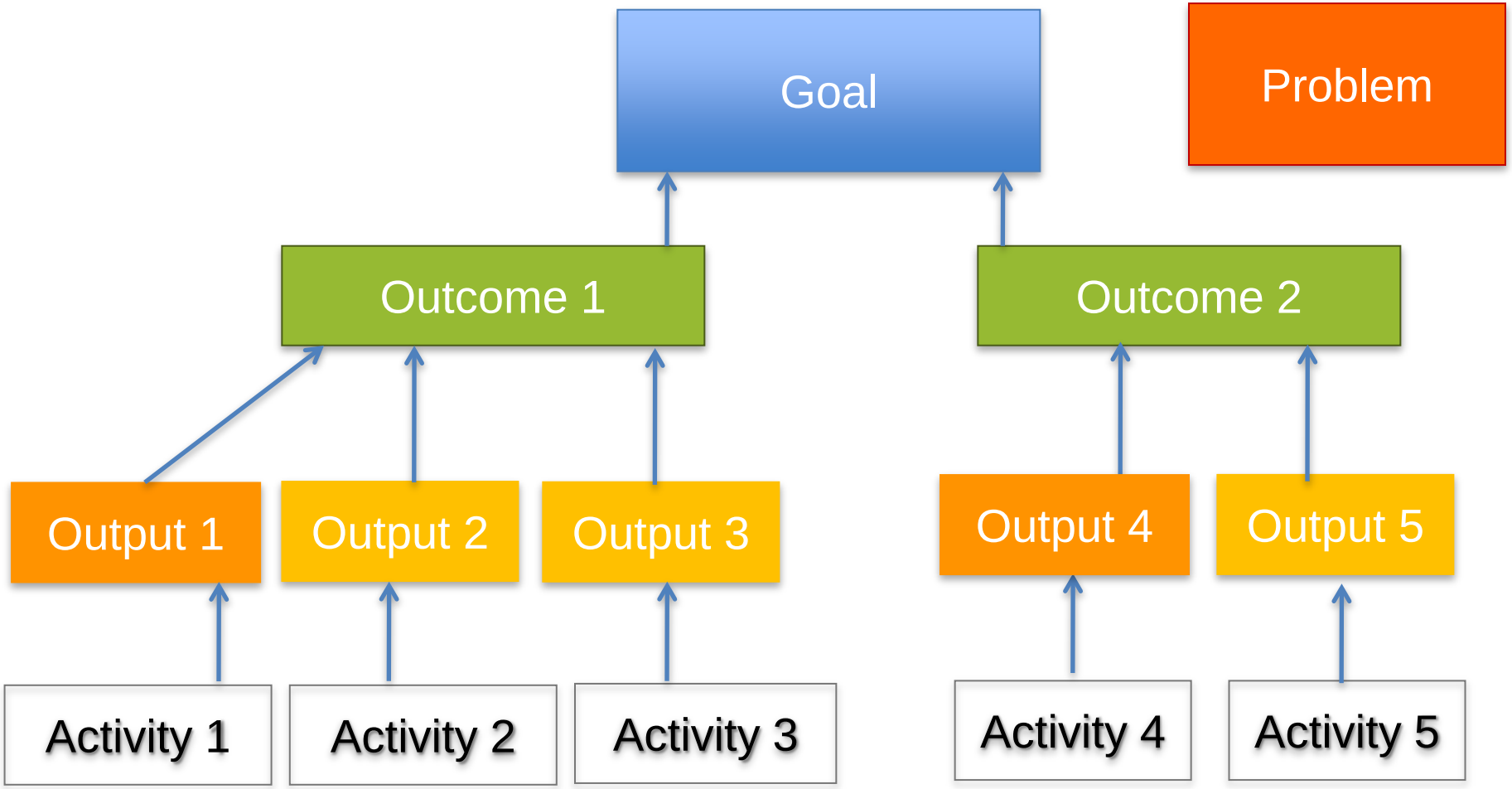
… are usually specific tasks that are allocated to individuals or groups

… be designed having regard to the skills and expertise of the agency and stakeholders

… should be listed in chronological order under each output

“Activities are defined using an action verb in a present tense, eg. Design, draw up, search, construct…”

Using the Project Tree



SOURCE: NEBIU, B. (2002): Developing Skills of NGOs, Project Proposal Writing. Szentendre: The Regional Environmental Centre for Central and Eastern Europe.

Group Work: Let's design your own project

Considering your own case study and the scenario that you have described, define:

- **The problem**
- **The goal of the project**
- **2 outcomes related to <u>water, excreta or wastewater management</u>**

"Linking up Sustainable Sanitation, Water Management & Agriculture"

This training was organized by:

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SSWM is an initiative supported by:

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Cap-Net

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sustainable sanitation alliance

ecosan SERVICES FOUNDATION

ENPHO Creating Eco Societies

eawag aquatic research
Sandec Water and Sanitation in Developing Countries

Water Supply & Sanitation Collaborative Council

Xavier University Environmental Sanitation Center

giz Sustainable sanitation ecosan

Global Water Partnership

I·C·L·E·I Local Governments for Sustainability

Indian Water Works Association

IUCN

IWA International Water Association

Norwegian University of Life Sciences

SARAR Transformación

SEI Stockholm Environment Institute

UNDP

cewas international centre for water management services

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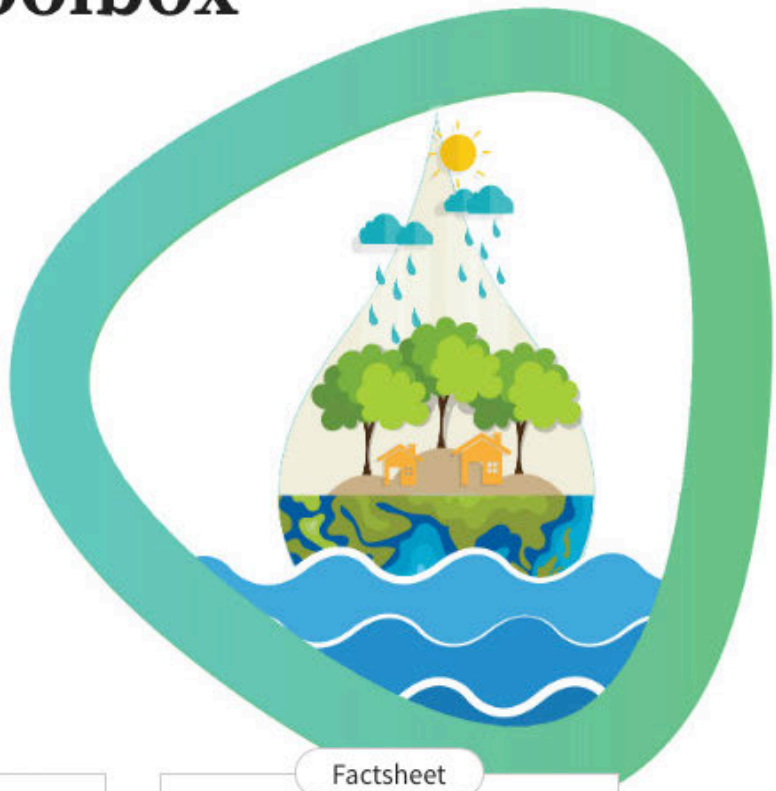
Sanitation Systems and Technologies

Based on the Compendium of Sanitation Systems and Technologies, eawag

Sustainable Sanitation and Water Management Toolbox

Linking Up Sustainable Sanitation, Water Management & Agriculture



Get Started

Solution Finder

Browse Perspectives / SSWM Catalogue

Hot Topics:

Factsheet

Safe water. Use drip irrigation.

News

Become a water, sanitation & waste entrepreneur

Factsheet

Understand the Nutrient Cycle

Perspectives

Sanitation Systems Perspective

Find technologies and socio-economic approaches to optimise your local water management and sanitation system. What is the

View in English | العربية

Planning and Programming Perspective

Explore concrete tools that help you to better plan and execute sustainable water management and sanitation solutions. There is

View in English

Water & Nutrient Cycle Perspective

Find technologies and socio-economic approaches to optimise your local water management and sanitation system. This perspective

View in English

Humanitarian Crises Perspective

Discover tools and approaches that help you promote sustainable sanitation and water management in humanitarian crises settings

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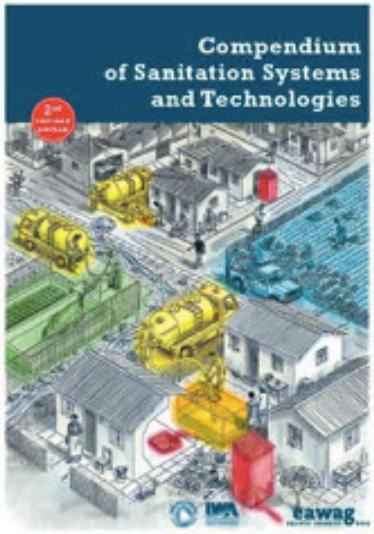
SOLUTION FINDER

What is the eCompendium?



It is an interactive version of the eCompendium Key Resources, a compilation of appropriate sanitation technologies, plus a tool for combining technologies in a full system.

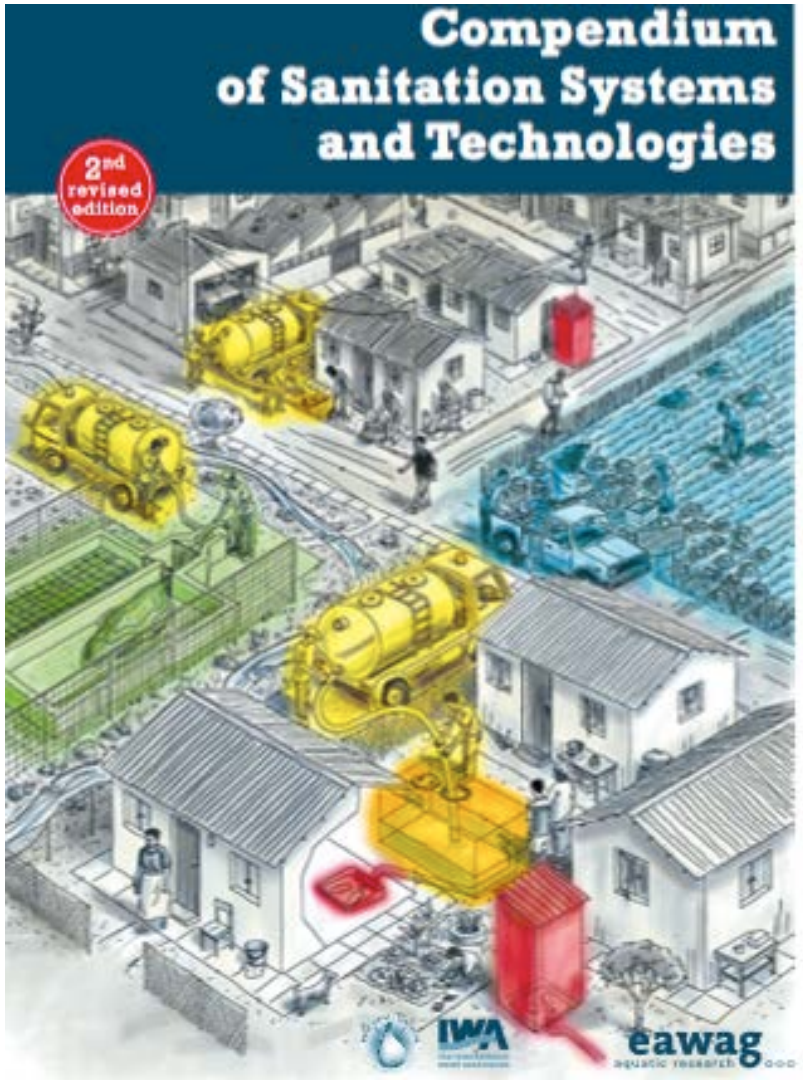
The Compendium of Sanitation Systems and Technologies was first published in 2008 during the International Year of Sanitation, and the Second Edition was published in 2014.

The document's popularity is its brevity - ordering and structuring a huge range of information on tried and tested technologies in a single document. As in the first edition we present only proven technologies that are appropriate for low- and middle-income settings. Also, we include only "improved" sanitation technologies, featuring safe, hygienic, and accessible sanitation. In this eCompendium edition we present the whole range of urban, peri-urban and rural technologies (e.g. from simple pits to conventional sewers).

You can order a hardcopy or download the PDF **here**.

Compendium of Sanitation Systems and technology

TILLEY, E.; ULRICH, L.; LUETHI, C.; REYMOND, P.; ZURBRUEGG, C. (2014): Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (Eawag).



1. Introduction

Definition

- **A sanitation system is a context-specific series of technologies and services for the management of wastes (or resources).**

- **A sanitation system is comprised of Products (wastes) which travel through Functional Groups which contain Technologies which can be selected according to the context.**

- **By selecting a Technology for each Product from each applicable Functional Group, one can design a logical Sanitation System.**

Source: Eawag (2014): eCompendium – The Online Compendium of Sanitation Systems and Technologies. Dübendorf: Swiss Federal Institute of Aquatic Science and Technologies (Eawag).

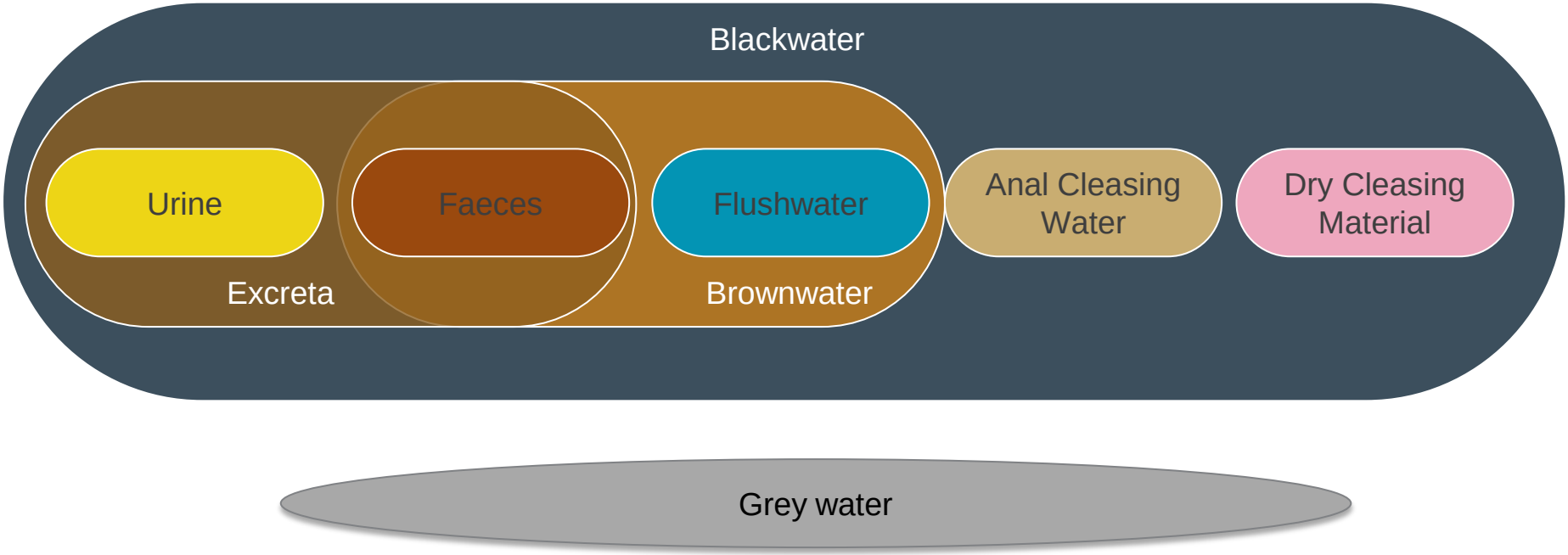
2. Sanitation **Products**

Product list

- Primary (Input) Products
  - Urine
  - Faeces
  - Excreta
  - Dry Cleansing Materials
  - Anal Cleansing Water
  - Flushwater
  - Blackwater
  - Brownwater
  - Greywater
  - Organics
- Secondary (output) Products
  - Pre-Treatment Products
  - Stored Urine
  - Dried Faeces
  - Compost
  - Pit Humus
  - Sludge
  - Effluent
  - Biogas
  - Biomass
  - Stormwater

2. Sanitation Products

Primary products



2. Sanitation Products

Characteristic of products

	Total	Greywater***	Urine	Faeces
Volume [l/cap·yr]	25,000-100,000	25,000-100,000	500	50
Nutrients Nitrogen	2 - 4 kg/cap·yr	5%	85%	10%
Phosphorous	0.3 - 0.8 kg/cap·yr	10%**	60%	30%
Potassium	1.4 - 2.0 kg/cap·yr	34%	54%	12%
COD	30kg/cap·yr	41%	12%	47%
Faecal coliforms	-	10^4-10^6 /100ml	0*	10^7-10^9 /100ml

* healthy people; ** can be as high as 50%, depending on washing and dish-washing powder used; *** values representative for industrialized countries

2. Sanitation Products

Transformation of products

Primary (Input) Products	Process	Secondary (output) Products

3. Functional Groups

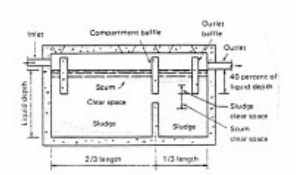
What are Functional Groups?

A functional group is a grouping of technologies that have similar functions.

User Interface

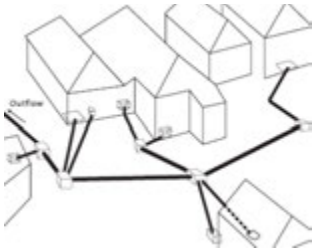
e.g. cistern flush toilet

Collection and Storage/ Treatment



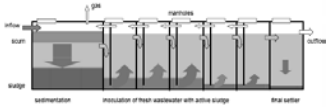
e.g. septic tank

Conveyance



e.g. simplified sewer

(Semi-) centralised Treatment



e.g. Anaerobic Baffled Reactor or Waste Stabilisation Pond

Use and/or Disposal

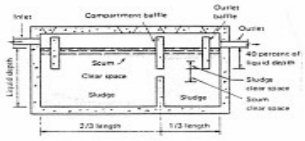
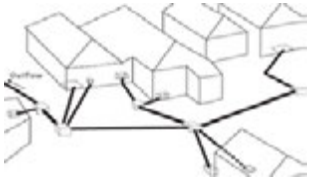
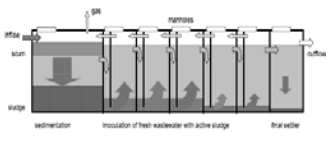
p.ex. composting or soak pit

Input: Primary Products → Output: Secondary Products

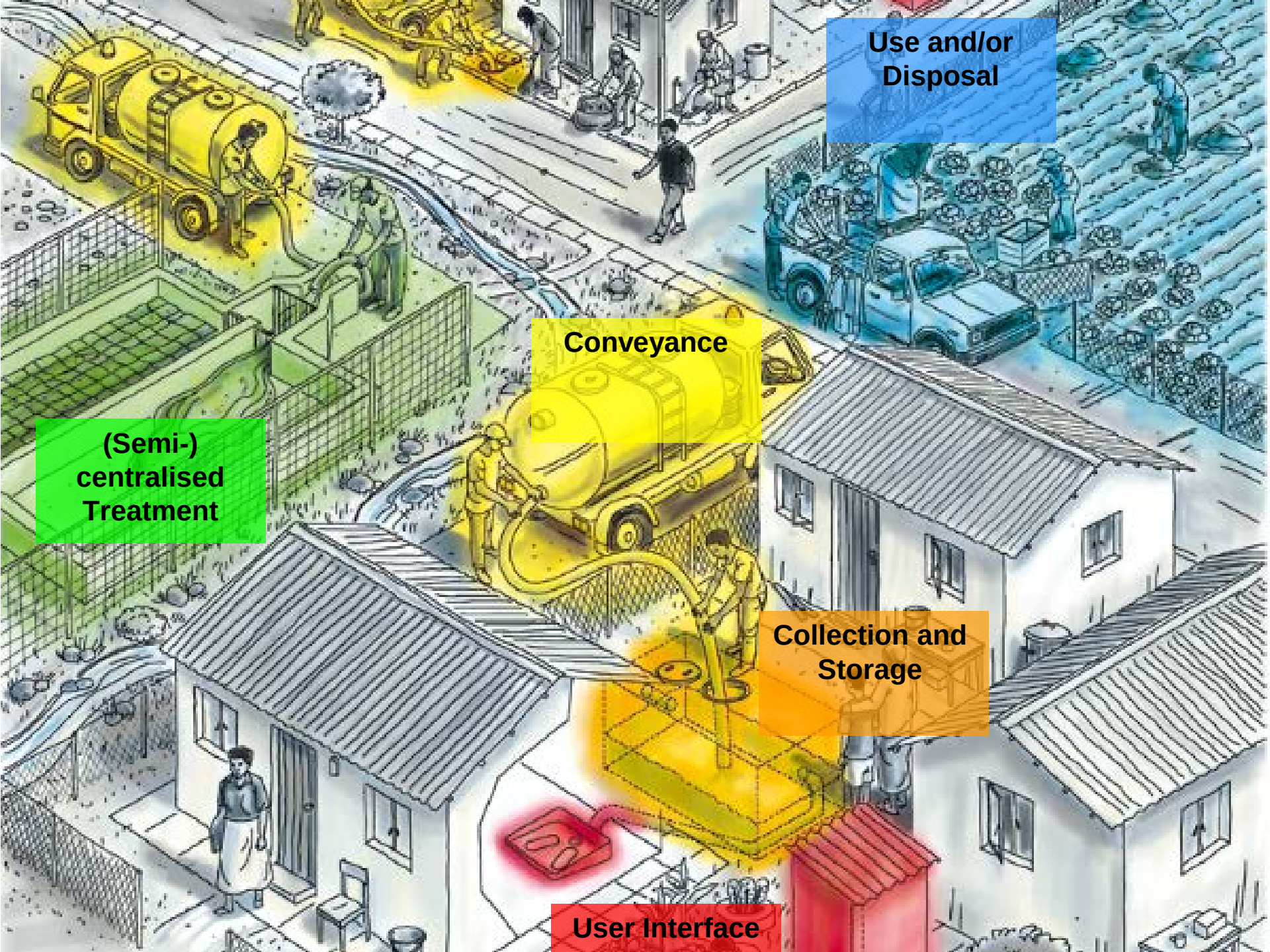
Source: Eawag/Sandec (Editor) (2008): Sanitation Systems and Technologies. Presentation. Duebendorf: Swiss Federal Institute of Aquatic Science (Eawag), Department of Water and Sanitation in Developing Countries (Sandec).

4. Sanitation Systems

Which technologies can perform which function?

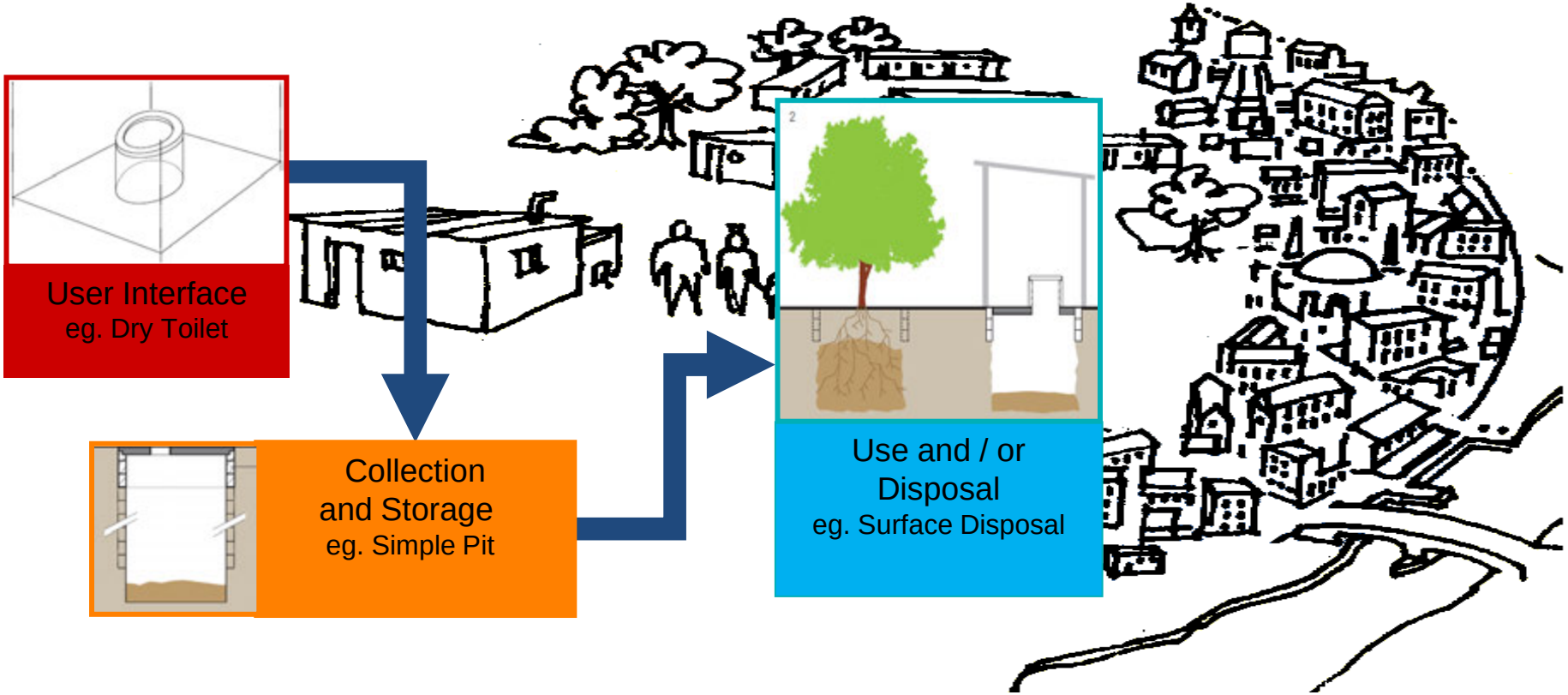
User Interface	Collection and Storage/ Treatment	Conveyance	(Semi-) Centralised Treatment	Use and/or Disposal
				
• Dry Toilet • Urine Diverting Dry Toilet • Urinal • Pour-Flush Toilet • Flush Toilet • Urine Diverting Flush Toilet •Etc.	• Single VIP • Dehydration Vaults • Septic Tank • Composting Chamber • Anaerobic Baffled Reactor • Anaerobic Filter • Etc.	• Human-Powered Emptying and Transport • Motorized Emptying and Transport • Simplified Sewers • Small-Bore Sewer • Conventional Gravity Sewer • Jerry Can/Tank •Etc.	• Anaerobic Baffled Reactor • Anaerobic Filter • Trickling Filter • Waste Stabilisation Ponds • Activated Sludge • Constructed Wetland • Co-composting •Etc.	• Application of Urine • Application of Dehydr. Faeces • Compost • Irrigation • Aquaculture • Soak Pit • Leach Field • Land Application • Surface Disposal • Etc.

Only selected combinations of technologies will lead to functional systems.


Use and/or Disposal
Conveyance
(Semi-) centralised Treatment
Collection and Storage
User Interface

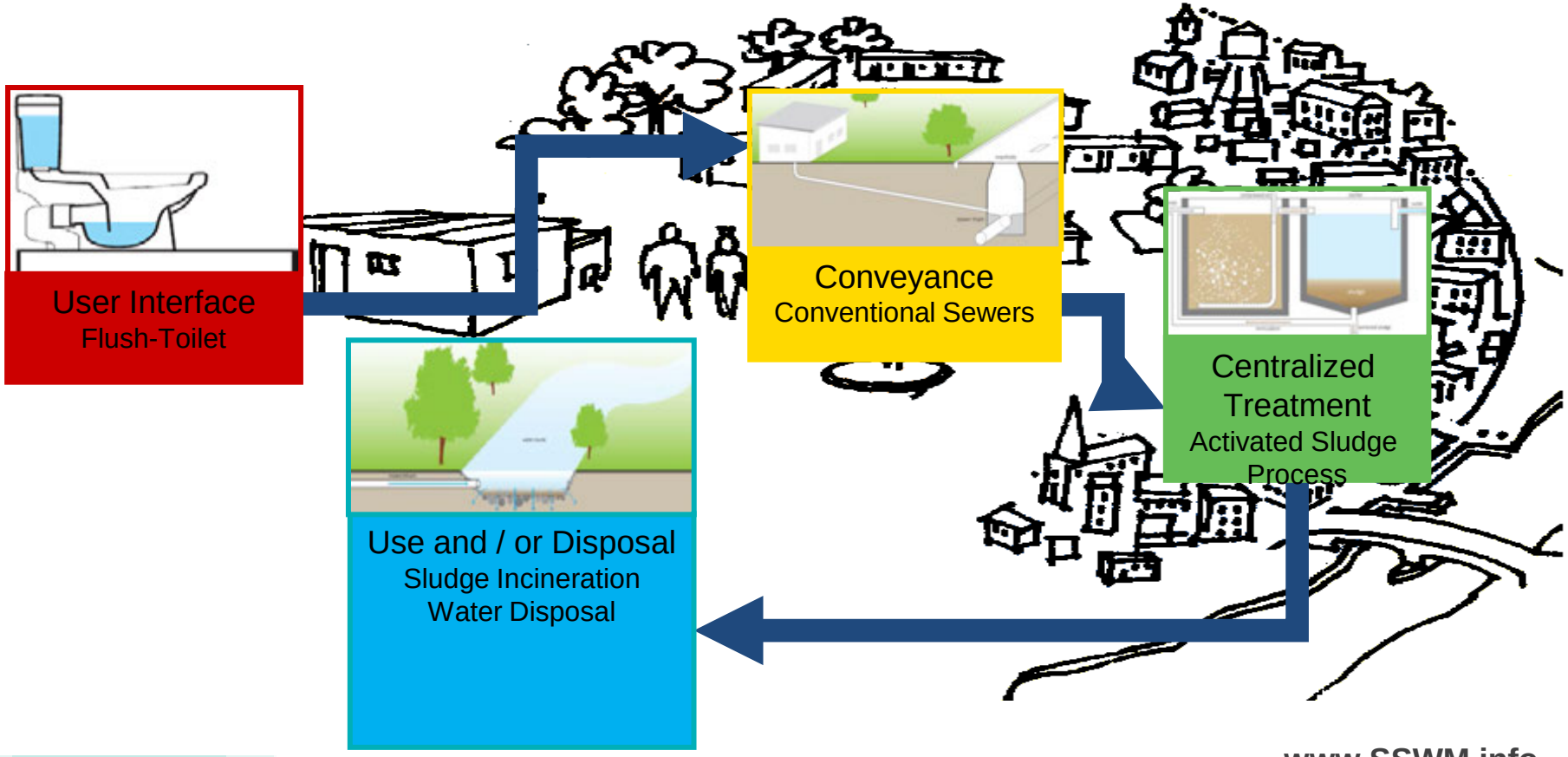
4. Sanitation Systems

- **The typical rural context**



4. Sanitation Systems

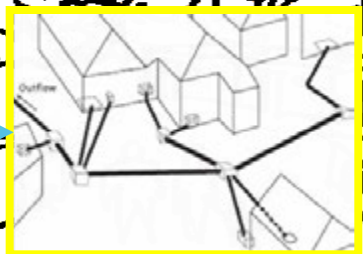
- The typical urban context



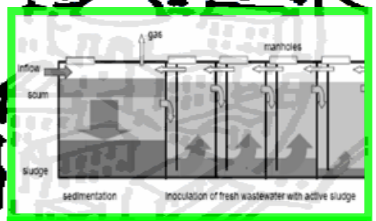
5. Sanitation Technologies

Sanitation Systems

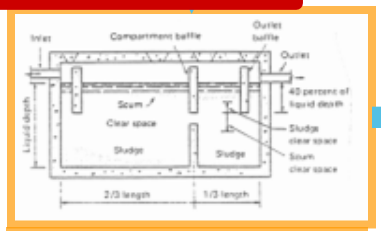
User Interface



Conveyance



(Semi-) centralised Treatment



Collection and Storage/ Treatment

Use and/or Disposal

5. Sanitation Technologies

Functional Group: User Interface

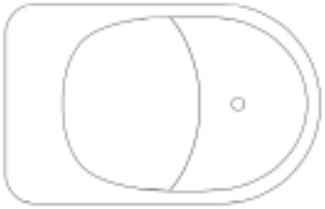
User Interface
e.g. dry toilet, pit latrine

- Type of toilet, pedestal, pan, or urinal with which the user comes in contact .
- Way by which the user accesses the sanitation system.
- Its choice depends on the availability of water.
- Grey water and storm water do not originate at the user interface.

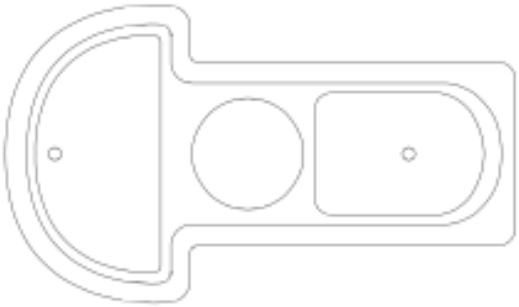
User Interface

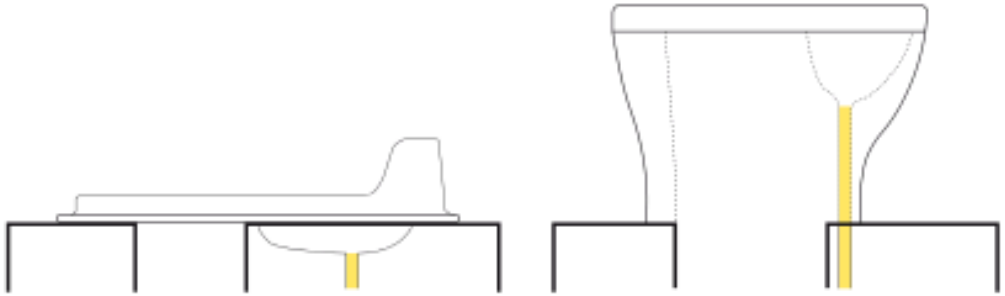
Urine Diverting Dry Toilet (UDDT)

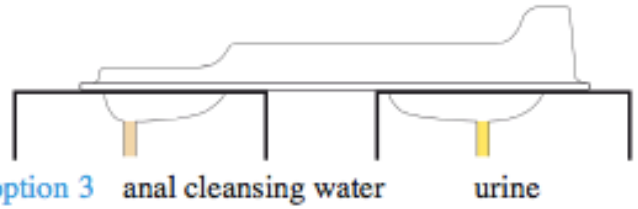
for wipers



for washers





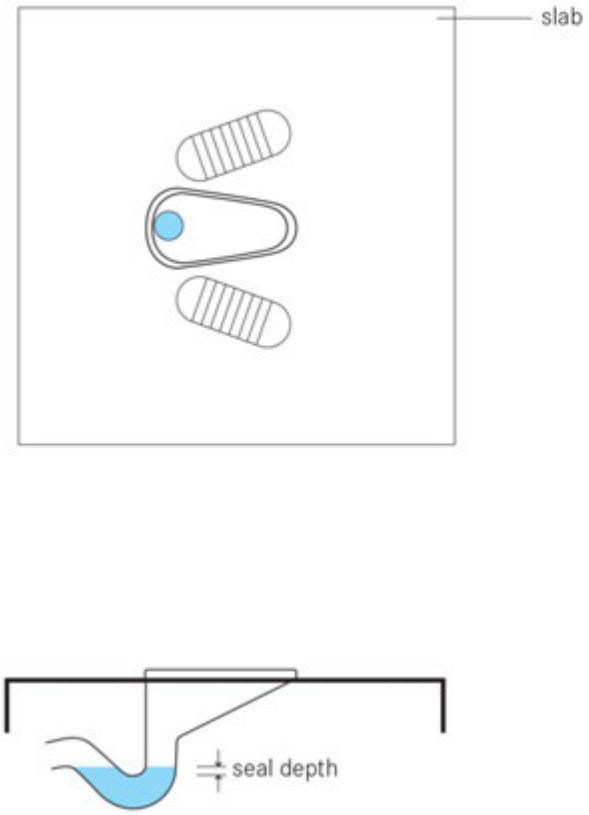


User Interface

Urine Diverting Dry Toilet (UDDT)

User Interface

Pour Flush Toilets



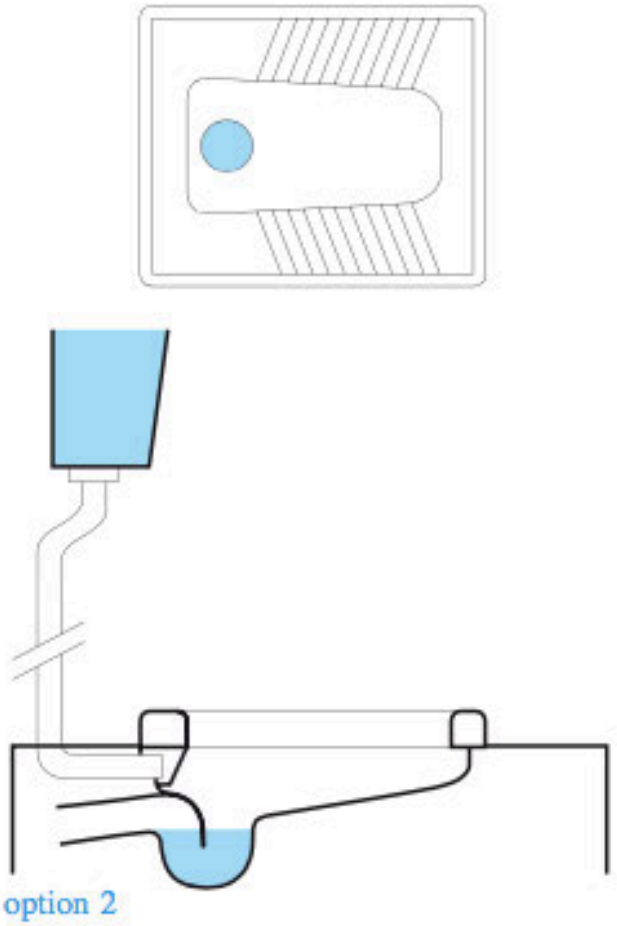
User Interface

Pour flush toilets

User Interface

Cistern Flush Toilet

option 1



option 2

Cistern Flush Toilet

© Scott Perry

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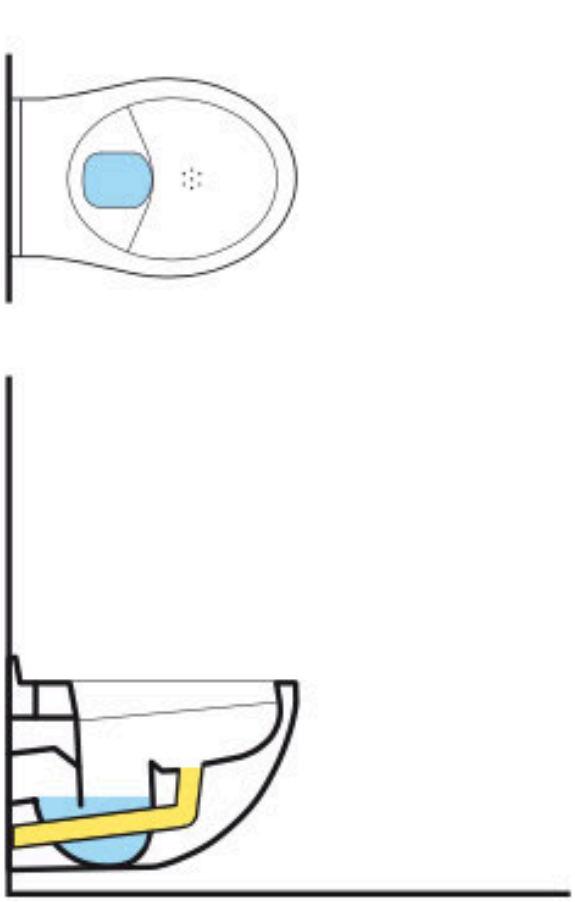
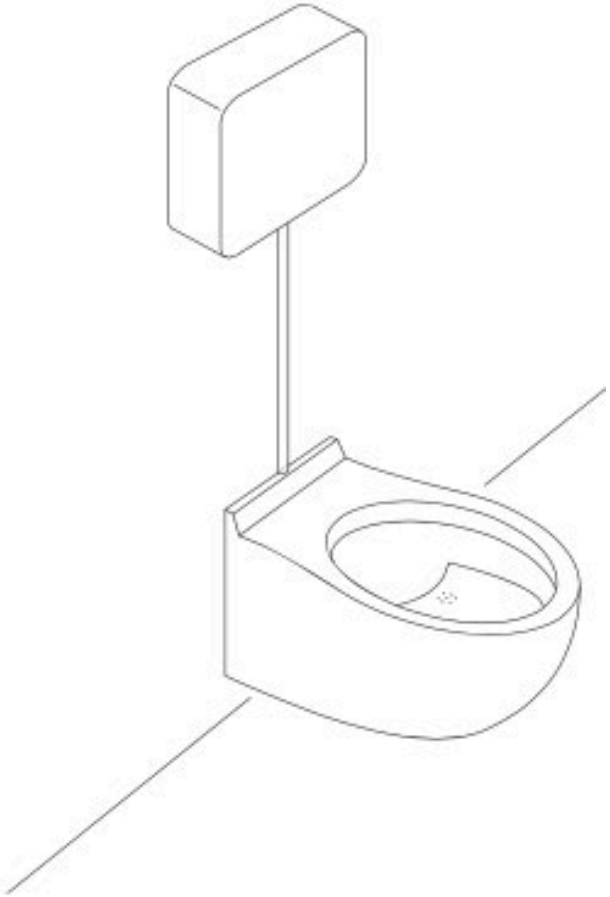
User Interface

Urine Diverting Flush Toilet (UDFT)





Urine Diverting Flush Toilet (UDFT)

User Interface

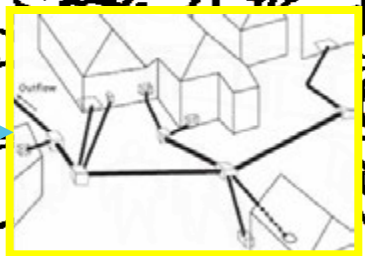
How to choose the user interface?

- Availability of water for flushing.
- Habits and preferences of the users.
- Local availability of materials.
- Compatibility with the subsequent collection and storage/ treatment or conveyance technology.
- Special needs of user groups.
- Need for recover urine and faeces for its reuse in agriculture.

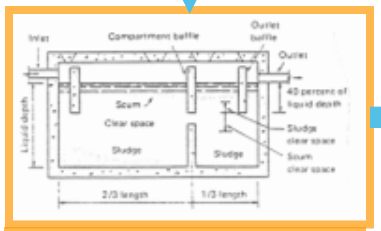
5. Sanitation Technologies

Sanitation Systems

User Interface

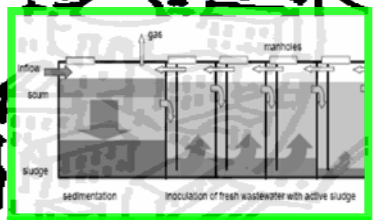


Conveyance



Collection and Storage/ Treatment

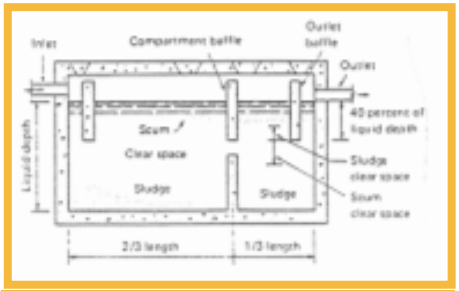
Use and/or Disposal



(Semi-) centralised Treatment

5. Sanitation Technology

Functional Group: Collection and Storage/Treatment

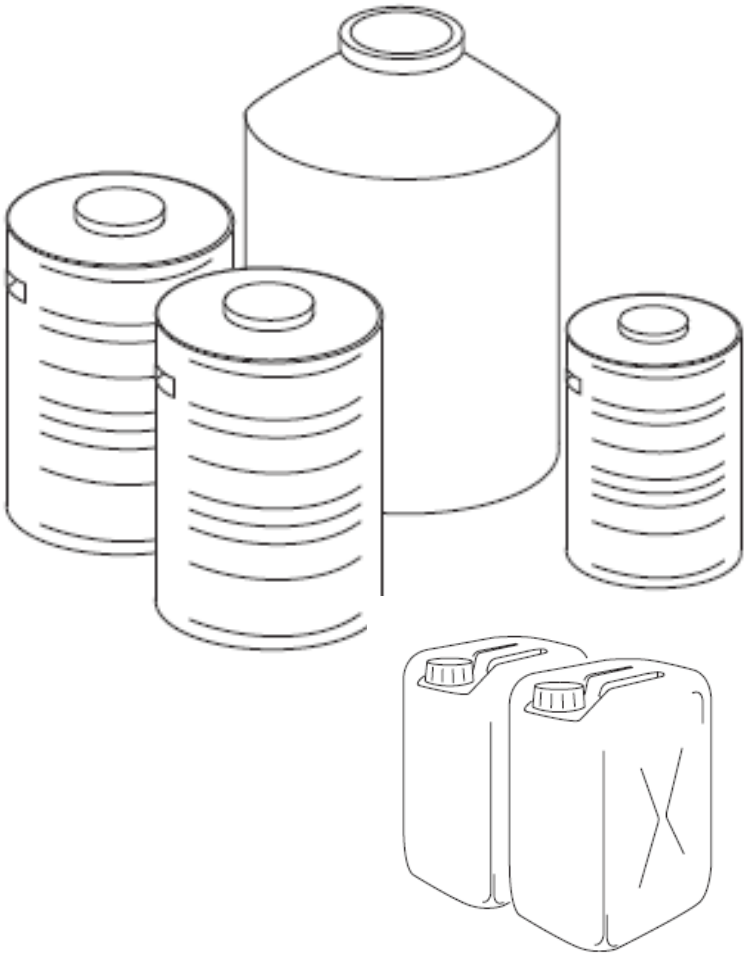


Collection and Storage/ Treatment
e.g. septic tank

- Ways of collecting, storing, and sometimes treating the products that are generated at the user interface.
- Treatment that is provided by these technologies is often a function of storage and usually passive.
- Products that come out by these technologies often require subsequent treatment before use and/or disposal.

Collection and Storage/ Treatment

Urine Storage Tank/ Container



When urine cannot be used immediately or transported using a conveyance technology:

-it can be stored onsite in containers or tanks.

-The storage tank must then be moved or emptied into another container for transport.

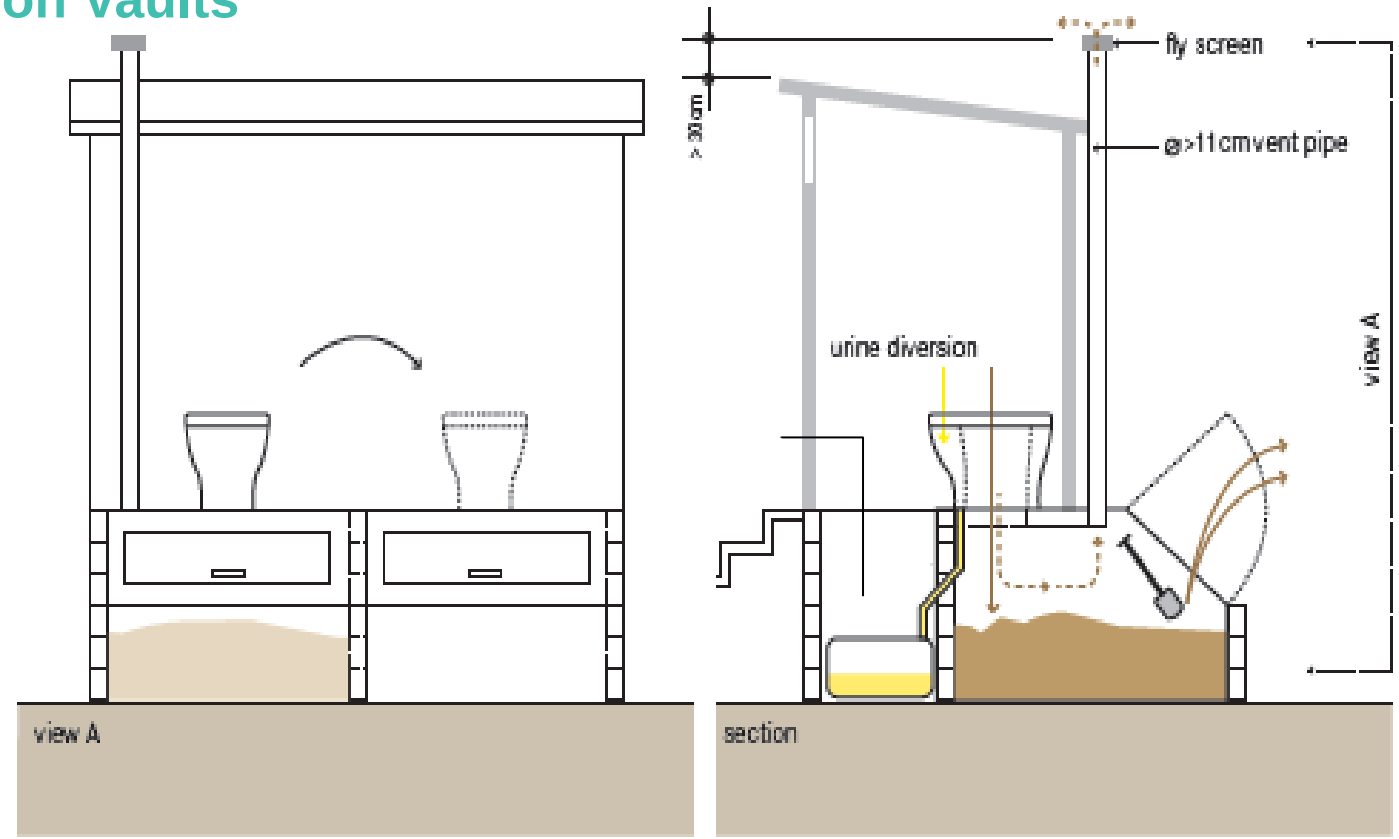
-Urine should be stored at least 1 month before use.

Collection and Storage/ Treatment

Urine Storage Tank / Containers

Collection and Storage/ Treatment

Dehydration Vaults



-Dehydration vaults are used to collect, store and dry (dehydrate) faeces.
-Faeces will only dehydrate when: the vaults are well ventilated, watertight to prevent external moisture from entering and when urine and anal cleansing water are diverted away from the vaults.
-Requires UDDT as user interface. Ash, lime, soil should be added. Min 6 months.

Collection and Storage/ Treatment

Dehydration Vaults

Collection and Storage/ Treatment

Example: Waterless System with Urine Diversion

Drums for collection and storage of faeces, Philippines

Source: GTZ-Philippines

Collection and Storage/ Treatment

Example: Waterless System with Urine Diversion adapted to an existing house

Durango, México

Collection and Storage/ Treatment

Dehydration Vaults

- Easier emptying
- Significant reduction in pathogens
- Dried faeces can be user as soil conditioner
- Suitable for rocky and/or flood prone areas, or where the groundwater table is high

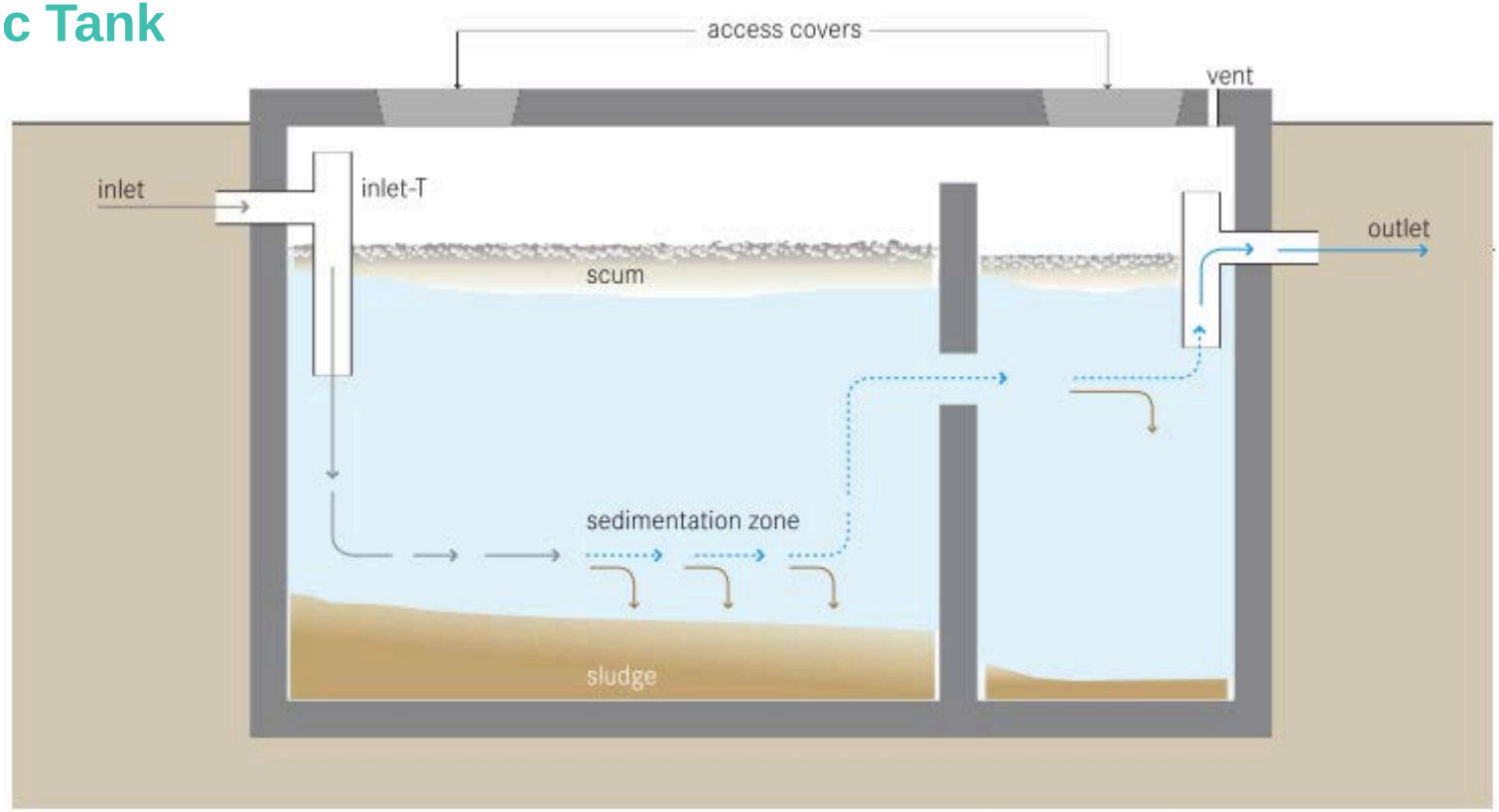
- Requires acceptance
- Requires constant cover material

Anaerobic Digestion

"Degradation and stabilization of organic compounds by microorganisms in the absence of oxygen, leading to production of biogas".

Collection and Storage/ Treatment

Septic Tank



- A septic tank is a **watertight** chamber made of concrete, fibreglass, PVC or plastic, through which blackwater and greywater flows for primary treatment.
- Settling and anaerobic processes reduce solids and organics, but the treatment is only moderate.

Collection and Storage/ Treatment

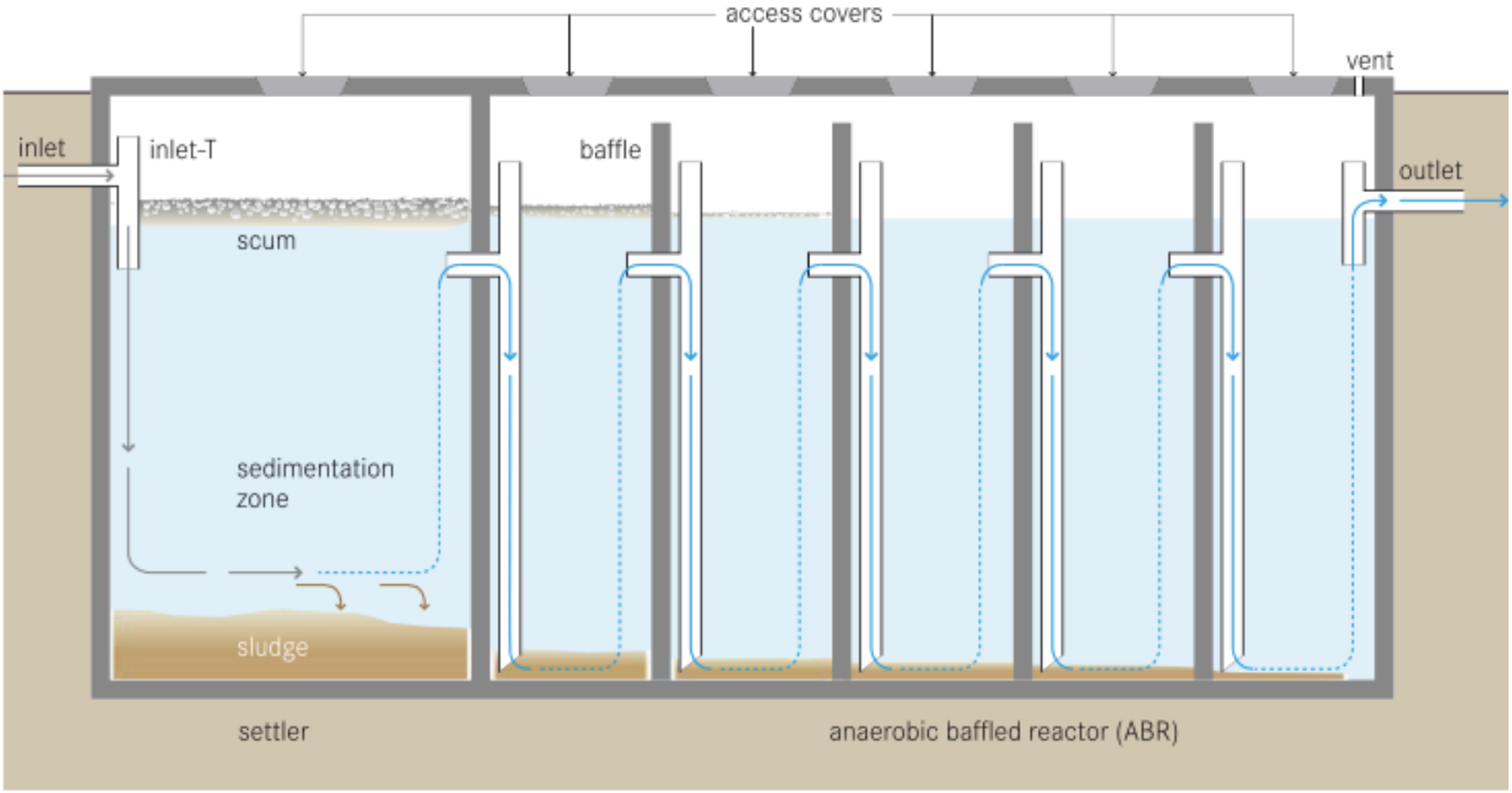
Septic Tank

- Simple and robust
- Long service life
- Low operating cost
- Little space

- Low reduction in pathogens, solids and organics.
- Effluents and sludge require further treatment and/or appropriate discharge
- Regular desludging must be ensured.

Collection and Storage/ Treatment

Anaerobic Baffle Reactor



Collection and Storage/ Treatment

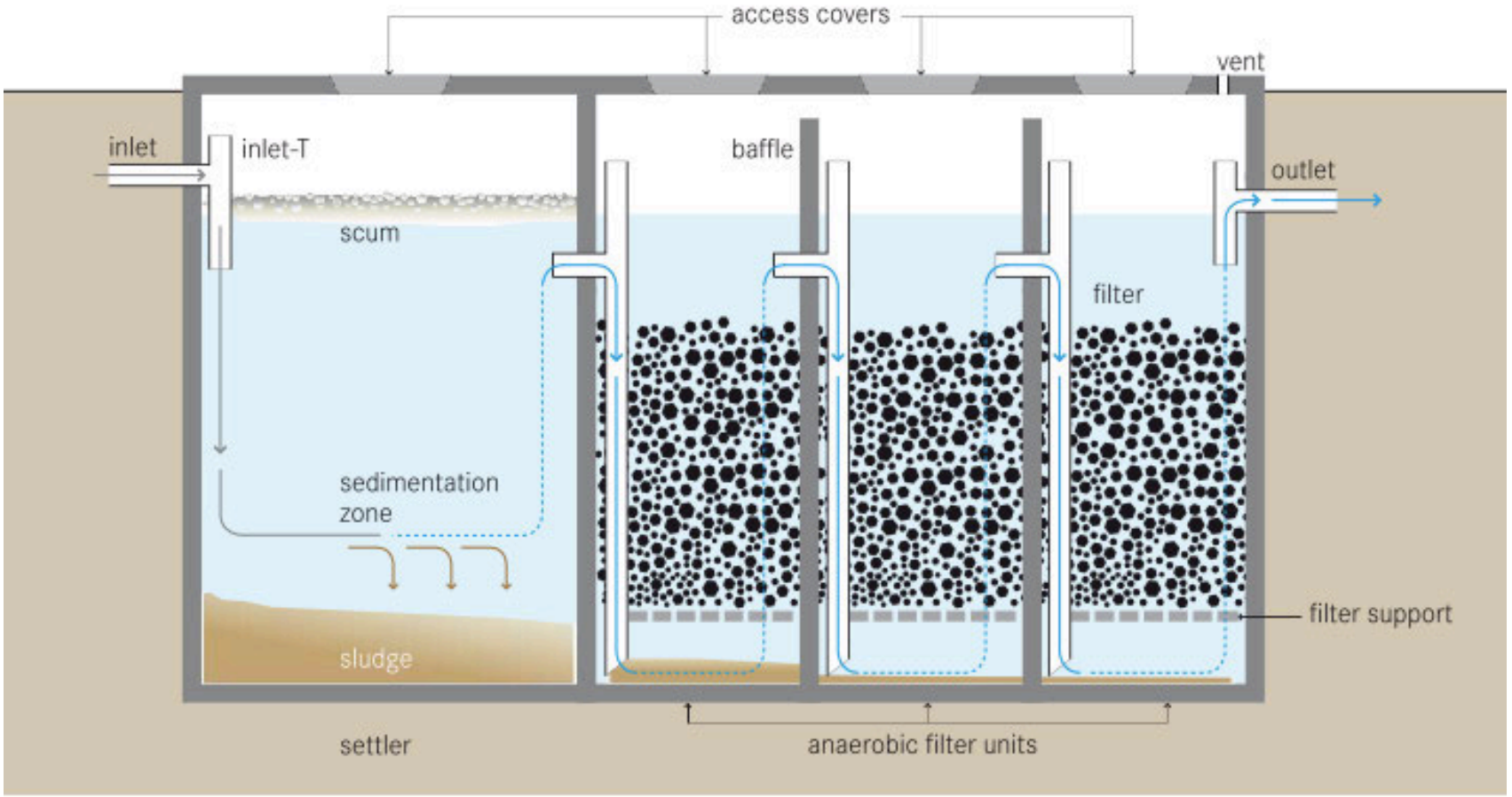
Anaerobic Baffle Reactor

Collection and Storage/ Treatment

Anaerobic Baffle Reactor

Collection and Storage/ Treatment

Anaerobic Filter

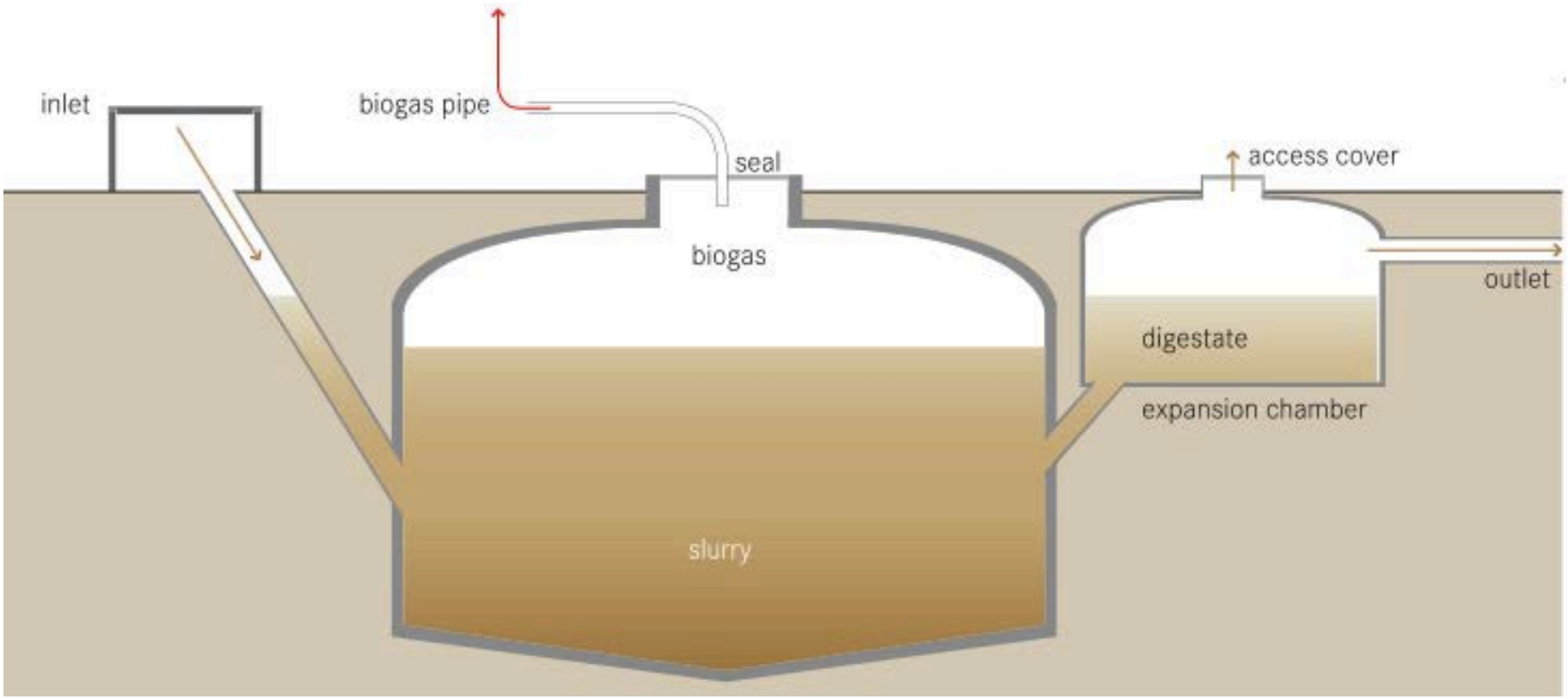


Collection and Storage/ Treatment

Anaerobic Filter

Collection and Storage/ Treatment

Biogas Reactor (Anaerobic Digestor)



Anaerobic treatment technology that produces (a) a digested slurry (digestate) that can be used as a fertilizer and (b) biogas that can be used for energy.
Biogas is a mix of methane, carbon dioxide and other trace gases which can be converted to heat, electricity or light. 15-25 days retention time.

Collection and Storage/ Treatment

Biogas Reactor

Floating dome

Balloon plants

Fixed dome

Collection and Storage/ Treatment

Biogas Reactor

- Generation of renewable energy
- High reduction of organic and solids
- Excellent fertilizer
- Little space

- Incomplete pathogen removal
- Requires expert design and skilled construction
- Correct O&M is critical

Collection and Storage/ Treatment

Choice of technology

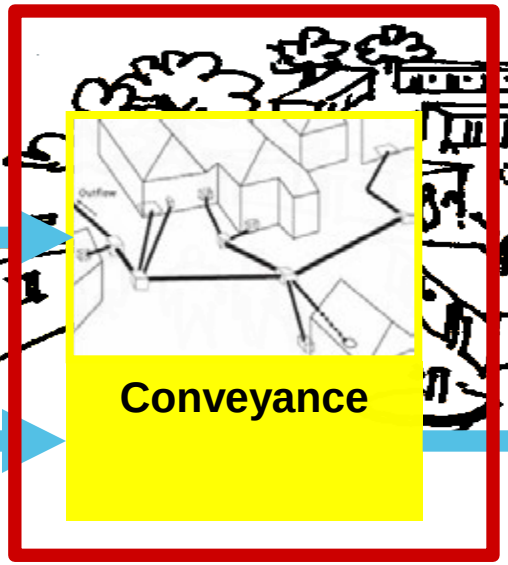
In any given context, the technology choice generally depends on the following factors:

- Availability of space
- Soil and groundwater characteristics
- Type and quantity of input products
- Local availability of materials
- Desired output products
- Availability of technologies for subsequent transport
- Financial resources
- Management considerations
- User preferences

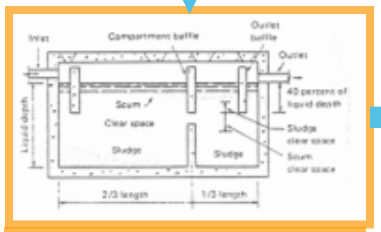
3. Sanitation Technologies

Sanitation Systems

User Interface

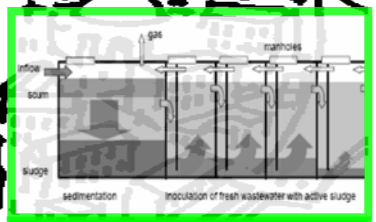


Conveyance



Collection and Storage/ Treatment

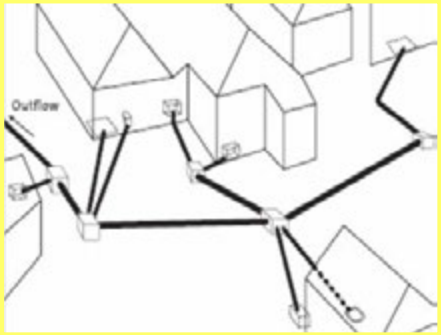
Use and/or Disposal



(Semi-) centralised Treatment

2. Sanitation Technology

Functional Group: Conveyance



Conveyance
e.g. Simplified sewer, truck lorries

Transport of products from one functional group to another.

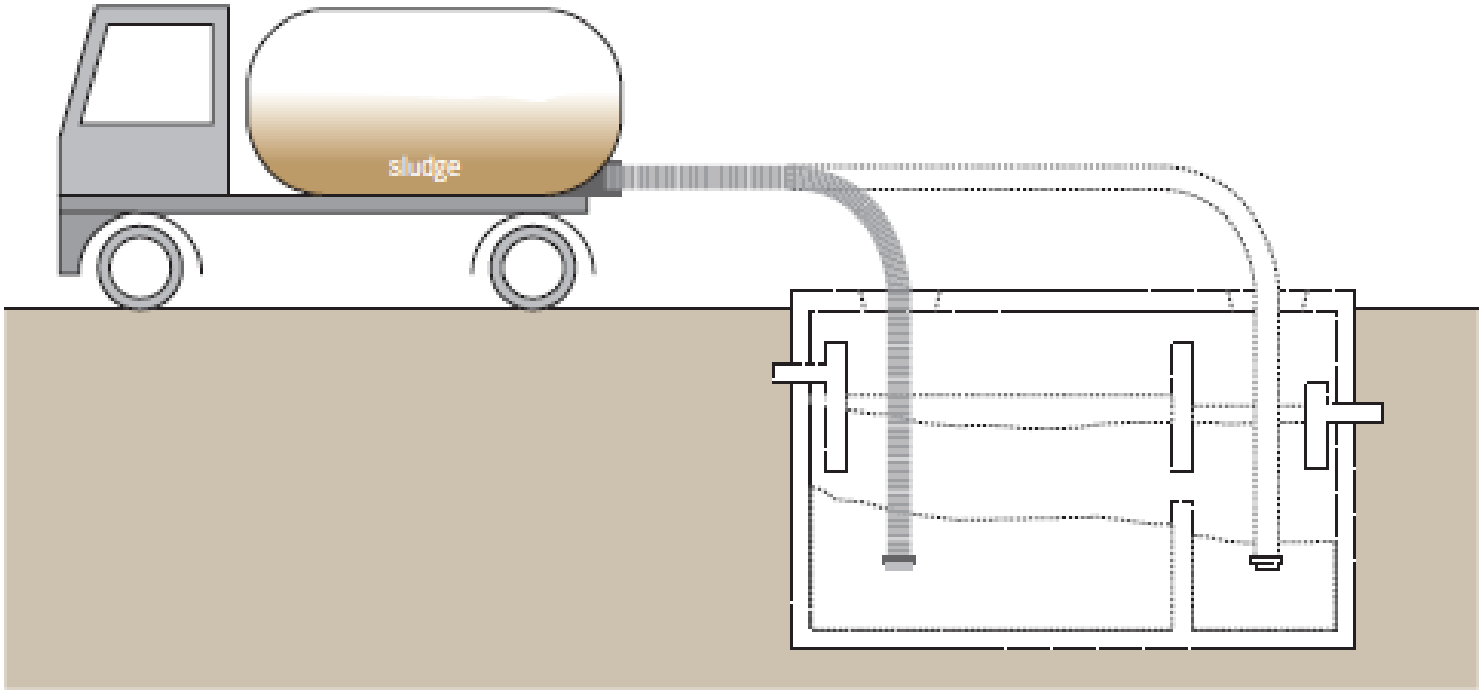
What happens when the pit is full?

- Overflowing
- Manual emptying
- Motorized emptying

- Blackwater
- Greywater
- Sludge
- Urine
- Dried faeces
- Pit humus
- Etc.

Conveyance

Motorized Emptying



Refers to a vehicle equipped with a motorized pump and a storage tank for emptying and transporting faecal sludge, wastewater and urine.

Pumping trucks or vacuum truck (3-12 m^3)

Conveyance

Motorized Emptying

Conveyance

When is motorized emptying not possible?

- Trucks cannot access, because the roads do not make it possible
- Trucks cannot pump, because the sludge is too thick to be pumped
- Households cannot afford the service

People resort to manual emptying.

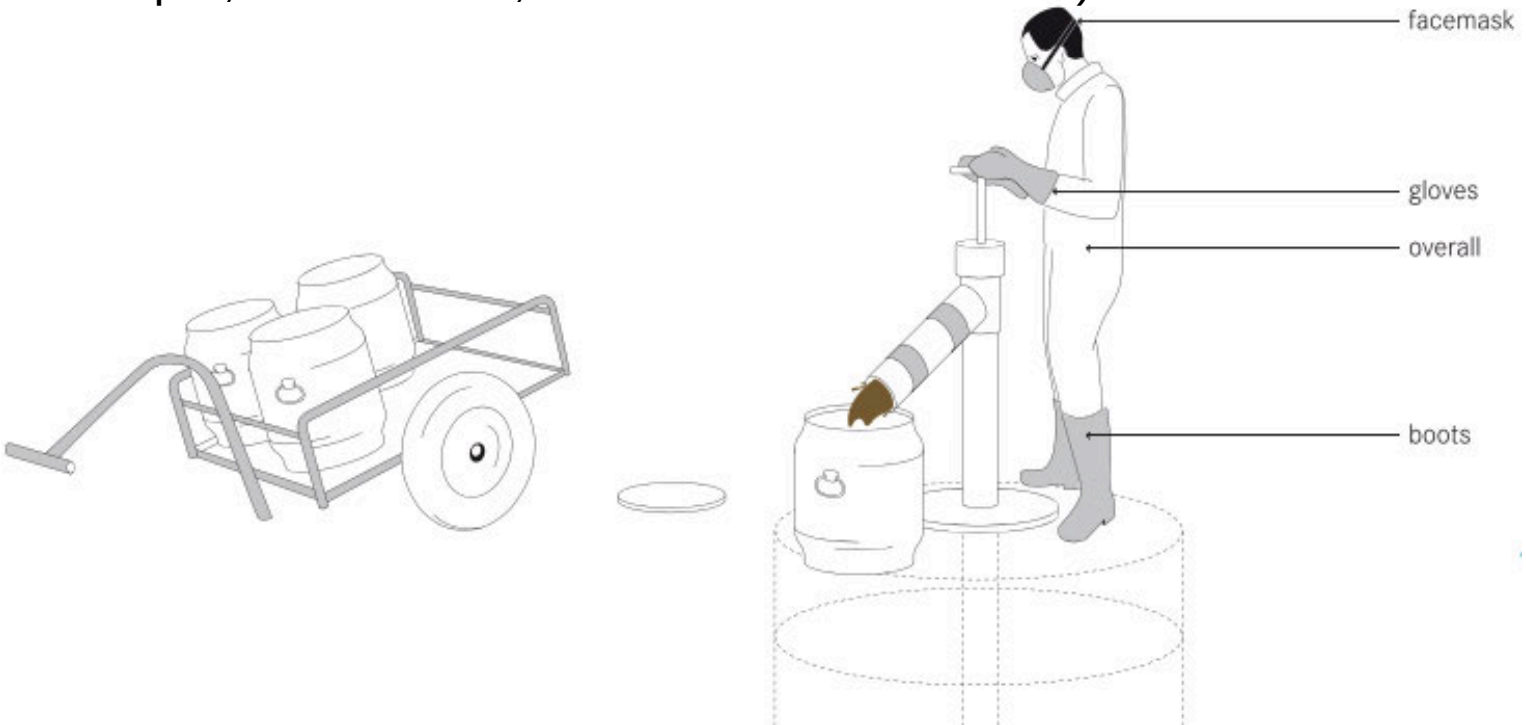
Conveyance

Human-powered Emptying and Transport

Refers to the different ways in which people can manually empty and/or transport sludge and solid products generated in on-site sanitation facilities.

Human-powered emptying of pits, vaults and tanks can be done in one of two ways:

- Using buckets and shovels
- Using a portable, manually operated pump specially designed for sludge (e.g., the Gulper, the Rammer, the MDHP or the MAPET).



Conveyance

Human-powered Emptying and Transport

Conveyance

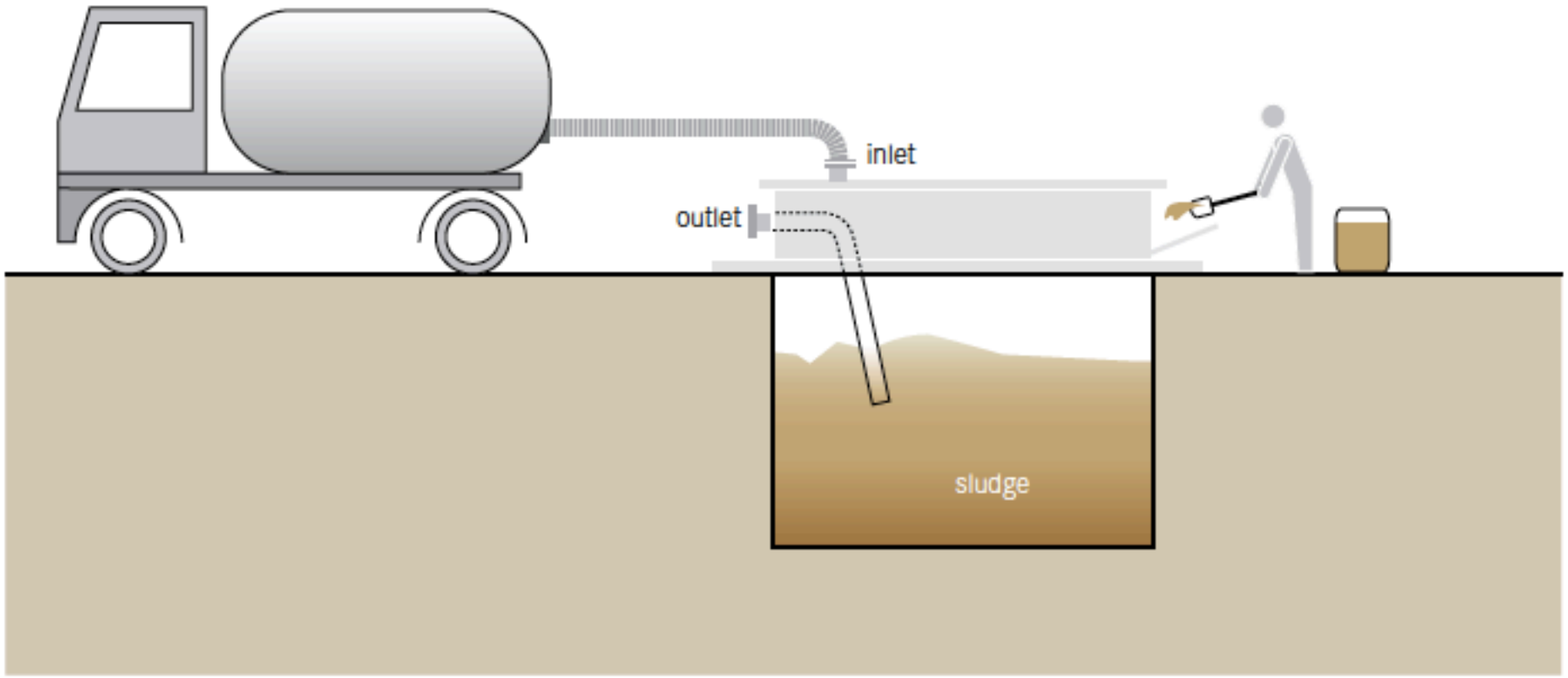
Human-powered Emptying and Transport

Using buckets and shovels:

- fossa alterna
- UDDTs

Conveyance

Transfer stations (Underground Holding Tank)



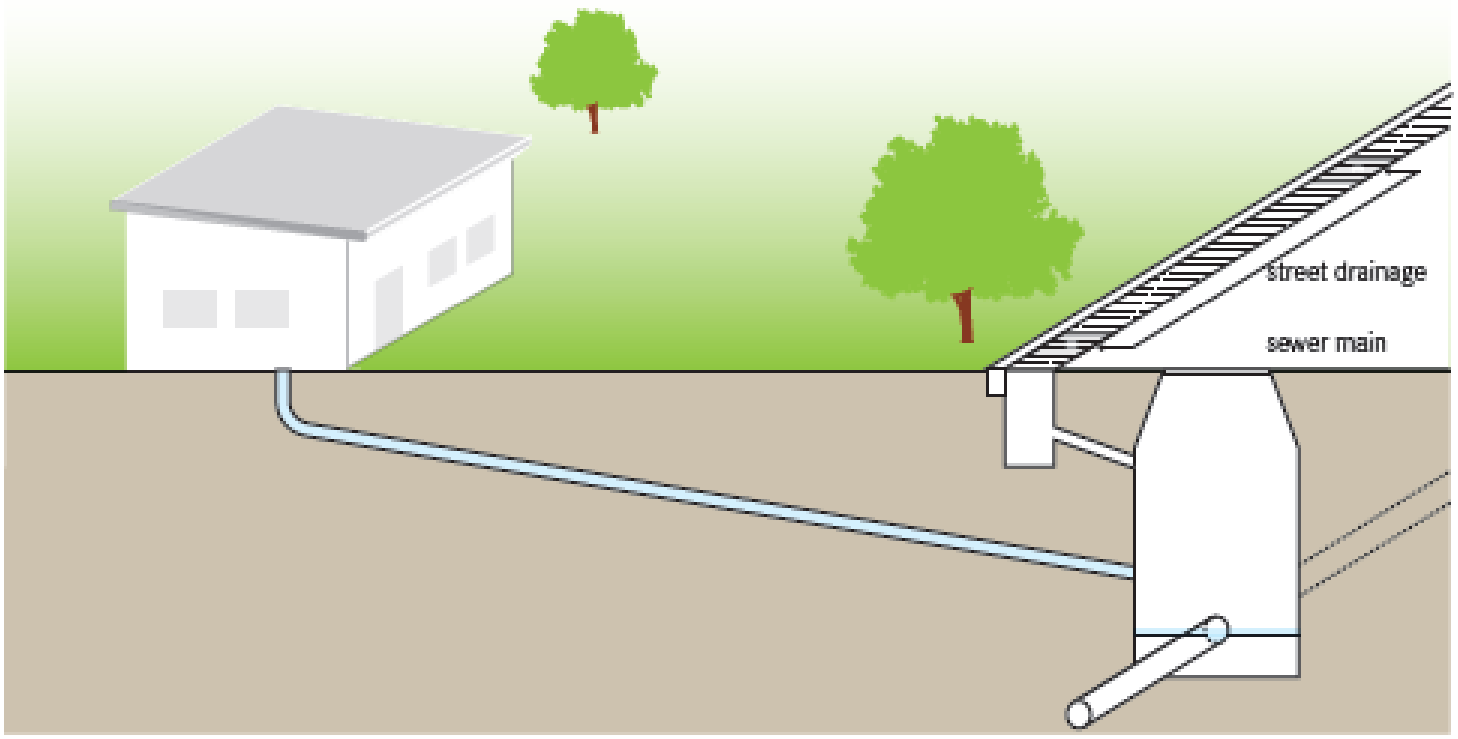
Holding tanks that act as intermediate dumping points for faecal sludge when it cannot be easily transported to a (Semi-) Centralized Treatment facility.

Conveyance

Human-powered Emptying and Transport

Conveyance

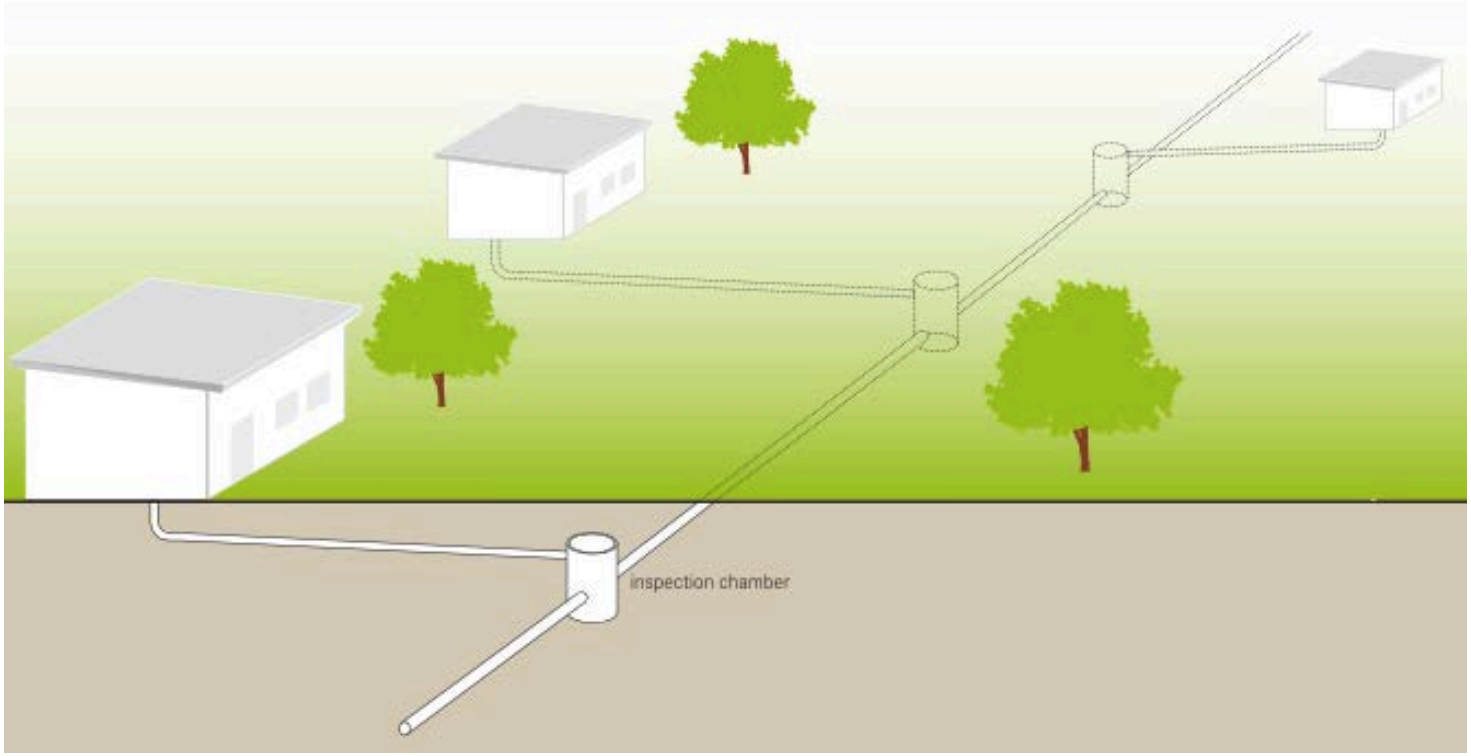
Conventional Gravity System



Large networks of underground pipes that convey blackwater, greywater and, in many cases stormwater from the houses to the wastewater plants.

Conveyance

Simplified / shallow /condominial sewer



Sewerage network that is constructed using smaller diameter pipes laid at a shallower depth and at a flatter gradient than conventional sewers.
The simplified sewer allows for a more flexible design at lower costs. 20-50% less expensive that conventional.
Continuous risk of clogging. Continuous inspection needed.

Conveyance

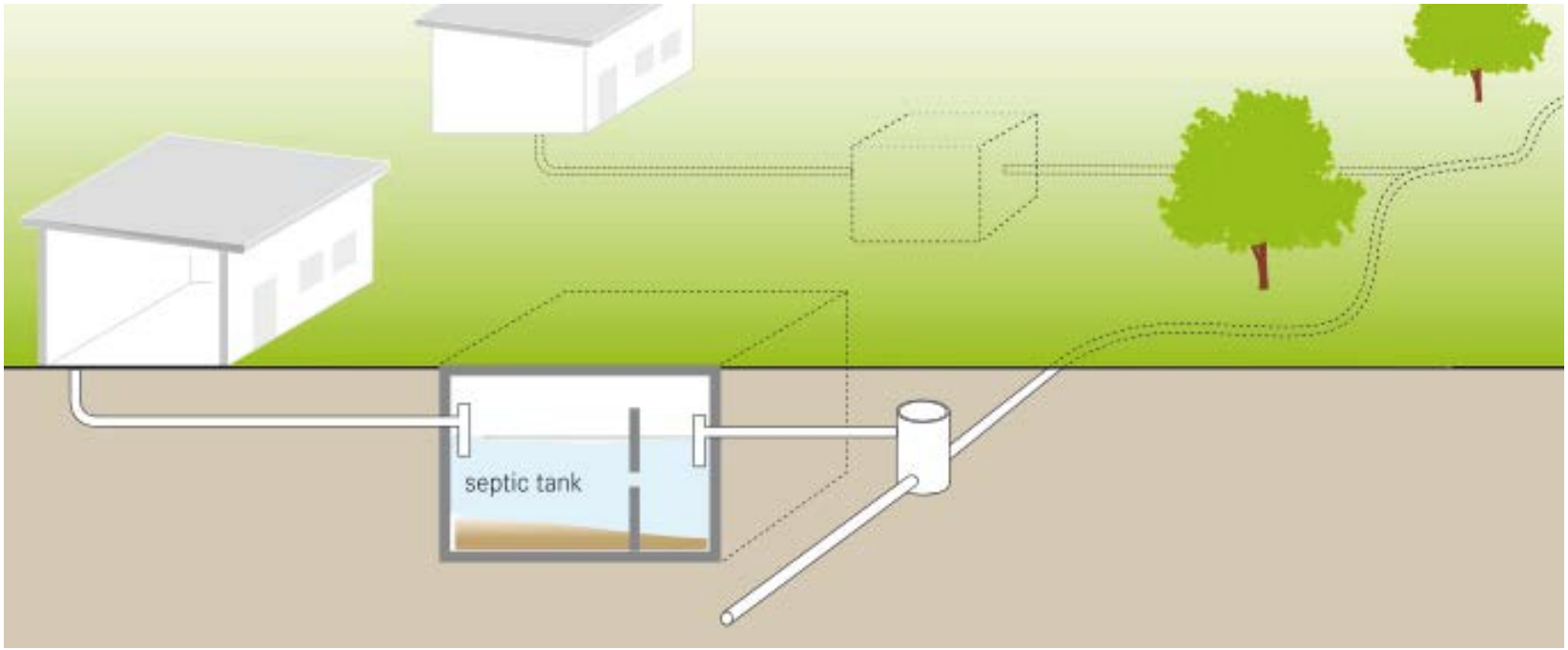
Simplified Sewer

Specially appropriated in dense areas.

Blockages are common.

Conveyance

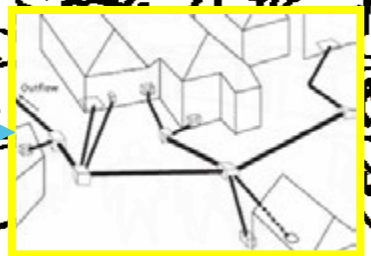
Solids-free Sewer



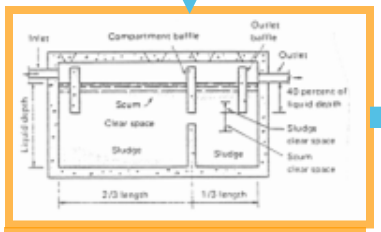
Network of small-diameter pipes that transports pre-treated and solids-free wastewater (such as septic tank effluent).
It can be installed at a shallow depth and does not require a minimum wastewater flow or slope to function.
Less expensive of all sewer systems.

Sanitation Systems

User Interface

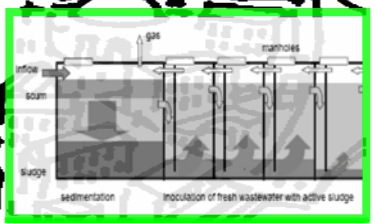


Conveyance



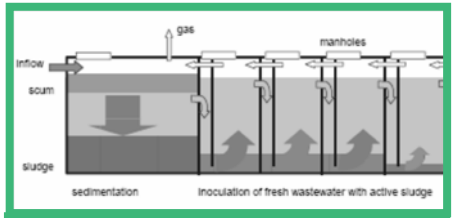
Collection and Storage/ Treatment

Use and/or Disposal



(Semi-) centralised Treatment

Functional Group: (Semi-) centralised Treatment



(Semi-) centralised Treatment
e.g. Anaerobic Baffled Reactor or Waste Stabilisation Pond

- Treatment technologies that are generally appropriate for large user groups
- O&M and energy requirements of technologies within this functional group are generally higher than for smaller- scale technologies.
- The technologies are divided into 2 groups:
  - Treatment of blackwater, brownwater, breywater or effluent (e.g. biogas settlers, ABRs, WSPs, constructed wetlands)
  - Treatment of sludge (e.g. planted or unplanted drying beds, composting, anaerobic digestion)

2. Sanitation Technology

Functional Group: (Semi-) centralised Treatment

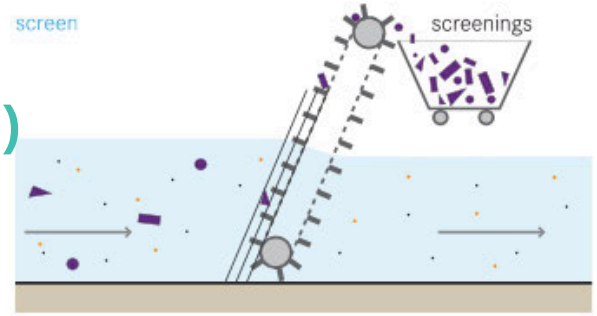
- Treatment of blackwater
  - Anaerobic
  - Aerobic

Pre-treatment technologies: remove oil, grease, sand or trash + **Primary: liquid-solid separation** + **Secondary: removal of organic matter and SS** + **Post treatment: removal of pathogens, nutrients…**

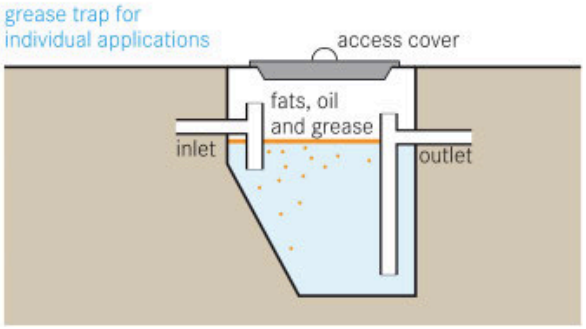
(Semi)-centralized treatment

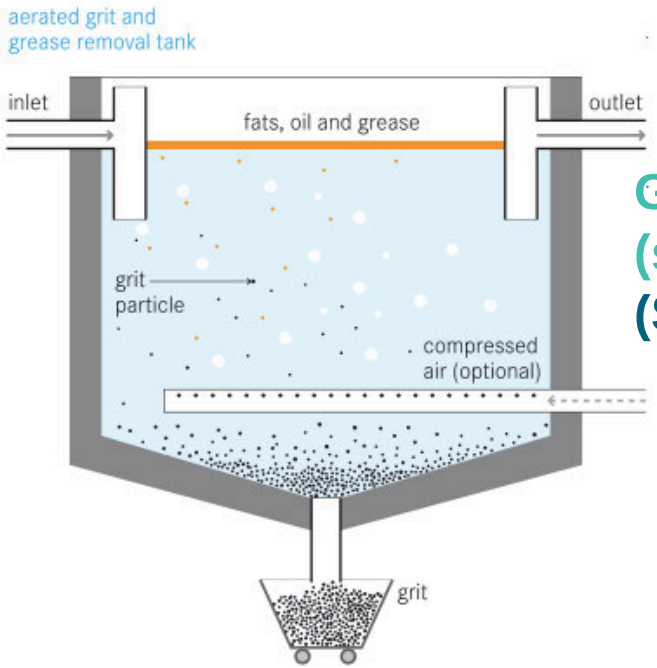
Pre- Treatment Technologies (physical mechanisms)

Screen (Screening)



Grease Trap (Flotation)



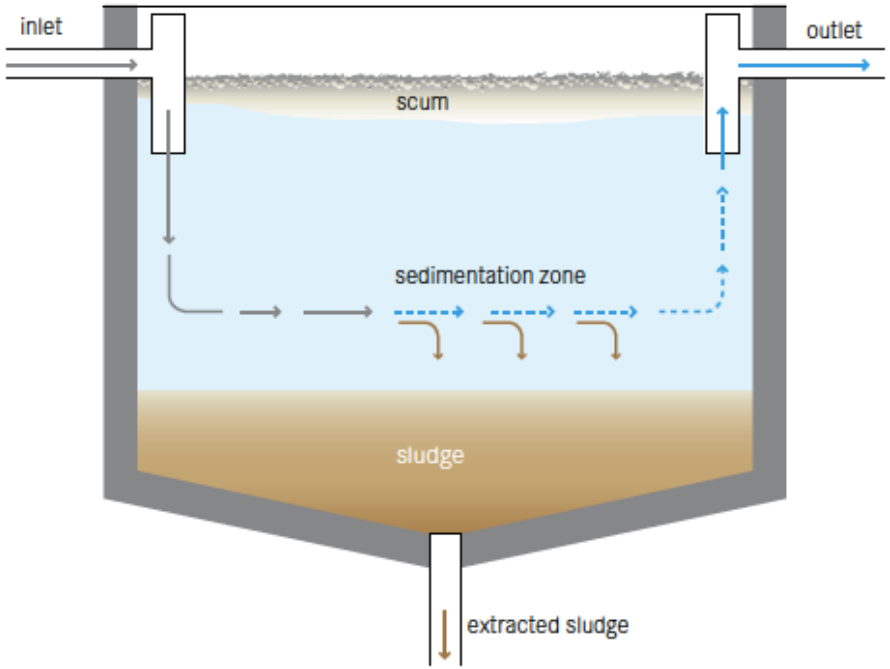


Grit Chamber (sand trap) (Settling)

- Preliminary removal of oil, grease, and various solids (e.g., sand, fibres and trash).
- Built before a conveyance or treatment technology, they can retard the accumulation of solids and minimize subsequent blockages.
- Reduce abrasion of mechanical parts.
- Extend the life of the sanitation infrastructure.

(Semi)-centralized treatment

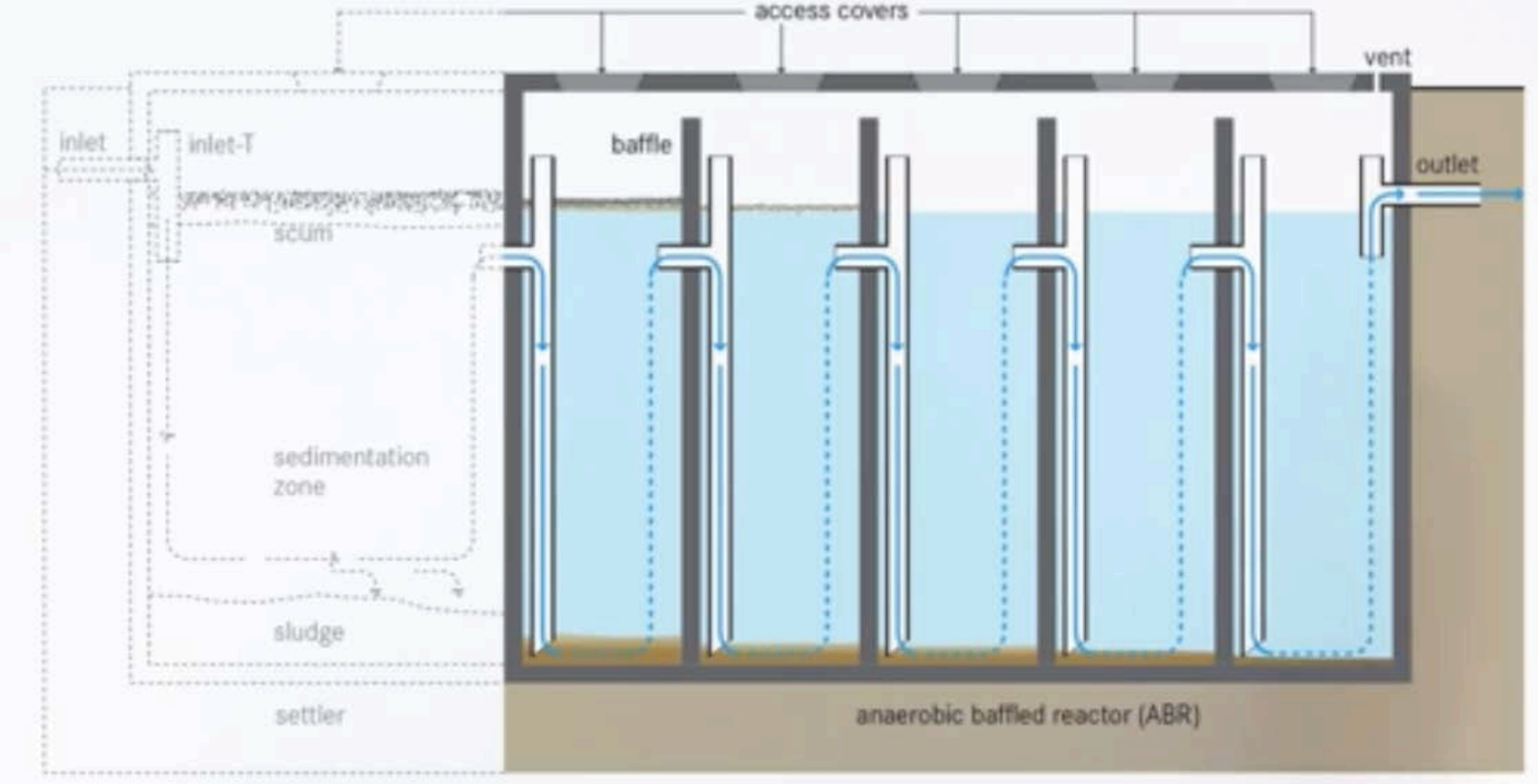
Settler (sedimentation or settling basin/tank, or clarifier)



- A settler is a primary treatment technology for wastewater; it is designed to remove suspended solids by sedimentation.
- The low flow velocity in a settler allows settleable particles to sink to the bottom, while constituents lighter than water float to the surface.

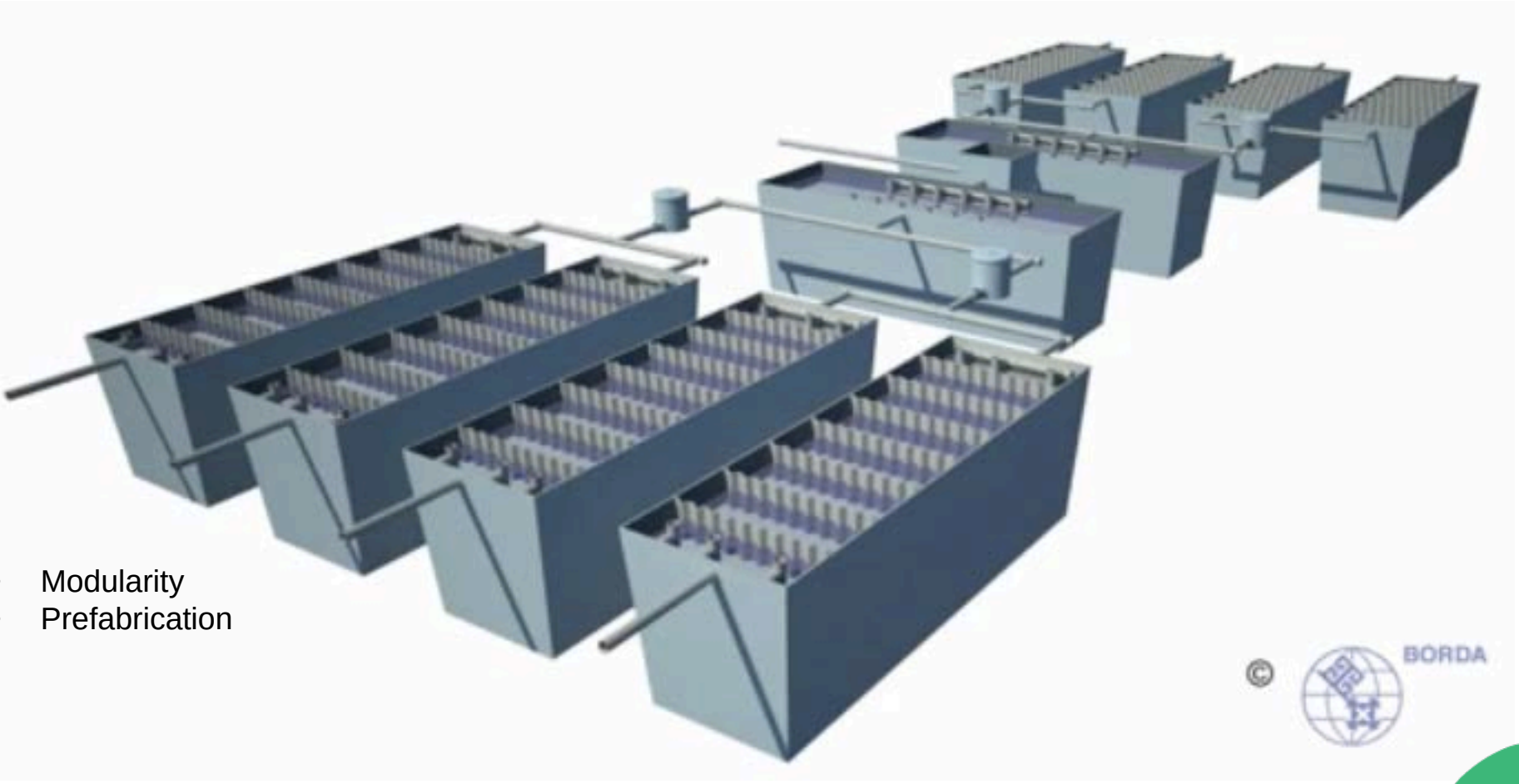
(Semi)-centralized treatment

Anaerobic Baffle Reactor



(Semi)-centralized treatment

Anaerobic Baffle Reactor



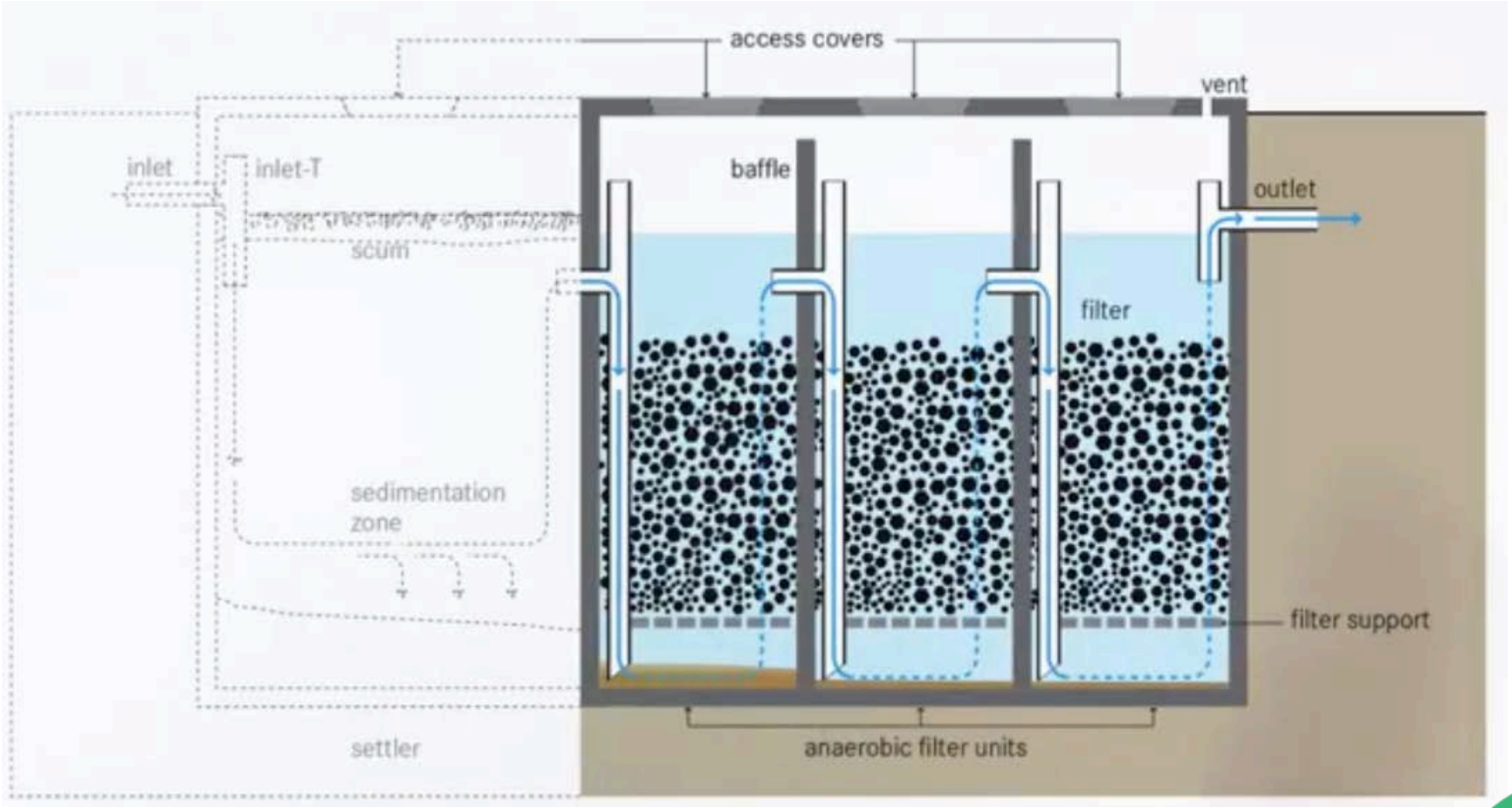
- Modularity
- Prefabrication

(Semi)-centralized treatment

Anaerobic Baffle Reactor

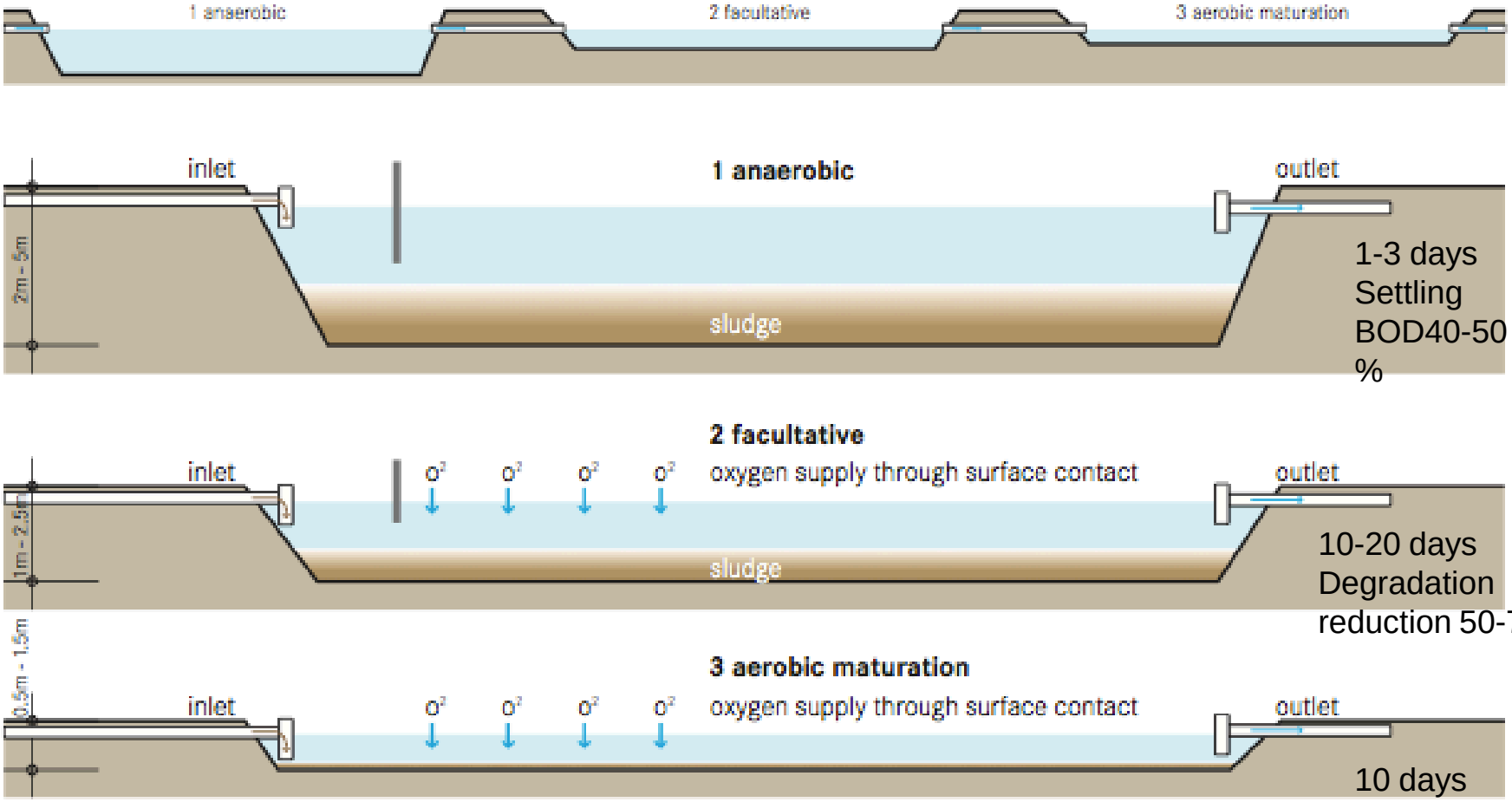
(Semi)-centralized treatment

Anaerobic Filter



(Semi)-centralized treatment

Waste Stabilization Ponds (WSP)



(Semi)-centralized treatment

Waste Stabilization Ponds (WSP)

It is ideal in warm climates if enough space and supervision are available

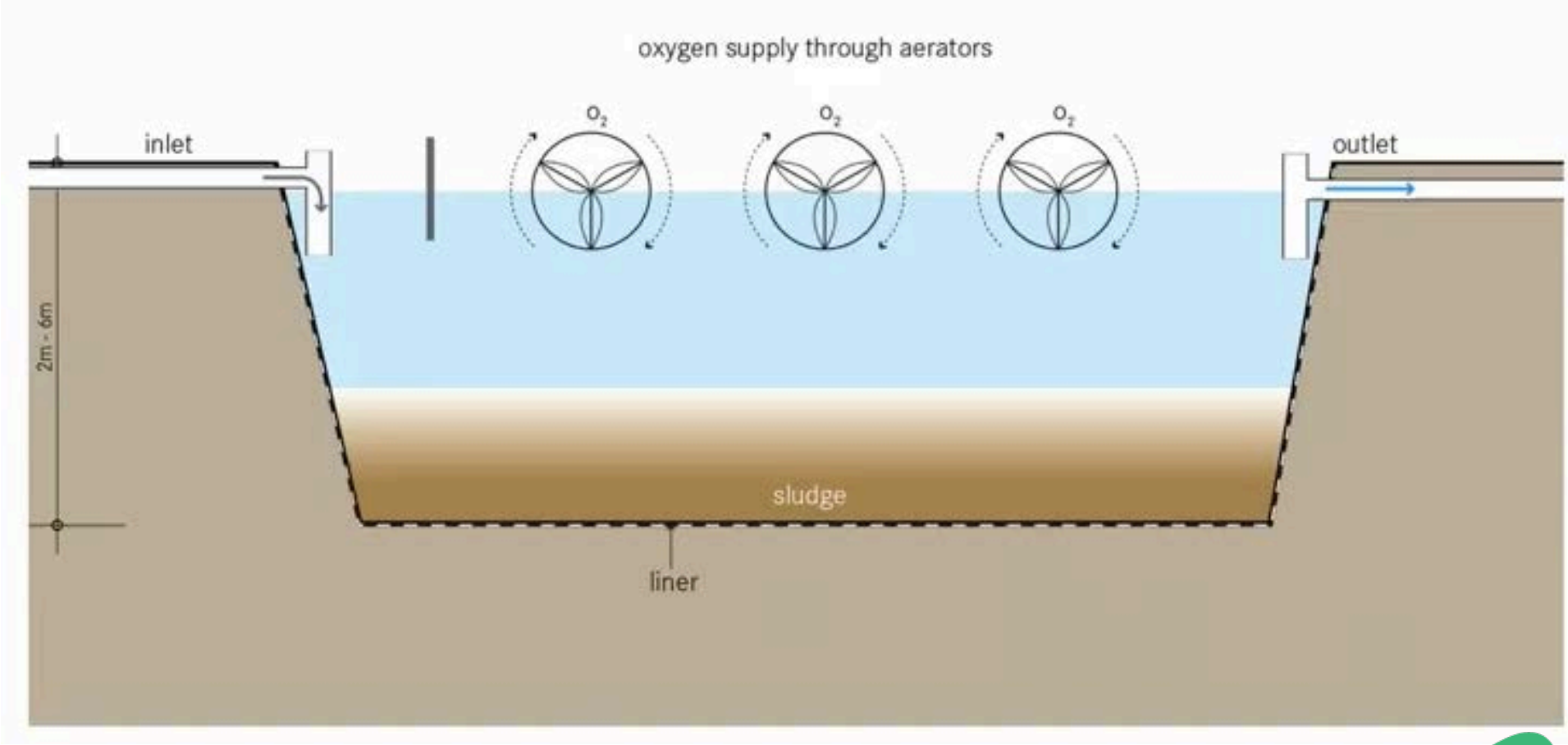
- Not appropriated for cold climates
- Requires a lot of space
- Potential for bad odours (anaerobic)

(Semi)-centralized treatment

Aereated ponds

(Semi)-centralized treatment

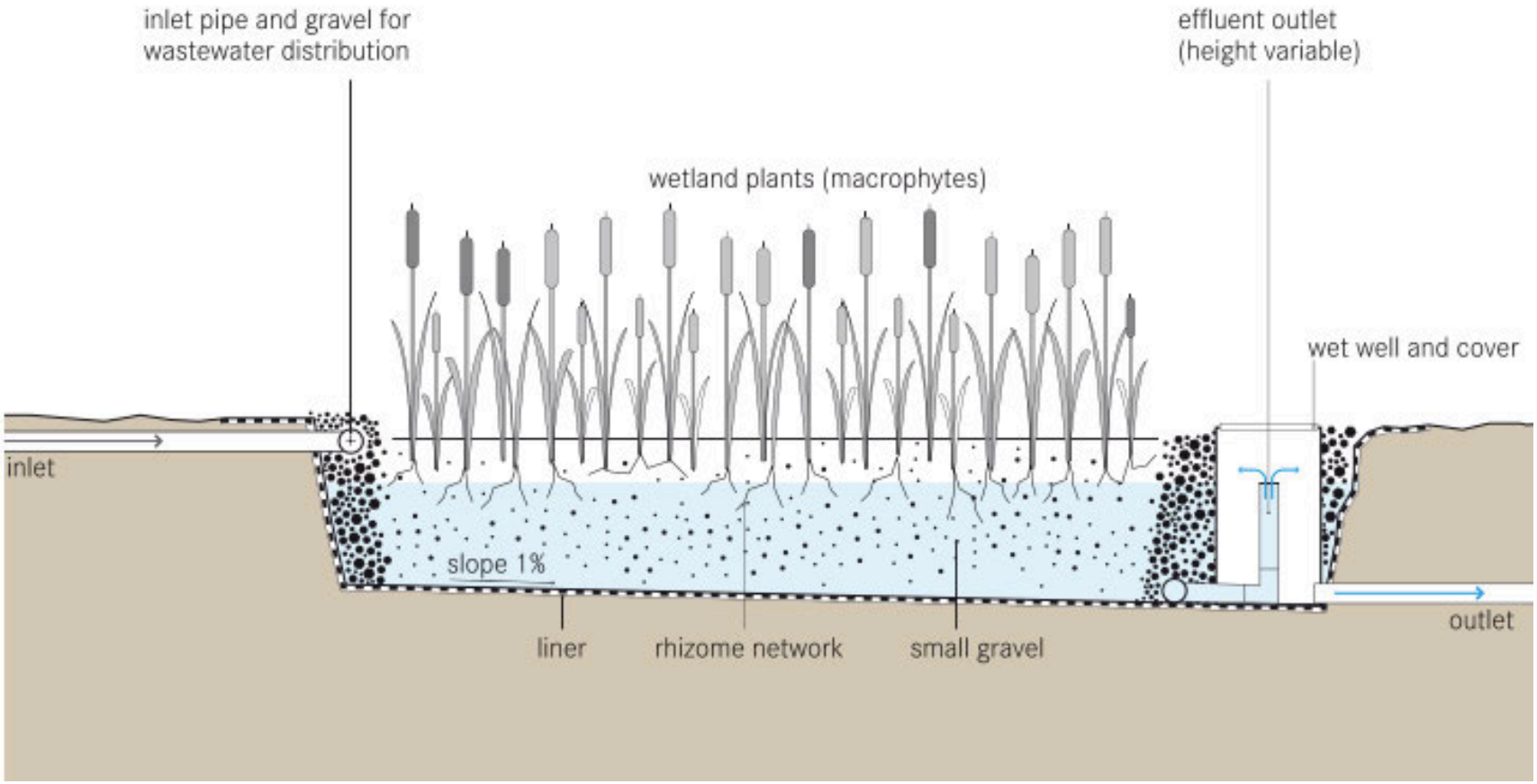
Aereated ponds



Mechanical aerators provide oxygen and keep the aerobic microorganisms suspended. 3- 20 days.

(Semi)-centralized treatment

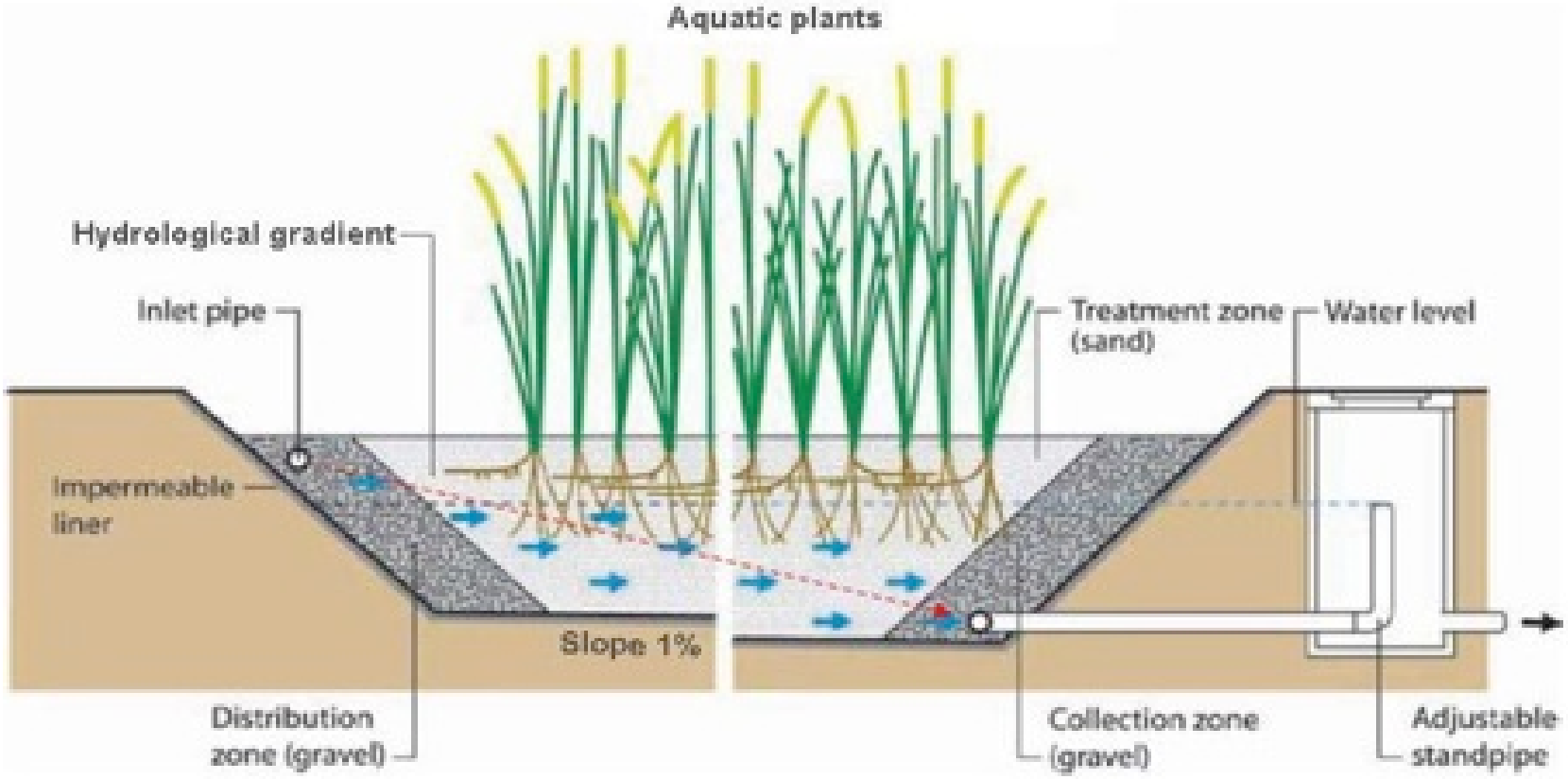
Horizontal Subsurface Flow Constructed Wetland



A large gravel and sand-filled basin that is planted with wetland vegetation. As wastewater flows horizontally through the basin, the filter material filters out particles and microorganisms degrade the organics. (5 – 10 m^2/person)

(Semi)-centralized treatment

Horizontal Subsurface Flow Constructed Wetland

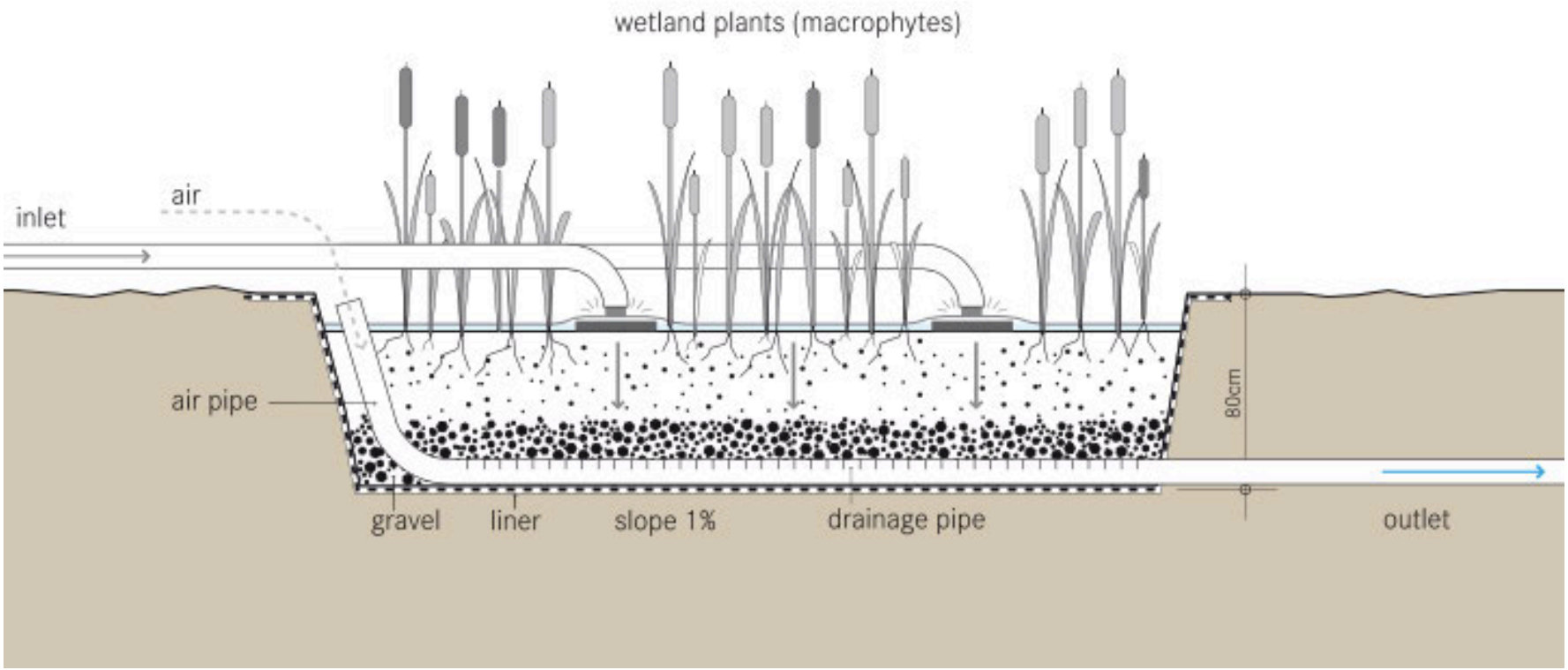


(Semi)-centralized treatment

Horizontal Subsurface Flow Constructed Wetland

(Semi)-centralized treatment

Vertical Flow Constructed Wetland



Aerobic conditions improved.
Water is poured intermittently, 4 to 10 times per day.
A good primary treatment is critical.

(Semi)-centralized treatment

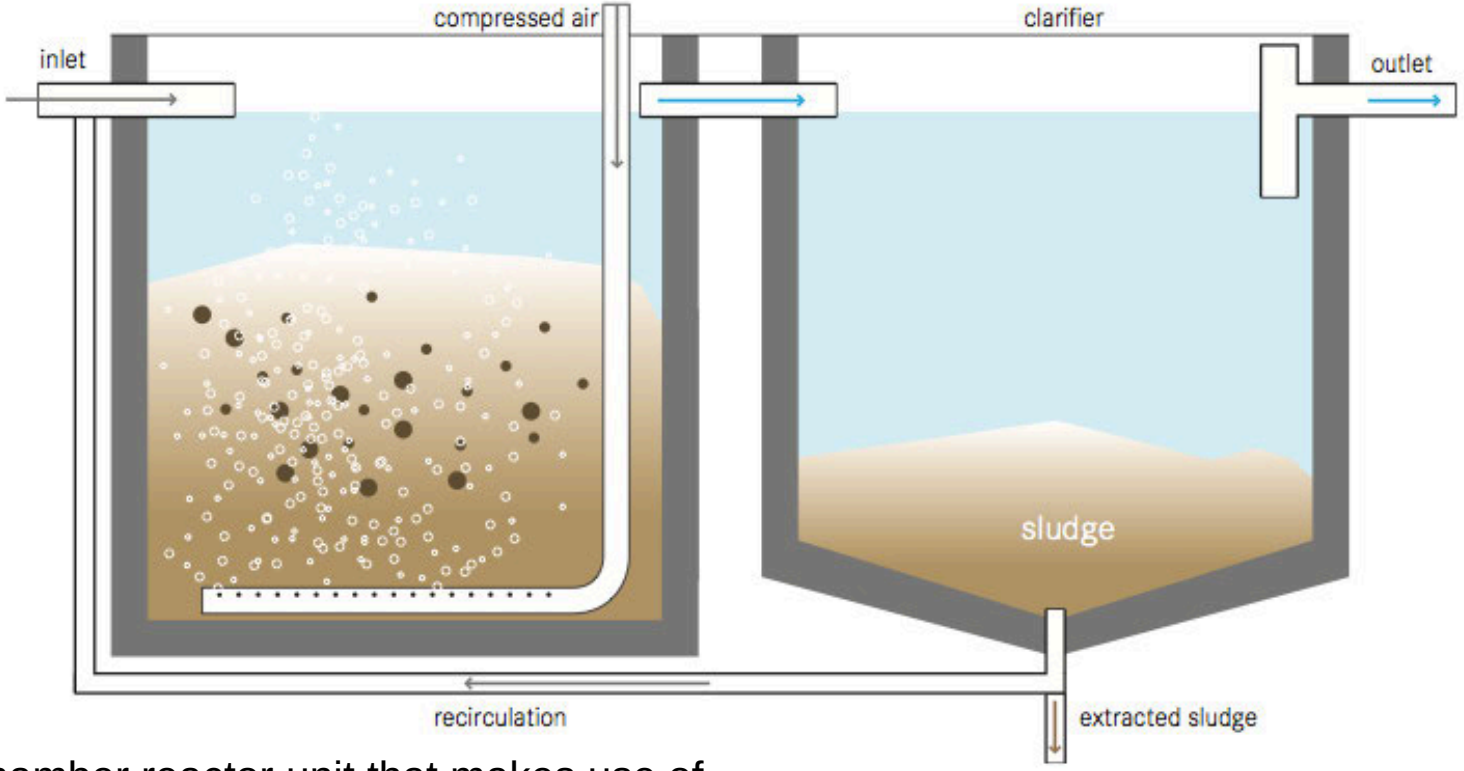
Vertical Flow Constructed Wetland

(Semi)-centralized treatment

Vertical Flow Constructed Wetland

(Semi)-centralized treatment

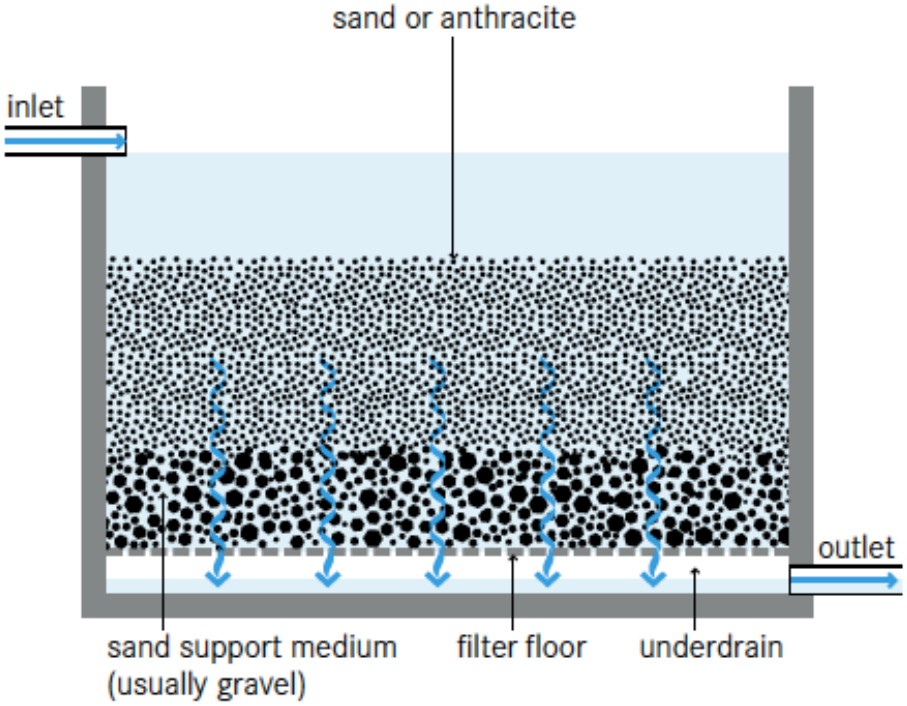
Activated Sludge



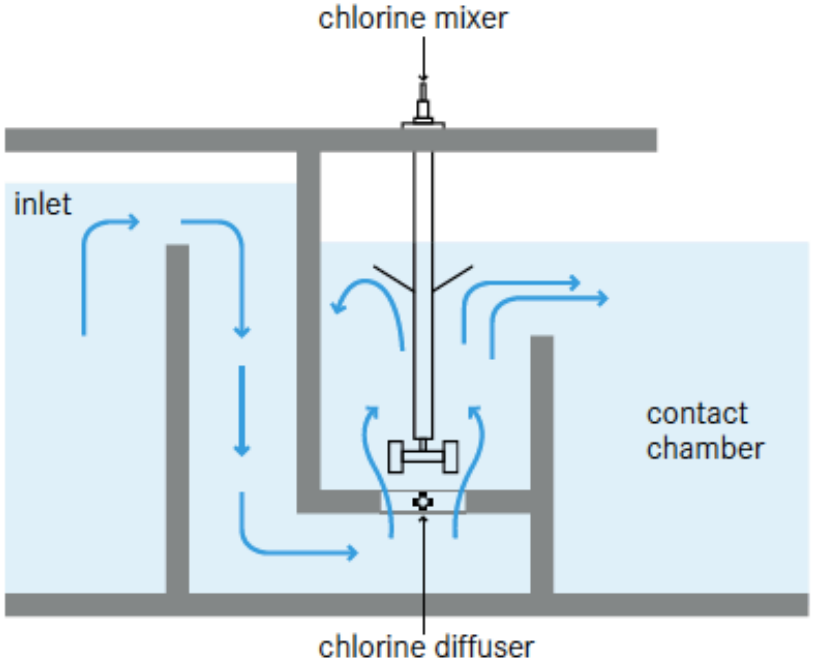
- Multi-chamber reactor unit that makes use of
- Highly concentrated microorganisms to degrade organics and remove nutrients
- To maintain aerobic conditions and to keep the activated sludge suspended, a continuous and well-timed supply of oxygen is required.

(Semi)-centralized treatment

Post-treatment: Tertiary Filtration and Disinfection



tertiary filtration (e.g., depth filtration)



disinfection (e.g., chlorination)

- To remove pathogens, residual suspended solids and/or dissolved constituents.
- Depends on the end-use of the effluent or national standards for discharge in water bodies

(Semi)-centralized treatment

Technology choice

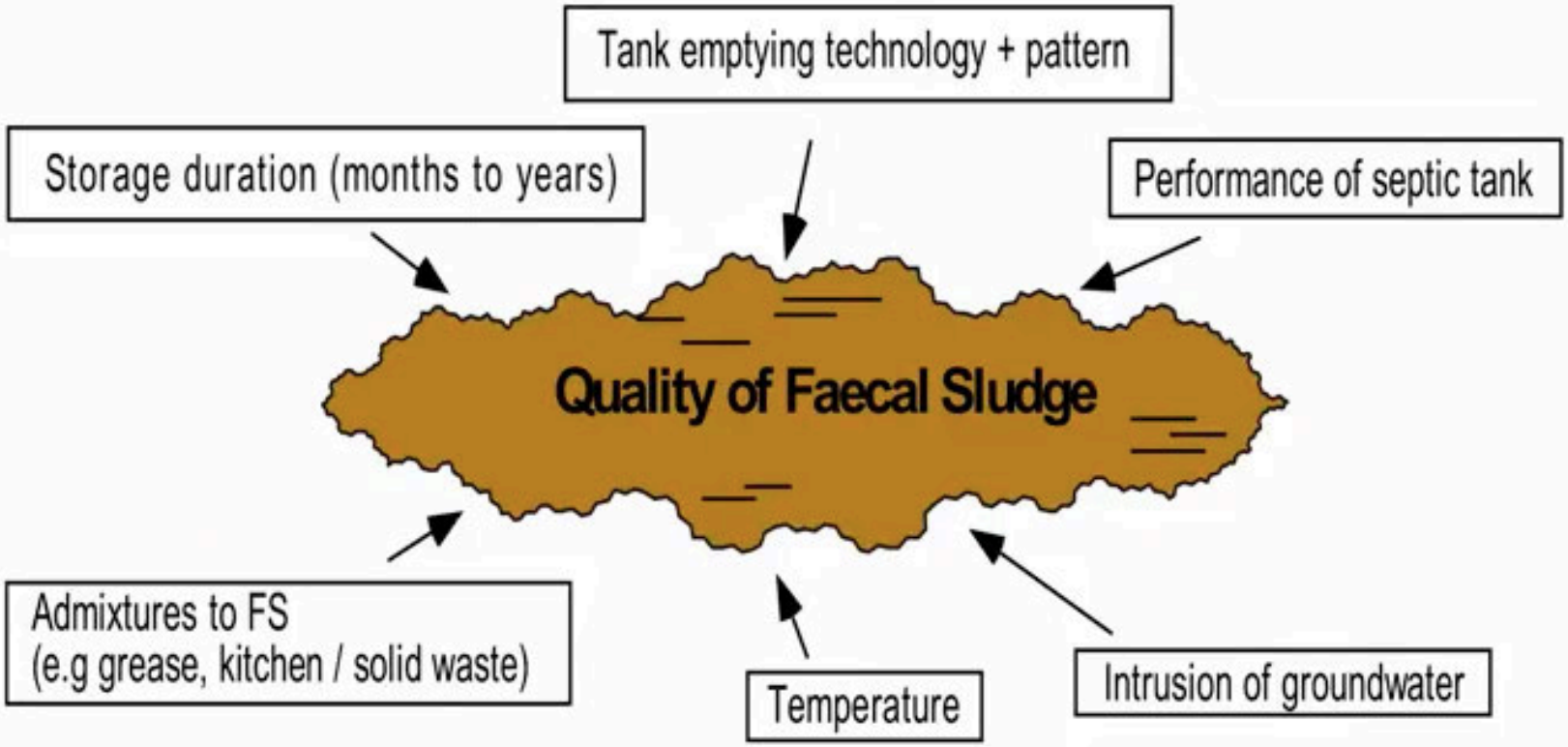
In any given context, the technology choice generally depends on the following factors:

- Type and quantity of products to be treated
- Desired output product (end-use and/or legal quality requirements)
- Financial resources
- Local availability of materials
- Availability of space
- Soil and groundwater characteristics
- Availability of a constant source of electricity
- Skills and capacity (for design and operation)
- Management considerations

(Semi)-centralized treatment

Sludge, faecal sludge, septage: sludge coming from onsite sanitation

Factors that affect faecal sludge from pits or septic tanks:



(Semi)-centralized treatment

Processes required to treat sludge:

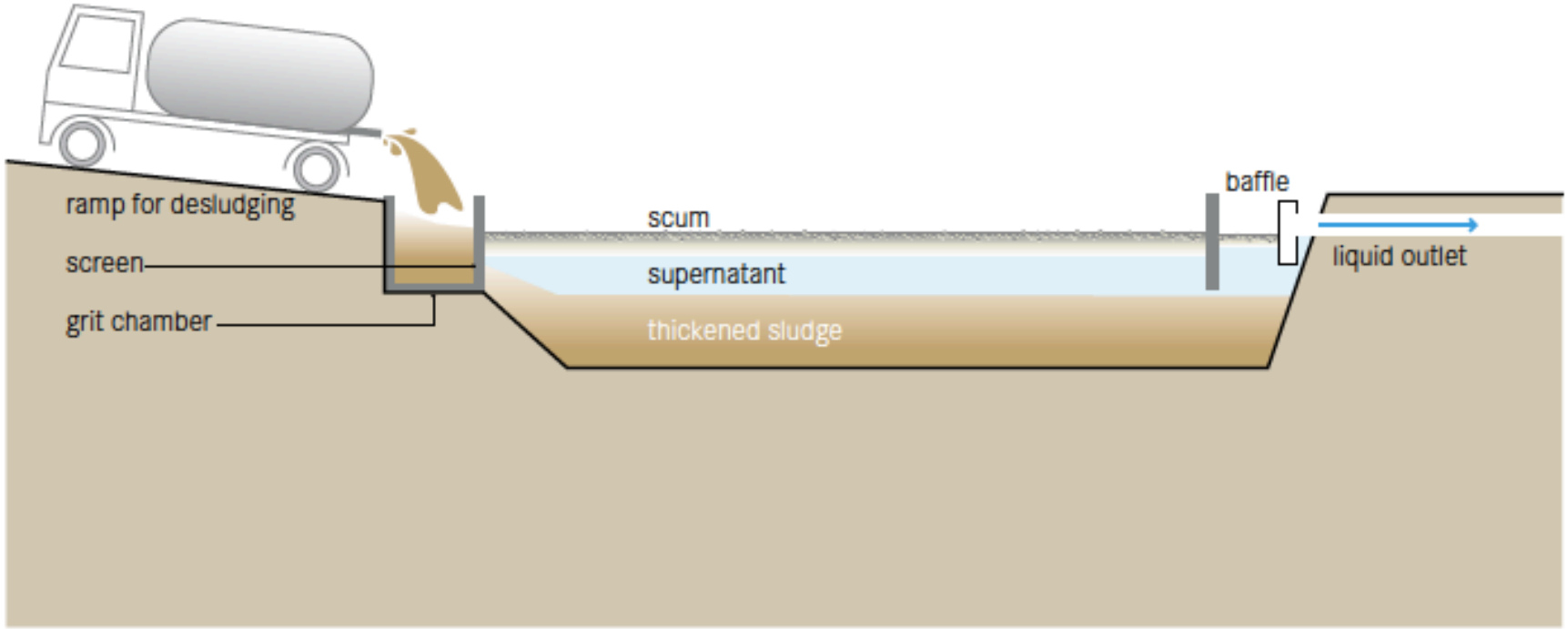
- Solid-liquid separation
- Stabilisation
- Dewatering/drying
- Pathogen reduction

- Important to define the end-use/disposal and define the treatment accordingly

End use could be: dry sludge as fertilizer, as fuel in pellets or biogas

(Semi)-centralized treatment

Sludge Treatment: Sedimentation / Thickening ponds



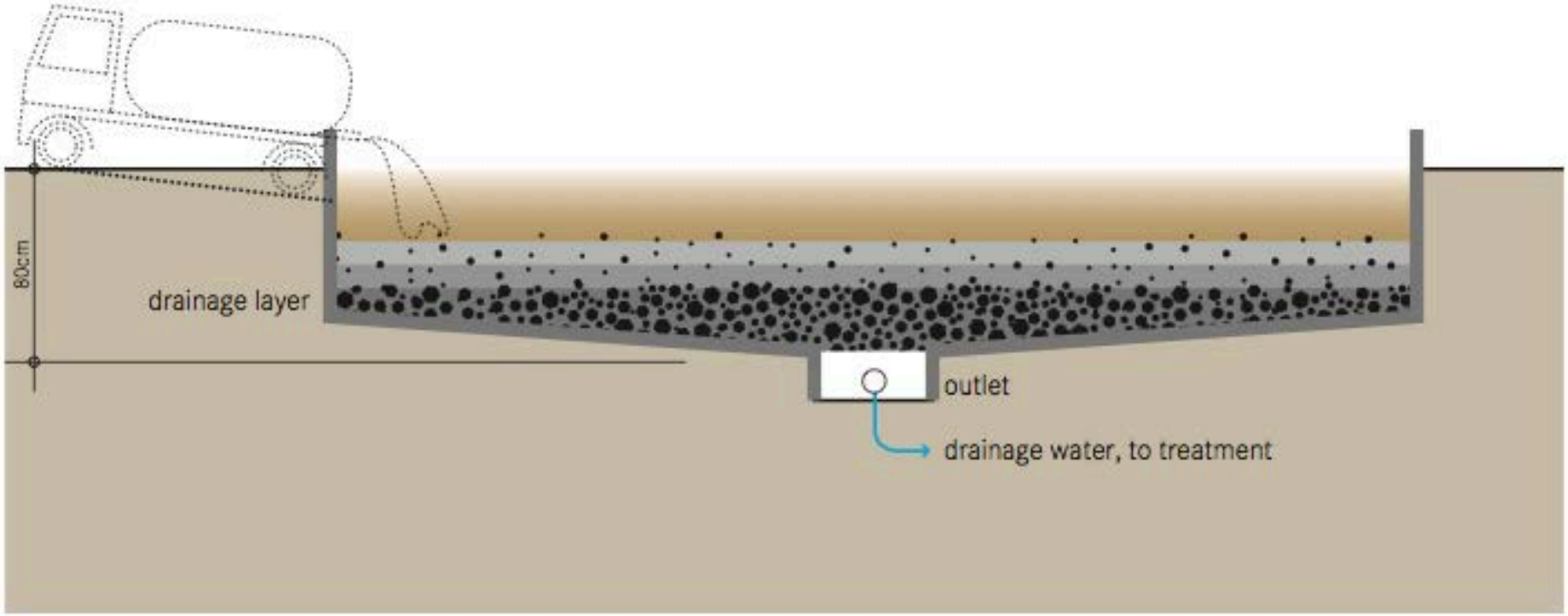
Sedimentation or thickening ponds are settling ponds that allow sludge to thicken and dewater. The effluent is removed and treated, while the thickened sludge can be further treated in a subsequent technology.

(Semi)-centralized treatment

Sedimentation /Thickening ponds

(Semi)-centralized treatment

Sludge Treatment: Unplanted Drying Beds



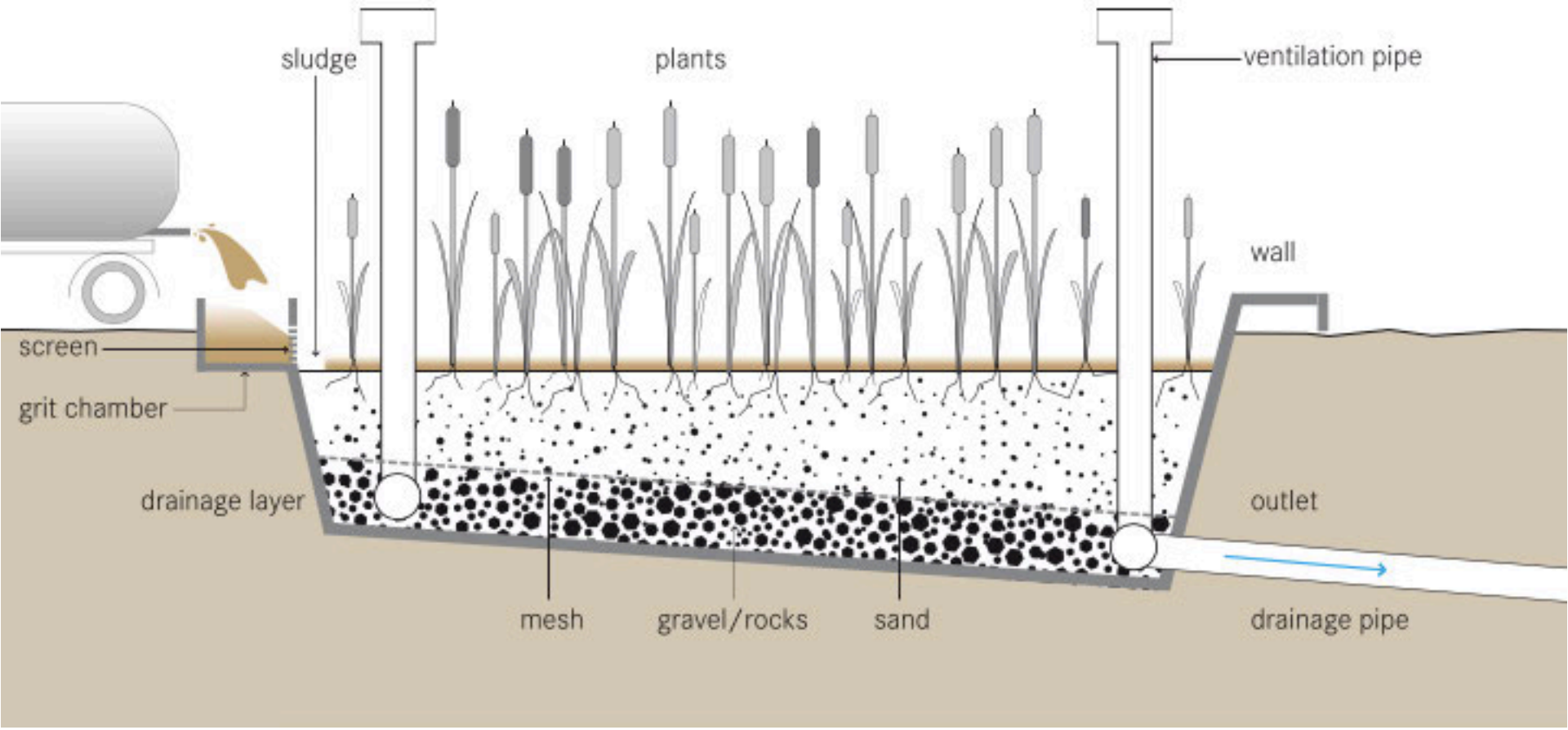
Most common sludge treatment technology.
At the bottom there are perforated pipes that collect the leachate.

(Semi)-centralized treatment

Sludge Treatment: Unplanted Drying Beds

(Semi)-centralized treatment

Planted Drying Beds



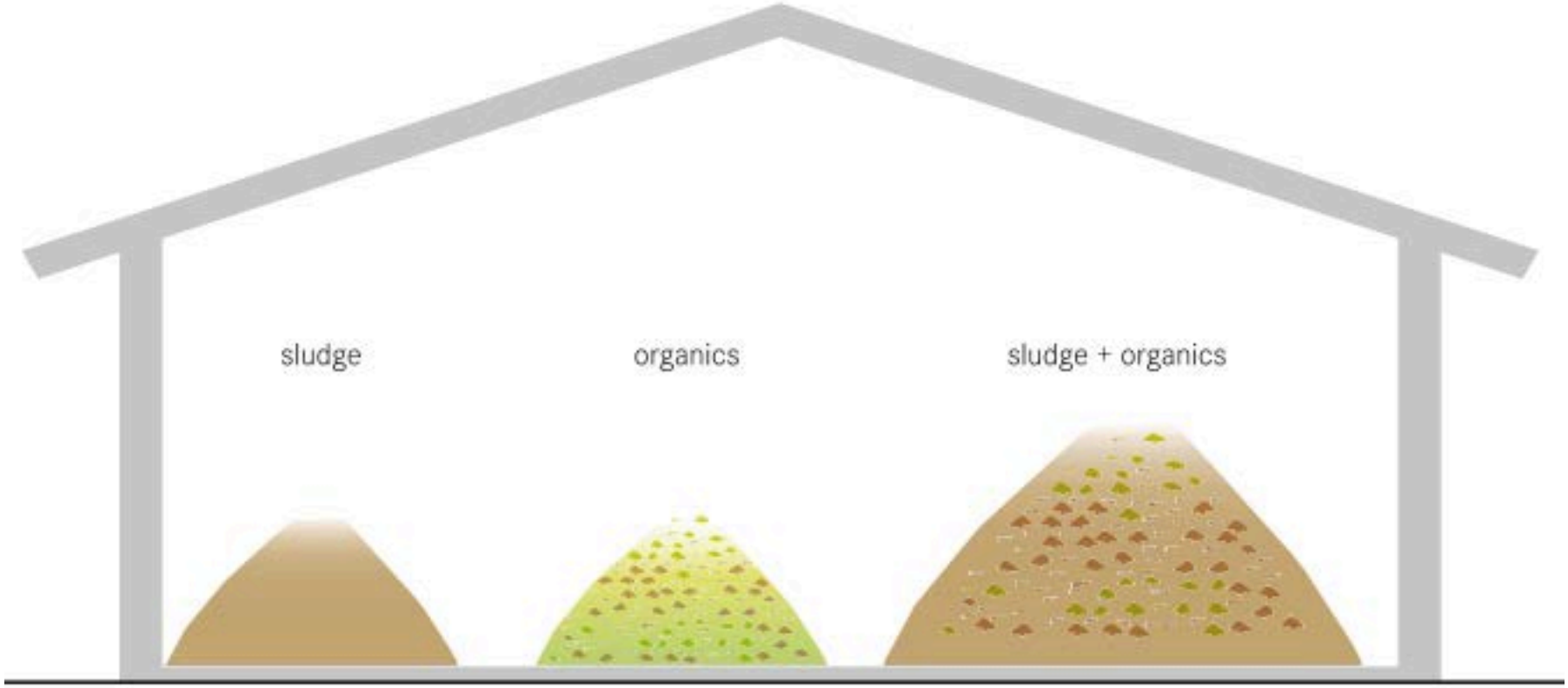
It doesn't have to be disludged after each feeding.
Sludge can be added layers after layers. Much high HRT and stabilization achieved.

(Semi)-centralized treatment

Planted Drying Beds

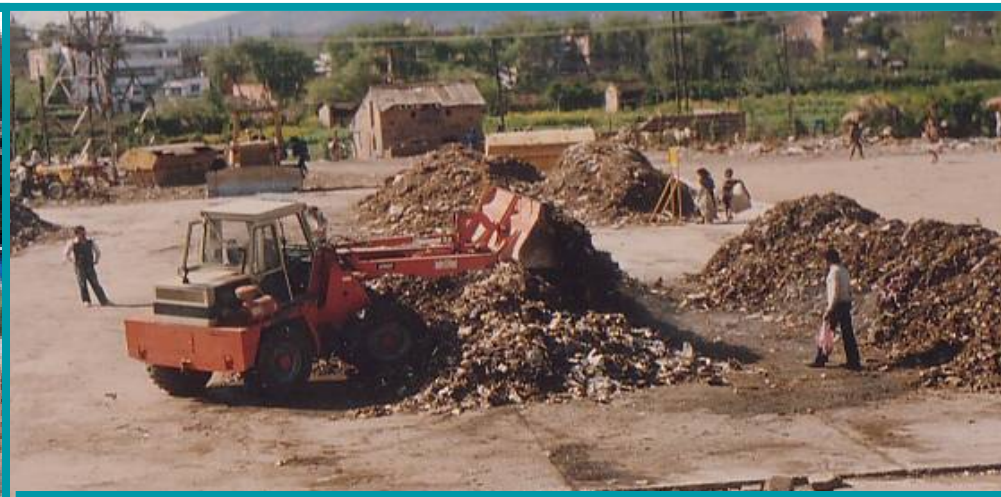
(Semi)-centralized treatment

Co-composting



(Semi)-centralized treatment

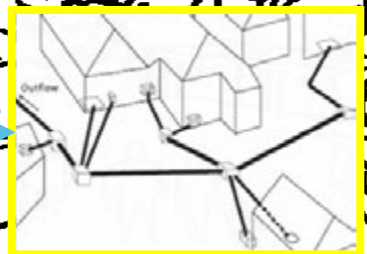
Co-compostagem



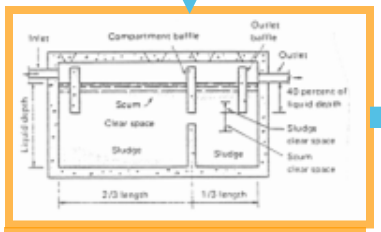
3. Sanitation Technologies

Sanitation Systems

User Interface

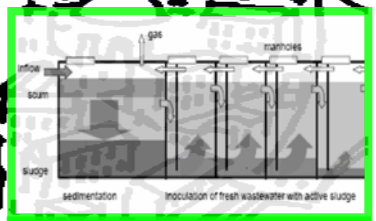


Conveyance



Collection and Storage/ Treatment

Use and/or Disposal



(Semi-) centralised Treatment

2. Sanitation Technology

Functional Group: Use and/or Disposal

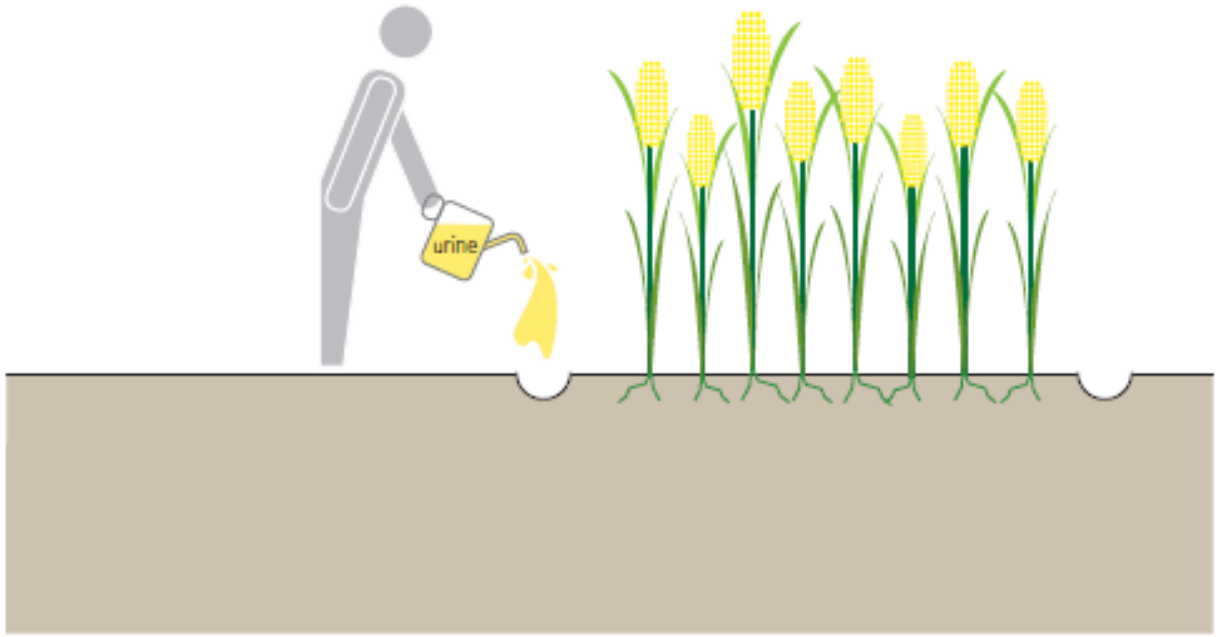
Use and/or Disposal
e.g. composting or soak pit

Methods by which products are:

- Returned to the environment, either as useful resources or reduced-risk materials.
- Products can also be cycled back into a system (e.g., by using treated greywater for flushing).

Use and/ or disposal

Application of stored urine



1 m^2 of cropland can receive 1.5 L of urine per growing season (this quantity corresponds to the daily urine production of one person and to 40-110 kg N/ha).

The urine of one person during one year is, thus, sufficient to fertilize 300 to 400 m^2 of cropland.

Use and/ or disposal

Application of stored urine

Young festivalgoers showing how it's done


25,000 litres of Roskilde Festival piss
on its way to be recycled.
BEERCYCLING
LANDBRUG FØDEVARER
sten your piss.
farmers can
to beer again.
what comes out of you
ater. In fact, it is a highly
armers of Denmark are
tival – quite literally.
ght have a beer from crops
BEERCYCLING

Use and/ or disposal

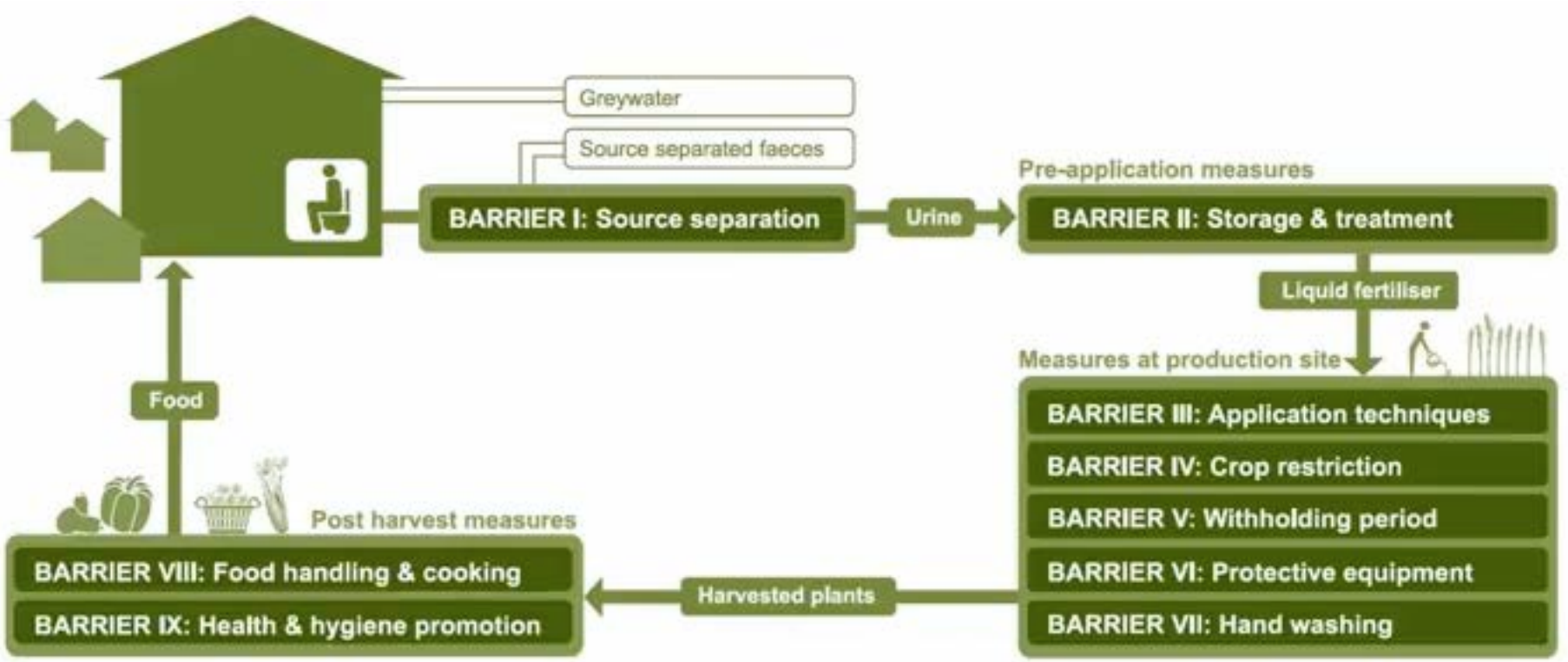
Application of stored urine

Use and/ or disposal

Barrier approach, WHO Safe reuse of Excreta and Wastewater Guidelines

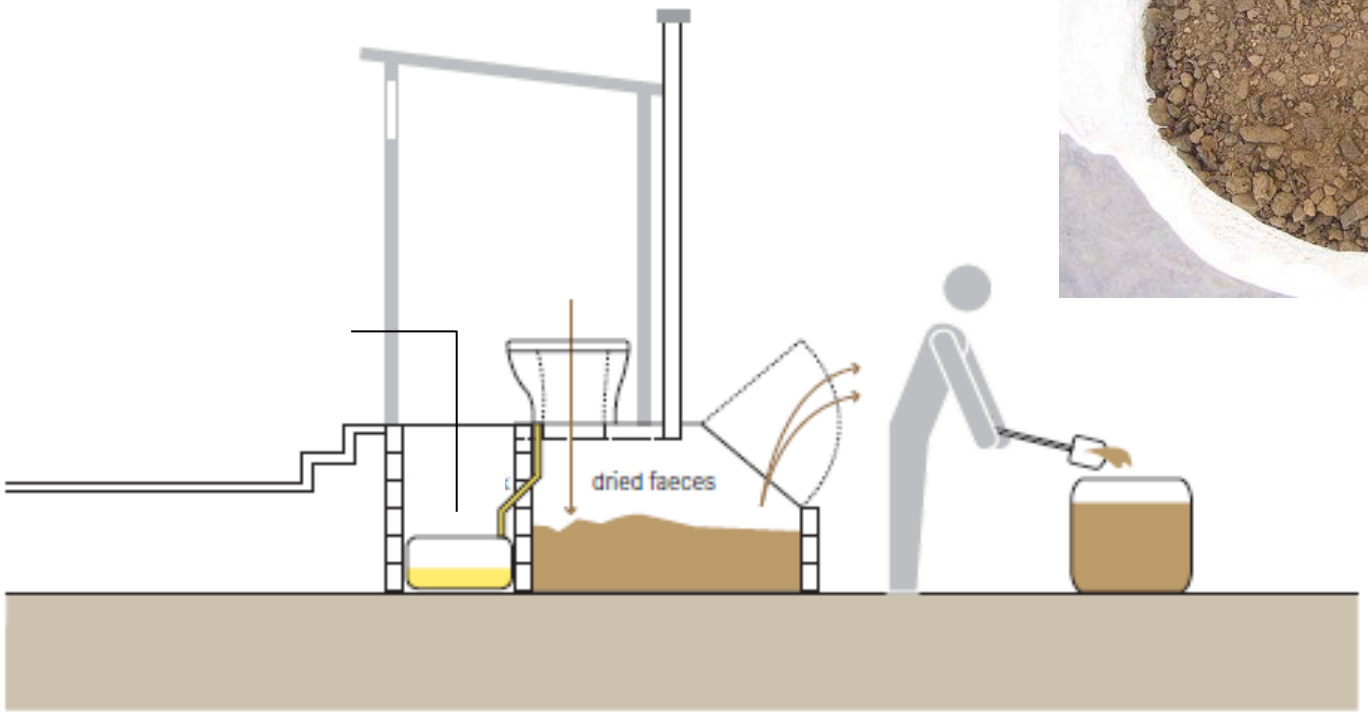
Use and/ or disposal

Barrier approach, WHO Safe reuse of Excreta and Wastewater Guidelines



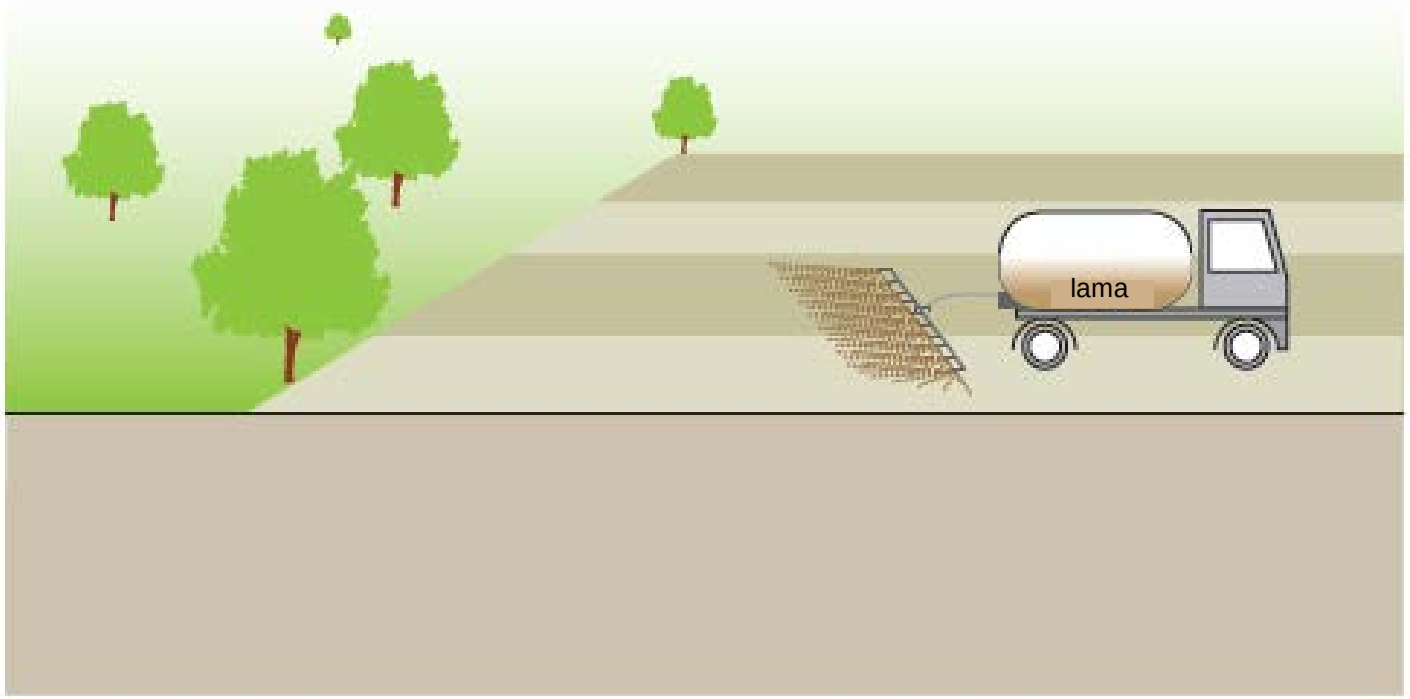
Use and/ or disposal

Application of Dehydrated Faeces



Use and/ or disposal

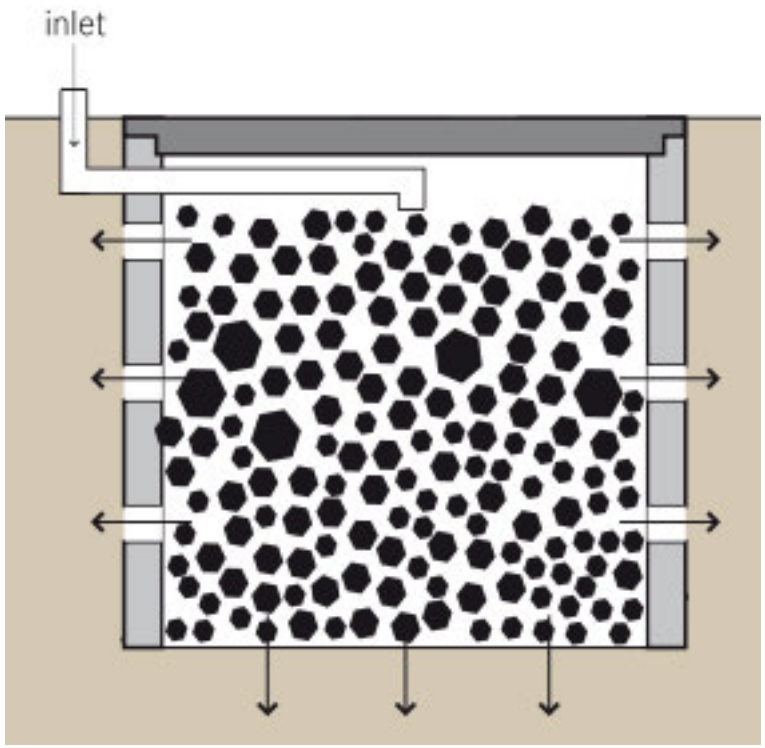
Application of sludge



Sludge that has been treated (e.g., co-composted or removed from a planted drying bed, etc.) can be used in agriculture, home gardening, forestry, sod and turf growing, landscaping, parks, golf courses, mine reclamation, as a dump cover, or for erosion control

Use and/ or disposal

Soak Pit



-Also known as a soakaway, cesspool, cesspit or leach pit.

-It is a covered, porous-walled chamber that allows water to slowly soak into the ground.

-Pre-settled effluent from a collection and storage/treatment or (semi-) centralized treatment technology is discharged to the underground chamber

-it infiltrates into the surrounding soil.

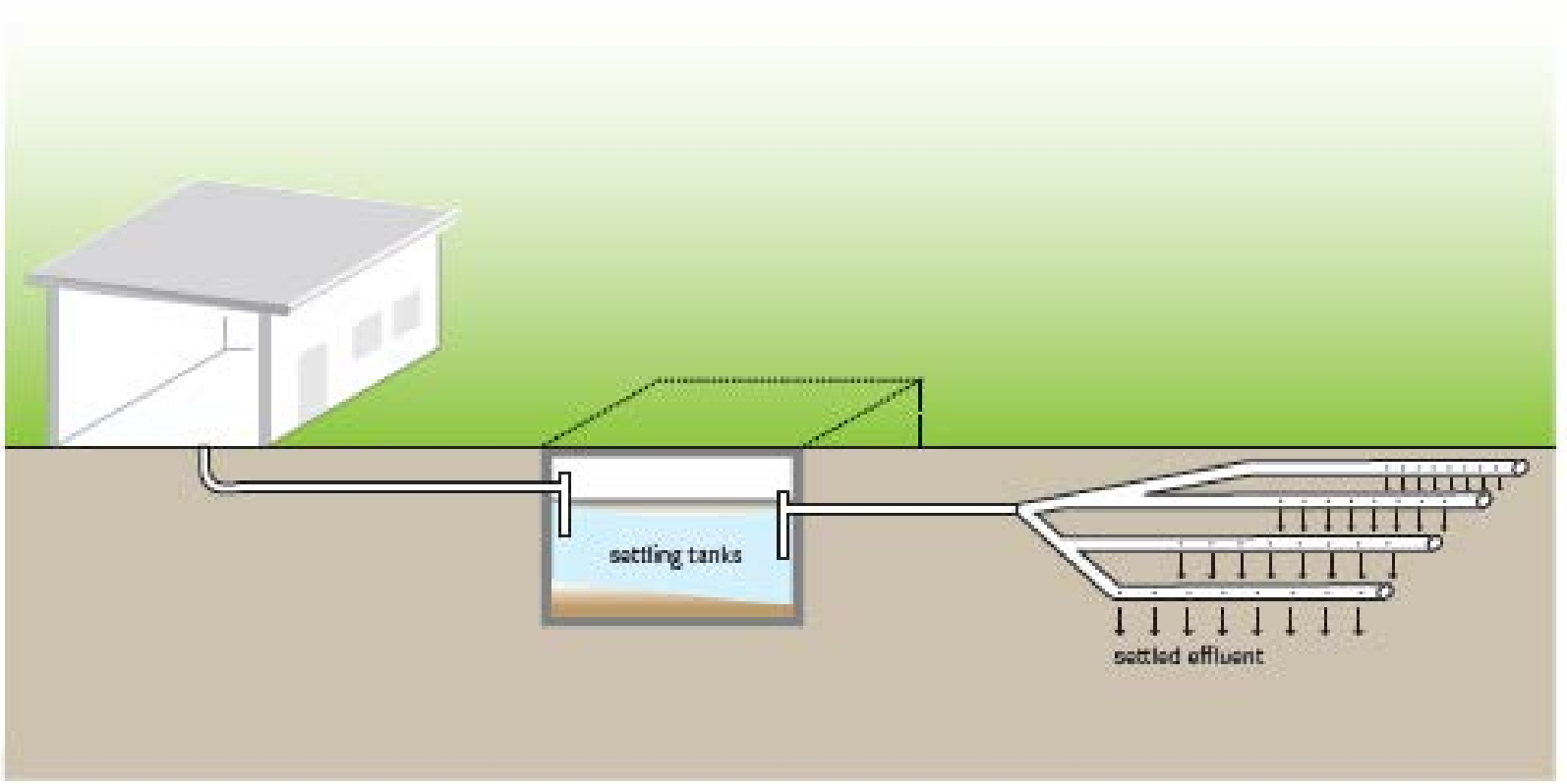
-Primary treatment is required

Use and/ or disposal

Soak Pit

Use and/ or disposal

Leach Field



- Network of perforated pipes that are laid in underground gravel-filled trenches
- It dissipates the effluent from a water-based collection and storage/treatment or (semi-)centralized treatment technology.

Use and/ or disposal

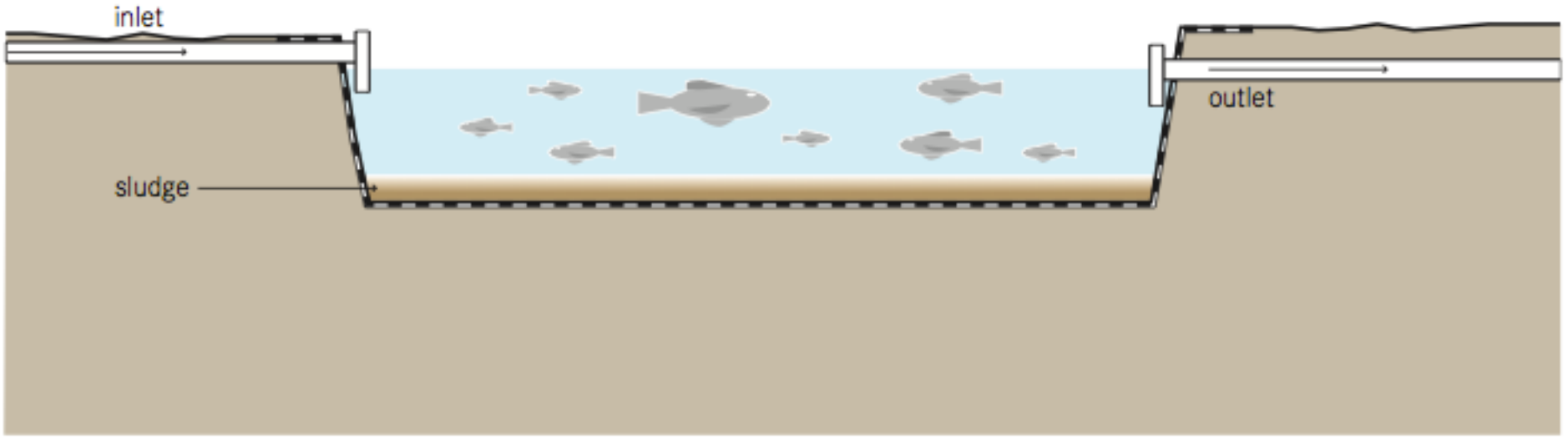
Leach Field

Use and/ or disposal

Leach Field

Use and/ or disposal

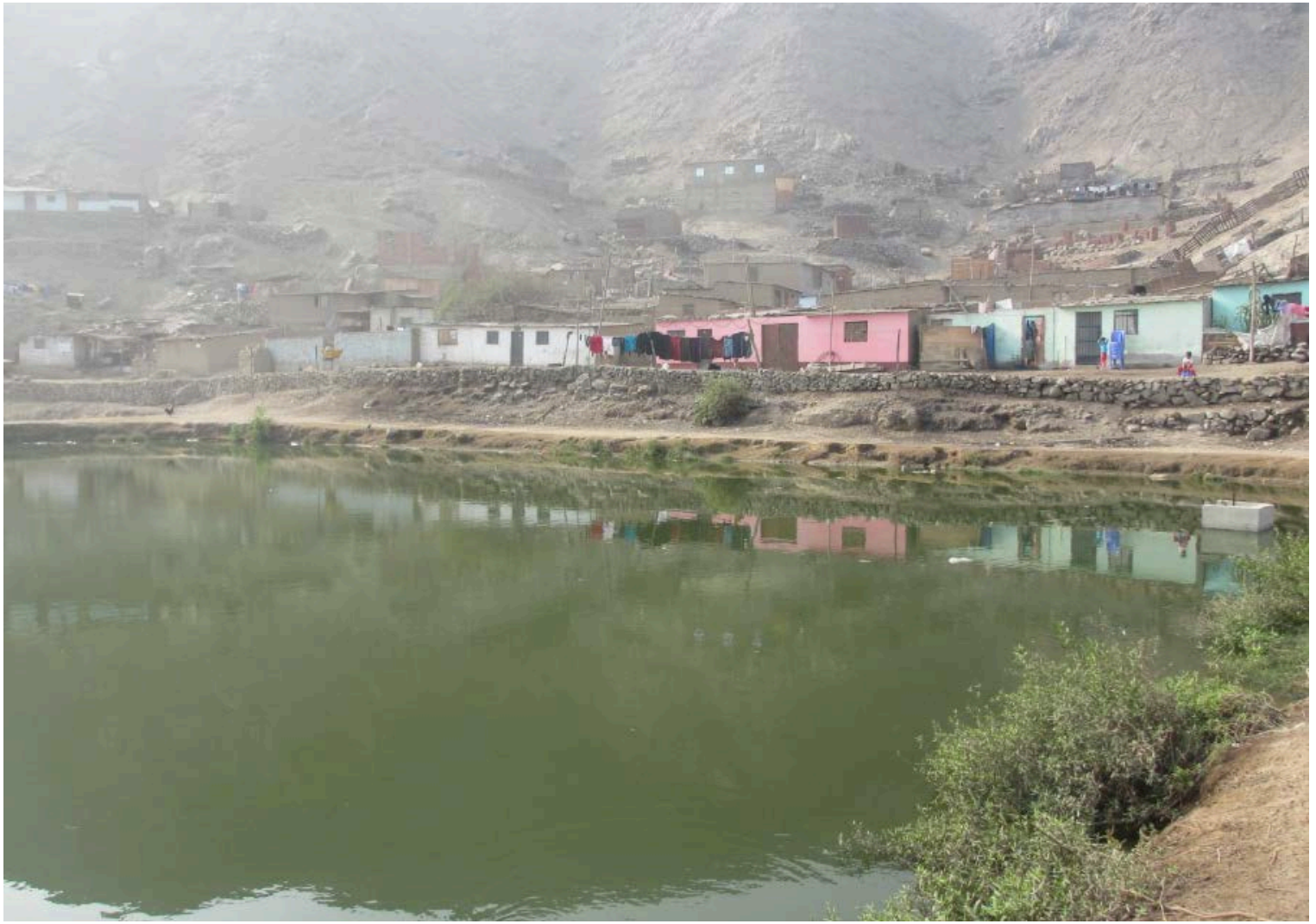
Fish pond (Aquaculture)



Fish can be grown in ponds that receive effluent or sludge where they can feed on algae and other organisms that grow in the nutrient-rich water.
The fish, thereby, remove the nutrients from the wastewater and are eventually harvested for consumption.
Only fish tolerant of low dissolved oxygen levels should be chosen. Carp, milkfish and tilapia.

Use and/ or disposal

Fish Pond (Aquaculture)

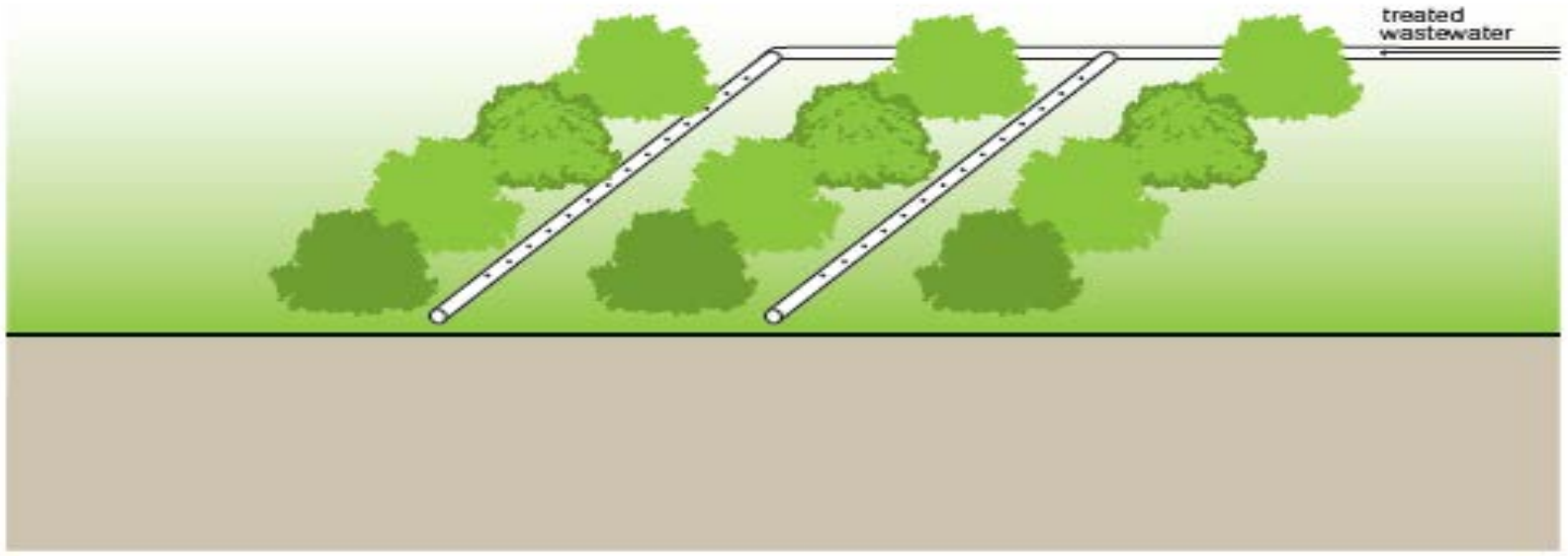


Use and/ or disposal

Fish Pond (Aquaculture)

Use and/ or disposal

Irrigation



Water that has had secondary treatment (i.e., physical and biological treatment) should be used to limit the risk of crop contamination and health risks to workers.

There are two kinds of irrigation technologies appropriate for treated wastewater:

1) Drip irrigation above or below ground, where the water is slowly dripped on or near the root area; and
2) Surface water irrigation where water is routed overland in a series of dug channels or furrows.

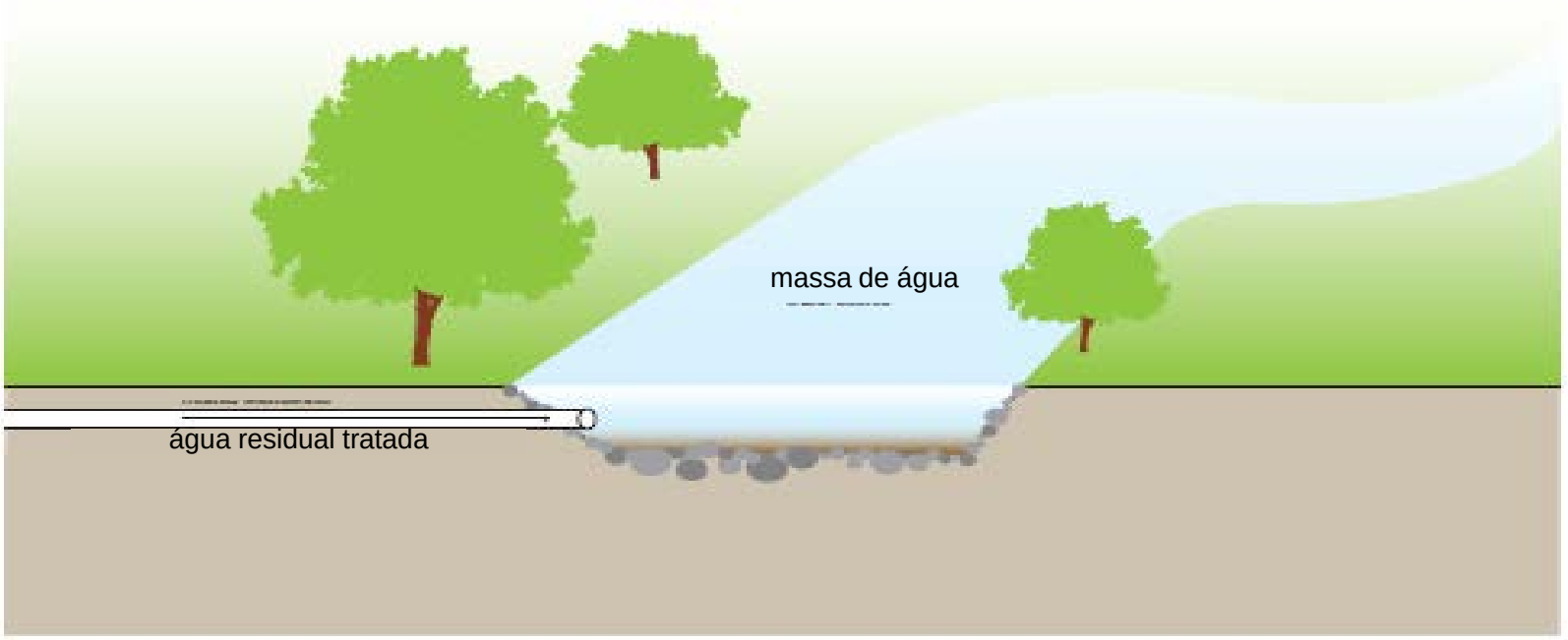
To minimize evaporation and contact with pathogens, spray irrigation should be avoided

Use and/ or disposal

Irrigation

Use and/ or disposal

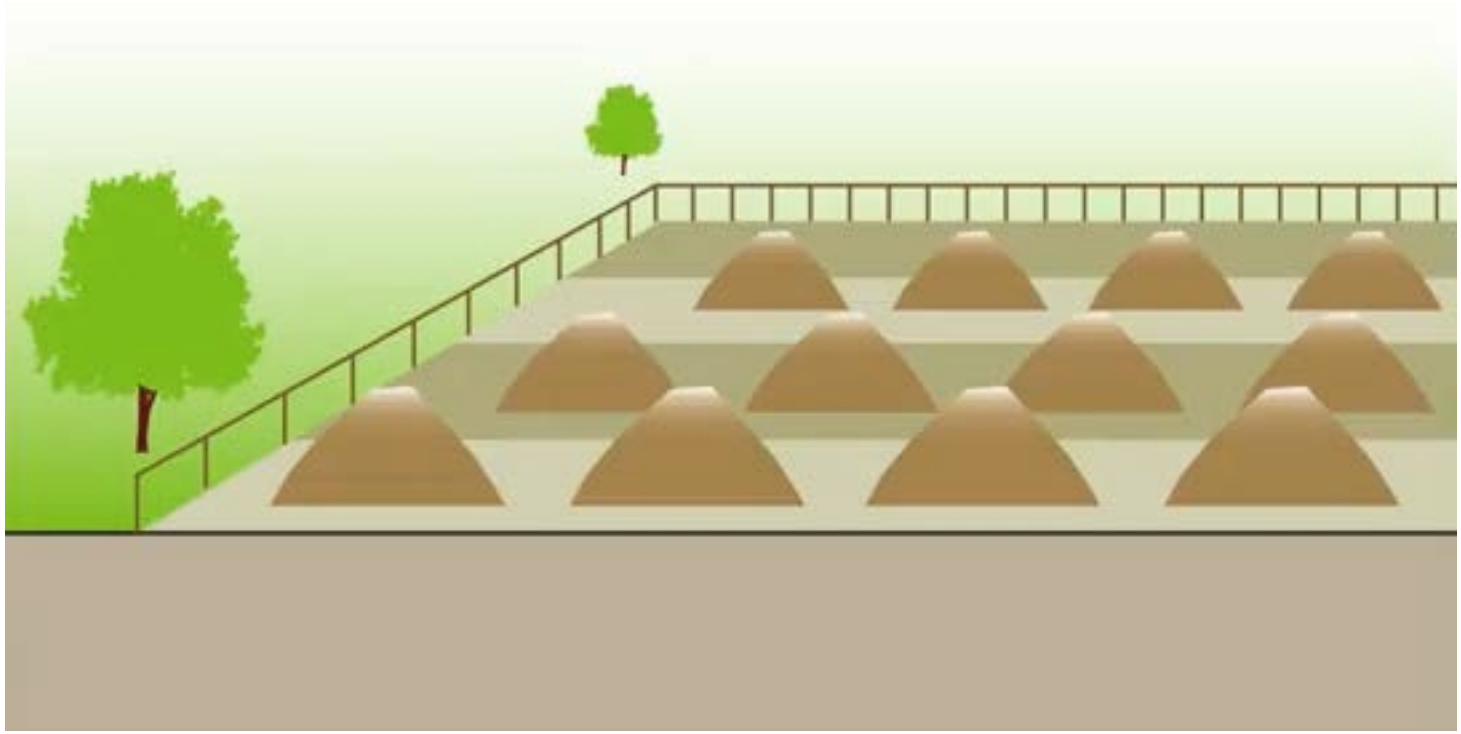
Water Disposal / Groundwater Recharge



Treated effluent and/or stormwater can be directly discharged into receiving water bodies (such as rivers, lakes, etc.) or into the ground to recharge aquifers.

Use and/ or disposal

Surface Disposal



Piling of sludge, excreta when it is not going to be used.

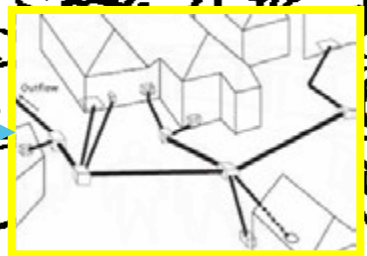
Landfilling of sanitation products is not recommended.

Attention must be paid to avoid leaching.

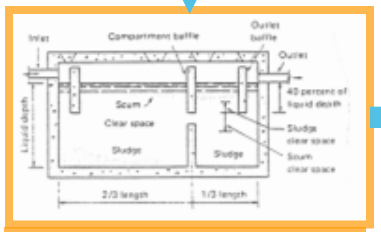
3. Sanitation Technologies

Sanitation Systems

User Interface

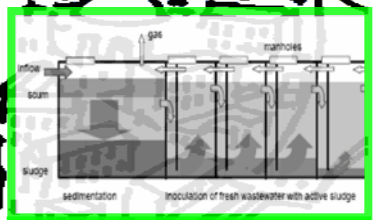


Conveyance



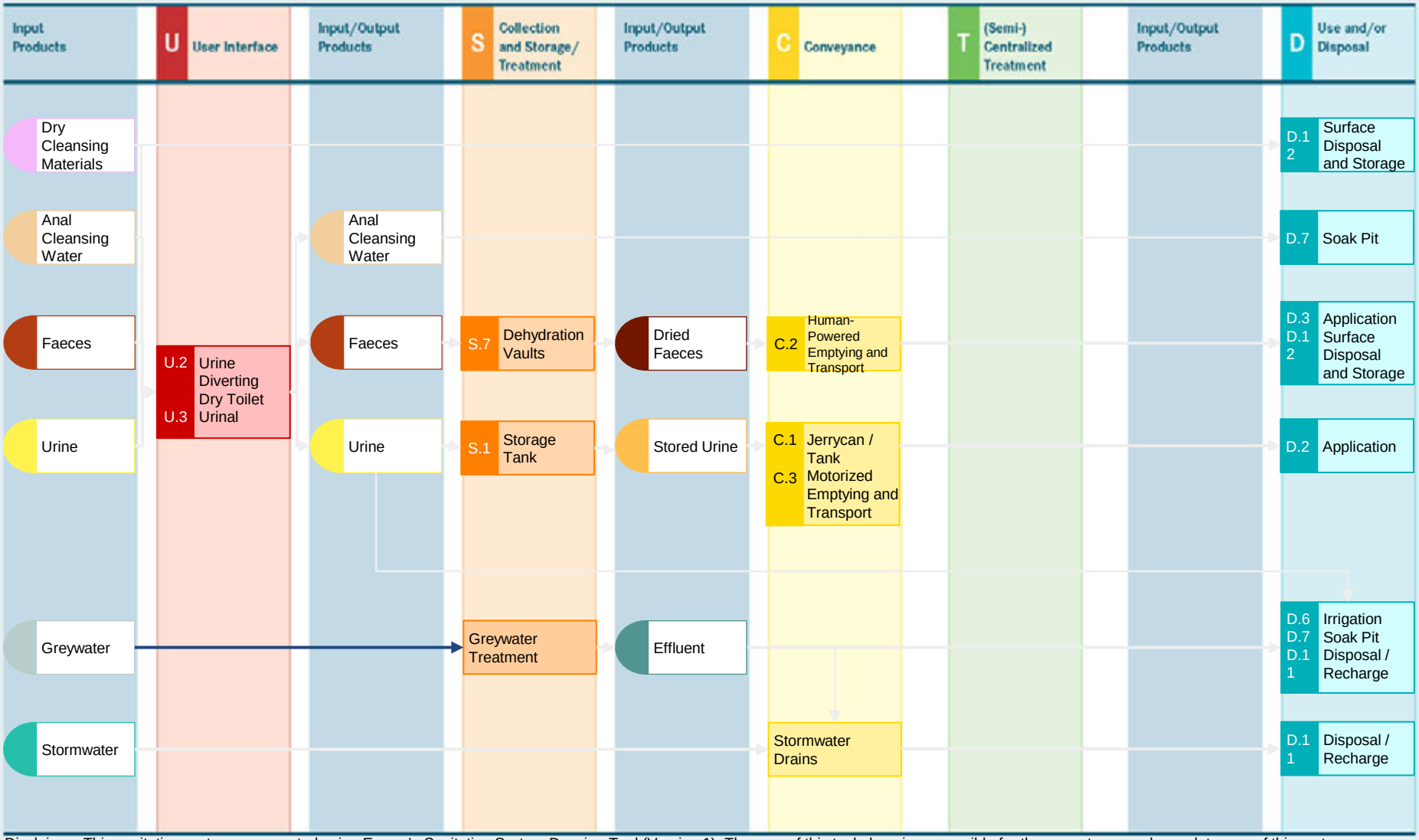
Collection and Storage/ Treatment

Use and/or Disposal



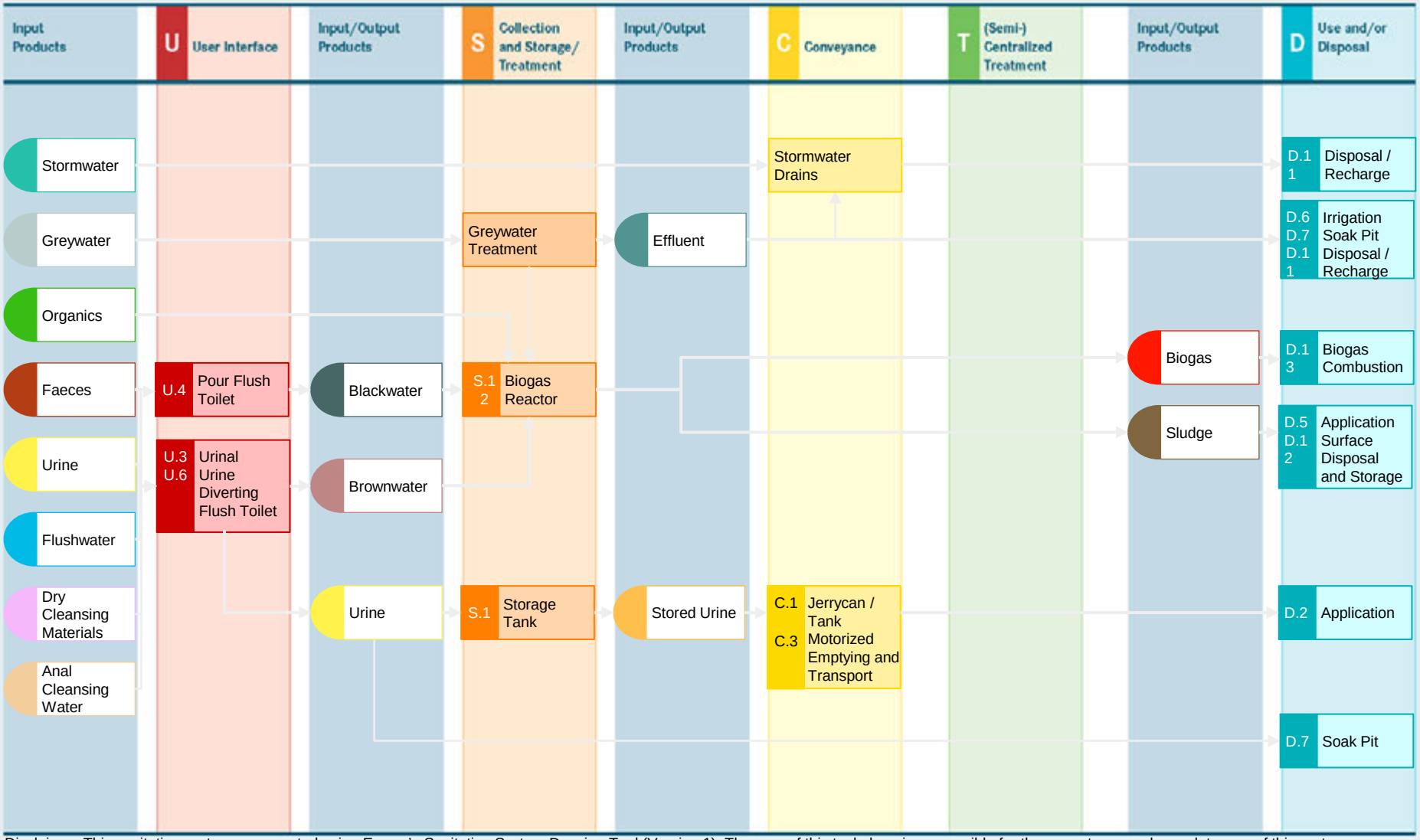
(Semi-) centralised Treatment

Sanitation System: System 4: Waterless System with Urine Diversion



Disclaimer: This sanitation system was created using Eawag's Sanitation System Drawing Tool (Version 1). The user of this tool alone is responsible for the correctness and completeness of this system.

Sanitation System: System 5: Biogas System



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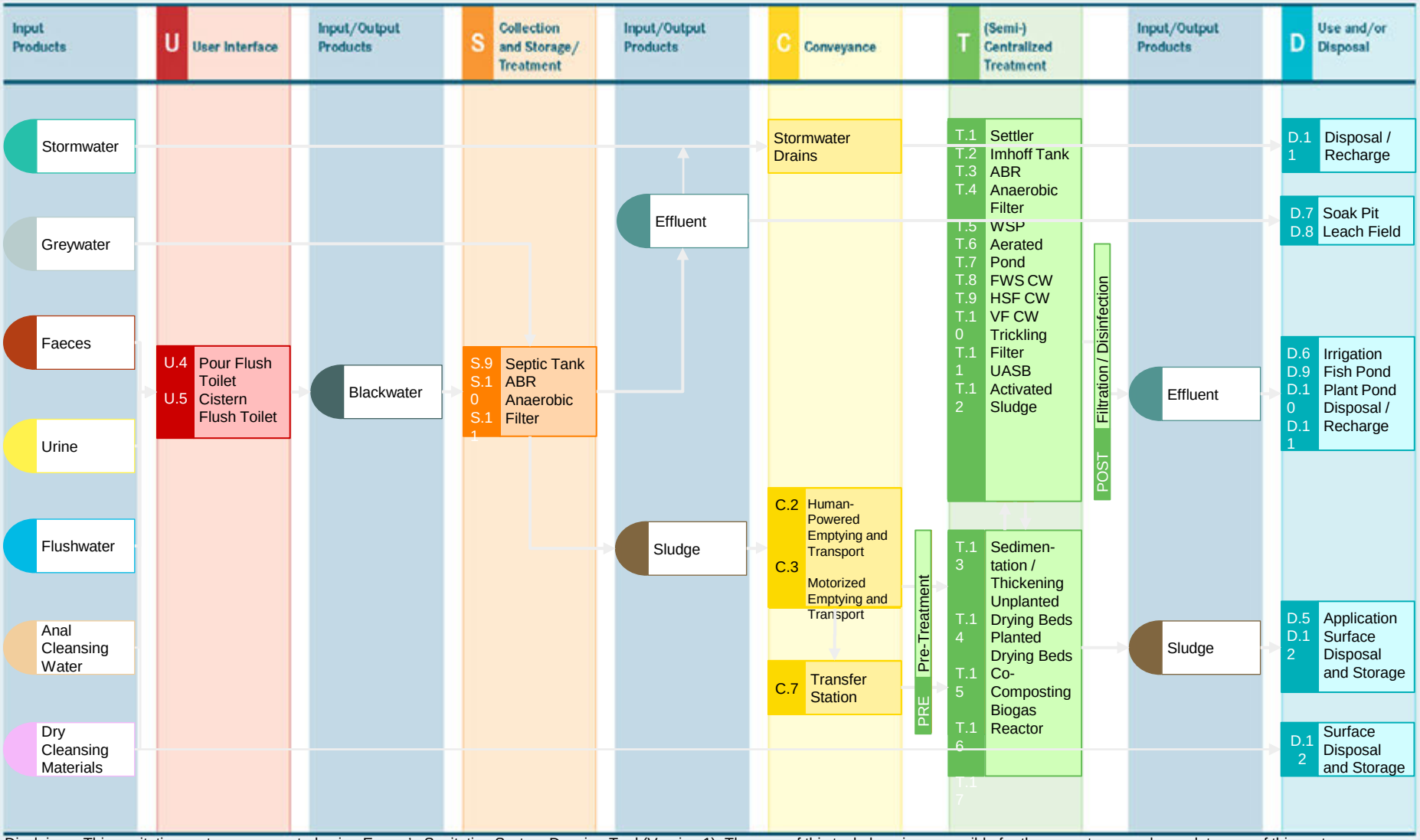
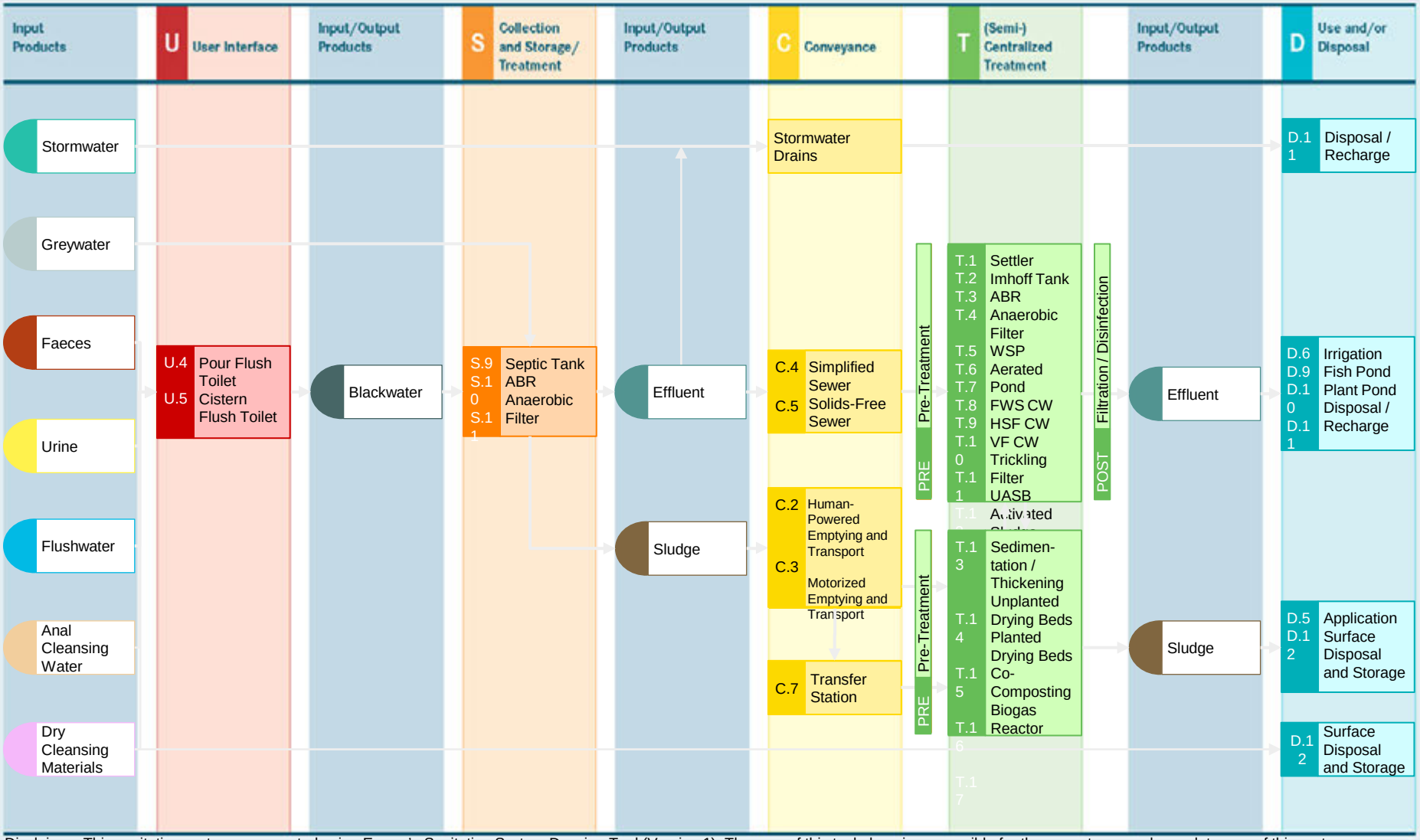
Sanitation System: System 6: Blackwater Treatment System with Infiltration



Disclaimer: This sanitation system was created using Eawag's Sanitation System Drawing Tool (Version 1). The user of this tool alone is responsible for the correctness and completeness of this system.

Sanitation System: System 7: Blackwater Treatment System with Effluent Transport



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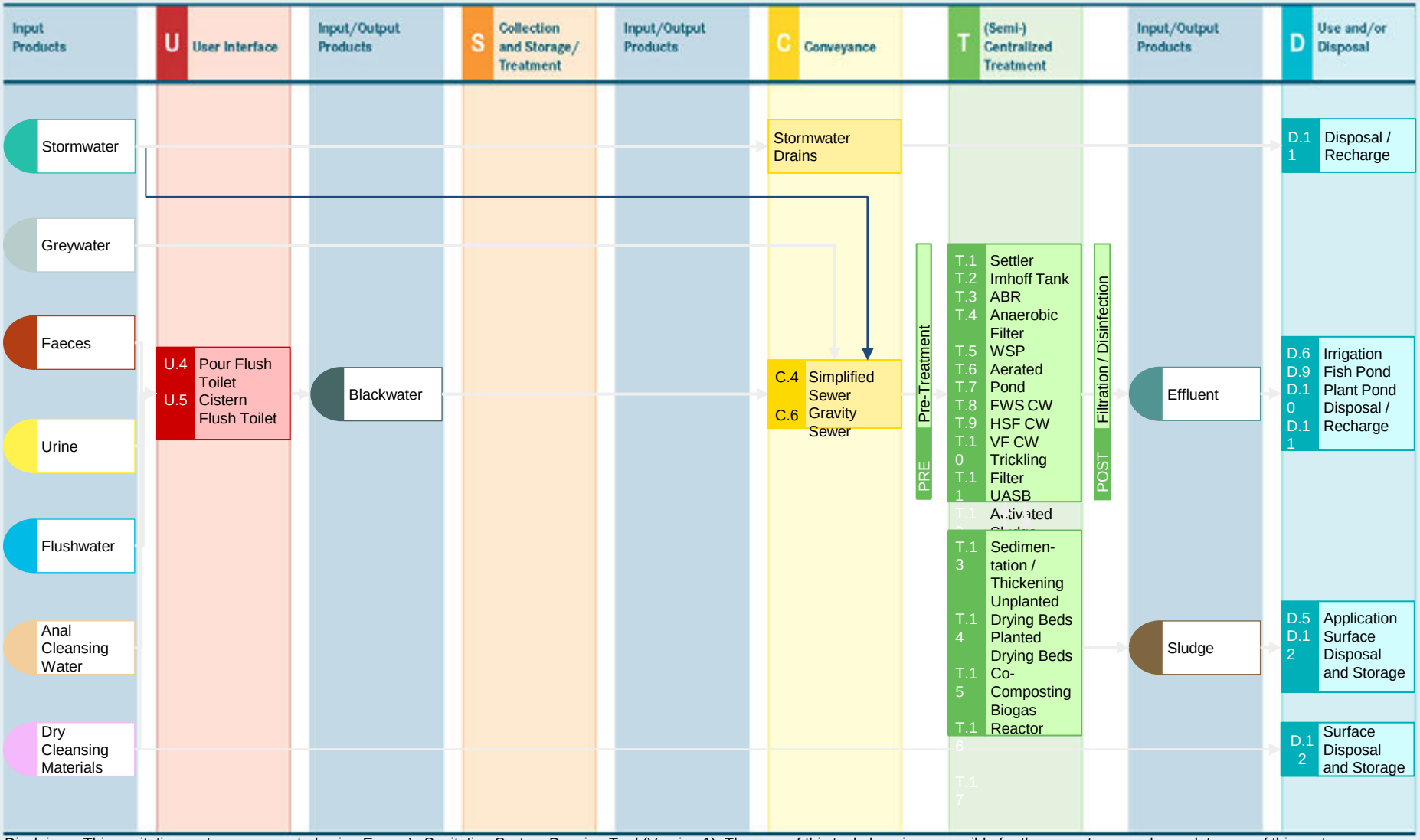
Sanitation System: System 8: Blackwater Transport to (Semi-) Centralized Treatment System



Disclaimer: This sanitation system was created using Eawag's Sanitation System Drawing Tool (Version 1). The user of this tool alone is responsible for the correctness and completeness of this system.

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Confederazione Svizzera
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Federal Department of Foreign Affairs FDFA
Swiss Agency for Development and Cooperation SDC

giz On behalf of Federal Ministry for Economic Cooperation and Development

Cap-Net

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IUCN

IWA International Water Association

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UNDP

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