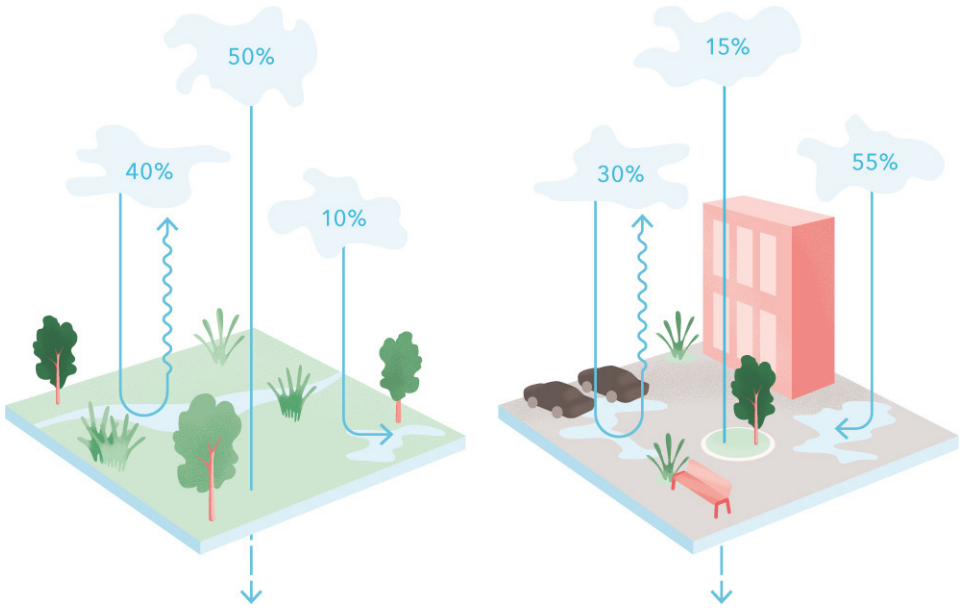
Problem with excess rainwater

Floods caused by torrential rain and snowmelt are an increasingly common sight in urban environments. One of the reasons for this is the **increase in impermeable areas and the decrease in green areas** due to urbanisation and expanding construction activities. Development has consequences that reduce the infiltration of rainwater into the soil, thereby disrupting the natural water cycle.



The water cycle in natural and urban environments. In the natural environment, about 50% of rainwater infiltrates into the soil, 40% evaporates and only 10% goes to surface run-off. In urban environments, the proportion of surface run-off can be 55% or more, which is the primary cause of urban flooding.

Problems occur when there is heavy rainfall on artificially surfaced environments and the grate sewers and stormwater drainage cannot accommodate the increased amounts of water. This results in **floods and a concurrent risk of pollution**. Climate scientists predict that the amount of rainfall and the frequency of torrential rains will continue to rise, which means that the occurrence of floods will increase in the coming years. **Sustainable urban drainage systems** need to be implemented to ensure the resilience of urban areas to a changing climate.

While the traditional piping solution only allows rainwater to drain away, a well-designed sustainable drainage system offers many more **opportunities and benefits:**

- Reduces noise and wind corridors, improves air quality and regulates temperature.
- Reduces the risk of flooding associated with stormwater run-off in the urban environment and purifies water.
- Supports people's physical and mental health.
- Adds and connects green areas, supports urban biodiversity.
- Creates a pleasant living environment by adding greenery and pleasant recreation areas to the urban space.
- Offers more benefits than the pipeline system and stays in the same price range – in other words, in addition to preventing stormwater problems, you can also achieve a diverse environment for the same investment.

Solution for excess rainwater

Sustainable urban drainage systems are facilities that mimic natural ecosystems in stormwater drainage, enabling more efficient and environmentally friendly stormwater management. A sustainable urban drainage system is a **chain of sequential stormwater management techniques** that gradually reduces the amount and flow rate of stormwater run-off and removes various pollutants (e.g. phosphorus and nitrogen compounds, heavy metals, suspended solids). In the case of sustainable urban drainage systems, it is possible to distinguish between different levels, from local solutions at the source to regional stormwater run-off control systems.

Run-off control at the source (e.g. a private property)	Run-off control on site (e.g. a street or block)	Regional run-off control (e.g. district, municipality)
e.g. permeable paving, green roofs, rainwater harvesting	e.g. detention basins, green areas, infiltration trenches, ponds, swales	e.g. wetland, bigger pond
Prevention and attenuation of stormwater run-off at the source	→ Further attenuation, detention and treatment of storm-water run-off	→ Treatment and discharge of stormwater run-off from the whole region into sewerage or water body

The sustainable urban drainage system starts at the source of the stormwater run-off (in urban areas, this is mainly on the roofs of buildings and impermeable surfaces such as asphalt), where efforts are made to prevent stormwater run-off as much as possible. The rainwater is then diverted to the next parts of the system and finally to the sewer and/or water body. The further away from the source, the higher the amount of water that drainage solutions have to cope with, as the area to be controlled increases at each stage.

The choice of a suitable solution for the area must be based on the **available options** (e.g. lack of stormwater sewerage, presence of a ditch), **soil characteristics** (clayey, sandy) and **relief** (flat), **existing infrastructure** (including paved areas, existing buildings) and a **number of factors** that determine the feasibility of the solution, opportunities and techniques. There are suitable techniques available for private properties, apartment associations, public buildings as well as public open spaces. You can find examples of possible solutions on the inside of this leaflet.

The leaflet was produced in 2020 within the "Development of sustainable and climate resilient urban storm water management systems for Nordic municipalities – LIFE UrbanStorm" project that is co-financed by the LIFE+ programme of the European Union and the Estonian Environmental Investment Centre.

The aim of the project is to increase the capacity of Estonian municipalities to adapt to climate changes, especially in managing the floods caused by torrential rains. The project is being implemented by Viimsi Municipality (the lead partner), Baltic Environmental Forum Estonia, Estonian University of Life Sciences, and Tallinn Urban Environment and Public Works Department.

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For more information on the LIFE UrbanStorm project and sustainable urban drainage systems, visit urbanstorm.viimsivald.ee

SUSTAINABLE URBAN DRAINAGE SYSTEMS:

A guide to sustainable stormwater systems

UrbanStorm

Sustainable urban drainage systems

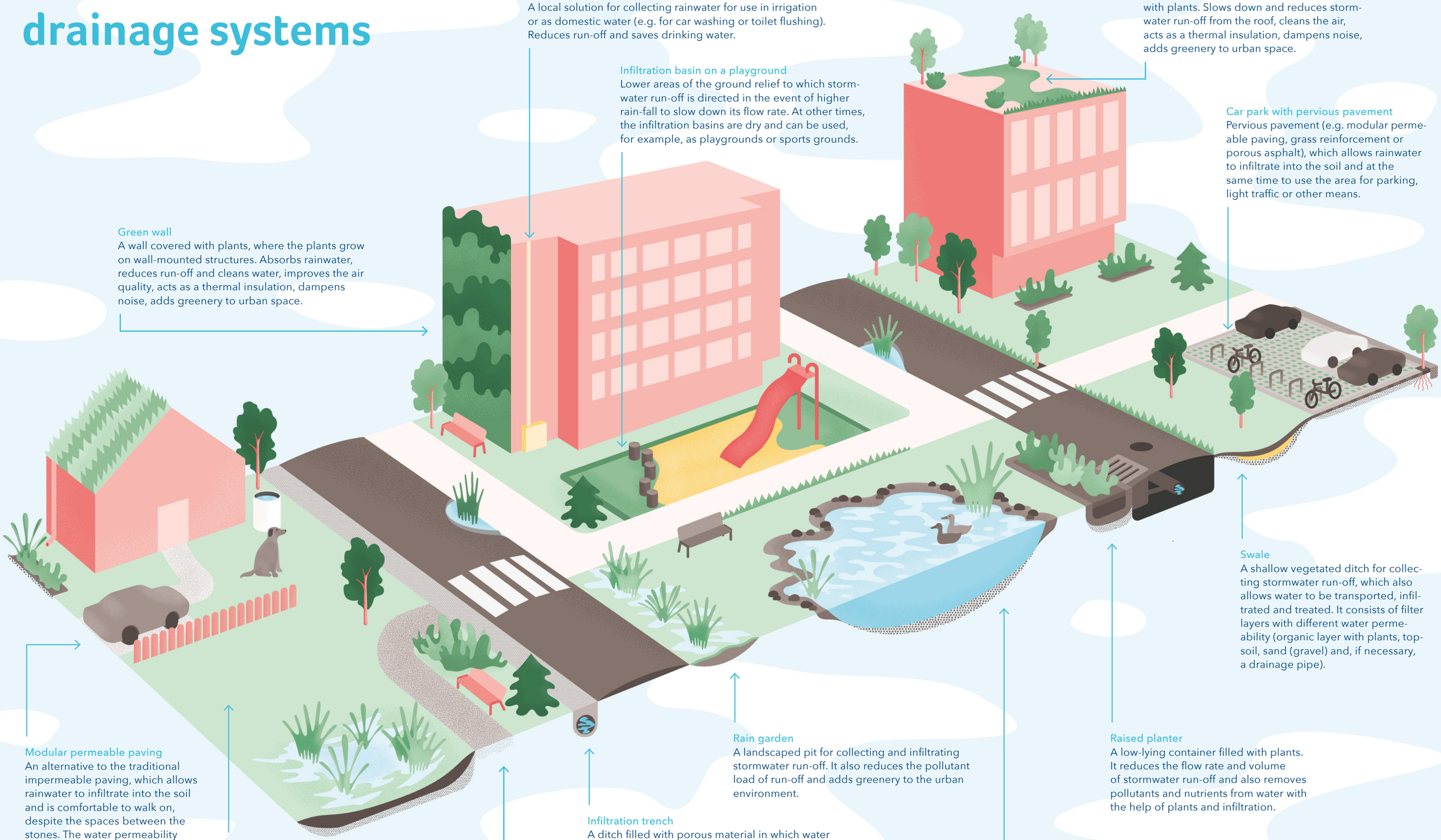
Rainwater harvesting system
A local solution for collecting rainwater for use in irrigation or as domestic water (e.g. for car washing or toilet flushing). Reduces run-off and saves drinking water.

Infiltration basin on a playground
Lower areas of the ground relief to which storm-water run-off is directed in the event of higher rain-fall to slow down its flow rate. At other times, the infiltration basins are dry and can be used, for example, as playgrounds or sports grounds.

Green roof
Roof partially or completely covered with plants. Slows down and reduces storm-water run-off from the roof, cleans the air, acts as a thermal insulation, dampens noise, adds greenery to urban space.

Car park with pervious pavement
Pervious pavement (e.g. modular perme-able paving, grass reinforcement or porous asphalt), which allows rainwater to infiltrate into the soil and at the same time to use the area for parking, light traffic or other means.

Green wall
A wall covered with plants, where the plants grow on wall-mounted structures. Absorbs rainwater, reduces run-off and cleans water, improves the air quality, acts as a thermal insulation, dampens noise, adds greenery to urban space.



Swale
A shallow vegetated ditch for collec-ting stormwater run-off, which also allows water to be transported, infil-trated and treated. It consists of filter layers with different water perme-ability (organic layer with plants, top-soil, sand (gravel) and, if necessary, a drainage pipe).

Modular permeable paving
An alternative to the traditional impermeable paving, which allows rainwater to infiltrate into the soil and is comfortable to walk on, despite the spaces between the stones. The water permeability is ensured by the porous material between the paving stones.

Green area
Green areas are very important buffer areas in the urban environment, where stormwater run-off can be temporarily directed if necessary. At the same time, green areas create a pleasant living environment and support the diversity of urban nature.

Bulk material pavement
Pervious pavement consisting of gravel, crushed stone or similar bulk material.

Infiltration trench
A ditch filled with porous material in which water infiltrates into the soil. If necessary, a drainage pipe is also installed inside the porous material.

Rain garden
A landscaped pit for collecting and infiltrating stormwater run-off. It also reduces the pollutant load of run-off and adds greenery to the urban environment.

Pond
A body of water permanently filled with water, the water level of which rises in the event of higher rainfall. It helps to reduce the risk of flooding, purifies water (through sedimentation, microorganisms and vegetation), diversifies urban space and supports biodiversity.

Raised planter
A low-lying container filled with plants. It reduces the flow rate and volume of stormwater run-off and also removes pollutants and nutrients from water with the help of plants and infiltration.