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STUDY:
Rainwater reuse in Kurzeme region municipalities

Consultant:
Jurijs Kondratenko

Introduction

- **Study aim:** Identify trends, suitable solutions, and development opportunities for rainwater reuse in the Kurzeme region.
- **Study scope:**
  - Analysis of historical and projected climate and precipitation trends
  - Evaluation of rainwater quality requirements (EU and international context)
  - Review of sustainable management principles and best practices
  - Assessment of regulatory and planning frameworks
  - Identification of flood-prone areas and municipal initiatives
- **Methods:** Literature and legislative review, workshops, and surveys, providing both quantitative and qualitative insights.

Regional context and background

- The Kurzeme region is located in the western part of Latvia. It borders the Baltic Sea to the west and Lithuania to the south, while connecting with the Zemgale and Riga regions to the east.
- Kurzeme covers 24.85% of Latvia’s territory and is home to more than 270,000 residents.
- The region comprises eight municipalities: six counties (Dienvidkurzeme, Kuldīga, Saldus, Talsi, Tukums, and Ventspils) as well as two state cities (Liepāja and Ventspils).

Regional context and background

- The Kurzeme Planning Region is a subordinate public entity operating under the supervision of the Ministry of Smart Planning and Regional Development.
- The region's economy is driven by manufacturing, logistics, renewable energy, and tourism. Kurzeme's access to wind, solar, biomass, and geothermal resources supports the growth of green energy and innovation.
- Kurzeme is an active partner in international cooperation, particularly in the Baltic Sea region. Through diverse local and international projects, the Kurzeme Planning Region actively supports sustainable development, innovation, mobility, and social inclusion across the region.

Regional context and background

- Climate change is increasingly affecting water resource availability and quality in Latvia, including the Kurzeme region.
- Future projections show:
  - More frequent heavy rainfall events
  - Greater risks of both flooding and drought
- Currently, most Kurzeme municipalities focus on drainage via sewerage, with little emphasis on reuse.
- Key challenges:
  - Outdated infrastructure
  - Insufficient legal and policy frameworks
  - Low public awareness

Past Trends and Future Projections in the Kurzeme Planning Region

Climate scenarios in Latvia based on IPCC Sixth Assessment Report:

- SSP1-2.6 (low change)
- SSP2-4.5 (moderate change)
- SSP3-7.0 (significant change)

Temperature rise:

- +2°C threshold likely exceeded by 2021-2050
- Winters: more rainfall, less snow → higher runoff → greater need for rainwater collection
- Summers: longer heatwaves → higher irrigation and cooling demand

Seasonal changes:

- Fewer frost days (-70 by 2100)
- Longer vegetation period (+30-66 days, esp. along the coast) → longer irrigation season, higher water demand

Past Trends and Future Projections in the Kurzeme Planning Region

Sea level rise:

- +53-71 cm by 2100 → coastal flooding, erosion, and groundwater salinization risks

Precipitation trends:

- Historical average: 656 mm (1961-1990) → 685 mm (1991-2020)
- Projected increase: +18-24% (mainly in the winter season)

Heavy rainfall events:

- Increase from 18 to 22 days per year
- Average intensity on wet days: ~5.7 mm

→ Necessity for efficient rainwater collection, storage, and reuse systems

Conclusion:

- Climate change will significantly affect water resources in Kurzeme.
- Rainwater reuse is a key step toward sustainable, climate-resilient water management.

Quality Requirements for the Use of Rainwater

Regulation (EU) 2020/741

- Establishes minimum requirements for safe water reuse and promotes environmentally friendly alternatives to new water abstraction or desalination.
- Requires risk management plans to:
  - Protect public health and drinking water sources.
  - Raise public awareness of water reuse benefits.
- Permitted uses:
  - Agricultural irrigation (food and non-food crops).
  - Industrial and municipal applications.
  - Other uses, if environmental and health protection criteria are met.

European Standard EN 16941

- Provides guidelines for local non-potable water systems using rainwater or treated greywater.
- Aims to reduce potable water consumption and support sustainable resource management.

Quality Requirements for the Use of Rainwater

Australia – Australian Guidelines for Water Recycling (AGWR)

- Framework based on health risk assessment and microbiological safety.
- Acceptable health risk: ≤ 10^{-6} DALY/year (~1 illness per 1,000 people).
- Defines pathogen reduction targets (log reductions) based on intended use.

California – State Regulations

- Strict requirements for rainwater reuse.
- Non-potable uses (e.g., toilet flushing, laundry, irrigation):
  - E. coli < 100 CFU/100 ml
  - Turbidity < 10 NTU
- Potable uses:
  - ≥ 3-4 log pathogen reduction
  - Turbidity < 0.3 NTU
- Systems must:
  - Be separate from the public water network.
  - Include cross-contamination prevention measures.

Quality Requirements for the Use of Rainwater

Both EU and international standards emphasize:

- **Risk management** and **health protection.**
- **Water quality monitoring** and maintenance.
- **Safe and sustainable** implementation of rainwater reuse systems.

Principles of Sustainable Rainwater Management (SRM)

Main Goals

- Safe and efficient collection, conveyance, and use of stormwater
- Flood risk reduction and improved urban ecology
- Relief of sewerage networks and treatment plants
- Enhancement of biodiversity and public space quality

Guiding Principles

- Urban systems should mimic natural hydrological processes
- Promote infiltration, retention, and reuse of rainwater on-site

Typical Sustainable Rainwater Management (SRM) Hierarchy

1. Reduce runoff – permeable surfaces, rainwater reuse
2. On-site treatment & infiltration – decentralized systems
3. Centralized treatment – outside the site
4. Discharge to separate stormwater sewer
5. Discharge to combined sewer system

Planning of Sustainable Rainwater Management

Integrated Planning Approach

- Combines urban planning, engineering, landscape architecture, and environmental management
- Aims to protect water quality and enhance aesthetics and ecology

Key Design Considerations

- Geological & hydrological conditions
- Groundwater levels
- Land use & existing infrastructure
- Flood pathways & ecological integration

Design Goals

- Promote biodiversity and aesthetic value
- Create functional, attractive public spaces
- Support green and blue infrastructure for flora, fauna, and microclimate balance

Sustainable Rainwater Management Techniques

Retention Ponds

- Permanent water bodies for stormwater retention, sedimentation, and treatment
- Provide landscape and recreational benefits

Ditches & Swales

- Facilitate water conveyance and infiltration
- *Swales*: shallow, vegetated depressions filtering runoff
- *Bio-swales*: natural + engineered systems (e.g., drainage pipes, geotextiles)

Rain Gardens

- Small-scale vegetated systems for stormwater capture and biological treatment
- Ideal for residential and low-traffic areas

Constructed Wetlands

- Use natural processes for pollutant removal
- Resilient to variable loads; suitable for stormwater and wastewater

Sustainable Rainwater Management Techniques

Infiltration Systems

- Include wells, trenches, fields, basins
- Support groundwater recharge and pollutant sedimentation
- Best for green spaces and runoff-heavy areas

Permeable Pavements

- Materials like eco-pavers, porous asphalt
- Allow infiltration, reduce runoff, and optimize urban surfaces

Green Roofs

- Promote rainwater retention and evaporation
- Mitigate urban heat island effect
- Improve building energy efficiency
- *Extensive roofs*: low maintenance
- *Intensive roofs*: more vegetation & recreational use

Reuse of Rainwater Compared with Combined Sewer Systems

- Rainwater reuse significantly reduces pollutant discharge to water bodies.
- Combined sewer overflows can contribute up to 95% of annual river pollution (e.g., pharmaceuticals, hormones, pesticides).
- Conventional drainage can contaminate groundwater through infiltration.
- Improved surface water quality supports public health, fisheries, and tourism.
- Lower wastewater volumes increase treatment efficiency and reduce maintenance costs.
- Decentralized systems (e.g., infiltration basins) reduce infrastructure expansion needs.
- Enhanced water system resilience to climate impacts.
- Optimized wastewater flows enable thermal energy recovery and reduce energy use.

Rainwater Quality and Reuse Potential in Different Land-Use Areas

Roads & Highways

- Pollutants: Oils, lubricants, heavy metals (Zn, Cu, Pb), rubber particles, hydrocarbons.
- Potential impacts: Toxicity to aquatic organisms, sediment contamination, bioaccumulation.
- Reuse potential: Limited reuse only after advanced treatment (non-food crops).

Parking Areas & Industrial Sites

- Pollutants: Petroleum products, metals, detergents, solid waste.
- Potential impacts: Water toxicity, oxygen depletion, aesthetic degradation.
- Reuse potential: Suitable only for restricted irrigation (non-food crops).

Residential Areas

- Pollutants: Nutrients (N, P), pesticides, animal waste, detergents, litter.
- Potential impacts: Eutrophication, algal blooms, pathogen contamination.
- Reuse potential: After filtration and disinfection, suitable for irrigation of gardens and lawns.

Rainwater Quality and Reuse Potential in Different Land-Use Areas

Commercial Areas (Retail, Food Service Establishments)

- Pollutants: Food waste, detergents, fats, cleaning agents.
- Potential impacts: Oxygen depletion, increased turbidity, odor formation.
- Reuse potential: Suitable only for restricted irrigation; direct contact with food crops should be avoided.

Construction Sites

- Pollutants: Sediments, sludge, concrete wash water (high pH), construction debris.
- Potential impacts: Increased turbidity, oxygen depletion, pH alteration.
- Reuse potential: Not recommended for irrigation due to unstable pH and high suspended solids content.

Agricultural Land

- Pollutants: Nutrients, pesticides, animal waste.
- Potential impacts: Eutrophication, bacterial contamination, oxygen depletion.
- Reuse potential: Suitable only for restricted irrigation; direct contact with food crops should be avoided.

Rainwater Quality and Reuse Potential in Different Land-Use Areas

Roofs

- Pollutants: Debris, metals (Zn, Pb), bird droppings.
- Potential impacts: Localized contamination, clogging of drainage systems.
- Reuse potential: Highly suitable for urban greening, green roofs, and toilet flushing.

Urban Open Areas (Parks, Sports Fields)

- Pollutants: Fertilizers, herbicides, organic waste, bacteria and pathogens.
- Potential impacts: Nutrient enrichment, oxygen depletion, bacterial contamination.
- Reuse potential: Ideally suited for landscape and lawn irrigation after basic disinfection.

Ports and Marinas

- Pollutants: Oils, paints, heavy metals.
- Potential impacts: Toxicity to marine organisms, sediment accumulation.
- Reuse potential: Not recommended for reuse due to the persistence of hydrocarbons and metals.

Planning Documents and Legal Framework for Sustainable Rainwater Management - National Level

Environmental Policy Guidelines 2021-2027

- Focus on flood risk reduction, water treatment, and urban quality of life
- Targets by 2027:
  - Green infrastructure access for 18,000 inhabitants
  - Flood protection for 194,000 inhabitants
  - Creation of 60 ha of new green infrastructure
  - 20% increase in water reuse by enterprises
- Key actions: climate adaptation, flood risk management, rainwater use in households & economy

Climate Change Adaptation Plan up to 2030

- Focus on adapting urban areas to higher rainfall intensity
- Promotes green infrastructure and drainage modernization
- Measures include:
  - Expanding stormwater capacity
  - Developing flood models and guidelines
  - Adapting buildings to climate impacts

Planning Documents and Legal Framework for Sustainable Rainwater Management - National Level

Water Management Law

- Establishes river basin management plans for ecological protection and flood control
- Requires flood risk assessments, risk maps, and public participation

Law on Environmental Impact Assessment

- Ensures development projects undergo environmental impact review
- Evaluates effects on water resources and ecosystems

Environmental Protection Law

- Mandates pollution reduction and sustainable resource use
- Supports eco-innovation and environmental management tools

Land Reclamation Law

- Regulates drainage system maintenance and operation
- Defines responsibilities of landowners and municipalities
- Highlights municipal capacity challenges and legal gaps for systems on private land

Planning Documents and Legal Framework for Sustainable Rainwater Management - National Level

Water Services Law

- Defines rainwater discharge into combined sewer as a public service
- Separate stormwater systems managed under municipal authority
- Municipalities may adopt local binding regulations for integrated wastewater and stormwater management

Cabinet Regulations

- **No. 34:** Emission limits for water pollutants
- **No. 118:** Surface and groundwater quality standards
- **No. 174:** Procedures for public water services
- **LBN 003-15:** Climatology construction standards
- **LBN 223-15:** Sewerage structures
- **LBN 224-15:** Drainage and hydrotechnical structures

Planning Documents and Legal Framework for Sustainable Rainwater Management - EU Level

Water Framework Directive (2000/60/EC)

- Ensures good ecological status for all water bodies
- Requires river basin management plans
- Focus on pollution reduction, including surface runoff and rainwater

Floods Directive (2007/60/EC)

- Mandates flood risk assessment across EU territories
- Calls for flood hazard and risk maps
- Integrates flood risk management with water management planning

Planning Documents and Legal Framework for Sustainable Rainwater Management - EU Level

Urban Wastewater Treatment Directive (91/271/EEC)

- Limits pollution from urban wastewater and combined sewer overflows
- Aims to prevent eutrophication
- Does not apply to rainwater that remains unmixed with wastewater

EU Regulation 2020/741 on Water Reuse

- Sets minimum standards for the reuse of treated water, especially in agriculture
- Promotes sustainable water management and scarcity reduction
- Defines quality, risk management, and monitoring criteria for reclaimed water

Rainwater in the Water Balance of Municipalities and Water Utilities in the Kurzeme Region

- Rainwater significantly contributes to total wastewater volumes.
- Large spatial differences due to inconsistent reporting practices.
- Wastewater flows increase in winter due to stormwater and groundwater infiltration.
- Stormwater and infiltrated groundwater account for a major share of treatment volumes and costs.
- Effective rainwater management is economically and operationally important.

Rainwater in the Water Balance of Municipalities and Water Utilities in the Kurzeme Region

Rainwater in Municipal Water Balances

- Rainwater abstraction varies widely across municipalities:
  - Liepāja (2024): 2.68 million m³ of rainwater, 32% of total water abstraction
  - Talsi, Kuldīga, Saldus: negligible reported rainwater abstraction
- Largest stormwater discharges (2024):
  - Ventspils: 252,000 m³ (8% of total wastewater)
  - Liepāja: 161,000 m³ (2%)
  - Dienvidkurzeme: 63,000 m³ (5%)
- Differences mainly due to incomplete reporting. Actual rainwater volumes are likely higher than reported.
- Stormwater represents a significant cost factor for municipalities.

Rainwater in the Water Balance of Municipalities and Water Utilities in the Kurzeme Region

Seasonal Variations in Water Utilities

- Water abstraction peaks in late spring-summer (July).
- Lowest abstraction in autumn and early spring.
- Wastewater discharges peak in winter, especially February.
- Winter volumes exceed summer levels by more than twofold. Main causes: stormwater and groundwater infiltration.
- Rainwater, drainage water, and groundwater conveyance and treatment account for approximately 40-50% of total wastewater treatment costs.
- Water service tariffs (2024, incl. VAT):
  - Up to ~EUR 2 for water supply
  - Up to ~EUR 5 for combined services

Overview of Existing and Planned Rainwater Management Measures

Dienvidkurzeme

- Focus on flood risk in tourism and settlement planning.
- Climate adaptation prioritized in Development Programme (2022-2027).
- Projects:
  - Conventional drainage in Aizpute
  - ERDF wetland-based retention and infiltration in Priekule

Kuldīga

- Sustainable Development Strategy (2022-2046): green infrastructure, water quality, flood-risk reduction.
- Promotes drainage restoration, sewer separation, rainwater reuse (non-potable).
- Projects:
  - Stormwater networks in street reconstructions
  - Oil separator installation
  - ERDF project in Skrunda (system expansion, pond naturalisation)

Overview of Existing and Planned Rainwater Management Measures

Liepāja State City

- Priorities: climate adaptation, flood protection, sustainable water management.
- SECAP (2023-2030): upgrade drainage, restore watercourses.
- 60+ street reconstructions (2021-2025) expanded stormwater systems.
- ERDF project in South-Western area: water body rehabilitation, green infrastructure, flood-risk reduction, sediment reuse for landscaping.

Saldus

- Development Programme (2022-2028):
  - Modernize water, sewerage, and stormwater systems
  - Adapt drainage
  - Urban greening
- SECAP: reduce stormwater inflow to sewers.
- Projects: irrigation rainwater tanks, new retention capacity.

Overview of Existing and Planned Rainwater Management Measures

Talsi

- Development Programme (2022-2028): climate resilience, green infrastructure.
- Actions mainly focused on storm sewer construction.
- Considering ERDF climate adaptation programme.

Tukums

- Sustainable Development Strategy (2022-2042): sustainable stormwater and flood protection, reuse systems.
- Development Programme: promotes green infrastructure.
- Projects: improved stormwater conveyance near railway.
- Planned ERDF projects:
  - Rain gardens
  - Infiltration systems
  - Tree planting with rainwater storage

Overview of Existing and Planned Rainwater Management Measures

Ventspils Municipality

- Joint Sustainable Development Strategy with Ventspils State City: resilient, green-blue infrastructure, flood-risk reduction.
- Investments in drainage rehabilitation (e.g., Blāzma, Piltene).
- Further ERDF applications under consideration.

Ventspils State City

- SECAP (2023-2030):
  - Adapt infrastructure to rainfall changes
  - Increase stormwater storage
  - Reduce flood risk by ≥5%
- Projects:
  - Stormwater collector rehabilitation
  - ERDF project combining drainage upgrades with urban greening
  - Tree planting with rainwater-based irrigation

Overview of Existing and Planned Rainwater Management Measures

Recommendations for Planning Documents

- Integrate stormwater management and rainwater reuse comprehensively across all planning documents, ensuring coherence between development plans, spatial plans, SECAPs, and urban greening strategies.
- Conduct climate risk and vulnerability assessments and mapping to identify priority areas. These assessments should serve as a technical basis.
- Incorporate principles and requirements for sustainable stormwater management into planning documents, with a clear emphasis on nature-based and resource-efficient solutions.
- Include a dedicated climate section in development programmes and sustainable development strategies, defining strategic objectives. Where appropriate, quantitative targets may be set (e.g., newly created retention volume in m³, hectares of permeable surfaces, number or area of green roofs and rain gardens).
- Develop separate urban greening plans that assess existing and required ecosystem services, identify problem areas, and define priority investment zones. These plans should establish a green space network as the backbone of blue-green infrastructure.

Overview of Existing and Planned Rainwater Management Measures

Recommendations for Planning Documents

- Strengthen the principle that stormwater management and flood risk reduction are integral to spatial planning, rather than solely technical or engineering issues. New developments and renovations should prioritise decentralised, nature-based solutions and limit the expansion of impervious surfaces.
- Include requirements in land-use and building regulations for a minimum percentage of green and water-retaining areas. Zoning plans and graphical layouts should designate flood pathways, floodplains, and retention areas, where construction is restricted or only permitted if it does not impede water flow and storage.
- Define in spatial plans that stormwater should, wherever possible, be retained and managed within the property or block, with connection to centralised sewer systems allowed only as a secondary solution.
- Explicitly assign the role of parks, green corridors, and other public open spaces as flood buffer zones and water retention areas during extreme rainfall events in their zoning and use regulations.

Areas of KPR Affected by Short-Term Flooding: Saldus

- Located in Ciecere River valley
- Topography and filled historic watercourses contribute to flooding
- 2011 floods prompted drainage system improvements
- Some historic infrastructure still limits runoff efficiency

Recent Measures

- Emphasis on nature-based solutions to slow runoff
- Green infrastructure projects:
  - Bus station
  - Residential zones on Lielā, Varavīksnes, and Dzirnavu Streets

Challenges

- Private landowners have filled drainage ditches
- No replacement systems, worsening localized flooding

Areas of KPR Affected by Short-Term Flooding: Tukums

Flood risk and stormwater studies

- City centre (2023), Western part of centre (2025)
- Aim: develop a sustainable rainwater management model and flood mitigation measures

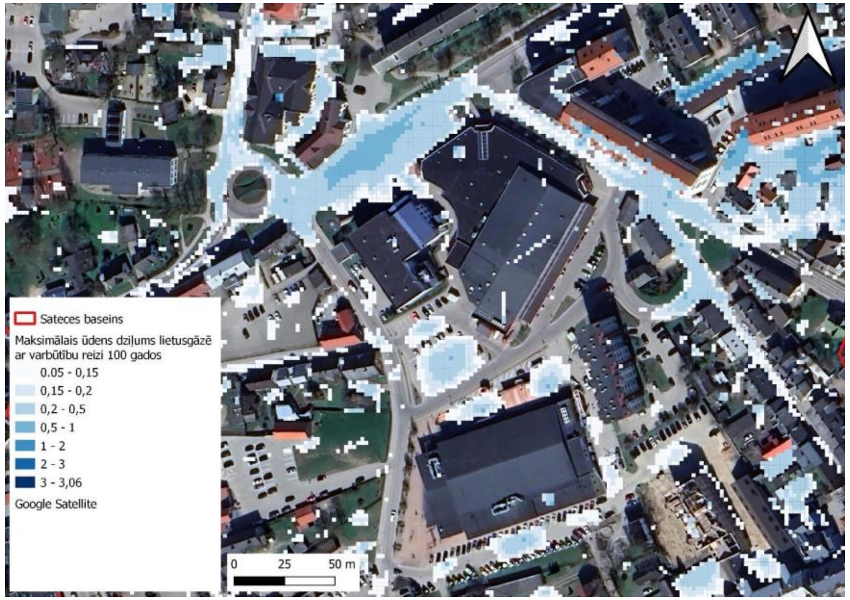
Findings

- Current stormwater system functions under normal conditions
- Overload during intense/extreme rainfall, especially near Stadiona Street and Katrīna Square
- Estimated flood volumes:
  - ~800 m^3 (10-year event)
  - Up to 2,800 m^3 (100-year event)
- Climate change expected to increase flood frequency and intensity

Recommendations

- Expand the stormwater network: connect rooftops to existing system; use decentralized green infrastructure (e.g., infiltration zones)
- Apply water retention measures for stormwater control in future development areas


2.5km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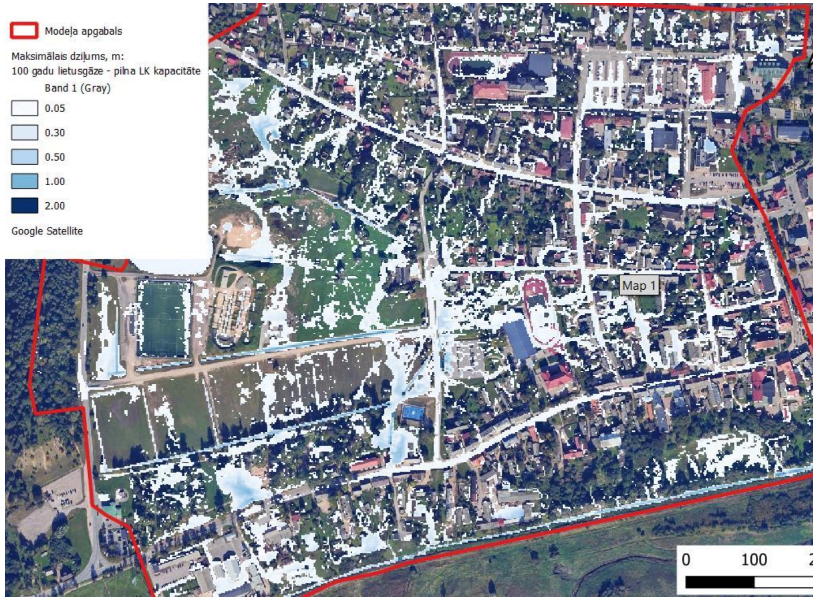
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Catagorization of Flood-prone Areas

Historic City Centre Areas with Combined Sewer Systems

- Flooding occurs during intense rainfall events due to insufficient system capacity.
- When stormwater mixes with domestic wastewater, combined sewer overflows occur, leading to surface water pollution.
- Potential stormwater management measures:
  - Sustainable solutions such as rain gardens, bioswales, permeable pavements, green roofs, and tree planting systems with stormwater reuse can slow inflow to the combined sewer system and reduce overall volumes.
  - Where feasible, the construction of separate stormwater sewer systems is recommended, with system parameters optimised through the integration of nature-based solutions.

Catagorization of Flood-prone Areas

20th-Century Stormwater Drainage Systems with Insufficient Capacity

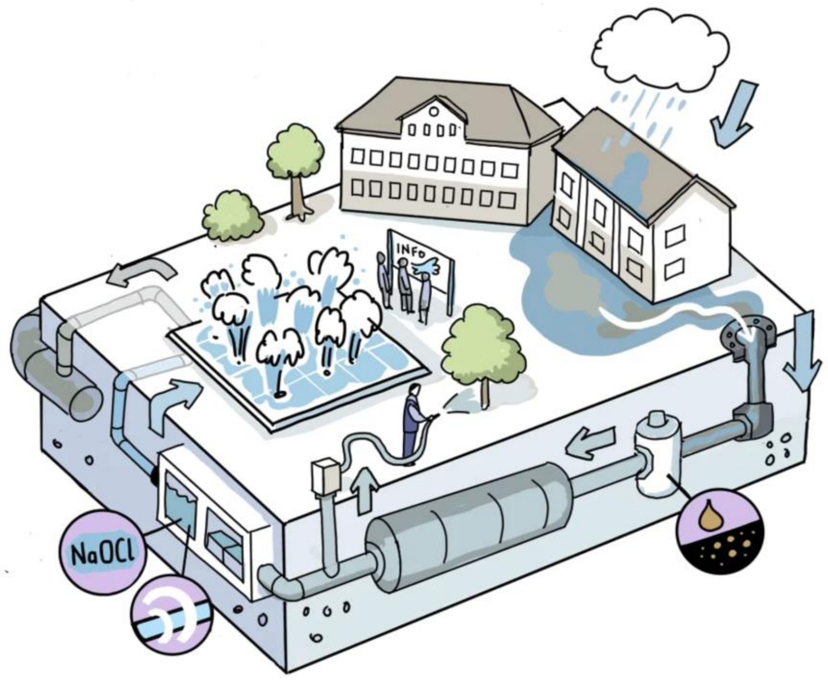
- Climate change-induced increases in rainfall intensity are raising flood risk.
- Potential stormwater management measures:
  - Sustainable solutions such as rain gardens, bioswales, permeable surfaces, green roofs, landscape retention basins, and ponds can retain, store, and reuse stormwater on site.
  - In certain cases, increasing the capacity of stormwater sewer systems may also be necessary.

Catagorization of Flood-prone Areas

Areas with Absent or Decommissioned Drainage (Melioration) Systems

- Flooding occurs due to the malfunction of drainage systems caused by filled or obstructed water conveyance sections.
- Many shared drainage system elements were removed during land privatisation processes.
- Potential stormwater management measures:
  - Restoration or construction of drainage systems is required; however, this is often complicated by property ownership issues and limited municipal land-use rights.
  - The issue should be addressed at the national legislative level to enable municipalities to invest in the construction and maintenance of drainage systems of municipal importance on privately owned land.
  - Alternative solutions include land expropriation or buy-back mechanisms.
  - Sustainable measures such as sedimentation basins and ponds can help optimise drainage system capacity.

Examples of Rainwater Use in Latvia



Saldus Municipality

- A feasibility study has been conducted in Saldus with the aim of collecting and treating surface runoff so that the water can be reused for various municipal purposes, including irrigation of public green areas and operation of a public fountain.
- Rainwater is stored in an underground reservoir and treated using quartz filtration and UV disinfection, while filter backwash wastewater is discharged into the sewer system.
- The project, which initially focused on installing a fountain in the city’s central square, has evolved into an integrated solution combining flood risk reduction, rainwater harvesting and reuse, and improvements to public space quality.
- The estimated implementation cost of the project is **EUR 618,383**, including a 5% contingency and 21% VAT.

Examples of Rainwater Use in Latvia

Skanste Green-Blue Corridor, Riga

- Major sustainable infrastructure project
- Provides:
  - Stormwater retention & filtration (vegetation + soil)
  - Groundwater recharge and biodiversity support
  - Recreational value
- Proven flood resilience under extreme rainfall
- High economic efficiency (benefit-cost ratio > 3.5:1)

Bonava Latvija Residential Developments, Riga

- Locations: Turaidas Street, Krasta Quarter
- Use of bioswales, infiltration trenches, and reservoirs
- Results:
  - Reduced runoff and improved microclimate
  - Minimal flooding during 2024 storm
- Ongoing research collaboration to optimize systems and cut costs

Skanste Green-Blue Corridor

Bonava Latvija Residential Developments

Examples of Rainwater Use in Latvia

Dailes Theatre Square Rain Garden, Riga

- Integrates stormwater infiltration into public space
- Enhances biodiversity, runoff control, and aesthetic value

Examples of Rainwater Use in Latvia

Rūjiena Cultural Centre Square

- Combines:
  - Rain gardens
  - Bioswales
  - Dry riverbed feature
- Delivers filtration, infiltration, and microclimate regulation
- Upgrades public space quality and design

Examples of Rainwater Use in Latvia

Kandava Promenade

- Cascade of ponds and ditches for drainage and conveyance
- Serves recreational area (playground)
- Ensures safe, efficient water circulation

Examples of Rainwater Use in Latvia

Elemental Business Centre, Riga

- Rainwater reuse for irrigation and technical needs
- Achieved BREEAM Outstanding sustainability rating
- Benefits:
  - Lower potable water use
  - Reduced maintenance costs
  - Promotes corporate environmental responsibility

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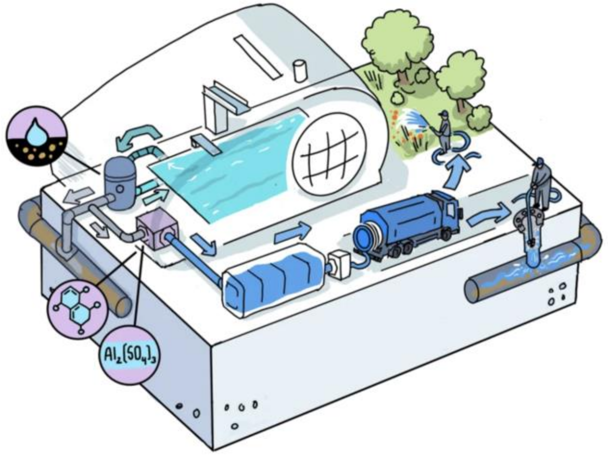
Examples of Rainwater Use in WaterMan Project Model Regions

Poland, Braniewo Municipality

Project 1 – Rain Garden at the Sports Centre

- A rain garden has been established in the parking area of the Braniewo public swimming pool, transforming an impervious surface into a green infrastructure element for local stormwater retention and infiltration.
- The solution reduces flood risk, decreases the load on the sewer system, mitigates the urban heat island effect, and enables irrigation of vegetation without the use of drinking water.
- In addition to its functional benefits, the rain garden also serves as a tool for public education on sustainable water management and the impacts of climate change.

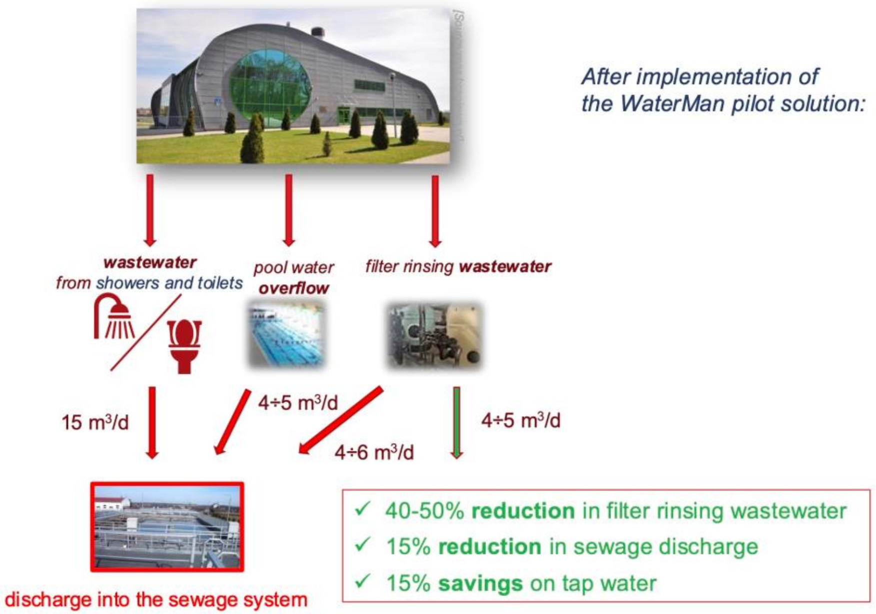
Examples of Rainwater Use in WaterMan Project Model Regions



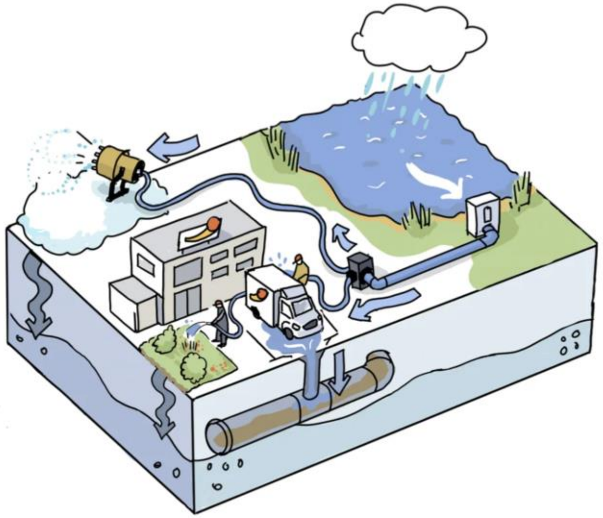
Poland, Braniewo Municipality

Project 2 – Reuse of Swimming Pool Filter Backwash Water

- Within this pilot project, filter backwash wastewater from the Braniewo swimming pool is collected and treated using coagulation, sedimentation, and dechlorination processes.
- The treated water is reused for municipal purposes, such as sewer system flushing and irrigation of green areas.
- Achieved benefits:
  - 40-50% reduction in filter backwash wastewater volumes
  - 15% reduction in water discharged to the sewer system
  - 15% savings in drinking water consumption
- The Braniewo initiative serves as an example of sustainable water management in the Baltic Sea region, highlighting the importance of local, circular solutions under climate change conditions.



Examples of Rainwater Use in WaterMan Project Model Regions



Sweden – Västervik Municipality

Multifunctional Pond System

- Stormwater from an 80 ha catchment area is stored in multifunctional “mini-ponds” and used for irrigation, urban landscaping, and technical purposes, including artificial snow production.
- The ponds are designed as multifunctional water sources with abstraction points located close to potential points of use.
- Natural purification processes are supported through ecosystem-based management, allowing the water to be used without additional treatment. Where necessary, disinfection technologies can also be applied.
- Currently, six such ponds are in operation in Västervik.
- The project demonstrates that stormwater can become a sustainable resource for local water supply, enhancing climate resilience and water conservation, and that the approach is easily transferable to other municipalities in the Baltic Sea region.

Examples of Rainwater Use in WaterMan Project Model Regions

Lithuania – Gargždai (Klaipėda Municipality)

Pond-Based Rainwater Storage and Treatment Project

- A pilot project has established a stormwater retention and natural treatment pond that collects runoff from a 110 ha residential area.
- Treatment is achieved through a two-stage sedimentation process, relying on natural ecosystem processes.
- The project aims to reduce flood risk and decrease drinking water consumption by reusing treated stormwater for municipal purposes, including irrigation of green areas, sewer flushing, and firefighting.
- The project was implemented in cooperation with Klaipėda University and the “Klaipėda Region” Association, with EUR 272,195 in funding from the Interreg Baltic Sea Region Programme.
- It serves as a national-level precedent for the development of regulatory frameworks for water reuse in Lithuania.

Examples of Rainwater Use in Europe

Sweden – Malmö: A Leader in Sustainable Rainwater Management

Dagvattenparken

- 23,000 m² green area combining recreation and stormwater retention
- Capacity: 6,600 m³ of water during heavy rainfall
- Reduces flood risk, enhances landscape & biodiversity

Hyllie Vattenpark

- Educational & interactive park focused on the water cycle
- Engages residents, especially children, in climate awareness

Västra Hamnen

- Transformed from industrial area → carbon-neutral district
- Uses open rainwater management:
  - Green roofs, canals, ponds
  - Creates an aesthetic, eco-friendly urban landscape

Examples of Rainwater Use in Europe

Hyllievångsparken

- Developed since 2018 as a climate-resilient urban park
- Features retention depressions and stream systems (capacity: 7,000 m^3)
- Integrates recreation, ecological design, and community participation

Emporia Shopping Centre

- 27,000 m^2 green roof – one of the largest in Europe
- Benefits:
  - Reduces urban heat island effect
  - Improves rainwater retention and biodiversity

Ekostaden Augustenborg

- Model for urban regeneration & sustainability
- Open drainage system: 6 km of channels, 10 ponds
  - Retains up to 90% of rainwater, prevents flooding
- Includes green roofs, renewable energy, and strong citizen involvement
- Improves both ecological and social outcomes

Examples of Rainwater Use in Europe

Denmark – Greve Municipality

Biodiversitetspark (Biodiversity Park)

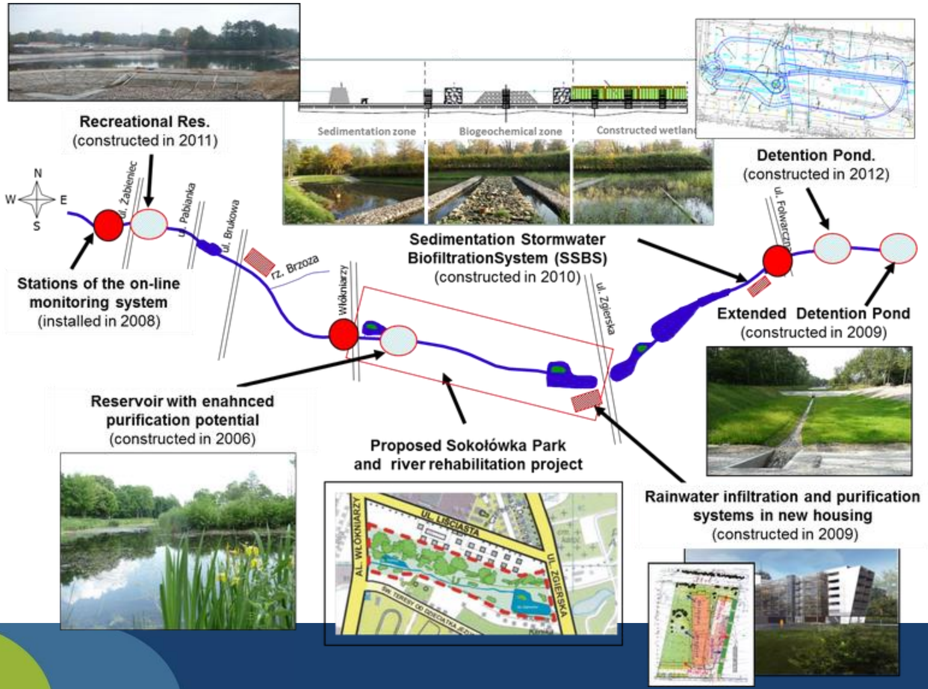
- System of stormwater ponds for retention & purification
- Reduces flood risk and improves water quality
- Tests new SCL filtration technology:
  - Enables cost-efficient water purification
  - Enhances biodiversity
- Multifunctional space with walkways, bridges, and educational features

Examples of Rainwater Use in Europe

Poland – Łódź

Sokołówka River Restoration Project

- Applies ecohydrological principles to urban planning
- Infrastructure:
  - 3 stormwater reservoirs
  - Biofiltration system
- Outcomes:
  - Reduced flood risk
  - Improved water quality & biodiversity
  - Public participation and social benefits
- Demonstrates a shift to integrated "blue-green networks" for cities



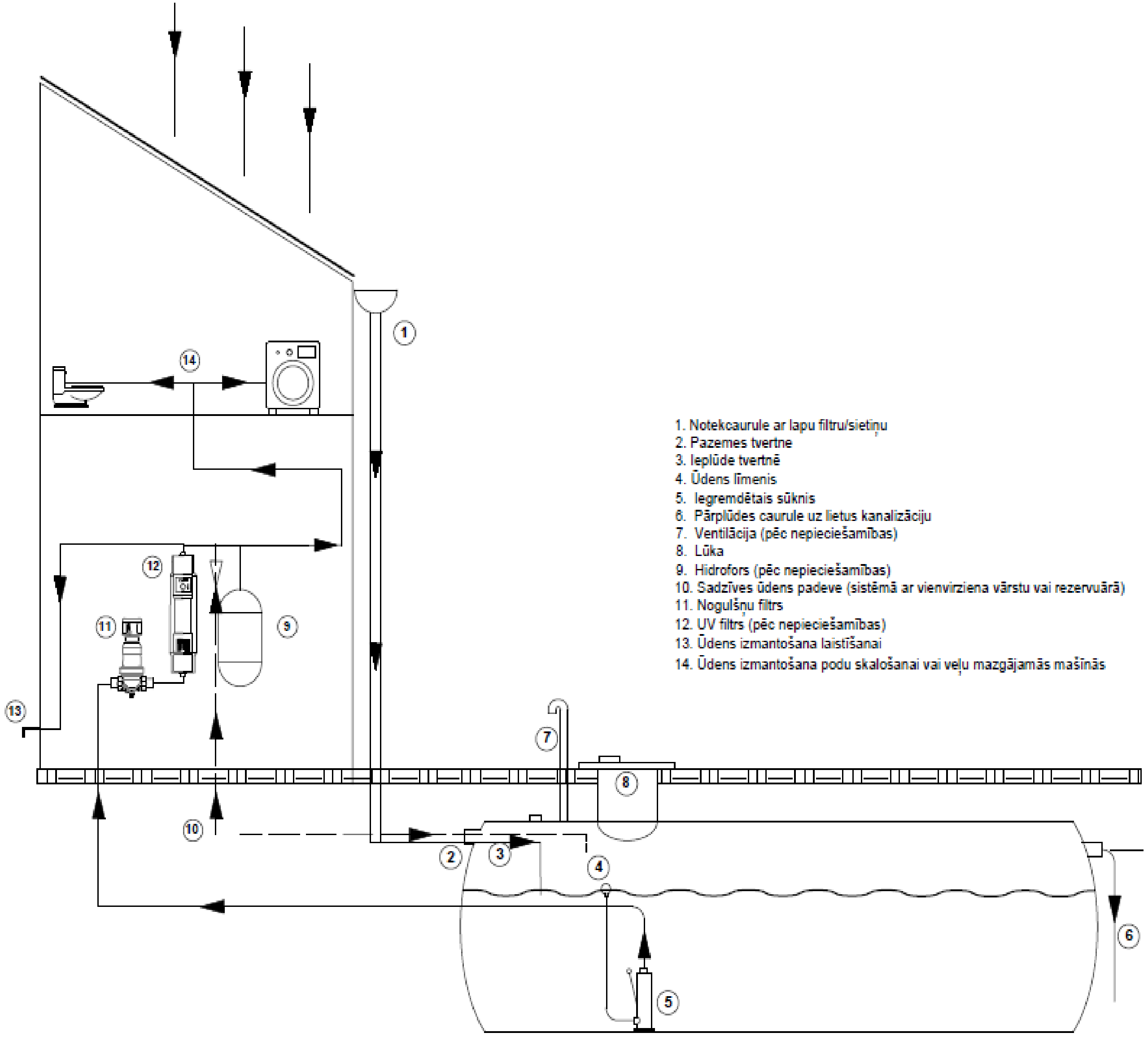
Good Practice and Typical Examples of Rainwater Reuse

Single-Family Houses – Toilet Flushing and Irrigation

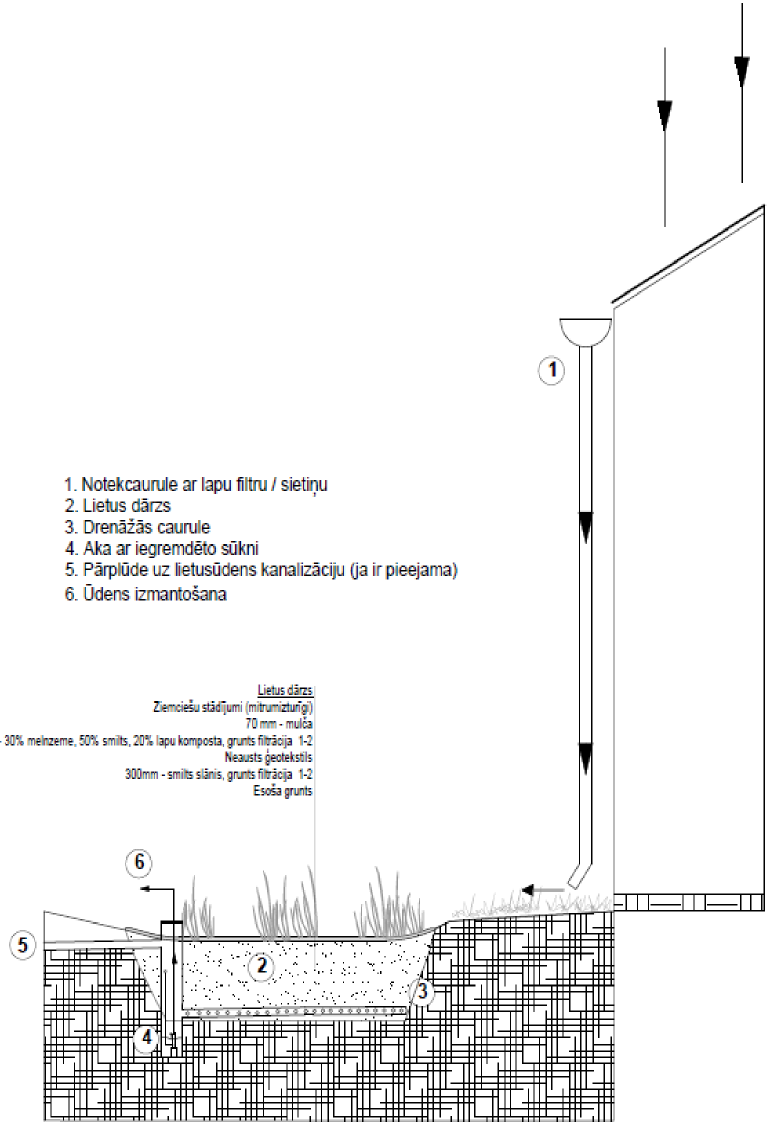
- Rainwater is collected from the building roof, filtered through a leaf screen, and conveyed by pump or gravity to an above-ground or underground storage tank. The water is supplied to the toilet cistern via a separate inlet and valve system, allowing a switch to the central water supply when necessary.
- If the water is intended for irrigating lawns, trees, or ornamental plants, only minimal treatment is required, such as a leaf screen, a first-flush diverter, and sediment filtration.
- Where local conditions permit, storage and treatment can be provided using nature-based solutions such as multifunctional ponds, rain gardens, and bioswales.

Commercial or Public Buildings – Toilet Flushing

- Rainwater is collected from large roof surfaces, stored in large underground tanks, and treated in accordance with regulatory requirements, for example using first-flush diverters, suspended solids filters, and UV or chlorine disinfection.
- A separate non-potable (“non-drinking”) water distribution system supplies water exclusively to toilets.
- An automated pumping system with sensors and control valves switches to the central water supply when tank water levels are low.



1. Notekcaurule ar lapu filtru/sietiņu
2. Pazemes tvertne
3. Ieplūde tvertnē
4. Ūdens līmenis
5. Iegremdētais sūknis
6. Pārplūdes caurule uz lietus kanalizāciju
7. Ventilācija (pēc nepieciešamības)
8. Lūka
9. Hidrofors (pēc nepieciešamības)
10. Sadzīves ūdens padeve (sistēmā ar vienvirziena vārstu vai rezervuārā)
11. Nogulšņu filtrs
12. UV filtrs (pēc nepieciešamības)
13. Ūdens izmantošana laistīšanai
14. Ūdens izmantošana podu skalošanai vai veļu mazgājamās mašīnās



1. Notekcaurule ar lapu filtru / sietiņu
2. Lietus dārzs
3. Drenāžās caurule
4. Aka ar iegremdēto sūkni
5. Pārplūde uz lietusūdens kanalizāciju (ja ir pieejama)
6. Ūdens izmantošana

Typical Investment Costs and Payback Periods for Rainwater Use Systems in Single-Family Houses

- Rainwater use is environmentally justified and beneficial for society; however, it is important to assess its financial return and investment payback period.
- Rainwater use reduces drinking water consumption and related costs. In households without separate irrigation water meters, it also reduces wastewater charges.
- “Active” rainwater use systems have higher costs, and collected rainwater does not fully meet demand; therefore, under average tariff conditions, these systems do not achieve financial payback. Only “passive” solutions, such as infiltrating rainwater into the ground and later abstracting it via wells or ponds, are economically viable.
- In specific cases, payback periods can be significantly reduced if construction costs are lowered through self-installation or if the catchment area and collected rainwater volumes are larger.
- Higher water and wastewater tariffs can further improve the economic viability of rainwater use systems.

Economic Effectiveness of Rainwater Reuse

Nye, Aarhus (Denmark) – Centralised Stormwater System for Secondary Water Use

- Centralised collection and treatment of stormwater/surface runoff using filtration, ultrafiltration, and UV disinfection.
- Secondary water supplied for toilet flushing and laundry.
- Provides up to 40% of total water demand in the area using treated rainwater.
- Initial phase serves approximately 600 households; long-term plans aim to supply around 15,000 residents.
- Connection fee ~EUR 3,600 and annual maintenance costs of EUR 50-150 per household.
- Economic performance improves under high water price conditions.

Ibis Gent-Dampoort (Belgium) – Hotel Greywater Reuse for Toilet Flushing

- The system saves approximately 1,500 m^3 of drinking water per year per building by reusing shower water for toilet flushing.
- The estimated payback period is 7-8 years, even with moderate system capacity.

Economic Effectiveness of Rainwater Reuse

Sörsjön, Jönköping Region (Sweden) – Multi-Apartment Greywater Reuse Project

- Greywater systems collect water from showers, sinks, and washing machines and reuse it for non-potable purposes such as toilet flushing.
- Approximately 30% reduction in drinking water consumption.
- The calculated payback period is approximately 68 years. However, when considering wastewater charges, economies of scale, and subsidies, the payback period is significantly reduced.

"Circular Water Home" Pilot Project (Netherlands) – Combined Rainwater and Greywater Reuse

- Rainwater is collected from the roof, treated, and used for showers, baths, sinks, and garden irrigation. Greywater from baths and showers is then collected, treated, and reused for toilet flushing and laundry.
- The system achieves >90% savings in drinking water consumption at the household level and reduces wastewater volumes by approximately 40%.
- The payback period varies widely (9-33 years) depending on installation costs and tariff levels.

Potential Funding Sources for Sustainable Rainwater Management

Latvian Environmental Protection Fund (LEPF)

- Supports projects that improve environmental quality
- Focus areas:
  - Rainwater management solutions
  - Public education and awareness
- Provides national-level funding for sustainability initiatives

EU Structural Funds

European Regional Development Fund (ERDF), Cohesion Fund (CF), European Social Fund+ (ESF+)

- Finance large-scale infrastructure and modernisation projects:
  - Centralised sewerage systems
  - Rainwater collection and reuse systems
  - Climate adaptation and resilience measures

Potential Funding Sources for Sustainable Rainwater Management

Interreg Cross-Border Cooperation Programmes

Latvia–Estonia, Latvia–Lithuania, Central Baltic, Baltic Sea Region

- Support joint projects in:
  - Water resource management
  - Biodiversity protection
  - Urban sustainability
- Offer up to 80% co-financing of eligible costs
- Open to municipalities, research institutions, NGOs, and businesses

Potential Funding Sources for Sustainable Rainwater Management

Horizon Europe

- EU's main research and innovation programme
- Funds projects in:
  - Water management and reuse
  - Climate risk reduction
  - Smart, nature-based technologies

New European Bauhaus Initiative

- Supports urban development integrating:
  - Sustainability
  - Aesthetics
  - Public participation
- Eligible projects include nature-based rainwater management solutions
- Encourages creative, community-driven approaches to urban resilience

Financial Benefits for Municipalities

- The financial benefits of stormwater and treated wastewater management in municipalities are reflected in both direct cost savings and long-term economic gains.
- The implementation of integrated blue-green solutions reduces flood risk and pressure on infrastructure, thereby decreasing the need for costly sewer system upgrades and flood protection measures.
- The reuse of treated wastewater and rainwater lowers drinking water consumption, energy costs, and the load on wastewater treatment facilities, contributing to the stability of utility tariffs. Moreover, such solutions are often eligible for support from climate and cohesion funding instruments.

Financial Benefits for Municipalities

- Data from the Kurzeme region indicate that water consumption increases by an average of 10% during the irrigation season, corresponding to 3-5% of annual consumption. The use of drinking water for irrigation results in annual costs of approximately EUR 625,000, highlighting significant potential for savings.
- A major challenge is also the inflow of stormwater into combined sewer systems, which can account for up to 50% of total wastewater volumes. The associated costs in the Kurzeme region exceed EUR 5 million per year and are effectively covered by overall user charges.
- Solutions that reduce stormwater inflow into sewer systems are therefore economically beneficial for society as a whole and should be considered in the economic evaluation of stormwater management strategies.

Interreg Baltic Sea Region

Co-funded by the European Union

KURZEME PLANNING REGION

SUSTAINABLE WATERS
WaterMan

Thank you for your attention!

Jurijs Kondratenko
+371 28349594
yurikondratenko@inbox.lv