D.T3.3.3 FUA-LEVEL CONCEPT ON INTEGRATED CUW MANAGEMENT

MBVOD

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PREPARED BY

CONTENT

1. INTRODUCTION

Water supply is not something that goes without saying. Water is a key natural and living resource. Stocks of quality drinking water are limited, and the risks associated with their availability are increasing in the face of increasing pressures on these sources. In order to ensure quality drinking water and the good condition of water bodies, we as a society must be aware of the problems we cause with our activities, and look for solutions to overcome these challenges. At the individual and social level, we must strive for responsible drinking water consumption, try to replace drinking water for certain needs, and at the same time take care of the good condition of surface waters in order to preserve biodiversity and ecosystem functions and reduce their negative impacts of more frequent extreme weather events. In 2016, Article 70a was added to the Constitution of the Republic of Slovenia, which stipulates that everyone has the right to drinking water, that water resources are a public good in the management of the state and that they serve for sustainable supply of drinking water of households and are not marketable goods in this part. Since then, the Constitution also stipulates that the supply of drinking water to the population through the self-governing local communities is provided directly and non-profit.

In the circular economy, water reuse also plays a key role, bringing significant environmental, social and economic benefits. In addition, gray water (i.e. wastewater from bathrooms, laundry and kitchens), which accounts for about 50 to 80% of residential wastewater, can be widely used for urban irrigation and for domestic purposes (such as toilet water), as well as rainwater. This valuable potential is already being exploited by many countries in southern and north-western Europe, while the use of water reuse solutions is still limited in most parts of the EU. Low awareness of the potential benefits among stakeholders and the general public, limited institutional capacity to design and institutionalize re-use measures, and a lack of financial incentives are the main obstacles currently preventing the wider scope of these practices.

2. Determination of the territory covered by the strategy

The functional urban area of Maribor in case of circular water use has been defined by the supply system managed holistically by MBVOD. These includes supplying drinking water to consumers from the Municipality of Maribor, Ruše, Selnica ob Dravi, Hoče - Slivnica, Miklavža na Dravskem polje, Duplek, Pesnica, Sentilj, Kungota, Lenart, Sv. Ana, Benedikt, Sveta Trojica in Slovenske gorice, Sveti Jurij in Slovenske gorice, Cerkvenjak and Gornja Radgona. As part of the public service, approximately 167 thousand consumers from 212 settlements are supplied in the mentioned territory in the company's system. The average household size is 2.5 members with an average monthly consumption of 9 m^3 per household.

Figure 1: Map of all Maribor's FUA municipalities

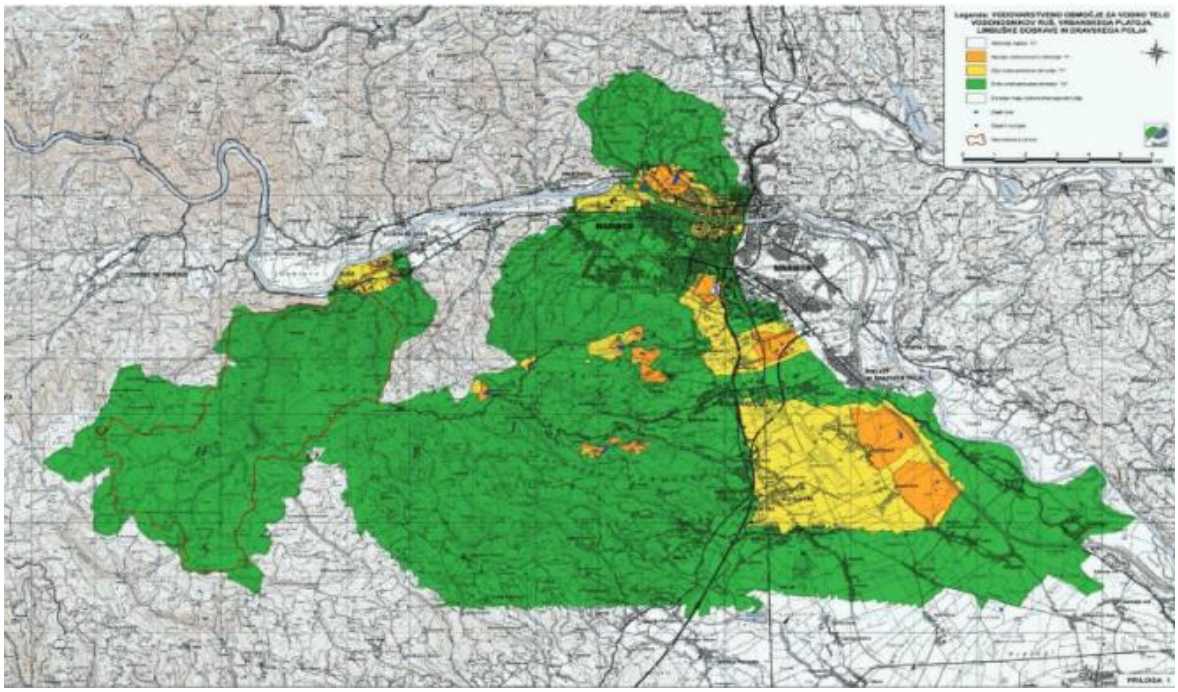

Figure 1: Pumping stations and water protection areas. Source: Decree on the water protection area for the water body of the Ruše aquifers, the Vrbanski Plato, the Limbuška dobrava and the Drava plain.

3. Stakeholder Involvement

MBVOD's stakeholders' engagement strategy has followed the five-tier process from the start: gathering and sharing information, dealing with concerns and grievances, assessing the impact and importance of different stakeholder groups, communicating back and forth through various methods, and building conclusions together.

3.1. The Municipality of Maribor

The territory of the Municipality of Maribor covers 147,5 km2 with population of 110.871 inhabitants, measured in 2018. The main river is Drava with flow rate cca. 670 m3/s and with a good water quality. The average annual precipitation is 926 mm. In recent years, the Municipality of Maribor has proven that even a municipality burdened with a difficult economy and various other social challenges can successfully direct its development path towards a brighter future. Since 2014, MOM has been planning a comprehensive urban system that would include the integrated management of all waste and water generated in the region, based on a circular economy policy, efficient and sustainable use of energy and water, and the use of recycled waste and water as new resources. At the same time, the system would incorporate the fundamental principles of a collaborative economy with the involvement of civil society, which is being pursued by both the European Commission and the United Nations.

3.2. Sewage Utility Company

Water discharged in the sewage system is water which, after use or as a result of precipitation, is discharged into water directly or through sewage and appropriate treatment. Municipal wastewater is generated in households, public facilities, production and service activities, where the quality of wastewater is similar to domestic wastewater. Industrial wastewater is generated in industry, craft, economic, agricultural activities and after its generation is not similar to municipal wastewater, as it is polluted with various pollutants depending on the type of activity. Rainwater wastewater as a result of precipitation flows from paved surfaces or other material-covered surfaces directly into the water or is discharged into the public sewer. Public company Nigrad d.o.o. is responsible for management, operation and maintenance of the sewerage system. High seasonal precipitations can cause mixing of stormwater, rainwater and wastewater resultin in overflow of parts of the sewage system. Nigrad is actively trying to encourage citizens to reroute their stormwater and rainwater arising from their surfaces away from the sewage into private rainwater barrels or to ensure sinkholes intended to recharge the aquifers.

As part of the concession, Nigrad performs drainage and treatment of municipal wastewater and rainwater, maintenance of sewerage network of all profiles, maintenance and management of treatment plants, penetration and cleaning of clogged sewer pipes of all profiles, pumping and removal of sewage sludge and small municipal sewage treatment plants all diameters and flow measurements.

3.3. Waste Water Treatment Company

Wastewater treatment is a process through which wastewater is treated to such an extent that it meets environmental and other quality standards. Wastewater treatment may include (depending on the required treatment standards) mechanical, chemical or biological processes and combinations thereof. The public service provider does not use chemicals or other aggressive substances to treat wastewater. In order to monitor the implementation of measures to reduce water pollution and achieve emission limit values,

monitoring of this wastewater is necessary. Private company Aquasystem is responsible for wastewater treatment plant with capacity of 190.000 PE but for now only 136.000 PE is connected to it. Purified water is of good quality, which is confirmed by regular testing. While MARIBOR FUA has no pipeline system for reusing of purified wastewater, there are currently no possibilities for reusing it – purified wastewater for now flows into the Drava river.

3.4. Key CE Stakeholders

MBVOD has defined as key stakeholders several CE actors that were present at all stakeholder group meetings and have presented their vision of water circularity in cities. Mainly, the Institute Wcycle Maribor – Institute for Circular Economy (IWM) and the company Deltaplan, d.o.o., have been very active in presenting viable (and possibly feasible) options for targeted implementation that could bring about significant changes in circular water management.

To implement circular economy in Maribor, five publicly owned companies, which are exclusively or predominantly owned by the municipality of Maribor, established the Wcycle Maribor Institute (IWM) in April 2017. The IWM is the umbrella organization responsible for implementing projects arising from start-ups, citizens themselves or private entities. The presentation of the Wcycle Maribor project was carried out as part of the European Week of Cities and Regions in October 2016 in Brussels with the support of former European Commissioner dr. Janez Potočnik, and was presented to the citizens of Maribor in November 2016. The concept was then unanimously supported by the City Council, which in March 2017 blessed the further development and establishment of IWM.

4. Baseline assessment

4.1. Assessment of Existing Strategic Priorities

Already in 2018, the Municipality of Maribor has adopted in an intensive co-creative process with all relevant stakeholders the Strategy for Transition of the City of Maribor into Circular Economy, where the chapter on water reuse and use of rainwater sets forth specific ambitions to be achieved by the FUA, the citizens and public utility companies in terms of partially replacing drinking water with rainwater and/or recycled wastewater. Moreover, in 2021, the Municipal Environmental Protection Plan of the Municipality of Maribor 2021 – 2030 is being adopted addressing circular water management as one of the key priorities in the city by 2030.

Therefore, the Municipality of Maribor, together with MBVOD, is concentrating its resources in order to try to explore the possibilities of implementing a distribution system for recycled water in the city with a view to later implementation. As systemic implementation is currently not economically feasible due to the abundance of fresh water, representatives of the above organizations are working with local, national, international and European institutions to prepare the necessary documents to provide appropriate incentives on the demand side.

4.2. Assessment of Drinking Water

In Maribor and the surrounding municipalities, water sources are connected to a common water supply system, which is managed by MBVOD. The quality of drinking water depends on the condition of the connected water systems, the efficiency of their management and protection. In order to ensure quality drinking water, it is necessary to maintain the quality of groundwater, water bodies from which drinking water is pumped, surface waters, and to ensure quality management of the water supply and sewerage network. The drinking water supply program, which is formed every four years, takes into account local (municipal) regulations and national and EU guidelines. The program is submitted to the Ministry of the Environment and Spatial Planning, which formulates the Operational Program for Drinking Water Supply at the national level.

In 2019, drinking water in the Maribor was assessed as compliant with the requirements of the Rules on Drinking Water, with the exception of 39 out of 650 samples (6.00%) taken from the network. The cause is mostly microbiological parameter indicators (coliform bacteria). The National Laboratory for Health, Environment and Food estimates that drinking water in the entire drinking water supply system in Maribor FUA in 2019 was safe and that the operator took appropriate measures to ensure protection of human health from the harmful effects of contaminated drinking water. Compared to the previous year (2018), the percentage of non-compliant samples is higher.

The report of the local public utility service for drinking water supply states that the reasons for such a microbiological situation are the inadequate condition of internal installations, insufficient investment of funds for regular maintenance of infrastructure and ensuring quality drinking water supply, and cases of fecal pollution of water resources. However, exceedances of pesticide limit values are cited as causes of chemical non-compliance. Drinking water losses are also problematic, accounting for 32% of all pumped water in 2018. In the last decade, there has been a trend of increasing water losses. MBVOD has developed its own digital application called WaterLoss MBV, which uses water meter data to monitor water

consumption at all times, detecting deviations in quantities, which are mostly due to breaks in the water supply network. Such an approach reduces the reaction time in repairing the damage to the network.

In principle, MBVOD prepares a plan for the rehabilitation of the water supply network for each municipality on an annual basis. In reality, the annual remediation work differs from the plan envisaged, mainly due to the limited resources available. In 2019 and 2020, a plan for reconstructions and new constructions (expansion) of the water supply network 2020 - 2026 was prepared for Maribor, where the priorities of replacements were set on the basis of the most critical sections (sections with the most fractures in the last five years).

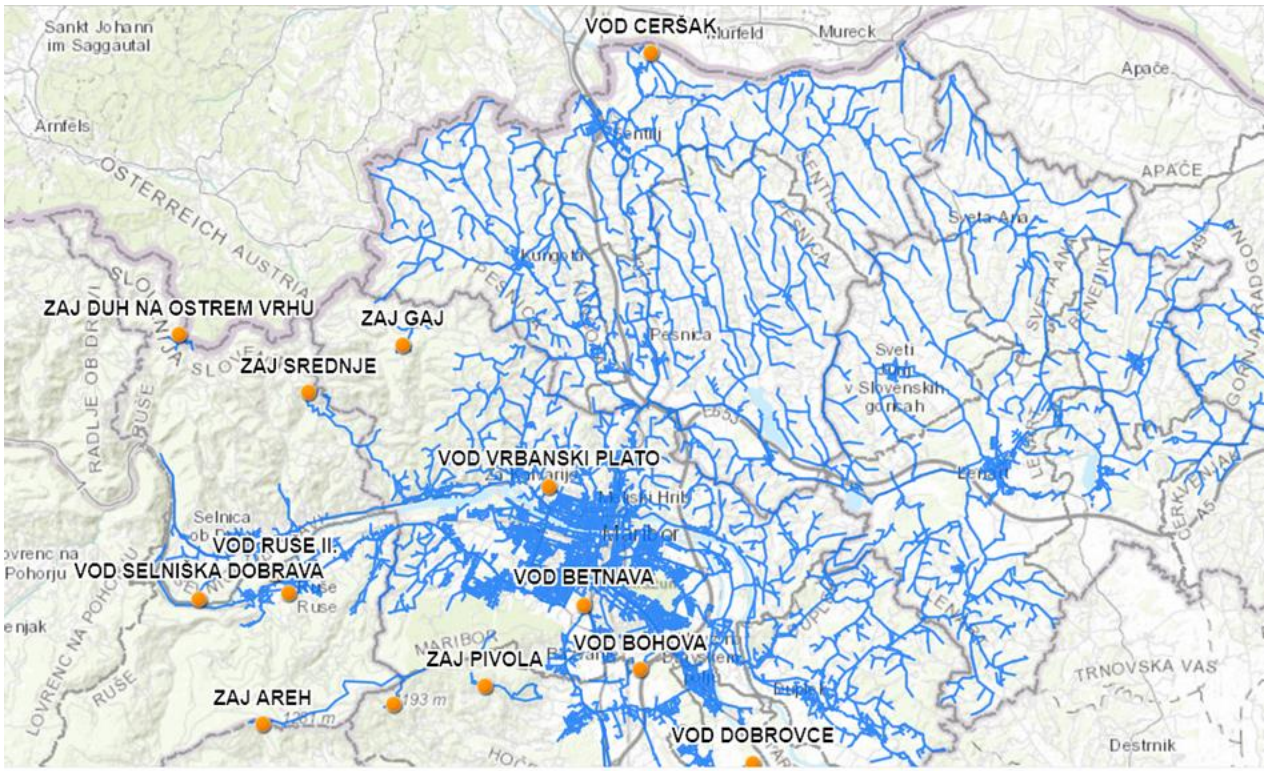

Figure 3: Drinking water supply network in Maribor FUA

4.3. State of Groundwater in Maribor FUA

The main source of drinking water in Maribor is groundwater. In the future, increased pressure and greater variability of groundwater sources (water content, quality) are expected, which poses risks to water supply. The water body of the Drava Basin is statistically characterized by a negative trend (decrease) of the groundwater level. The share of granted water rights in this area is between 75% to 100% depending on the available water quantities. In the area of the Vrbanski Plato, a sufficient amount of water is provided by artificial enrichment due to the damming of the Drava river and the implementation of the first phase of active protection.

The Groundwater Status Regulation defines the procedure for determining the threshold value for groundwater quality, chemical and quantitative status parameters, groundwater quality standards, groundwater quality threshold values, conditions for good quantitative and chemical status, criteria for identifying and reversing relevant and continuous increasing pollution trends, criteria for determining the load of a groundwater body when it is necessary to implement measures due to non-achievement of groundwater targets, and additional requirements for the preparation of a program of measures for

groundwater. Groundwater as a source of drinking water in the area of the Maribor and surrounding municipalities is especially protected by a decree, which defines water protection areas and water protection regime for the water body of the Ruše Aquifer, Vrban Plateau, Limbuška Dobrava and Drava Field. Groundwater analyses in MOM do not show significant deviations from the values measured in 2018. The narrower area of the city of Maribor is characterized by a marked change in the composition of groundwater. Groundwater in the city center is more mineralized, and the proportion of sodium and chloride in the mineral composition itself is increased. The first reason for this is built-up and asphalted surfaces, resulting in less groundwater supply with rainwater. Another reason is the salting of asphalt surfaces. Sodium and chloride concentrations fluctuate considerably throughout the year. It should be noted that the impact of wastewater is not negligible either. This is expressed by the annual presence of certain drug and caffeine residues in groundwater. Among the plant protection compounds whose presence has been confirmed in groundwater, atrazine and its degradation product desethyl-atrazine occur in the largest cases. The limit value set by the Groundwater Regulation was not exceeded in any sample. In groundwater, the presence of modern pollutants such as perfluorinated compounds and drug residues (mainly salicylic acid and carbamazepine) has been detected at most measuring points. Due to its persistence in nature, it is estimated that the trend in concentrations will increase over the years.

4.4. State of Surface Waters in Maribor FUA

The Drava River and its tributaries represent key surface water bodies of Maribor FUA. A good chemical standard has been established for most water bodies in Slovenia, including the Drava ones. However, problematic mercury content exceeding environmental standards has been detected in most of these water bodies. Exceedances are due to diffuse sources of immissions (chemicals, consumer goods, fossil fuels). The ecological condition of the Drava River between Maribor and Ptuj is assessed as good. However, in the Drava river basin, more than half of the water bodies do not achieve good ecological status. The leading reasons for this are hydromorphological alteration and general degradation together with nutrient loading from intensive farming. In the Maribor area, general parameters of water pollution are monitored, such as: insoluble substances, nitrogen compounds, oxygen conditions, organic matter load and total phosphorus. The latest report on the state of the environment states that phosphorus loads stand out in the pollution of surface waters, which indicates the load of municipal wastewater.

Prevention of direct discharges of wastewater into surface waters is one of the measures that would certainly improve the chemical and microbiological condition (Vinarski potok, Radvanjski potok and the Drava river). It is especially characteristic of the Drava River that the number of fecal bacteria in the area of Maribor increases significantly. The content of pesticides in groundwater shows a marked downward trend in concentrations. Based on the compounds found in wastewater, it is found that the number of pharmaceutically active compounds found is increasing. Monitoring of more modern pollutants such as perfluorinated compounds, hormone disruptors, drug residues, anti-corrosion agents, artificial fragrances is becoming an increasingly established approach to monitoring groundwater quality. Recent analyses also show an excessive load of surface water with ammonium, which indicates the pollution of surface water from wastewater, agriculture (livestock and fertilizers) and other pollutants, such as leaching of water from grey infrastructure, industrial water inflows, etc. The report on the state of the environment states that the concentrations of both nitrates and pesticides in the city center are increasing, which indicates their intensive use in the maintenance of public areas. Measurements also indicate an increase in mineral salt concentrations, which may be due to the salting of roads and / or the discharge of wastewater from certain industrial activities. The Drava River is exposed to hydromorphological pressures due to the use of water energy, and changes also cause flood protection.

4.5. State of Waste Water in Maribor FUA

Most of the Maribor wastewater from households, industry and meteoric water is treated at the Maribor Central Wastewater Treatment Plant, which has a capacity of 195,000 population units and performs three phases of treatment (mechanical, biological and sludge treatment). 94% of wastewater from Maribor is treated at the central treatment plant. In the area of Maribor, there is 485,284 m of sewerage network, 3323 pumping facilities, 61 major unloaders and 35 pumping stations. As part of the concession, Nigrad performs drainage and treatment of municipal wastewater and rainwater, maintenance of sewerage network of all profiles, maintenance and management of treatment plants, penetration and cleaning of clogged sewer pipes of all profiles, pumping and removal of sewage sludge and small municipal sewage treatment plants all diameters and flow measurements.

More than 60% of the area of Maribor is located in the water protection area, which means that the regulation of wastewater disposal in these areas is a priority. The Rules on the discharge and treatment of municipal wastewater and stormwater set out the requirements for the provision of services of the obligatory local public utility service for the discharge and treatment of wastewater and stormwater. Treated wastewater from the area of Maribor is discharged into the Drava or into the channel of HPP Zlatoličje (at the high water level of the Drava). Analyzes of treated water at the outlet show that in 2004-2019 all outflow parameters were in accordance with the requirements of the environmental permit. In the period from 2007 to 2016, a few events were detected when wastewater was at the inflow of the WWTP due to unpredictable extraordinary pollution of inadequate quality (fuels, acids, detergents, extraordinary sudden amount of mechanical waste). Inadequate quality of wastewater at the inlet had a strong impact on the reduced efficiency of the treatment process in two events.

Rainwater drainage is a service of a public service provider, which is not charged, but is listed on monthly statements only as a notification of the situation. Activities related to the removal of rainwater from the public sewerage system are carried out by Nigrad because due to climate change there are downpours of higher intensity than anticipated in the sewerage planning. Abundant rainwater in the sewer causes many inconveniences, such as flooding of facilities, inability to discharge wastewater to treatment systems and significantly stronger abrasion of the network. This is a serious issue, which is regulated in the Slovenian legal system by laws and regulations in the field of emissions of substances in wastewater disposal and by-laws in the field of public environmental protection services. The Decree on the Discharge and Treatment of Urban Wastewater stipulates that the planning, construction, reconstruction or maintenance of facilities in the agglomerations must ensure that measures are envisaged and implemented to reduce the amount of rainwater discharged into the public sewer. The mentioned issue is also regulated in Article 17 of the Decree on Emissions of Substances and Heat in the Discharge of Wastewater into Waters and Public Sewerage, which states that the owner of the facility must discharge rainwater that flows directly from the roof of the facility directly or indirectly into the water. this is technically feasible, unless it uses this water as an additional source of water for purposes where there is no need to ensure the quality of drinking water, such as flushing toilets, washing clothes or watering. Smooth discharge of wastewater or. adequate flow of sewage can be ensured only in strict compliance with all regulations, so it is necessary to exclude rainwater from the public sewer system and thus contribute to its normal operation.

5. Vision

In an intensive co-creation process, MBVOD and stakeholders have envisaged the following baselines for the vision for integrated CUW management in Maribor FUA:

- Accessible (available) and sufficient quantities of healthy drinking water for every citizen.
- Protection of water resources against pollution and excessive use and elimination of water losses from (dilapidated parts) of the water supply network.
- Safe drinking water gives us life!
- Elimination or remediation of existing sources of groundwater pollution (large 'point' sources and many diffuse small sources of pollution).
- Providing sufficient groundwater even during dry years / periods.
- Continuous monitoring of the chemical and quantitative status of groundwater.
- Protection and conservation of groundwater as a source of drinking water. The essence is invisible to the eyes!
- Implementation of anti-flood measures where flood events have been recorded in recent decades or it is clear from the flood maps that these are flood risk areas.
- Introduction of new standards in the field of urban infrastructure: integration of green solutions and sustainable solutions (NBS) to increase climate and ecosystem resilience.
- Prevention of runoff of municipal wastewater and other types of polluted water into watercourses and existing surface waters.
- Creating conditions for good chemical and ecological condition of surface waters, so that they will be full of life, cleaned of micro pollutants, properly re-natured, able to perform ecological functions and ecosystem services.
- Waters, rivers, streams, lakes and ponds are valuable habitats!
- Promoting the system of water reuse: slightly polluted sanitary water in households can be used for flushing toilets, rainwater can be used for watering gardens, washing cars, etc.
- Targeted orientation - water should stay in the systems (natural / technical) for as long as possible and finally enter the ecosystems clean through natural solutions.
- Water can enter a new life cycle with reuse!

6. Strategic goals and objectives

6.1. Decreasing Water Loses

Decrease % of water losses with investments in old parts of water supply network – although Maribor FUA in the past years managed to reduce water losses in some parts of network, every year local communities of Maribor FUA are dedicating less investment funds to replace old parts of water supply network. Old network is not replaced according to the amortization plan and the trend of water losses is expected to be rising in the next years.

6.2. Increasing Rainwater Use

Increase retaining rainwater on the site as long as possible for potential further use - so far only new buildings are recommended to have solutions for keeping rainwater on the site. In Maribor, it would be necessary to identify locations in the city, where rainwater retainers could be installed and rainwater could be used for further use (to water city parks, etc.).

6.3. Improving Water Use Efficiency

Increase efficiency of water use among industry and households in Maribor with setting up water price system, which would encourage efficient water use - initiatives for efficient water use are already in action by Maribor Water Supply (MBVOD) and 90% of citizens already use tap water, but so far policy governance approach was used to encourage efficient water use.

6.4. Increasing the Use of Recycled Wastewater

Reuse of wastewater for production purposes - in Slovenia and in Maribor FUA reusing water for production purposes has not been a common practice so far. Therefore, in the future, the goal is to support and encourage good practice examples, that would contribute to change of business practices.