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

Budapest FUA

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CONTENT

INTRODUCTION

The circular urban water management strategy is covering the administrative and geographical territory of Budapest city.

The preparation of the strategy lays on the Municipality of XIV. district Budapest, Zugló. Therefore, the strong and continuous cooperation with municipalities of other districts and the capital city was in the focus during the development of the document.

The first level of co-creative strategy building is the stakeholder group, the stakeholder meetings. Different sectors and experts were invited and attended on the stakeholder meetings in Budapest: NGOs, local authorities, neighbor settlements, Budapest districts and Budapest city administration, sectoral private companies, Budapest Technical University, sectoral suppliers, and media.

The Baseline assessment of Budapest shows the proper availability of citizens to excellent quality fresh water, the high rate of connection to sewage network, and sufficient capacity of trash water treatment.

The trend of increased sealed soil parallel with the dramatic decreasing of green areas cause negative effects on the water management of the urban area.

In water management of the city the following critical issues were identified due to climate change:

- Floods on Danube – flood protection – flood risk management
- Critically low water level on Danube
- Rising temperature - Heat island effect
- Heavy rainfalls - Sewer overloads - flooding

The future vision of Budapest water management projects urban-adaptable solutions (green roofs, grey water and rainwater collection) in infrastructure and natural areas contributing to the resilient system. The leadership of municipalities in knowledge sharing, setting up new regulations, show good examples with pilots and institutional investments, and support the citizens in private projects is also desired element.

To reach the projected vision the main strategic goals were identified and supported by specific objectives.

Retain water as long as possible on site: To avoid the disadvantages of the climate change on urban water management, water retention is one of the highest priority in climate adaptive urban planning.

Guarantee good quality of water bodies: Drinking water is supplied from the wells of Danube, water property provides potential for the tourism and health services, hence the good quality of water bodies is crucial for Budapest.

Increase efficiency in water use and distribution: The loss of water network in Budapest is in the midfield of Europe, but the age of the system and condition of pipelines hold the risk of increasing water loss.

Recycle and reuse wastewater: Clear regulation of the treatment and use of greywater is the first step of application of the technologies.

Promote multiple water use and water sustainability: The leader role of city management is a key factor in involvement and motivation of the residential and business sector and utilise the potentials of circular water use.

Preserve flow in water bodies: Flood prevention is one of the most crucial point water management of Budapest. The former standards of prevention and alleviation of damages need upgraded and innovative

approach.

1. Determination of the territory covered by the strategy

By the OECD definition the Budapest FUA territory counts over 180 settlements with cca. 3 million inhabitants, variable geographical and hydrological areas. The settlements of Budapest FUA do not perform coherent cooperation or administrative regulation.

Due to the size, the incoherent cooperation, and the lack of administrative cohesion of the OECD FUA, the ownership and operation model of the water and sewage management, Zugló decided to cover the **administrative and geographical territory of Budapest** city by the strategy.

Budapest – with 1.7 million inhabitants and 23 districts - has two-tier administration. The municipality of the capital city (Budapest Board) coordinates several services and supplies for the whole city – e.g. public transport, water sewage and waste management, maintenance of green areas etc. and the 23 districts (Zugló Municipality Is one of them) have authority and scope in local services – e.g. public education, social and health services, local building regulations, maintenance of public spaces.

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2. Stakeholder involvement

The first level of co-creative strategy building is the stakeholder group, the stakeholder meetings were organized regularly by the Municipality of Zugló.

Different sectors and experts were invited and attended on the stakeholder meetings in Budapest: NGOs, local authorities, neighbor settlements, Budapest districts and Budapest city administration, sectoral private companies, Budapest Technical University, sectoral suppliers, and media.

The same target group was invited to the knowledge transfer training.

The aim of the meetings and the training was to present the project, disseminate the knowledge on CUWM and open a wider discussion about the status and needs of urban water management in Budapest and neighborhood in aspect of climate change.

The first steps of common vision and strategy building started in the training and in the SG meeting in June 2020 with problem mapping, facilitated discussions and an online questionnaire on strategic visions and goals.

Challenges in vision and strategy building process:

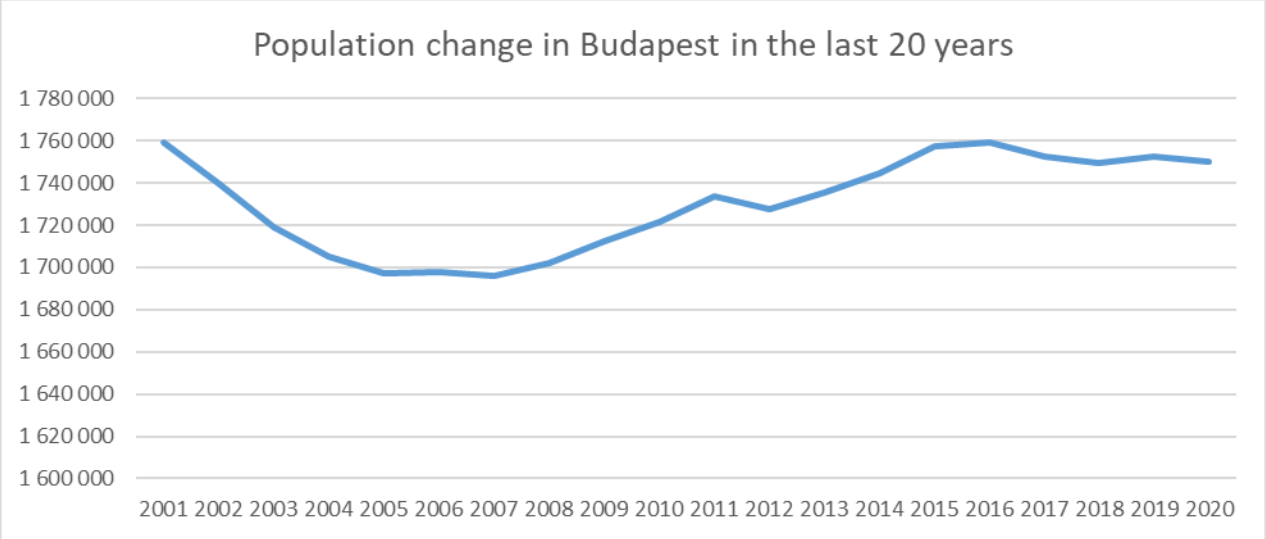
- low level of engagement of the target group, only a few partners took part on all the events, new members needs basic info about the project and the process of involvement starts from point zero
- few feedback on the questionnaire after the meetings from the attendees, easier way of online feedbacks and generate more small group meetings and interviews with key stakeholders can support the feedback from the members
- finding and engagement of the key stakeholders needs high effort and personal networking capacity
- assigning the owner/taskmaster of the CWC local strategy is challenging, as the territory targeted by the strategy is larger than the territory and authority of the project owner (District XIV.)

3. Baseline assessment

The data and significant trends of water management of Budapest listed in this chapter are the abstract of the FUA-LEVEL SELF-ASSESSMENTS ON BACKGROUND CONDITIONS RELATED TO CIRCULAR WATER USE document. The complete analysis is available on the CWC website.

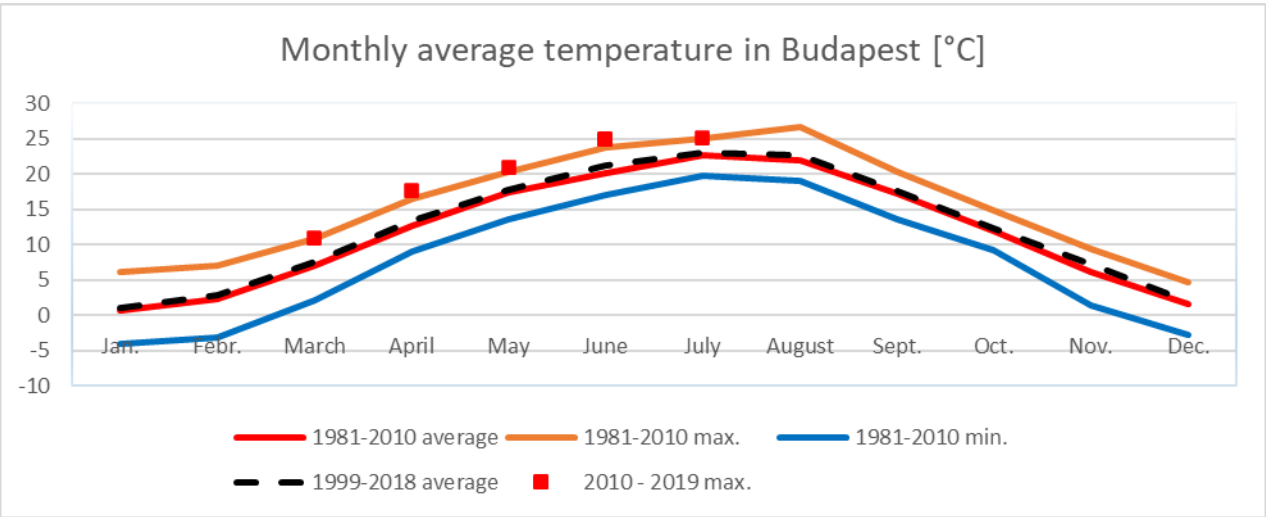
3.1. POPULATION

The city has 1.7 million inhabitants, the trend of population shows a moderate change in the last 20 years.



3.2. CLIMATE

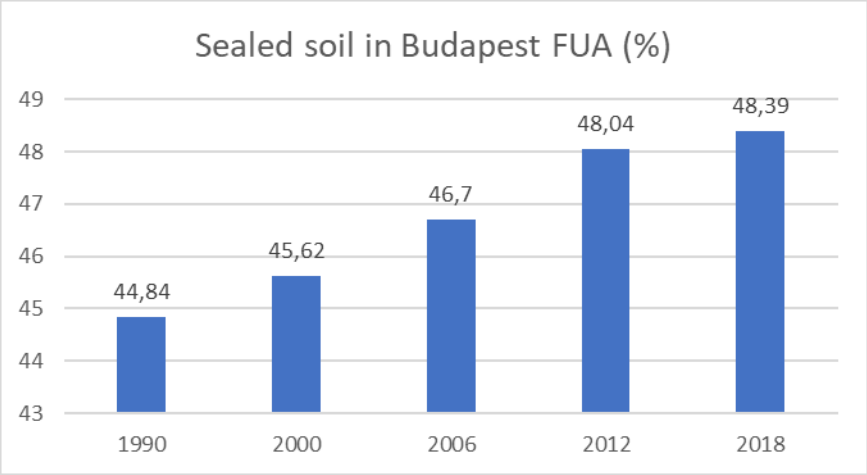
The monthly average temperature shows moderate increasing, but the maximum temperatures of the spring and summer months show significant high new records.

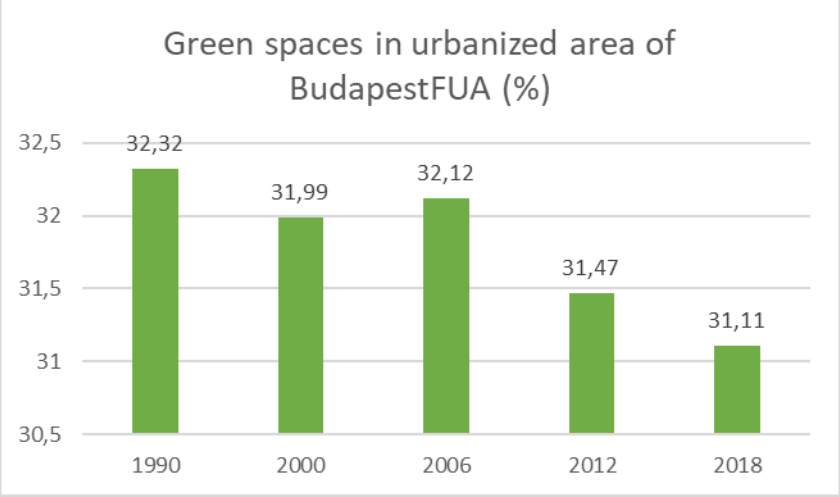


3.3. SEALING SOIL

The total area of Budapest is 525.13 km2. The paved surfaces (asphalt, cement, stone) of the city are dramatically increased in last decades due to the increasing property sector.

the sealed area was estimated from CORNIE land cover databases by different land use categories of the city. The trend of increased sealed soil form 44.84% (1990) to 48.48% (2018) parallel with the dramatic decreasing of green areas from 32.32% to 31.11% during the same period cause negative effects on the water management of the urban area.

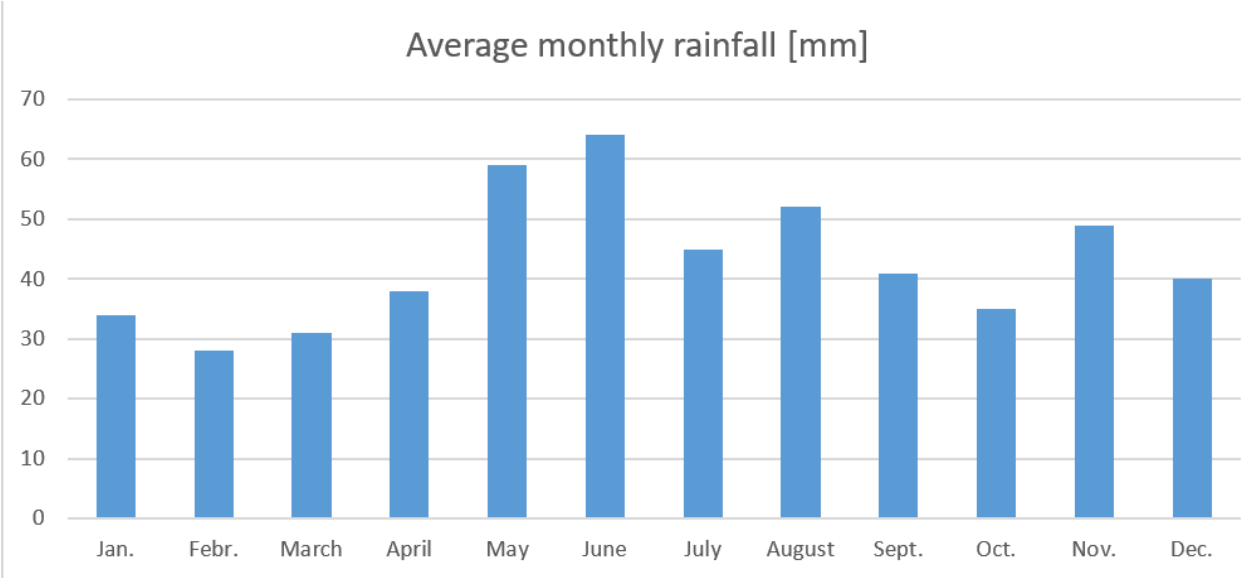




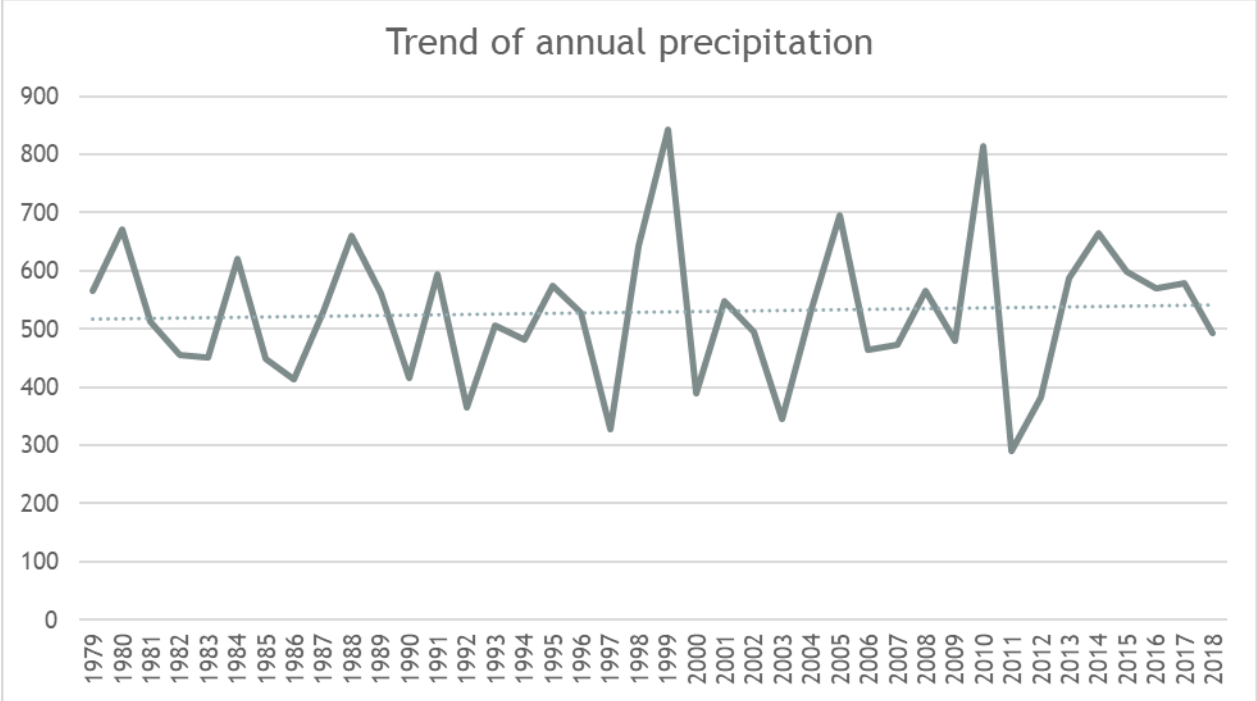
3.4. ANNUAL PRECIPITATION

The average annual precipitation is 516 mm, with peaks in May July August and November.

The balance of the precipitation during the year shows strong volatility and the effects of climate change are clearly identified in extreme heavy rains with flash floods and damages caused by storms and long drought periods. Not only in summer but winter and spring drought is even more frequent.



The trend of the preciitation shows a moderate increasing from 1979 and the scale of volatility is even wider in the recent decade.



3.5. WATER DISTRIBUTION SYSTEM

The greatest water body of the city is the Danube with an average 1100-3100 m3/s water flow. Several smaller creeks are flowing in the river: Rákos, Szilas, Mogyoródi, Csömöri, Aranyhegyi, Gyáli, Hosszúréti, Ördögárok. Extreme fluctuations caused by the climate change are remarkable in last decade. The highest flood on the Danube in Budapest was detected in 2013 (891 cm) the lowest in 2018 (33 cm).

The main water source of the city are the coastal wells in prohibited areas of the Danube. The quality of supplied drinking water is sufficient, 100% of residential buildings are connected to the water network.

The raw water from radial collector wells on Csepel Island needs to be treated to reduce the iron and manganese content. The wells on other water bases such as Szentendrei Island or Margaret Island produce water with so good quality that only disinfection is required to maintain microbiological stability. For disinfection, either UV radiation or chlorine can be used. Since UV radiation as well as O3 (ozone) treatment have only on-site effects, chlorine usage is widespread to avoid secondary pollution from the distribution network.

Water loss in 2018 was 15.5%. This was a 0.8% decrease over the previous year. Reasons include less pipe fractures, less failures and the mild winter.

There is no dual system water supply network.

In practice there is no separation of first flush rainwater. The collected water goes through the same system whether it falls in the beginning of a precipitation event or not. Mostly in the uptown districts of the capital there is a separated pipe system for rainwater and wastewater collection. In central areas rainwater and wastewater is collected by the same network and transferred to the wastewater treatment plants.

96% of residential buildings are connected to the sewage network. The treatment capacity is sufficient for the water consumption.

All the three treatment plants use mechanical, biological and chemical steps. A heavy rainfall can overload the plants and in that case a part of the incoming wastewater will be treated only mechanically.

3.6. FRESH WATER

166 million m3 water has been extracted in 2018 from Budapest and suburb water base. For usage in Budapest the estimated amount is 156 million m3. 190 l/day per capita (industrial usage included).

Despite in Hungary and in Budapest the quality of tap water fits to the international standards, behind the exponentially growing consumption of bottled water the most common reason is the worry about health issues of tap water.

Campaigns to popularize tap water and to draw attention of environmental problems of the enormous volume of PET bottles can lead to change consumption habits.

3.7. CLIMATE CHANGE

As in every Central European city, climate change arises several issues in water management.

Floods on Danube - flood protection - flood risk management

The climate change raises the frequency and risk for severe floods. In the past 20 years there were four flood events on the Danube in Budapest when the water level exceeded the 3rd grade of flood alarming level. The highest water levels increased. In order to ensure the safety of the city the flood protection works should be additionally 1.3 m higher than the official flood level.

Critically low water level on Danube

Due to droughty weather conditions the periods with low water level on the Danube are increasing and occur more frequently than decades earlier. This causes problems in the shipping area, however, the

discharge and water level of the Danube could influence the available water supply it did not cause any problem in low water conditions.

Rising temperature - Heat island effect

The annual mean temperature in Budapest in the past 30 years increased nearly by 2°C. The number of heat days is increasing while the number of frosty days is decreasing. The rising of the temperature is more significant in the densely built-in areas. The heat island effect can be shown in the number of warm nights, when the temperature does not fall under 20°C. While in the middle of the 20th century this number mostly was between 4 and 16, in the past ten years it was between 15 and 41.

Heavy rainfalls - Sewer overloads - flooding

However, there is no significant change in the amount of annual precipitation, the highest daily precipitation amount in central Budapest was in 2015 since the beginning of measurements in 1901. The heavy rainfalls occur more frequently what can lead to the overload of sewer networks. In that cases the sewage is transferred to creeks without purification increasing ecological and public health risk. If the gullies cannot manage the quantity of rain that falls in heavy rains or storms, the rainwater flows through streets, flooding areas. This can endanger cars, cellars or other values, making the transportation impossible.

4. VISION OF CIRCULAR URBAN WATER MANAGEMENT

In the future Budapest the technical infrastructure, urban-adaptable solutions (green roofs, grey water and rainwater collection) and natural areas contribute to the sustainable climate adaptive and harmonized water management system.

The municipalities play key role in the game of information and knowledge sharing, setting up new regulations, show good examples with pilots and institutional investments, and support the citizens in private projects.

Measures of increasing green areas, especially alongside the roads and tram rails, transformed parking spaces, green walls and roof area are supporting the climate adaptive urban management and water retention in the city.

Methodology:

The first step was identifying the barriers and problems during the SGMs. The methodologies were facilitated discussions and problem mapping in the menti.com. After the SGM online questionnaire was sent out to the attendees. The circular urban water management vision was completed with the related vision elements of the SECAP of Budapest.

Although Zugló and Budapest were running two parallel processes of creating common vision the core elements of the outcomes are in utter harmony.

5. Strategic goals and objectives

5.1. Strategic goal 1: Retain water as long as possible on site

Increasing paved and decreasing green area in Budapest, increased intense of land use lead to fast runoff of precipitation. Even more volatile precipitation and increasing average temperature are leading to drought periods. The water storage capacity of the soil needs better utilization.

To avoid the disadvantages of the climate change on urban water management, water retention is one of the highest priority in climate adaptive urban planning.

5.1.1. Objective: Development of green and blue infrastructure

Extension of green and blue areas of the city with increased green area per capita improves the water retention capacity of soil, balances the extreme temperatures in the built environment, supports the prevention of floods, flash floods, and overload of the sewage system.

Indicators: rate of green and blue in the total city area, rate of green area/capita, increased green area of brown field development projects, size of revitalized water bodies

5.1.2. Objective: Adaptive rainwater management

Prior objective is to retain and store the precipitation in place: utilization of soil capacity completed with other storage technologies (green roofs, rain gardens, water tanks etc.)

The regulated and safe runoff of rainwater in urban areas ensures the proper urban service for the citizens. Technical planning needs to be supported with modelling and forecast system covering the whole geographical area of Budapest, with special focus on the critical spaces (basements, tunnels).

5.1.3. Objective: Mitigation of heat island effect in urban areas

The city encourages the builders in public and private sector the use of technologies supporting the mitigation of heat island effect: water permeable pavements, green walls and roof contribute for a better water retention and balanced evaporation.

5.2. Strategic goal 2: Guarantee good quality of water bodies

Drinking water for the consumers is supplied from the wells of Danube. The karst water property provides specific potential for the tourism and health services. Further elements of blue infrastructure are important for the local tourism and wellbeing of inhabitants. Hence the good quality of water bodies is crucial for Budapest.

5.2.1. Objective: Resilient management of drinking water sources, risk management plan in aspect of climate change

To ensure the safe and good quality water supply, the operational and technical parameters need to be updated for the new extreme parameters caused by climate change. Detailed analysis will be elaborated to identify the risks and provide solutions.

5.2.2. Analysis of vulnerability of water bodies, mitigation, and management plan of risks

Based on the water quality monitoring system in cooperation with natural conservation authorities a detailed vulnerability map and action plan need to be developed. The extension of natural areas ensures the improving parameters of circular urban water management.

5.3. Strategic goal 3: Increase efficiency in water use and distribution

The loss of water network in Budapest is in the midfield of Europe, but the age of the system and condition of pipelines hold the risk of increasing water loss.

5.3.1. Objective 2.1. Monitoring program of water loss in public buildings

A monitoring program will be set up to identify the water loss in in public buildings and establish the refurbishments.

5.3.2. Objective 2.1. Awareness raising programmes

Promotion of drinking tap water, awareness raising of the citizens on water consumption and saving potentials ensures high contribution to the sustainable water management. Engagement of different target groups needs tailored communication and education campaigns.

5.4. Strategic goal: Recycle and reuse wastewater

The lack of regulation of grey water use in households or in urban services hinders the spread of reuse technologies. Designers, building owners, building authorities need clear regulation of the treatment and use of greywater, this is the first level of application of the technologies in practice.

5.4.1. Regulation of greywater use in households and

The city administration has the potential to Initiate the legal act on grey water use. Development of technical recommendations for building owners and designers can increase the interest of users as well.

5.4.2. Objective: Incentive prices for multiple water use in households

The pricing system should encourage the consumers to reuse water. The best incentive is a progressive pricing system for households with greywater system. In first step is to set up pricing model and pilot projects with monitoring system.

5.5. Startegic goal 5: Promote multiple water use and water sustainability

The leader role of the city management is a key factor in involvement and motivation of the residential and business sector.

5.5.1. Objective: Leadership in climate adaptive urban water management

The climate change and circular urban water management will be leader horizontal aspects in the development and operation of the city: in new and updated regulations, in urban planning processes, procurements. A knowledge transfer platform of climate change mitigation and adaptation will be set up, to encourage the stakeholders adapting the new approach. Awareness raising of citizens and involvement them in concrete local actions and pilot projects is on the priority list as well.

5.6. Strategic goal: Preserve flow in water bodies

Flood prevention is one of the most crucial point water management of Budapest. The effects of climate change in highest water level threated several areas of the city. The former standards of prevention and alleviation of damages need upgraded and innovative approach.

5.6.1. Flood prevention: new standards, upgraded infrastructure and risk management plan

Upgrading the critical sections of damns on Danube to the new increased highest flood level in parallel with promotion of innovative solutions of flood prevention of buildings.

5.6.2. Updating of the risk management action plan of water damages

Beyond prevention, the action plan in case of damages caused by extreme weather conditions like heavy rains and flash floods needs to be approved with new standards.