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Evaluation Report on the Pilot Activities with a Strong Focus on the Stakeholders' Feedback

WP4 – Activity 4.4.
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Acknowledgements

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List of Participants

A total of 30 experts registered to participate in the 1st Knowledge Transfer Training Workshop, while 3 of them – due to their occupation – could not attend the workshop. A total of 27 experts registered to participate in the 2st Knowledge Transfer Training Workshop, while 7 of them – due to their occupation – could not attend the workshop. However, 13 Environmental Management Engineering MSc students, as the volunteers of future water experts, attended the workshop.

List of participants (name and institution) – 1st training

Arjun Avasthy	Regional Environmental Center for CEE	Hungary
Csaba BERECZKI	Hortobágy National Park Directorate	Hungary
Kitti BERKÓ	OVF – Middle Tisza District Water Directorate	Hungary
Erika BÓDI	University of Debrecen	Hungary
Razvan BOGZIANU	National Administration "Apele Romane"	Romania
Dávid CSISZÁR	Aquaprofit Zrt.	Hungary
János FEHÉR	GWP CEE	Hungary
Zoltán FÜLÖP	Debreceni Vízmű Zrt.	Hungary
Bernadett GÁLYA	University of Debrecen	Hungary
Luboslava GARAJOVA	VUVH Water Research Institute	Slovakia
Judit GÁSPÁR	GWP CEE	Hungary
Lazar IGJNATOVIC	Jaroslav Cerni Institute	Serbia
Csaba JUHÁSZ	University of Debrecen	Hungary
István KOMLÓSI	University of Debrecen	Hungary
Attila LOVAS	Middle Tisza District Water Directorate	Hungary
Lenka MARTONOVA	VUVH Water Research Institute	Slovakia
Branislava MATIC	Jaroslav Cerni Institute	Serbia
Attila NAGY	GWP CEE	Hungary
Tamás NAGY	OVF – Middle Tisza District Water Directorate	Hungary
Stelian NISTOR	University of Oradea	Romania
Beáta PATAKI	University of Debrecen	Hungary
György RÁTFAI	Middle Tisza District Water Directorate	Hungary
Sorin RINDASU	National Administration “Apele Romane”	Romania
Nikolett SZŐLLŐSI	University of Debrecen	Hungary
János TAMÁS	GWP CEE	Hungary
Levente UNGVÁRI	Debreceni Vízmű Zrt.	Hungary
Melinda VÁCI	Middle Tisza District Water Directorate	Hungary

List of participants (name and institution) – 2st training

Kitti BERKÓ	OVF – Middle Tisza District Water Directorate	Hungary
Erika BÓDI	University of Debrecen	Hungary
János FEHÉR	GWP CEE	Hungary
Marinela GALE	Romania Water Administration, Crișuri Branch	Romania
Bernadett GÁLYA	University of Debrecen	Hungary
Judit GÁSPÁR	GWP CEE	Hungary
Tamás MAGYAR	University of Debrecen	Hungary
Serban MUREȘAN	University of Oradea	Romania
Ovidiu MUREȘAN	Oradea Water Company	Romania
Attila NAGY	GWP CEE	Hungary
Tamás NAGY	OVF – Middle Tisza District Water Directorate	Hungary
Mónika NAGY	Trans Tisza Water Directorate	Hungary
Stelian NISTOR	University of Oradea	Romania

Lidia OLAH	University of Oradea	Romania
Beáta PATAKI	University of Debrecen	Hungary
Csaba PREGUN	University of Debrecen	Hungary
Marek SÚĽOVSKÝ	Water Research Institute	Slovakia
Nikolett SZŐLLŐSI	University of Debrecen	Hungary
János TAMÁS	GWP CEE	Hungary
Cornel TĂUT	Romania Water Administration, Crișuri Branch	Romania

13 MSc students (from Brazil, Eritrea, Nigeria, Kazakhstan, India, Mexico)

Medet IBRAIMOV	University of Debrecen	Hungary
Rakan NABER	University of Debrecen	Hungary
Mehari GEBREYESUS	University of Debrecen	Hungary
Jessica MORAES	University of Debrecen	Hungary
Ana DIAS	University of Debrecen	Hungary
Kamolthip MAHAVONG	University of Debrecen	Hungary
Ana ROCHA	University of Debrecen	Hungary
Karishma	University of Debrecen	Hungary
Oscar RODRIGUEZ	University of Debrecen	Hungary
Odunayo ADENIYI	University of Debrecen	Hungary
Mohammed ADAM	University of Debrecen	Hungary
Diana QUINTIN	University of Debrecen	Hungary
Reena MACAGGA	University of Debrecen	Hungary

1. Agenda

Venue: University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management (FAFSEM), Institute of Water and Environmental Management (IWEM), H-4032 Debrecen, Böszörményi út 138., Hungary (https://mek.unideb.hu/en/node/347)
Training dates: 10 September 2018 and 5 October 2018.

Time	Topic	Description
In: Building B, Conference Hall		Chair: János Fehér
09:00-09:20	Welcome	Welcome by the host Faculty (*Prof. István Komlósi, Dean of FAFSEM of UD*) Welcome by the host Institute (*Prof. János Tamás, Director, IWEM of UD*)
09:20 – 09:40	Project information	Short presentation on the JOINTISZA project and the main objectives and outputs of WP4. Activity 4.4 Pilot Activity: Urban Hydrology Management (*Attila Nagy*)
09:40 –10:10	About the Manual	Introduction of the Manual for Knowledge Development Tools and Knowledge Transfer in Urban Hydrology (*János Tamás, Attila Nagy*)
10:10 – 10:40	The Guideline	Guideline for the assessment of the case studies results – Application of process-oriented spatial decision supporting tools, methods in urban hydrology for middle sized cities in CEE based on the reference sites (*János Tamás, Attila Nagy – 1st workshop*) (*Stelian Nistor, Ovidiu Muresan – 2nd workshop*)
10:40 – 11:00	COFFEE BREAK	
11:00 – 11:30	Interactive decision-making	Decision-making process using the Manual and Guideline
11:30 – 13:00	Group training	Water resources challenges in urban areas and their integrated management (*All*)
13:00 –14:00	LUNCH BREAK	Campus Restaurant
In: Building N, room no. 15		Chair: János Tamás
14:00 –15:30	Hands-on training in the computer room. Part 1.	Introduction of the applicable and available databases Demonstration of process-oriented spatial decision supporting tools (*János Tamás*)
15:30-15:50	Coffee break	
15:50-17:10	Hands-on training in the computer room. Part 2.	Case studies Running individual examples (*Erika Bódi, Bernadett Gálya*)
17:10-17:30	Plenary session	Overview of the day, conclusions (*János Fehér*)

2. Workshop events

Welcome

By István Komlósi, the dean, on behalf of the host institute, the University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management and by János Tamás the WP4.4. leader.

Tour the table – introduction of the participants

Participating experts and partners introduced themselves very briefly in both Knowledge Transfer Training Workshops for Urban Hydrology Management (UHM).

Short description of the JOINTISZA project and WP4.4.

Attila Nagy gave a short overview on the focuses, aims and objectives of the JOINTISZA project, listed the project partners and associated strategic partners. The 6 outputs of the project were also mentioned: 2 out of them related to WP4.4. Then the Activity 4.4., Pilot Activity: Urban Hydrology Management was also introduced, highlighting the objectives and deliverables, giving a very brief overview of the concepts of the deliverables. There was an announcement at the end of the presentation in order to draw attention to the training related questionnaires that were to be filled in in the afternoon.

Introduction of the Manual for Knowledge Development Tools and Knowledge Transfer in Urban Hydrology

János Tamás presented a concise summary of the D.4.4.1.: Manual for Knowledge Development Tools and Knowledge Transfer in Urban Hydrology. He introduced all 7 chapters of the 128 pages long manual describing the current knowledge, collected physical data and best available technologies, systems and methodologies, policies applied in an integrated urban water management. Firstly, he explained the importance of Integrated Urban Hydrology Management (IUHM), since it is not yet integrated in the river basin management plans, though communal water consumption is one of the largest water consumptions in river basins, fundamentally influencing many people's well-being and often their health and has effect on huge values concentrated in a relatively small area. The manual aims to promote the integrated planning process organization parameters in urban hydrology. The Integrated Urban Water Management (IUWM) recognizes that problems encountered in one area of the system may be the result of (mis)management in another.
In the IUWM, all aspects of the urban water cycle are treated as one system and all relevant institutions are involved in ensuring that such integration is achieved. The key differences between conventional and integrated urban water management were also described. In the presentation, the following topics were described:

- The effect of climate change and urban microclimate on the urban water balance was described.
- Strategic planning and stakeholders and plans,
- Water supply (drinking water, industrial/commercial water, irrigation, thermal water)
- Storm water, excess water, flood, water storage
- Waste water, water recycling, alternative water source
- IT of IUWM (Smart City, data sources, SDSS)

Guideline for the assessment of the case studies results

In the first workshop, Attila Nagy presented a concise summary of the D.4.4.2.: Guideline– Application of process oriented spatial decision-supporting tools, methods in urban hydrology for middle sized cities in CEE based on the reference sites. He introduced all 4 chapters of the 144 pages long guideline. The guideline focuses on summarizing and integrating the sectors of the urban water management based on the case studies of two middle sized cities in the Tisza river basin: Debrecen of Hungary and Oradea of Romania.

It was described in the presentation that these cities can be representative for many other cities in the TRB concerning the size, location, geography and climatic conditions. On the other hand, the reason for selecting Debrecen and Oradea is that these cities have different geographical background. In this case Oradea can be representative for cities with watercourse and cities with hilly watershed and Debrecen can be representative for cities in plain sites without significant watercourse. Thus at least two hydrological circumstances can be assessed in the pilot. In the 1st workshop, the urban hydrological related issues of Debrecen were summarized and integrated. Debrecen is the regional economic, social and cultural centre of the Northern Great Plain region and the seat of Hajdú-Bihar County in Hungary. The population of Debrecen is about 205,000 and slightly rising. The city is situated on the Hungarian Great Plain, at a relatively flat area with an altitude of 119 m above sea level. It covers an area of 46,166 hectares with large urban farming belts, agricultural and forest belts. Debrecen has, typically for its Central European location: temperate continental climate. The microclimate is highly affected by the soil sealing. There is no river in the city, though the city is located on the watershed of two intermittent creeks. The creeks should play higher role in water retention and rain water harvesting, since the number of high intensity precipitation phenomena is increasing. The climate is continental. The source of drinking water is deep aquifers with rich thermal water sources thus there is a large thermal water utilization (spa). Local stakeholders and their role were also presented. Future water management strategy of Debrecen, namely the CIVAQUA programme was also described. IT tools, such as LIDAR technology, publicly available RS-based data and facility management of the city were also introduced.

In the 2nd workshop, the urban hydrological related issues of Oradea were summarized and presented by Stelian Nistor and Ovidiu Muresan. Oradea, the capital city of the Bihor County and the Crișana region, is one of the important centres of economic, social and cultural development in the western part of Romania. The city is nestled between the hills that separate and unify in a harmonious way with the Crișana plain. It is located on the banks of the Cris river that divides the city into almost equal halves. It covers an area of 11,556 hectares with large urban farming and industrial belts. The city is at an altitude of 126 m above sea level, in the opening of the Criș valley and the plain area, in an area of contact between the extensions of the Apuseni Mountains and the extended Crișana-Banat plain. It lies as the area of transition from relief hills to the Pannonian plain. The climate is temperate continental. The population of Oradea is just less than 200,000. There is moderate thermal water utilization (spa). The presentation highlighted the effect of a strong urbanization of the last half century on the urban water balance of the city. On the other hand, the continuously developing water supply and water treatment system of Oradea were also presented by introducing the improvement of the quality of drinking water supplied and water discharged into the effluent, de-pollution of the Crişul Repede river by diverting wastewater from the storm water networks into new domestic sewers, soil decontamination and provision of collection services for all within the concerned area concerned.

Interactive decision-making and group training

In the case of both workshops, the participants were divided into three groups. Experts from different water sectors were grouped together resulting in three groups with similar heterogeneity. The reason for this grouping technique was to ensure all sector-related knowledge in each group to have repetition in assessing the results. Six topics were covered within the group activities of the trainings: On 10th September 2018, the following topics were discussed:

- 1. Drivers and impacts of change to urban water management
- 2. Identifying stakeholders in the city
- 3. Conventional versus integrated urban water supply

On 05th October 2018, the following topics were discussed:

- 4. Conventional versus integrated urban stormwater management
- 5. Pressures and solution on urban integrated wastewater management
- 6. The differences between conventional and integrated approaches to decision making related to urban water management

Each group activity was started with an explanation of the exercises to be done in the following time. About 20-25 minutes were provided for each exercise with 4 minutes long presentation per group and a 10 minutes long summary of the exercises. The facilitators of the groups were Bernadett Gálya, Beáta Pataki and Attila Nagy. One representative from each group for each exercise summarized the agreed consensus of the group on a certain topic.

Results of the first three exercises conducted at the 1st workshop

1. Drivers and impacts of change to urban water management

The first exercise was a discussion about drivers and their impact on urban water management. In these exercises, groups identified possible drivers in urban water management. In their opinion, the following are drivers in urban water management: industrial, commercial area, parks, land use change, residential area, climate change, transport, wastewater, water supply, storm water, economic development, energy, waste management, urbanization, population growth, increasing complexity, future energy cost, deteriorating infrastructure, environmental management, education, stakeholders, inaccurate demand forecast, pollution, tourism, housing, emerging technologies, public behaviour and attitudes, irrigation, water quality, urban landscape, water treatment, urban agriculture, pond and wastewater treatment. After that, they answered the following questions: How will the driver influence water management of middle sized cities in the future? What kind of challenges will result from this? After that, the groups tried to divide these drivers into two groups (positive and negative drivers). During the discussions a new intersect category is created for those drivers, which can have both positive and negative effects in different circumstances (Table I.1.).
Based on the discussions, the following positive drivers were identified: park, education, environmental management, pond and public behaviour, stakeholders, emerging technologies, enhanced waste water treatment efficiency, ponds in small water retention aspect, grey water and new irrigation technologies. Negative drivers included pollution, tourism, climate change, transport, urbanization, inaccurate demand forecast, deteriorating infrastructure, population and health, lack of stormwater utilization, increasing amount of waste water, inappropriate waste water treatment etc.. The drivers which could be both positive and negative were urban agriculture, irrigation, economic development, water supply, water quality, transport and urban landscape. The reason for this was that these activities occurring in urban sites could be positive drivers, if good practice is applied and maintained. For instance, urban agriculture holds many potential benefits for hydrology, ecology, landscape, soil protection, health care, etc., if it is performed according to the good practice and sustainability.

Table I.1. Summarization of the drivers and their effect on urban hydrology (UHM)

Positive drivers	Negative drivers	Both
	First group	
park	pollution	urban agriculture
education	tourism	stakeholders
environmental management	climate change	urban landscape
pond	transport	
public behaviour	urbanization	
	inaccurate demand forecast	
	deteriorating infrastructure	
	population	
	health	
	Second group	
education	increase in complexity	irrigation
stakeholders	stormwater	economic development
urban agriculture	waste water	water supply
park	waste management	water quality
emerging technologies	climate change	transport
water treatment	population growth	urban landscape
future energy costs	urbanization	
waste water treatment	energy	
thermal water	pollution	
pond	tourism	
environmental management	inaccurate demand forecast	
	housing	
	deteriorating infrastructure	
	Third group	
green area increase	urbanization	type of flood protection
new improved technologies for WWT	industrial parks	small water plants
using grey water	CC	ground water reservoir
using information systems	increasing runoff	
quality of surface and groundwater	bad pipes	
new irrigation technologies	water transport	
	irrigation	

In the discussion part, the degree of sustainability of different implementation options was also assessed. According to the results, smart solutions, rainwater harvesting, more efficient water use, aquifer recharge and recovery were identified as the most sustainable implementation options in UH (Table I.2.)

Table I.2. Degree of sustainability of different implementation options in urban water management (UWM)

Option	Unsustainable					Sustainable					Reasons for score
	1	2	3	4	5	6	7	8	9	10	
Leakage reduction					x						Implementation of measures such as mains replacement, leakage detection, pressure management, etc.
Biogas production							x				Reducing energy cost
Sludge co-composting							x				Reducing CO_2 emissions and exploration of a new market
Rainwater harvesting								x			Rainwater collected centrally from the roofs of a housing development and reused for non-potable purposes
More efficient industrial /commercial/agricultural water reuse								x			Reducing industrial water usage in industrial urban belt. An industrial park.
Thermal water posttreatment						x					Desalination
Reuse of nutrients from wastewater for agriculture							x				Extraction of nutrients from wastewater for agricultural purposes
Sustainable Urban Drainage Systems (green rain harvesting) SUDS								x			Creation of swales, porous pavements, retention ponds, green roofs, etc. for the attenuation and treatment of stormwater
Reservoir						x					Construction of storage reservoir to capture high river flows
Flood protection infrastructure					x						Construction of levees, dykes, embankments and other flood defenses to protect property and infrastructure at risk from flooding
Wastewater reuse							x				Reuse of treated wastewater for non-potable purposes, such as irrigation of parks and recreation facilities, and for industry
Aquifer recharge and recovery									x		Storage of high flows in aquifers for use during peak periods
Constructed wetlands for wastewater treatment					x						Construction of wetlands for the treatment of greywater and stormwater
SMART digitized water								x			Energy and water saving
Flexible water tariff								x			Cost/benefit optimization

2. Identifying stakeholders in the city

In the second exercise, the participants identified the following stakeholders: waste management & recycling companies, urban farmers, youth clubs, tourism sector, labour unions, housing and construction industry, health services, fisheries management, universities & research institutions, professional associations, mining industry, home owners, NGOs, forestry commission, community-based groups, water utilities, catchment committee, environment agency, energy utilities, schools, local industry, women's groups, national water authorities and professional chambers. After this task, the participants made identification of stakeholders as water user associations or retailers (Table I.3.).

Table I.3. Stakeholders in Urban Water Management

Water user associations	Retailers	Both
First group		
waste management & recycling companies	urban farmers	
youth clubs	tourism sector	
labour unions	housing and construction industry	
health services	fisheries management	
universities & research institutions	professional associations	
mining industry	home owners	
NGOs	forestry commission	
community-based groups	water utilities	
catchment committee	environment agency	
energy utilities	schools	
local industry	women's groups	
national water authorities		
professional chambers		
Second group		
waste management & recycling companies	labour unions	youth clubs
universities & research institutions	health services	community-based groups
mining industry	energy utilities	tourism sector
NGOs	local industry	fisheries management
catchment committee	urban farmers	environment agency
national water authorities	schools	
professional chambers	home owners	
forestry commission		
housing and construction industry		
professional associations		
water utilities		
Third group		
water management company	citizens	natural park
city development	urban farmers	
industry (local)	fisheries management	
ministries		
NGOs		
national water authorities		

Two groups out of three identified the category "both", in which they identified stakeholders as both water users and retailers. As a conclusion, waste management & recycling companies, youth clubs, labour unions, health services, universities & research institutions, mining industry, NGOs, community-based groups, catchment committee, energy utilities, local industry, national water authorities, professional chambers were identified as water user associations. Tourism sector, Housing and construction industry, Fisheries management, Professional associations, Home owners, Forestry commission, Water utilities, Environment agency, schools were identified as retailers.
In the second part of this task discussion, the participants discussed which stakeholders related directly or indirectly to water. They discussed that the following stakeholders are related directly: waste management & recycling companies, labour unions, health, universities & research institutions, mining industry, catchment committee, energy utilities and national water authorities. Based on the experts' opinion, the following stakeholders were indirectly related to urban water management: youth clubs, NGOs and community-based groups.

3. Conventional versus integrated urban water supply

The third task the experts discussed was about conventional versus integrated water supply in the city. Within the task, groups filled out the following tables with their suggestions focusing on the conventional and integrated approach to the aspect of water supply in middle sized cities. All three groups identified similar characteristics for the different approaches. The approaches are summarized in Table I.4.

Table I.4. Conventional Versus Integrated Urban Water Supply Based on the Group Activities

Aspect of water supply	Conventional approach	More integrated approach
Supply-demand balance	Increased demand is met through investments in resources and infrastructure to increase supply (Overuse of water resources)	Options to reduce demand, harvest rainwater & reuse wastewater are given priority over development of new resources
Treatment	Treatment technologies are improved in line with the type of pollutant that needs to be removed. Postponing problems – postponing plan looking for method or money. Only to meet the requirements	Pollution control at the source and natural pre-treatment techniques are sought before new technologies are invested in
Leakage reduction	Acute leakage detection and repair is driven by economic factors	Leakage detection and repair, complex thinking on leakage reduction using best technologies is driven by economic, social and environmental factors,
Pricing	Users are charged for water based on a fixed cost or, if applicable, for the recorded volume they use. Often supported by government	Users can be charged based on tariff systems that account for different volumes of use, purpose of use, season, etc.
Resource planning	Predicted resource availability is based on past hydrological records	Predicted resource availability includes adjustments for different climate change scenarios Application of smart metering, raising awareness of water management,

Demand forecasting	Future water demand is estimated by using historical trends, demographic estimates and projected economic growth	Future water demand is estimated by analysing future end uses in different sectors and is considered to be uncertain.
End use requirements	Water of potable quality is supplied for all uses	Water of potable quality is provided only for uses that require it. Alternative sources are sought for non-potable demand

Results of the last three exercises conducted at the 2nd workshop

4. Conventional versus integrated urban stormwater management

The experts discussed conventional versus integrated stormwater management in the city. Within the task, groups filled out the following tables with their suggestions focusing on the conventional and integrated approach to the aspect of water supply in middle sized cities. All three groups identified similar characteristics of the different approaches. The approaches are summarized in Table I.5.

Table I.5. Conventional Versus Integrated Urban Stormwater Management (USWM)

Aspect of stormwater	Conventional approach	Alternative approach
Quantity	Stormwater is conveyed away from urban areas as rapidly as possible	Stormwater is attenuated and retained at source allowed to infiltrate into aquifers (QUALITY???) and flow gradually into receiving water bodies.
Quality	Stormwater is treated together with human waste at centralized wastewater treatment plants or discharged untreated into receiving water bodies	Constructed wetlands Stormwater is treated using decentralized natural systems, such as soils, vegetation and ponds
Recreation and amenity value	Not considered	Stormwater infrastructure is designed to enhance the urban landscape and provide recreational opportunities
Biodiversity	Not considered	Urban ecology – green infrastructure (blue/green), ecological stepping stones, new biotopes, etc. (Urban ecosystems are restored and protected through the use of stormwater to maintain and enhance natural habitats)
Potential resource	Not considered	Stormwater is collected for water supply and retained to support aquifers, waterways and vegetation (trees)

To summarize, in the case of a conventional approach stormwater is not considered to be a potential water resource or to have recreation and amenity value, furthermore the potential effect of stormwater retention on biodiversity is also not considered. Therefore instead of rapid drainage in a combined system, stormwater can be utilized in small water retention ponds or in constructed wetlands to increase infiltration, reducing floods and the city desert effect, and these constructions can enhance the urban landscape, ecological services of a city and can be a possible source for park or urban garden irrigation.

Group members were also asked to assess how conventional or integrated their own city (on the Tisza river basin) is in terms of stormwater management. The scale used was between 1-5, where 1 represents conventional and 5 represents alternative approach. The results are as follows:

Quantity: 2
Quality: 1
Recreation and amenity value: 3
Biodiversity: 2
Potential resource: 2

Overall, opinions were consistent that combined sewer systems are most prevalent in cities, especially in downtown regions. However, mainly in new residential and commercial areas, there are promising examples for separate collection and retention of stormwater integrating it to urban landscape, by providing green areas for the city.

5. Pressures and solution to urban integrated wastewater management

The experts discussed conventional versus integrated wastewater management in the city. Within the task, groups filled out the following tables with their suggestions focusing on the conventional and integrated approach to the aspect of water supply in middle sized cities. All three groups identified similar characteristics of the different approaches. The approaches are summarized in Table I.6.

Table I.6. Conventional Versus Integrated Wastewater Management (IWWM)

Aspect of WWM	Conventional approach	More integrated approach
Collection	Sewage drainage systems are centralised as the waste water treatment.	Grey and black water have to be collected separately and managed close to the source.
Treatment	Centralised treatment of combined wastewater elements based on energy and chemical-intensive infrastructure and technology	Separate wastewater elements are treated using innovative, decentralized technologies and natural systems
Treated effluent	Discharged downstream into receiving surface waters	Treated effluent is reused locally for non-potable water supply purposes (industrial, irrigation, etc.)
Nutrients	Not utilized, not recycled. Nutrients are disposed of in the environment through discharged effluent and sludge.	Nutrients are recycled and reused locally through the recycling of urine and creation of biosolids from faecal sludge
Sludge by-product	The sludge by-product is disposed of in landfill or through incineration	Sludge is digested to create biogas and converted to biosolids for the use as a fertilizer and soil conditioner
Energy consumption	High energy consumption used for treatment and pumping.	Less energy demand (natural systems), energy production, heating

Group members were also asked to assess how conventional or integrated their own city (on the Tisza river basin) is in terms of wastewater management. The scale used was between 1-5, where 1 represents conventional and 5 represents alternative approach. The results are as follows:
Collection: 2
Treatment: 1
Treated effluent: 1
Nutrients: 3
Sludge by-product: 5
Energy consumption: 4
Overall, opinions were consistent that the centralized collection and waste water system is prevalent in cities in the Tisza river basin. On the other hand, especially in middle-sized cities, secondary and tertiary treatment is widespread. A result of treatment a huge amount of sludge is produced, which is utilized in fermentation towers to produce biogas, as the energy source for the WWTP. Thus sludge is an input material for energy production. The fermented sludge is then utilised in composting, producing soil amendment utilizable in agriculture or urban parks for nutrient input for crop production.

6. The differences between conventional and integrated approach to decision-making related to urban water management

The experts discussed conventional versus integrated approach to decision-making related to water management in the city. Within the task, groups filled out the following tables with their suggestions focusing on the conventional and integrated approach to the aspect of water supply in middle sized cities. All three groups identified similar characteristics of the different approaches. The approaches are summarized in Table I.7.

Table I.7. Conventional and Integrated Approach to Decision-Making Related to Urban Water Management

Aspect of decision-making	Conventional approach	More integrated approach
Decision-making data	Decisions concern objectives and priorities for a single management sector	Decisions taken based on the objectives and priorities for urban development as a holistic view for UHMP; finding a balance between price and BAT
Scope of the decision-making process	Focusing on direct costs and benefits are the basis for decision-making, low cost solutions	Direct and indirect costs and benefits are incorporated into the decision-making process: joint decisions are needed
Future uncertainty	Consider future scenario as a fixed one based on historical and present data	Future scenarios are uncertain, environmental, social aspects and CC are concerned
Stakeholder involvement	Experts are making decisions, less stakeholder involvement.	Stakeholders from different fields are involved in the management planning process as a means of gathering knowledge and evaluating impact.
Use of indicators	Decisions evaluated against performance indicators that measure sector goals	Decisions compared with sustainability indicators that measure progress of overall IUWM goals

Group members were also asked to assess how conventional or integrated the decision-making process of urban water management in their own city is (in the Tisza river basin). The scale used was between 1-5, where 1 represents conventional and 5 represents alternative approach. The results are as follows:
Decision-making data: 3
Scope of the decision-making process: 2
Future uncertainty: 1
Stakeholder involvement: 2
Use of indicators: 1
Overall, opinions were consistent that in middle sized cities in the Tisza river basin, the stakeholder involvement and engagement in the decision-making process is not significant, mainly experts are involved and performance indicators are used. Decisions are generally based on direct cost-benefit measurements, highly due to low financial aspects and dependency on EU funding focusing on sector-specific infrastructural developments, investments. Nevertheless, based on the discussion, there are examples of joint data sources and common facility management services of different sectors (e.g. Internet-based Facility Management - eKÖZMŰ[1])

Hands-on training - Part 1.

The first part of the hands-on trainings were held by Professor János Tamás, who introduced the applicable and available data bases, data mining techniques, satellite data source and application on watershed scale applied in urban water management. At the beginning of the presentation, the data and information requirements of UH, data acquisition - mobile technologies and existing spatial supporting systems that are or can be applied in UHM, were summarized.. Furthermore, the following data sources were introduced to the participants, providing examples, exercises to get a brief overview of their application:

- ArcGIS online
- NASA's Global Change Master Directory
- NASA's Eyes on the Earth 3D
- NASA Applied Remote Sensing Training
- Copernicus Global Land Service
- Landsat Viewer
- Landsat Explorer
- European Drought Observatory
- DanubeGIS
- Sustainable Urbanizing Landscape Development
- Conflict management tool - AHP
- Weather Research and Forecasting Model Hydrological modelling system
- Arc Hydro Tools
- Urban Atlas

Hands-on training - Part 2.

The second part of the hands-on trainings was held by Bernadett Gálya and Erika Bódi-Buday, lecturers from the University of Debrecen. The pilot activities on UHM will demonstrate how urban hydrological parameters can support urban land cover and land cover change detection methods and their purposes for isolating and

[1] https://www.e-epites.hu/e-kozmu

ranking urban hydrological hotspots to detect the emergence or probability of occurrence and the likely severity of urban hydrological problems in a middle sized city (Figure III:1.). Integration of spatial UWM tools to the field of hydrology provides an up-to-date hydrological strategy for the improvement of city architecture, green surfaces, as well as the evaluation and improvement of preparedness for extreme hydrological situations and offers unified information and methodology for hydrological modelling of urban areas.

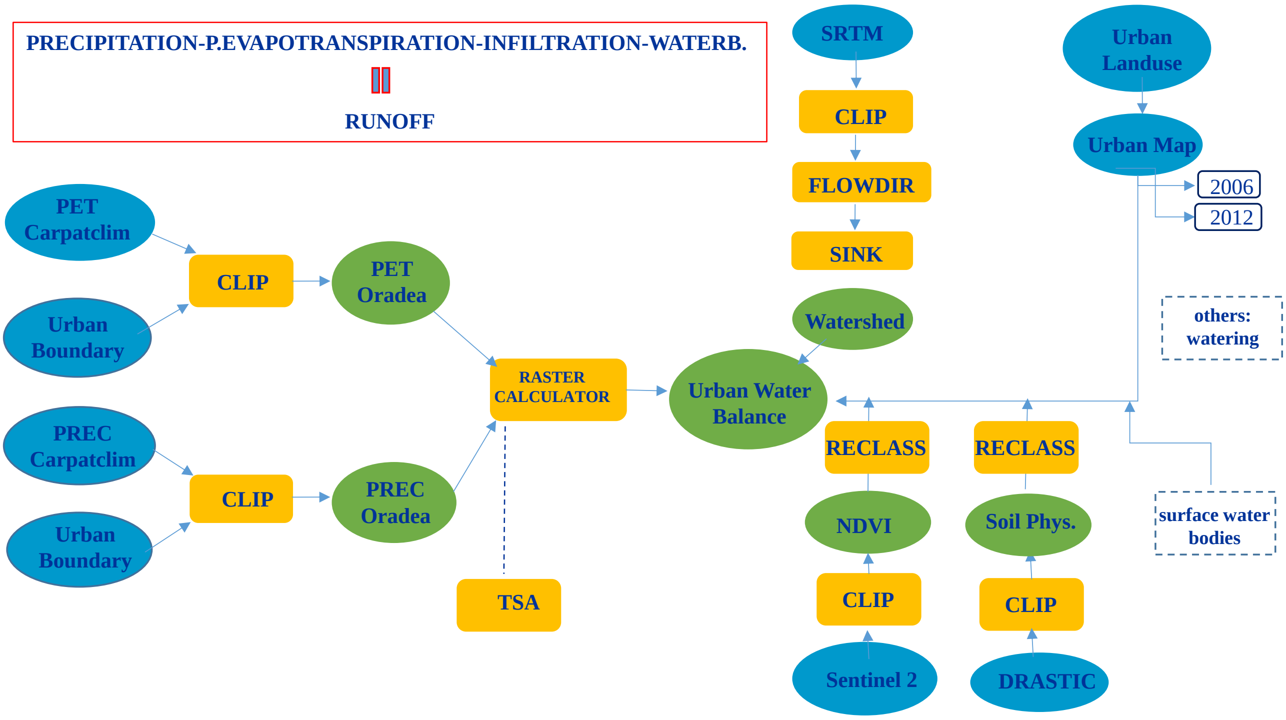

Figure III.1. Spatial Decision Support Tool in Urban Hydrology

3. Overview of the Workshops Based on the Participants' Feedback

At the end of the trainings, a questionnaire with 30 questions was requested to be filled in. A total of 31 participant experts (one quarter of them working in the field of urban water management) filled in the questionnaires with a possibility to comment on their answers. Specifically, the following questions were asked in the questionnaires:

1. Prior to the course, the organization of the training was good.
2. This is the first time for me learning about integrated urban hydrology.
3. Urban hydrology management is important for the Tisza river basin management.
4. The manual covers most of the sectors that play role in an integrated UH management.
5. The guideline covers most of the hydrological issues, which are relevant to the UH management of Debrecen and Oradea in the Tisza river basin.
6. Debrecen is an appropriate reference city to cover the UH problems of the Tisza river basin
7. Oradea is an appropriate reference city to cover the UH problems of the Tisza river basin
8. The group training was well-organised. I have received appropriate support during the group training.
9. The group training duration was appropriate.
10. The level of the training was appropriate.
11. I have learned good practices of IUHM.
12. I have learned new UH management practices.
13. The group exercises were useful for my field of interest.
14. The training was useful to reinforce cooperation with sectors in water management.
15. The training extended my knowledge of urban hydrology management in the Tisza river basin.
16. I work in the field of urban hydrology.
17. The hands-on training was well-organised. I have received appropriate support during the hands-on training.
18. The hands-on training duration was appropriate.
19. The level of the hands-on training was appropriate.
20. The practical exercises were useful.
21. The course extended my knowledge of input data sources for urban hydrology modelling.
22. I have gained sector-specific or practical skills relevant to my current job and professional development.
23. I have improved my competence in the use of Information and Communication Technology tools.
24. You have used the interpreted Earth Observation data prior to the training.
25. You will likely use EO data in your further work.
26. You have used the interpreted Open GIS platform prior to the training.
27. You will likely use Open GIS platform in your further work.
28. I will recommend this training to a colleague.
29. I am planning to share my experience and the lessons learned at my home institute.
30. Please specify what the key message of the training was for you.
31. Please specify lessons learned at the training from your point of view.

The first 29 questions should be answered in the following way: 0% completely disagree, 100% completely agree. Specifically, the answers given to the 29 questions listed are summarized in the following figure (Figure III.2.).

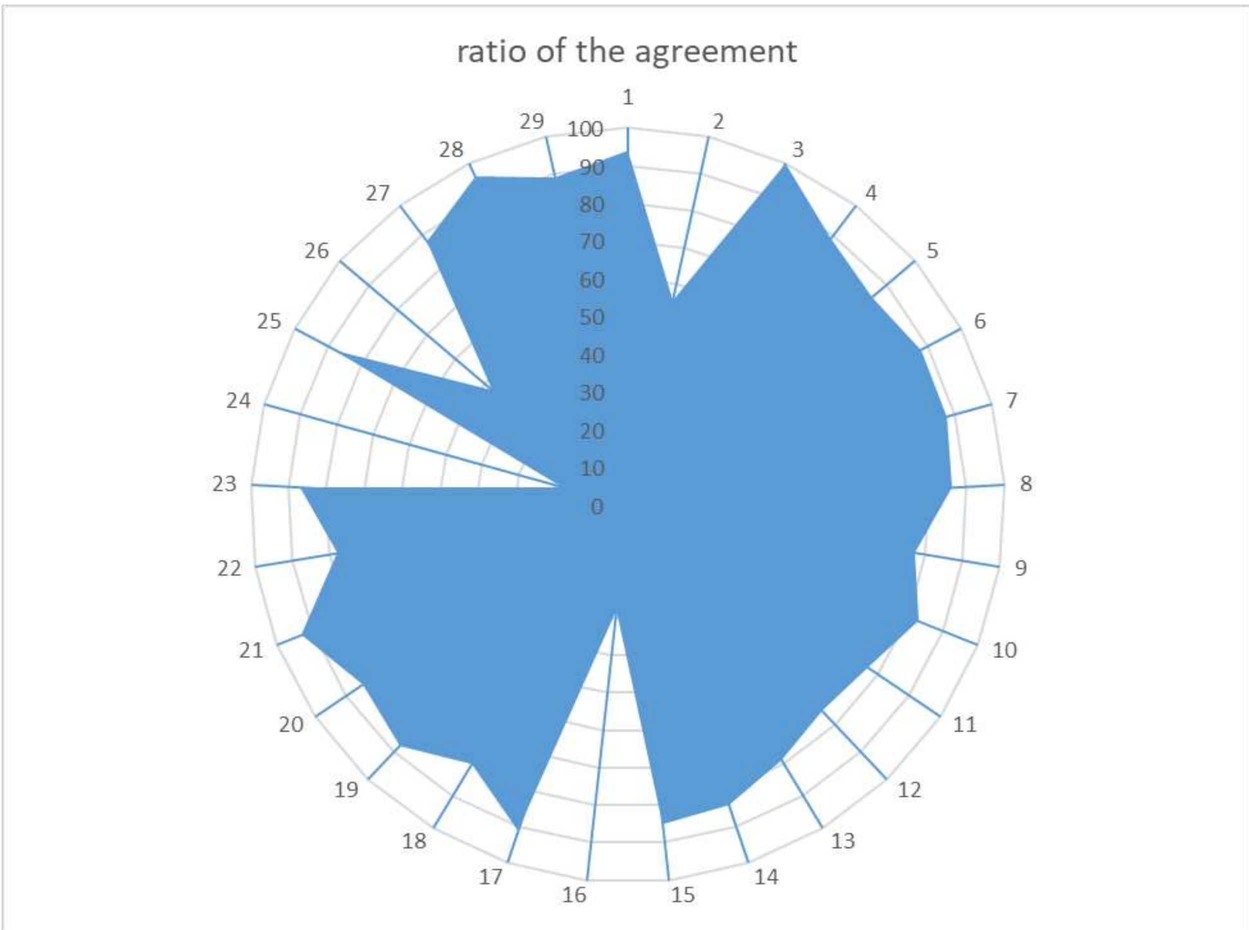

Figure III.2. Answers to the First 29 Questions

To summarize, in general, based on the feedback, most of the experts were satisfied with the organization of the trainings and declared that urban hydrology is an important issue in integrated urban water management. Participants also agreed that the cities identified for test urban sites represent middle-sized cities properly. Group work activities, hands-on trainings were also considered very useful and the level of the activity was appropriate, but the time for some exercises and hands-on trainings was short to discuss topics in more detail within group activities. There is a fairly good agreement on that the experts learned about new and utilizable urban hydrology management practices and extended theory knowledge on urban hydrology management. Earth observation data and the presented GIS methodology were relatively new for the audience and were considered to be utilized in their future work. According to the remarks, the key messages were that remote sensing, open platforms, several data sources as well as GIS datasets are available to public for use in urban management. Lessons learned were also identified by the participants: most of the UWM tools presented are complex integrated practical decision-making and problem solution tool in UWM.

4. Conclusions and Key Messages of the Workshops

Urbanization has been accelerating all over the world and this process is steadily increasing. The sustainability of an integrated river basin management is thus fundamentally dependent on holistic understanding of the elements of urban hydrological systems and the inter-relationships between sectors, and on planning our cities accordingly to improve the quality of life of their inhabitants.

Integrated urban water management requires holistic, integrated approach to fill the gap between urban planning and water management and even between different water sectors, to understand different interests and aspects of water planners in a city. There is a lack of educational programmes and teaching materials in the field of integrated urban water management are not available. Conventionally, parts of urban water management are discussed and taught in many disciplines separately: engineering, natural and environmental science, nature conservation etc. As a result, communication between water experts from different fields of urban planning is inadequate, which is a great barrier in joint collaboration and integrated measures in the field of sustainable urban water management. The Manual, the Guideline and the teaching materials for the workshops developed within WP4.4. in the JOINTISZA project provide a holistic framework to merge knowledge on different water sectors in the city. A detailed theoretical background of IUWM was developed in the Manual on the ground of a multidisciplinary task. Besides the background, case studies and a possible spatial decision support system were provided as an example for IUWM in the Guideline. Nevertheless, all knowledge – in general – cannot be capitalized on without knowledge transfer and trainings. The developed computer based hands-on training and interactive group training materials can be an inspiring fundamentals for capacity buildings for participating water experts and stakeholders from different water sectors with specified focus on 'water' in the city. Encouraging stakeholders in participation and facilitating stakeholder engagement is also very important and challenging issue, since it is a vital need to have experts and stakeholders from all parts and sectors of urban water management. The result of the trainings was that by using the training materials experts can learn the fundamental relationship within urban water management in order to help them understand consideration of other sector needs and interests during their planning process.

Certainly, the Manual, the Guideline and training materials focus on the Tisza river basin, providing an international scale basis for UWM. In the future, more efforts and work shall be done to implement IUWM on country based specifications, harmonizing with local organizational and legislative background with regard to the language of a certain country in order to find the best fit of IUWM in urban planning and decisions.

Abbreviations

AHP	Analytic Hierarchy Process
BAT	Best Available Technology
CC	Climate Change
EO	Earth Observation
FAFSEM	Faculty of Agricultural and Food Sciences and Environmental Management
GIS	Geographical Information System
GWP CEE	Global Water Partnership Central Eastern Europe
IUH	Integrated Urban Hydrology
IUHM	Integrated Urban Hydrology Management
IUWM	Integrated Urban Water Management
IWEM	Institute of Water and Environmental Management
IWWM	Integrated Waste Water Management
LIDAR	Light Detection and Ranging
NASA	National Aeronautics and Space Administration
NGO	Non-Governmental Organization
SSDS	Spatial Decision Support System
UH	Urban Hydrology
UHM	Urban Hydrology Management
USWM	Urban Storm Water Management
UWM	Urban Water Management
WWT	Waste Water Treatment
WWTP	Waste Water Treatment Plant

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