D.T3.4.3 NATIONAL LEVEL POLICY RECOMMENDATION DISCUSSION PAPER - GERMANY: ADAPTATION TO CLIMATE CHANGE THROUGH THE USE OF RAINWATER AND RECYCLED WATER

Subtitle

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Content

1. Introduction

Cities across the world are facing water supply challenges due to increasing demand, droughts, groundwater depletion, water quality deterioration, aging infrastructure and impacts of climate change. Climate change is increasingly becoming a water crisis - also in Germany.

The sustainable and efficient use of water resources is becoming more important than ever. Prolonged droughts, restrictions on irrigation and the temporary collapse of the drinking water supply in some German communities in the last three to four years are just a few examples. More than 40% of German forests are affected by damage caused by the prevailing droughts of recent years. At the same time, agricultural yields have decreased by about 20% compared to the previous years. Never before have so many German communities called for a more efficient and economical use of water or put a ban on irrigation and other uses. Some communities even had to be supplied with water by tankers due to the collapse of the water supply.

Also, more frequent and extreme rainfall events are leading to an increasingly hydraulic overloading of the combined sewers in cities resulting in serious damage from extreme floods. In its Natural Hazards Report 2020, the German Insurance Association (GDV) estimated the damages caused by forces of nature (storms, hail, floods, heavy rain) to approx. 2.6 billion euros in 2019, of which 500 million euros alone resulted from damages caused by floods and heavy rain[1].

All these impacts should be seen as a wake-up call by state governments and policy makers to eventually effect a paradigm shift in the water management, away from the linear flow of resources and towards a circular water management to close the local water cycle and conserve the natural water resources. As part of the circular water economy and to meet future water demands, rainwater harvesting and water recycling should become an integral part of the overall water resources management in Germany.

Many cities meet their water demand by importing water from surrounding regions, either due to scarce local water resources or very high water demand. The (decentralised) reuse of wastewater for different applications is a sustainable way to deal with wastewater in cities instead of its centralised treatment in wastewater treatment plants and subsequent discharge into water bodies. The challenge is to manage wastewater in such a way as to produce safely reclaimed water and by-products for reuse.

Cities need also to become greener to improve the urban climate and quality of life. Large amounts of water are also needed to irrigate open green spaces. The use of rainwater or recycled wastewater for irrigation and other domestic applications is economically feasible and is becoming essential, as the impact of climate change on the water cycle increases. The construction of a large number of rainwater cisterns in urban areas provide for a large retention volume and at the same time protect against floods during heavy rains.

The presence of blue-green infrastructure offers the opportunity to experience nature and enhance knowledge and awareness of nature conservation. The goal is urban resilience, which aims at addressing various societal challenges in a resource-efficient and adaptable way, while providing economic, social, and environmental benefits.

Water supply and sanitation need to become more resource-efficient and resilient, enabling a shift away from the pure wastewater disposal to more closed water cycles through water reuse.

[1] https://www.gdv.de/de/zahlen-und-fakten/publikationen/naturgefahrenreport

2. Analysis

The water infrastructure in Germany is in need of rehabilitation and renewal with an expected high capital expenditure. Climate change is causing more frequent flood and drought events. Falling groundwater levels are also causing the urban vegetation to dry out, whereby cities heat up as a result effecting higher mortality, especially among people with cardiovascular and respiratory diseases. Heavy rain, floods, drought and heat are extreme events that will increase in the future. Climate, society, environment and the economy are recognisably changing, thus giving rise to major concerns. The challenges are immense.

The growth or shrinkage of regions and cities require new solutions to deal with all available resources such as land, water, building material, energy, fauna and flora. How can we make living spaces and habitats more liveable, sustainable, safe and future-oriented, and at the same time guarantee the public services for the population? Policies should also actively support awareness raising for the sustainable use of water. This requires the establishment of an interdisciplinary, integrated water resources management in the federal states and municipalities at a national level.

Within the context of climate change and climate adaptation, the infrastructure should be preferably transformed into a flexible, efficient, resource-conserving as well as economical water infrastructure. High-performance and efficient water resources management infrastructures create the basic requirements for a safe and healthy living in cities and municipalities and guarantee the preservation and further ecological development of the natural water system. Traditional approaches cannot be simply further perpetuated in the future. These have to be improved, supplemented or replaced by new, future-proof solutions as needed.

As part of the discussions within the German Strategy for Adaptation to Climate Change and the National Water Dialogue of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Environment Agency, a number of operational goals have been already identified to make Germany more resilient to climate change and its impacts[2].

The impacts of the changes in rainwater distribution and water availability require fundamental changes in the water resources management in Germany. The conventional water infrastructure cannot continue in the currently existing structures, but requires a re-orientation with combination solutions and a sustainable use of the water resource.

Cities and municipalities should become more resilient to climate change and other challenges. Increasing competition for land in municipalities calls for a multifunctional land use and the creation of synergies using cross-sectoral coupling potentials. The goal should be to ensure the availability, quality and quantity of water for all sectors in an ecologically, economically and socially compatible manner.

The implementation of decentralised measures for rainwater and greywater management and reuse can increase water security and mitigate the problems associated with droughts, floods and heavy rain events, which are increasing in Germany, but also in other European countries.

[2] National Water Strategy (2021) Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). June 2021
https://www.bmu.de/pressemitteilung/bundesumweltministerin-schulze-legt-nationale-wasserstrategie-vor/

3. Legal framework

3.1. At National level

- Due to its federal structure, water law in Germany falls under the jurisdiction of the individual federal states (Länder). However, the laws at the federal level provide the framework and legal basis for the laws of the federal states. To date, there are no national guidelines for non-potable water quality and water reuse. Rainwater management is also not regulated at national level. Detailed information on the legal framework, policies and competences related to rainwater management and water recycling in Germany can be found in **D.T3.4.2: "Country report on the assessment of the national level legislative and policy frameworks"**.
- To date, many countries, including Germany, still lack national requirements for the quality of recycled water, especially for applications that go beyond agricultural reuse. In other countries, regulatory frameworks are available but limited to reuse for irrigation. There are increasingly legal regulations and standards which are set to target residential applications such as the use of recycled water for toilet flushing, gardening and other non-potable uses which don not require a drinking water quality.
- The Federal Water Act (WHG)[3] constitutes the main part of the German water law. It contains provisions on the protection and use of surface water bodies and groundwater, as well as regulations on the development of water bodies and water management planning. Flood protection and flood control measures are also anchored in the Federal Water Act, which contains the underlying principles to keep flooding under control. According to the Federal Water Act, rainwater should be infiltrated close to the site, used for irrigation or discharged directly into a water body via the sewer system, without it being mixed with wastewater. In most federal states, the infiltration of "harmless" rainwater is generally possible without a permit (permit-free infiltration). The discharge of rainwater into the sewer system is only permitted in exceptional cases.
- Germany is considered a water-rich country. Therefore, the use of wastewater as a resource has so far not been a goal within the overall water resources management in Germany. In some regions, however, public, industrial and agricultural sectors compete for the limited groundwater resources. The current legal framework limits water reuse on Germany. The barriers for water reuse are the lack of legal and organisational requirements, open questions about environmental and health risks as well as the question on the costs for suppliers and consumers.
- Water reuse for agricultural irrigation is also not regulated. There is also no defined legal framework for industrial water reuse. For greywater recycling and reuse mandatory regulations also do not exist. However, treated wastewater is an integral part of the water cycle. The aim is to produce service water in different qualities and quantities at competitive prices.

[3] https://www.gesetze-im-internet.de/whg_2009/

3.2. At European level

- At the European level, the European Water Framework Directive (WFD)[4] pursues in its major goals in Article 1 the promotion of the sustainable use of water resources and the reduction of the impacts of floods and droughts.
- In some European countries, especially in the Mediterranean regions, an overexploitation of the water resources is taking place. This is particularly a result of the high demand for water in irrigated agriculture. The leader in water reuse within the EU is Spain, where a legal framework has been in place since 2007. Here, 75% of the treated water is used in agriculture. Urbanisation and economic activities also contribute to this overuse. The impacts of climate change and the expected increase in the water demand for the different sectors will lead to increasing problems regarding the availability of water resources in Europe.
- The introduction of the EU Regulation 2020/741 on minimum requirements for water reuse in the European Union, which will be valid from June 26, 2023 is a first step to stimulate and facilitate water reuse in the EU[5]. The regulation provides for a harmonised approach regarding minimum requirements for reference pathogens and risk management for the use of treated wastewater for agricultural purposes. This implies that, for the first time, Germany will also have to meet minimum requirements for water quality, risk management and the safe reuse of treated wastewater.
- In this context, it should also be noted that water reuse as an alternative water supply option to address water scarcity in the EU had already been acknowledged in the 2012 Commission communications "A Blueprint to Safeguard Europe's Water Resources" (COM(2012) 673)[6] and in "Closing the loop – An EU action plan for the circular economy" (COM(2015) 614)[7].

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

[5] Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse. Official Journal of the European Union 5.6.2020. L 177/32. https://ec.europa.eu/environment/water/reuse.htm

[6] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Blueprint to Safeguard Europe's Water Resources. COM/2012/673. Brussels 14.11.2012 https://www.eumonitor.eu/9353000/1/j4nvhdfdk3hydzq_j9vvik7m1c3gyxp/vj4mtdb7jfxy

[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Closing the loop - An EU action plan for the Circular Economy. COM/2015/614. Brussels 2.12.2015 https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:52015DC0614

4. Targeted analysis of results

SWOT and Pestle analyses with evaluation criteria to assess rainwater harvesting and (grey) water recycling systems and their integration into existing water infrastructure were made.

SWOT ANALYSIS

STRENGTHS	*OPPORTUNITIES*
• *General availability of rainwater and greywater for reuse* • *Reduced dependency on external water resources (self-sufficiency)* • *Contribution to climate change mitigation* • *Offer a multitude of environmental, social and economic benefits* • *Reduced water costs* • *Availability of engineering expertise and best practices at national level* • *Existence of affordable and mature technologies suitable for local conditions* • *Public awareness and acceptance* • *Pro-active civil society (NGOs)* • *Existence of institutional structure* • *Strong water governance and decision support systems*	• *Secure water supply* • *Water conservation strategy in urban areas* • *EU Funding* • *New water markets and job opportunities* • *Cost recovery of water-related services* • *Decentralisation of political power* • *Enhanced environment and economy* • *Buildup of regional educational networks which offer training opportunities* • *Future implementation of the EU Regulation on minimum requirements for water reuse (for irrigation)* • *Public utilities as role models* • *Societal trends (increased environmental awareness, sustainability, energy-efficient buildings)* • *Positioning of the topic in the context of energy transition, decentralisation and energy efficiency aspects*
WEAKNESSES	*THREATS*
• *Absence of national legislative structure for rainwater management and water reuse* • *Lack of nationwide economic incentives and subsidies* • *Competition among the different water uses and sectors* • *Inadequate infrastructure and distribution networks* • *Requirement of a dual pipe system* • *Additional maintenance expenditure*	• *Climate change* • *Proper operation and maintenance of rainwater harvesting and greywater recycling systems* • *Adversary campaigns of the water utilities and lobby organisations* • *Negative studies and reports on water reuse (e.g. hygiene considerations)* • *Reduction in the savings potential in dependency of wastewater costs*

PESTLE ANALYSIS

POLITICAL ISSUES	*ECONOMIC ISSUES*
• *Government policies and special water tariffs for the different water uses* • *State support through subsidies* • *Inclusion of stakeholder involvement, public participation and open communication* • *Expansion of the water strategies to include comprehensive circular economy concepts*	• *Investment costs* • *Operation & maintenance costs* • *Water pricing* • *Financial resources* • *Prevailing economic factors* • *Absence of loans/subsidies*
SOCIAL ISSUES	***TECHNOLOGICAL ISSUES***
• *Socio-cultural and religious issues* • *Public acceptance* • *Public education & public awareness* • *Income status, education, living standards* • *User needs and demands* • *Minimisation of health impacts and risks*	• *Integration of decentralised technologies in the existing water infrastructure* • *Performance/Efficiency of water reuse treatment technologies* • *Technological innovations* • *Alternative and new technologies for new water markets*
LEGAL ISSUES	***ENVIRONMENTAL ISSUES***
• *Presence/lack of comprehensive national guidelines, regulations and public policies for rainwater management and water reuse* • *Tax system & water/wastewater pricing tariffs* • *Subsidies/funding* • *A coherent water reuse management* • *Stakeholder cooperation*	• *Environmental pollution and impacts* • *Well-defined water reuse criteria* • *Prevailing environmental and nature conservation laws* • *Risk assessment*

5. Policy recommendations

The Federal Association for Rainwater and water Recycling (fbr) has been advocating for more than 25 years, for appropriate measures for rainwater management and water recycling with the various components to preserve, improve and strengthen the blue-green infrastructure at property and district levels in cities and municipalities. We thus derive the following policy recommendations from the diverse practical know-how of our association.

Policy recommendations can already be derived from the 17 Sustainable Development Goals (SDGs) of the United Nations, in which water management is referred to in 6 relevant goals. In particular, SDG 6 "Clean Water and Sanitation: Ensure access to water and sanitation for all" stands in the foreground.

The following policy recommendations contribute to a resilient water infrastructure and protection of the water resources in cities and municipalities. The sustainable and future-viable municipality minimises resource consumption, closes cycles and connects ecosystems, uses plants (green) and water (blue) for a liveable environment. For this, rainwater harvesting and water recycling are key resources.

From today's perspective, an active and a consistent transition in dealing with water in the urban land-use is essential to counter the effects of climate change.

Issue 1: Integrating rainwater harvesting and greywater recycling (service water use) in the overall water resources management
Recommendation: - Incorporate decentralised water sources, such as rainwater and recycled water (service water) into the efficient water supply system; - Incorporate the retention, storage and utilisation of rainwater in the existing water supply as an integral part of the future water policy strategy. For construction sites, rainwater cisterns should be stipulated as part of the onsite property drainage, to store and reuse rainwater in the building. At district level in cities and municipalities, rainwater retention options should be considered and integrated. The existing water infrastructure in buildings should be made available for the integration of service water (Water Efficiency Ready). For new constructions or complete renovations of existing buildings, the legal basis for the (mandatory) construction of a dual-pipe system for service water use in buildings (rainwater and greywater) should be laid down. Toilets and urinals as well as washing machines in buildings should basically be operated with service water.
Rationale: Hardly any city can supply itself with high-quality drinking water for all use purposes merely from own local water resources. In view of the increasing incidence of droughts (water shortages), the "water supply" as a public service becomes particularly important. In this context, rainwater has become one of the most important alternative resources. Rainwater must be retained and stored where it falls and integrated into the water supply of cities and municipalities. There is a significant potential to supplement the water supply by using rainwater and recycled greywater. This is particularly true for months with high amounts of precipitation, which often occur in the dry months, during which rainwater can be stockpiled and used over the year. This will conserve the groundwater resources and buffer and store rainwater during heavy rain events.

Particularly in multi-storey residential buildings and dense urban centers, greywater reuse is also a viable option. Greywater is recycled and safely reused throughout the year for different applications such as toilet flushing, washing machines, irrigation, cleaning and firefighting. This can save 30 - 50% of the water used in buildings.

Issue 2: Rainwater retention to prevent local floods and impacts of heavy rainfall

Recommendation: In cities and municipalities:

- the retention and storage of rainwater should be implemented as a priority measure of rainwater management on properties;
- where possible, underground storage facilities should be constructed on public properties and use applications examined;
- the provision of water for firefighting should be supplemented by rainwater retention systems.

Rationale: Heavy rainfall events in urban areas can quickly lead to overloading of the existing water infrastructure in cities and municipalities. Sealed surfaces aggravate the problem and increase flood risks. Rainwater retention, combined with other measures of rainwater management such as infiltration, evapotranspiration or utilisation significantly contribute to reducing the impacts of heavy rainfall and floods. Since heavy rain events often occur during the summer months, valuable rainwater can be buffered locally and made available during dry periods, thus mitigating water scarcity as part of the climate change adaptation. The mere discharge of rainwater into surface water or the sewer deprives the area from this precious resource. A well-combined rainwater retention system with its flexible components, in combination with the existing systems, promotes the blue-green infrastructure in cities and municipalities (sponge city effect).

Rainwater storage systems used throughout the year reduce rainwater flow and runoff peaks (flood protection) and help protect surface and groundwater reserves during dry periods. Retaining rainwater in urban areas, instead of its discharge into the sewer or water bodies offers more environmental benefits and protection.

Issue 3: Conserve resources and combine water and energy efficiency
Recommendation: ▪ For non-potable water applications in multi-storey residential constructions or in municipalities, trade and industry, priority should be given to service water systems (rainwater/greywater); ▪ Heat recovery from service water systems should be exploited; ▪ Service water systems should be used for cooling and air conditioning; ▪ Potential synergies between water and energy should be identified and implemented in the urban and building planning.
Rationale: The drinking water demand as well as the amounts of generated wastewater in buildings can be significantly reduced through greywater recycling. This also results in continuous savings in the drinking water of approx. 30 - 50%, independent of the season. At the same time, wastewater is equivalently reduced. Combined with heat recovery, a significant amount of thermal energy can be recovered from wastewater. An effective, so far largely unused potential for air conditioning in buildings, are water-based cooling systems, which are operated with rainwater (adiabatic cooling). The use of the soft rainwater eliminates the need for softening or desalination processes. Rainwater-fed cooling and air-conditioning systems can significantly reduce energy consumption compared to the conventional air-conditioning. In addition, investment costs as well as material and maintenance expenditure are reduced. Wastewater also contains essential nutrients (nitrogen, phosphorus), which can be recycled and reused. Technologies to improve resource efficiency have been successfully tested and introduced in the technical regulations as resource-oriented sanitation systems (NASS)[8]. The use of these resources also requires new organisational and planning cooperation as well as financial support to further develop and introduce these technologies, above all against the background of global demand for resource-efficient cities of the future.

Issue 4: Create legal framework and financial incentives
Recommendation: ▪ In the Federal Water Act (WHG), the present path of wastewater disposal should be abandoned in line with the Circular Economy Act (KrWG) to give priority instead to avoiding, reducing and recycling of wastewater; ▪ During urban land-use planning, the local rainwater management and water recycling with their various modules should be basically taken into account during the planning process; ▪ A legal framework should be created for the integration of rainwater cisterns into the property drainage in order for states and municipalities to have the appropriate instruments at their disposal;

[8] DWA Working Paper **DWA-A 272E (2014)** "Principles for the planning and implementation of New Alternative Sanitation Systems (NASS)". The German Association for Water, Wastewater and Waste (DWA), Hennef. https://webshop.dwa.de/de/dwa-a-272-neuartige-sanitarsysteme-6-2014.html

- Tariffs for stormwater discharges into the sewer system should be anchored in the wastewater fees regulations according to the polluter-pays principle;
- The dual-pipe network for the separate collection of greywater and blackwater should be incorporated in the building codes.

Rationale: It is imperative to set the right course for the water resources management, which is one of the largest energy consumer and significant CO_2 emitter in a municipality, to achieve a greater resource efficiency. Cisterns, retention systems, and water recycling facilities should be laid down in the development plans at municipal level.

The adaptation measures of the water infrastructure require a sufficient and secured financing for the construction and operation of these systems. For the implementation of the different solutions, monetary incentives (subsidy systems, fee adjustments) should also be developed, in order to realise the measures at municipal or property level (private investors).

Issue 5: Remove barriers

Recommendation: In order to remove barriers, legal, financial and administrative measures often contribute to this, such as:

- the adjustment of laws and technical regulations;
- the establishment of necessary working methods such as agility, participation, communication or new planning instruments;
- the provision of sufficient, easily accessible human and financial resources;
- the building of suitable and flexible organisational structures for interdisciplinary and cross-sectoral integrated work.

Rationale: In practice, administrative structures and planning processes are still often unilaterally oriented towards conventional rainwater drainage and wastewater disposal. Therefore, the necessary local targets, administrative processes and rules, as well as human resources in the technical field are often lacking, in order to realise a water-conscious urban land-use in accordance with the applicable planning rules.

Water-conscious urban land-use requires a long-term and complex transformation process which must be supported by a wide range of actors and stakeholders, whereby personal, financial, institutional, professional and legal barriers may be encountered. Barriers can often be easily reduced through early discussions and networking among stakeholders. However, there are also barriers that require a joint, long-term and strategic approach.

Issue 6: Networking stakeholders and creating transparency
Recommendation: ■ Networking, targets and concepts should be developed and the right course should be set in order to drive forward the planning processes for new constructions and refurbishment projects quickly and productively. A crucial success factor is the early coordination and close and permanent cooperation from the framework to object planning; ■ The federal and state governments should adapt the legal framework for urban, infrastructure and project planning to ensure effective and transparent participation processes. Cities and municipalities are called upon to provide for appropriate administrative and decision-making structures, qualified personnel and suitable communication formats (e.g. round tables, zero-phase concepts), which have proven very successful in practice; ■ The framework for a successful and water-conscious urban land-use should be developed jointly with the stakeholders and communicated near to the citizens (citizen-oriented). Simplicity, transparency and practicality are recommended instead of over-regulation.
Rationale: Water-conscious urban land-use needs a good cooperation between all involved parties. The administrations of urban and open space planning, water resources management, urban drainage and green space maintenance are well advised to coordinate closely at management and technical levels. The interests of the municipal enterprises, politicians, investors, interest groups and citizens should be involved early and comprehensively. Integrative planning, communication and decision-making structures are very suitable to jointly develop goals, boundary conditions and solutions. For a sustainable water resources management, it is indispensable that existing data with regard to water resources and their quality, as well as to discharges from wastewater treatment plants and rainwater discharges are made transparent for the public without any barriers. Transparency also applies to costs and environmental impacts.