DVGW Innovation Programme Water

Action agenda for the future of water management

Roadmap 2030

DVGW DWA

Acknowledgement

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The roadmap and its focus areas

The Roadmap 2030 provides the action agenda for the future of water management in Germany. It highlights requirements and challenges that our water industry will face in the long term. It considers societal, political and technological changes and describes priority measures that are needed to adapt and safeguard the future of water management. The Water Management Roadmap 2030 is directed towards diverse stakeholders working within water and wastewater companies, governmental institutions, industrial and agricultural sectors as well as the wider water management community.

The Water Management Roadmap 2030 is the result of an intensive dialogue between representatives from the German Technical and Scientific Association for Gas and Water (DVGW), the German Association for Water, Waste and Wastewater (DWA) and the German water industry. The development of the Roadmap involved the following four step process:

1. Forecast“: trends and drivers of change,
2. „Vision“: a realistic, positively oriented, picture of the future,
3. „Backcast“: a backward projection from the vision to the present (implementation)
4. „Measures (agenda)“: a description of today‘s need for action up to 2030.

The „Vision 2100 - Vision of a water conscious society“ describes the ambition to achieve environmentally friendly, socially responsible, user-oriented action.

The water industry is convinced that clean water can only be made available to everyone in sufficient quantity and quality in the long term in a protected environment.

Six focus areas were identified from the ‘Vision 2100’ resulting in the ‘Roadmap 2030’ in the form of an ‘action agenda. The objective of these measures is to set the course for a ‘water transition’ where the necessary enablers are available now and in the near future. Following this path will result in visible breakthroughs achieved by 2030 at the latest, which will advance our water management towards the Vision 2100 in the following decades.

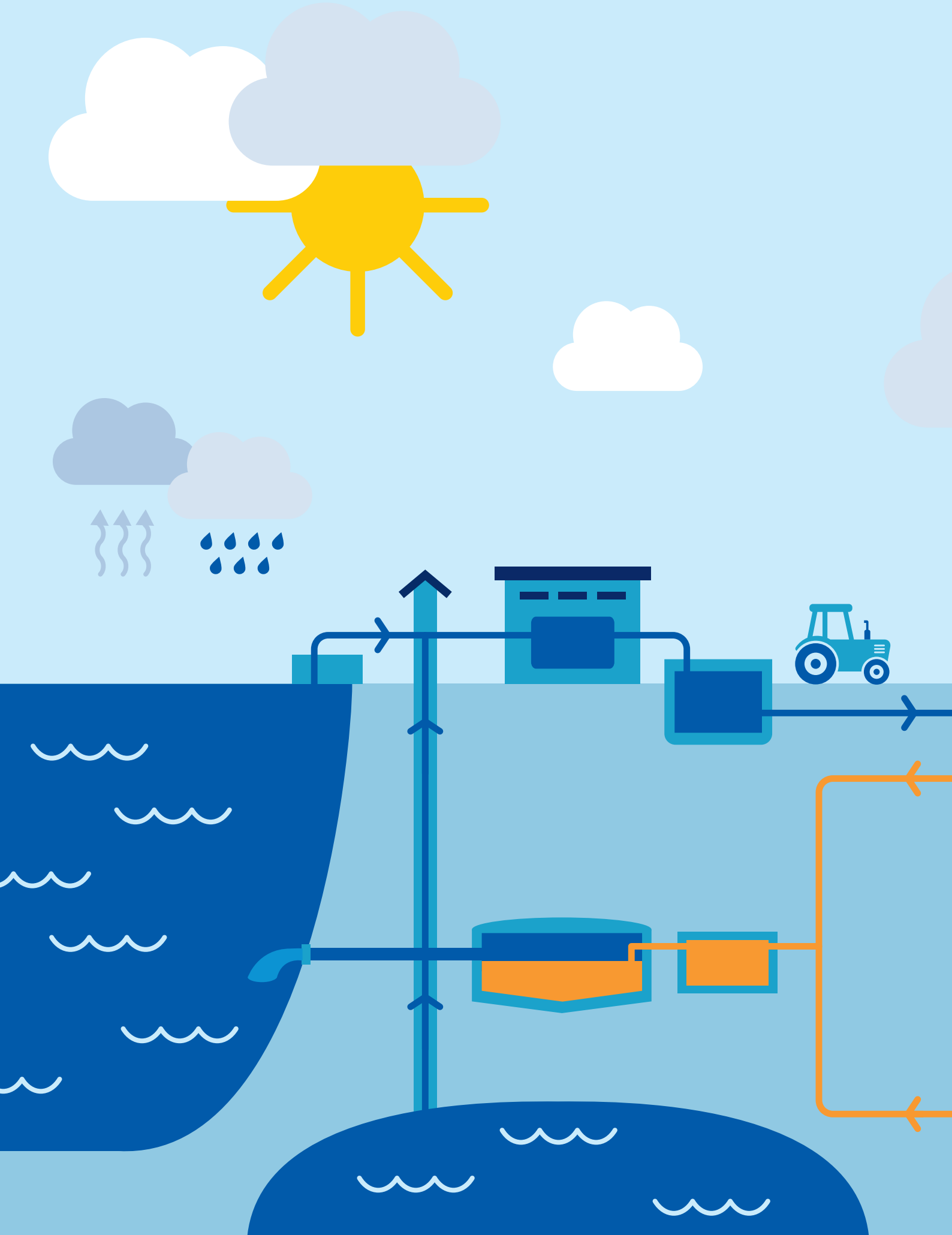
Many of the measures in the Water Management Roadmap 2030 have corresponding actions in the National Water Strategy (NWS) of the Federal Government, and in the work programmes of the federal states. We understand that these water

Vision 2100 was published in spring 2023.

management goals can often only be achieved through cooperation between operators, companies, legislators and state institutions.
The prerequisites for the success of the 'water transition' include secure long-term financing of the measures and sufficient personnel capacities across all stakeholders.
To facilitate this, Government funding programmes will need to be established.

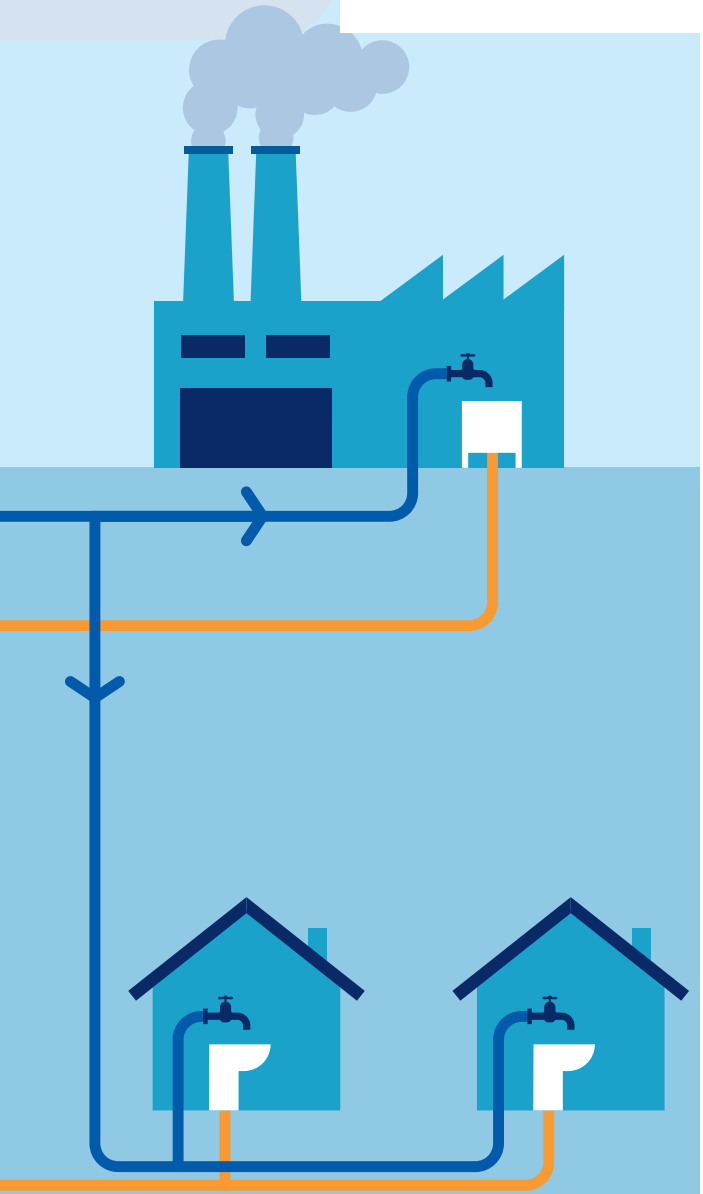
The Roadmap 2030 and it's measures are based on the compilation of broad technical expertise, practical perspectives and cutting edge research results. The Roadmap 2030 is intended to contribute to the joint implementation of the water transition to future-proof water management in Germany.

The fields of action of the Water Management Roadmap 2030



Focus area 1

Sustainable use of natural water resources



Background

In Germany, we are used to having high quality water available in any quantity and at any time. However, the last few years have shown, that the availability - at least in some regions – has been subject to restrictions at times. The future effects of climate change, specifically the increase in prolonged periods of drought in combination with temporarily falling groundwater levels coupled with a higher demand for water, will lead to a reduction in water levels or the drying up of water bodies in phases resulting in consequences for the availability of natural water resources. The risk of overuse of these resources may increase significantly on a regional and/or seasonal basis. For this reason, all water uses must constantly adapt to the changing conditions.

Natural water resources and the natural landscape water balance must be preserved for future generations both in terms of quantity and quality. Resources must not be overexploited. Therefore, it is necessary to improve the forecasting capability of important water management budget variables in river (sub)catchment areas and aquifers. Water balances must be drawn up in accordance with a standardised nationwide methodology. The methodology must consider available and usable water resources, as well as (expected) water withdrawals and water law permits for existing withdrawals of all user groups. This will require comprehensive and transparent records of all abstractions by all user groups. Ultimately, available and usable water must be compared to abstractions and future water requirements in river (sub)catchment areas and aquifers to derive the water balances. If abstractions and future water requirements exceed the usable natural water in the corresponding hydro(geo)logical units, use is no longer sustainable.

The holistic accounting is based on nationwide standardised procedures and conventions to determine the usable water resources including groundwater recharge and water demand.

There are currently many assessment methods used for water budgeting in Germany. This means that a national overarching water management assessment is not currently possible. National assessment methods need to be developed. These can then be used by authorities as legal enforcement tools as well as for regional / supra-regional water quantity management including for the planning of necessary water infrastructure. Furthermore, prioritization criteria are required, for example, on how to proceed in the event of regional water shortages and how to deal with temporary, as opposed to permanent, water shortages.

Incentives for the efficient use of natural water resources and corresponding requirements for operators‘ facilities will also help to prevent the overuse of natural water resources. This includes reducing leaks in pipes, careful use of drinking water by all user groups, efficient irrigation of agricultural land or the substitution of natural water resources. Where appropriate technical standards are not yet available to the required extent, they must be developed.

Overall, in the future, water quantity management must move away from administrative boundaries towards the river (sub)catchment level. The existing cross-border and inter-municipal cooperation should be strengthened accordingly.

In Germany, around 4,300 companies and public water supply companies have their own water extraction facilities. Approximately 400 water authorities are responsible for the enforcement of water law authorisations for abstraction.
The procedures for public water supply often result in uncertainties for all parties involved with long discussion periods, often lasting more than 10 years and involving legal proceedings. There is an urgent need to simplify and speed up such procedures.

Based on the aspects above, the following measures have been identified to achieve a sustainable use of natural water resources

1.1 Improve forecasting capability and capacity to act towards a flexible and future-oriented management of natural water resources
1.2 Develop procedures for the management of natural water resources including in situations of scarcity
1.3 Safeguard natural water resources for future use

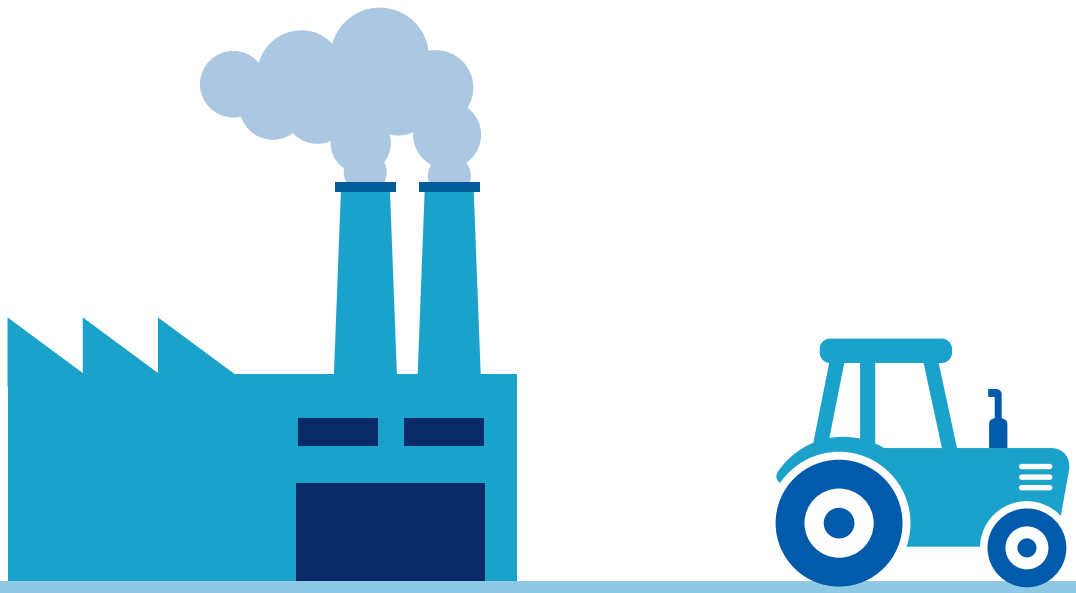
Measures in focus area 1

1.1 Improve forecasting capability and capacity to act towards a flexible and future-oriented management of natural water resources

Measure	Actors	Timeline
1.1.1 Development of a guideline for a national standardised methodology for determining variables for the landscape water balance,including groundwater recharge, water supply, usable water supply and water demand,as well as subsequent use in enforcement	LAWA, DVGW, DWA, Water authorities, all waterusers, experts	2023–2025 from 2026
1.1.2 Development and maintenance of a resource information system at the river catchment level with data related to groundwater recharge, water availability, usable water supply, and water withdrawal of all users	BMUV, UBA, LAWA, DVGW, scientific, Institutions	by 2024 then ongoing
1.1.3 Strengthen governance for water quantity management at the river basin level	LAWA, BMUV	until 2030

1.2 Develop procedures for the management of natural water resources including in situations of scarcity

Measure	Actors	Timeline
1.2.1 Development of a guideline for dealing with water scarcity, including an incentive system for the efficient use of natural water resources	LAWA, BMUV, UBA DVGW, DWA, bdew, VKU	2023–2026
1.2.2 Development of a nationally standardised definition of water parameters for low water and water shortage	LAWA, BMUV, UBA DVGW, DWA	2023–2026
1.2.3 Removing unauthorised groundwater abstractions	BMUV, LAWA, water authorities	2027



1.3 Safeguard natural water resources for future use

Measure	Actors	Timeline
1.3.1 Develop a proposal to simplifying and/or accelerate water law authorisations for public water supply (link to 4.3.1)	bdew, DVGW, VKU thereafter involvement of BMUV, LAWA	2023–2024
1.3.2 Designate priority areas for the future utilization of the public water supply in state development plans	Federal States with support of DVGW	from 2023
1.3.3 Develop cross-sectoral concepts for the efficient use of water and the substitution of natural water resources at the building, neighbourhood and catchment area levels. Update technical regulations as required	DVGW, DWA with the participation of BMUV, UBA, LAWA, industry, agriculture	2026–2030

Clear links to the following topics of the National Water Strategy: 1 Protect semi-natural water regime, ... water scarcity ... conflicting goals (A_1 - A15) and 7 Strengthen efficient administrations, improve data flows (A57 – A62).

Focus area 2

Near natural quality of waters

Background

Of the approximately 9800 managed surface water bodies in Germany, 36.1 percent were classified as having “moderate” status, 33.8 percent achieved “unsatisfactory” status and 19.2 per cent achieve “poor ecological” status. The watercourses that do not achieve “good ecological status”, have problems related to nutrients, fine sediment inputs and organic trace contaminants (including from agriculture) as well as inadequate water body structure.
The chemical status of these water bodies is classified as “not good” throughout Germany.
The reason for this is the (ubiquitous) presence of pollutants in the water bodies. Of the groundwater bodies in Germany, 63.7 percent achieved “good chemical status”, 36 percent achieved a “poor chemical status” and only very few groundwater bodies have not yet been assessed (0.3 percent).
The main reason for groundwater bodies having a “poor” status is due to excessive nitrate concentrations and almost 74 percent of these fail to meet the requirements due to this.

There are still major short comings in the implementation of the Water Framework Directive (WFD) and its daughter directives. These must be eliminated in the medium term. The regulatory gaps that exist between different areas of law (water law, soil protection law, waste law, building law, etc.) must be closed. To reach near-natural water status, it may be necessary to include a ban on certain substances. Combating pollution at the source is needed, as end of pipe solutions are insufficient to remove pollutants even when many purification steps are used. Illegal direct discharges must be subject to severe penalties and diffuse substance discharges, especially from agriculture, must be drastically reduced.

Substances that degrade and do not pollute the water cycle must be used instead of persistent, mobile and toxic (PMT) substances. Agricultural practices that are protective of water, nature, soil and plant health, must prevail and be strictly and consistently monitored. A basic prerequisite to achieve this is that the responsible authorities have sufficient staff and resources for these activities.

Near-natural water courses require appropriate transport pathways for organisms and sediments as well as natural bed, bank and floodplain structures. Near-natural water courses also enable a sustainable and cost-effective supply of drinking water.

Based on the aspects above, the following measures have been identified to achieve near-natural quality of waters

2.1 Establish a national data platform “Substances”
2.2 Adapt existing legal regulations and close regulatory gaps
2.3 Reduce pollution at the source
2.4 Minimise the discharge of pollution from mixed and rainwater into water courses
2.5 Improve of the morphological structures of water bodies

Measures in focus area 2

2.1 Establish a national data platform "Substances"

Measure	Actors	Timeline
2.1.1 National data platform "Substances" containing information and data on substance properties and the evaluation of substances (ecotoxicology, human toxicology)	BMUV, federal centre for trace substances, specialist and approval authorities Responsible authorities, UBA, responsible state authorities	2028

2.2 Adapt existing legal regulations and close regulatory gaps

Measure	Actors	Timeline
2.2.1 Identification of legal options to address gaps between different areas of law (water law, soil protection law, waste law, building law, etc.) and proposals for how these gaps could be closed	DVGW and DWA initiate legal opinion and collect case studies	2023–2026

2.3 Reduce pollution at the source

Measure	Actors	Timeline
2.3.1 Expand water quality monitoring to detect "new" substance inputs that are not yet regulated (e.g. non-target)	Authorities, operators measure and exchange data, DVGW and DWA advise	2023 then ongoing
2.3.2 Establish and strengthen early warning systems (e.g. via bioindicators) and establish appropiate risk management strategies	Authorities, operators (cross-border) DVGW and DWA advise	2024 then ongoing
2.3.3 Reduce pollution at the source and include multi-barrier measures e.g. expansion of industrial pre-treatment and reducing diffuse inputs	Federal government bdew, DVGW, DWA, VKU accompany	2023 then ongoing
2.3.4 Introduce producer responsibility, financing models based on the polluter pays principle	Federal government bdew, DVGW, DWA, VKU support the establishment of a financing model	2023 then ongoing

2.4 Minimise the discharge of pollutants from mixed and rainwater into water courses

Measure	Actors	Timeline
2.4.1 Initiate a study to identify the enforcement deficits	DWA	2030
2.4.2 Drive technical development and follow up with technical regulation, Including in areas beyond water management	DWA	2023–2033

2.5 Improve of the morphological structures of water bodies

Measure	Actors	Timeline
2.5.1 Remove transverse structures in the water course; review of the ecological transport path-ways for organisms and sediments	Water authorities, water maintenance associations and those responsible for water maintenance	2024–2045
2.5.2 Bring watercourses back to their natural status	Water authorities, water maintenance associations and those responsible for water maintenance, DWA	2023–2035 Start short term

Clear links to the following topics of the National Water Strategy:
3 Sustainable management of water bodies... achieve and preserve good status (A21 - A24), 4 Mitigate risks caused by pollutants (A25 - A40) and 7 Strengthen efficient administrations, improve data flows, ... (A57 - A62).

Focus area 3

Water conscious (urban) development

Background

Water conscious settlements are those that are worth living in. The careful use of water is an important component of climate adaptation and generates a great deal of added value for the inhabitants of settlements. Water conscious settlements are climate resilient, energy efficient and have a low CO_2 and water footprint. These settlements are characterised by the use of nature-based and multifunctional solutions for the retention, infiltration and evaporation of rainwater at sewer catchment, neighbourhood and property level.

The natural water balance in our neighbourhoods is often significantly disturbed or altered.
The implementation of water conscious measures in settlements is scarce and often selective.
The competition for space is immense and this is usually only avoided by designating new areas with impervious surfaces which further limit infiltration and increase the consumption of resources. Green roofs and facades are an exception so far, also on public buildings.

Local rainwater infiltration is not required in all bylaws. Rainwater is currently not recognised as a resource, and is not used or stored, but is quickly drained away from settlements. Municipalities striving to create water conscious settlements are hampered by the vast amount of regulation and its associated complexity and legal uncertainty as well as the unclear nature of stakeholder responsibility.

Water conscious settlements are preparing for increasing periods of heat and drought as well as an increased frequency of heavy rainfall events.
To combat this, paved areas must be reduced and a change in the way rainwater is handled is needed. Rainwater must no longer be channelled away from settlements but should be managed as a resource. Water conscious urban development is orientated, among other things, towards the supply requirements of urban greenery, the improvement of the urban microclimate, the restoration of the ecological function of water bodies, and a better management of situations with a scarcity or an excess of water like flood and overflow prevention. Local authorities consistently require localised rainwater management plans in all statutes.

Water conscious urban development has been implemented as a cross-sectorial task and various stakeholders are working together. Planning processes and standards for individual properties and public areas have been developed and a legal framework created.

The services provided by ecosystems established throughout the entire settlement area (residential, commercial, industrial and other utilised areas) contribute to the well-being and health of the population as well as the prosperity and attractiveness of the settlement. In water conscious settlements, water and resource cycles are closed as far as possible. This explicitly includes water reuse, contributing to the preservation of precious raw water resources for drinking water treatment However, this also requires management of the resource at the river basin level, and this can only be achieved if planning includes the surrounding area. This will only be achieved if comprehensive spatial planning becomes the basis for a water conscious transformation of settlement areas.

Local authorities will be required to successively convert neighbourhoods into water conscious settlements. This requires well-trained personnel working for the authorities. Holistic spatial planning includes the property and neighbourhood levels as well as the catchment area level of the existing supply and disposal structures. All of these levels deal with future needs and utilisation requirements and will adapt to them (“fit for purpose”).

Based on the aspects above, the following measures have been identified to achieve water conscious (urban) development

3.1 Policy advice
3.2 Elimination of legal hurdles and administrative barriers
3.3 Holistic spatial planning for a water conscious transformation
3.4 Create awareness and provide advice through effective communication

Measures in focus area 3

3.1 Policy advice

Measure	Actors	Timeline
3.1.1 Develop a model of a water conscious settlement (take into consideration various settlement structures, noting that the model must be adapted to the local conditions)	DWA with municipal umbrella associations and BMUV	2023 and ongoing
3.1.2 Form alliances with other stakeholders (architects, landscape architects, transport, construction, spatial planning, technical building planning, horticulture and agriculture)	DWA, various federal associations (e.g. architects' association)	2023 and ongoing
3.1.3 Enable Political decision-makers to recognise advantages and the necessity of transformation through consultation/information and to incorporate support for this into political action	DWA and other associations Industries	2023 and ongoing

3.2 Elimination of legal hurdles and administrative barriers

Measure	Actors	Timeline
3.2.1 Identify options for action and successful examples to demonstrate the implementation under the current legal requirements (e.g. amendment of the articles of association, expansion of the portfolio of measures)	Operators, DWA	2023 consecutive
3.2.2 Legally require the conversion to a water conscious city and back this with concrete regulations for enforcement (e.g. for building supervisory and water law procedures)	Legislators, DWA	2023 consecutive
3.2.3 Adapting technical regulations and identifying and communicating cross-sectoral adaptation requirements (construction, transport, etc.)	DWA, municipalities	2023–2030
3.2.4 Campaigns and events to promote water conscious urban development in the planning and approval process	DWA and stakeholders in the urban planning and the water management	from 2030

3.3 Holistic spatial planning for a water conscious transformation

Measure	Actors	Timeline
3.3.1 Create guidelines for holistic spatial planning and implement integrative planning at all levels	Municipalities	2023–2027
3.3.2 Consider land requirements for water conscious urban design in urban land-use planning	Municipalities	2025

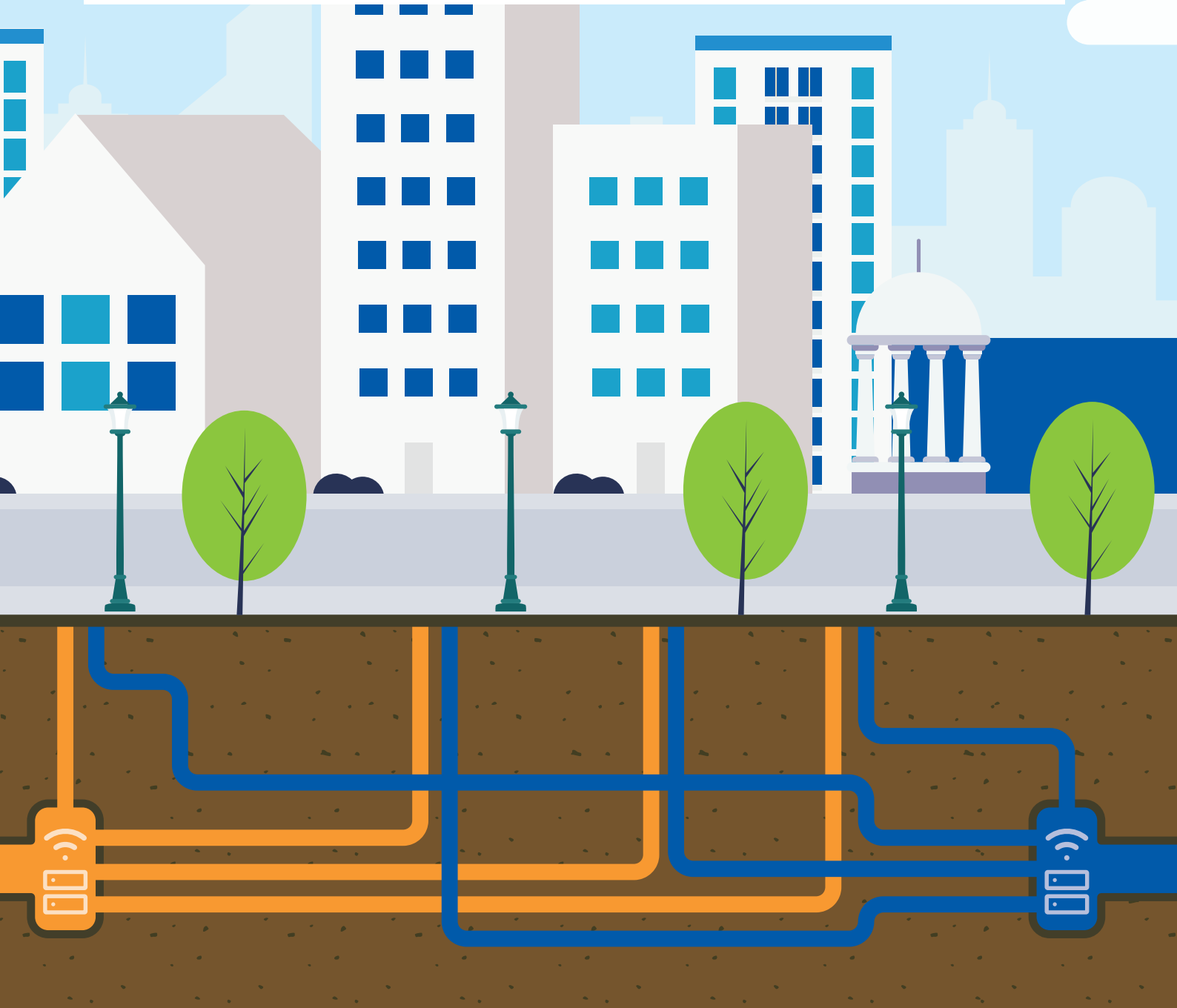
3.4 Create awareness and provide advice through effective communication

Measure	Actors	Timeline
3.4.1 Raise awareness through public relations and educational work	Associations, municipalities, water and wastewater disposal companies, educational institutions	2023 consecutive
3.4.2 Provide information centres, advisory services, experience and knowledge exchange about water conscious solutions; this requires financial support from federal, state and local authorities	Associations, local authorities, regional developers, planners, architects, IHK, 'Handwerkskammern', licensing authorities, developmentl banks	2024, available from 2025

Clear links to the following topics of the National Water Strategy: 1 Protect semi-natural water regime, ... water scarcity ... conflicting goals (A_1 - A15) and 3 Sustainable management of water bodies ... achieve and preserve good status (A16 – A20).

Focus area 4

Resilient water supply and disposal infrastructure



Background

In times of climatic, economic and demographic change, critical infrastructure services such as public water supply and wastewater disposal must fulfil society's long-term needs. Policy makers, society and the water sector as a whole must understand and accept change, rectify undesirable developments and recognise water infrastructure as an important enabler for future development.

In the future, our infrastructures will have to cope with the consequences of climate change including heavy rainfall, floods, drought, and low water levels.
Even if the supply of water across Germany is adequate, measures will still be needed to compensate for spatial and temporal shortages. Infrastructure must be provided to meet this need, including the construction of new dams.

Water infrastructures will continue to secure Germany's positive economic development in the future.
In a changing environment, water infrastructure enables the supply of water to urban and industrial regions and those living and working in rural areas, as well as effectively managing rain and wastewater and providing protection against flooding. Socially acceptable water infrastructure development needs to be holistic, taking all water uses into account and balance them against each other. This holistic approach is the basis here, although the measures of this roadmap focus on the supply and disposal infrastructure and the infrastructure of residential water management.

Our water infrastructures must promote resilience and offer protection for urban and rural settlements, as well as the transport, energy, industrial and environmental sectors.

The infrastructure must meet the requirements both in urban and rural areas and offer supply as well as protection from adverse conditions.

It is important to secure water infrastructures by putting interconnected systems into place to ensure sufficient water quantity and water quality. Water infrastructure is able to protect against contamination in the natural and technical water cycle and provide safe drinking water and water that is "fit for purpose". The combination of grey, with semi- and decentralised blue-green infrastructures, which treat rainwater depending on its pollutant load and enhance local infiltration and evaporation, decreases pressure on the central wastewater disposal infrastructure and promotes the local water cycle. The use of alternative water resources for certain needs, such as treated grey water or wastewater, relieves the burden on public water supply and natural resources and complements the technical management of the water cycle.

In addition to physical infrastructure, digital infrastructure is also essential. This includes monitoring networks, data portals and warning systems that support decision-making and planning processes for water management including water abstraction and demands, and the operation of water structures and facilities. This requires sufficient funding. The physical and digital infrastructure must be effectively protected against physical attacks, extreme (climatic) events as well as cyberattacks. Furthermore, resilience measures must ensure water supply and disposal in the event of crises and disasters, as well as in emergency state. Additional funding for climate adaptation and climate resilience must be made available – derived for example from the CO_2 tax, from an efficient payment system for services received by all users and from dedicated budgets for large infrastructure systems

Based on the aspects above, the following measures have been identified to achieve resilient water supply and disposal infrastructures

4.1 Adapt and develop principles of water management planning
4.2 Drive water infrastructure planning and realisation throughout Germany
4.3 Create the legal, personnel and financial conditions for future proofed infrastructures

Measures in focus area 4

4.1 Adapt and develop principles of water management planning

Measure	Actors	Timeline
4.1.1 Carry out a study on inter-municipal cooperation in the water industry in Germany: Task fulfilment, structures, financial viability, resilience and resources	DVGW, DWA with support municipal umbrella organisations, BMUV, LAWA	2024–2025
4.1.2 Development of risk-based planning principles for resilient water infrastructures for the public water supply, wastewater disposal, and rainwater management	DVGW, DWA, federal and state government for the legal framework	2026–2028
4.1.3 Nationwide standardised guideline for regional water supply concepts:		
a) Background and inventory study **b)** Development of a standardised methodology	**a), b)** BMUV, LAWA with sub-support DVGW, DWA	**a)** 2024–2025 **b)** 2025–2026
c) Implementation at statel and catchment area level	**c)** State authorities, communities and operators	**c)** 2027–2032

Measure	Actors	Timeline
4.1.4 Increase the resilience of urban areas to climate change through adapted rainwater management:		2023–2026
a) Heavy rain risk assessments including hazard maps, risk assessments and agreement on risk level	**a)** BMUV, BMWSB, DWA, LAWA, municipalities, operators	
b) Integration into planning processes and coalitions across sectors (heavy rainfall, but also heat and drought)	**b)** BMUV	
c) The provision of funding and implementation of legal obligations	**c)** BMUV, BBSR, u. a.	
d) Establishment of cooperations and networks	**d)** DWA, LAWA, municipalities, operators	

4.2 Drive water infrastructure planning and realisation throughout Germany

Measure	Actors	Timeline
4.2.1 Study of national water management infrastructure planning: dams, flood protection areas, groundwater recharge, long-distance supply, and considering spatial planning, nature and settlement development, etc.	BMUV, LAWA with the support of DVGW, DWA	2024–2026
4.2.2 Improved infrastructure maintenance and modernisation through		
a) Guidelines for mandatory principles for condition- and risk-oriented asset management and practical advice	**a)** DVGW, DWA in coordination with LAWA	2024–2026
b) Implementation by municipalities and operators, supported by incentive systemsmonitoring by the federal states	**b)** Municipalities with operators; LAWA	2027–2036

Measure	Actors	Timeline
4.2.3 Advance the modelling and expansion of flexible systems and the exploration of alternative water sources (semi-/decentralised material flow-oriented rainwater, wastewater and grey water management), through		2027–2040
a) Further development of regulations and legal requirements	**a)** DVGW, DWA	
b) Inclusion in water supply concepts	**b)** states, municipaties, operators	
c) Funding programmes and lighthouse projects. Demonstration in living labs	**c)** BMBF, BMUV, states, municipalities, operators	
4.2.4 Expansion of digital infrastructure for water management, including forecasting and monitoring systems, risk-orientated planning, decision-making and operational support systems. Beginning with the creation of a legal and technical framework for the collection, storage and use of data	Federal and state ministries and authorities, DVGW, DWA and operators of water management facilities, private providers of software solutions	2024–2030
4.2.5 Development and implementation of the concept “Resilient water infrastructure for coping with crises and disasters”, consisting of		
a) (Risk) analyses and derivation of relevant measures to increase resilience and emergency readiness of physical and digital infrastructures against external events, including network formation, fallback options and emergency supply infrastructure	**a)** BBK, BMUV with the support of DVGW and DWA	**a)** 2025–2026
b) implementation planning including resource requirements	**b)** BBK with federal government, federal states	**b)** 2027–2028
c) Inclusion in the federal states and municipalities, including regular exercises such as LÜKEX	**c)** Federal government, federal states, municipalities with operatorsmit Betreibern	**c)** 2030–2035

4.3 Create the legal, personnel and financial conditions for future-proofed infrastructures

Measure	Actors	Timeline
4.3.1 A comprehensive modernisation approach of water management approval and planning procedures, including the simplification of procedures, establishment of standardised approval processes (link to 1.3.1) standardisation of water management planning procedures and limitation of approval and participation procedures ("Infrastructure Acceleration Act for Drinking Water and Wastewater Projects")	Federal and state government	2024–2025
4.3.2 Create financing modules for infrastructure development: Apply a financing system for all types of water use and for all users, set up funding programmes, generate funding from the CO_2 tax for climate change adaptation, develop suitable payment schemes for water/wastewater services (link to 6.2)	BMUV, LAWA (financing of all user groups, funding programmes, CO_2 tax) bdew, VKU, municipal umbrella organisations with the support of DVGW and DWA	2025–2030 2025–2026

Clear links to the following topics of the National Water Strategy: 5 Water infrastructure adapted to the climate ... (A41 - A51) and 7 Strengthen efficient administrations (A57 - A62).

Focus area 5

Resource efficient and climate neutral water management

Background

The German Climate Protection Act calls for a 65 percent reduction in greenhouse gas emissions by 2030. The aim is to achieve climate neutrality in Germany by 2045. The water industry is facing the same challenges as all other economic sectors and German society as a whole. Key measures that the water industry can employ to achieve these targets are an increase in renewable energies, an increase in energy efficiency and a further reduction in the emission of harmful greenhouse gases. At the same time, drinking water resources must be protected and the safety of public water supply and wastewater disposal in Germany must be guaranteed without restriction.

Although public water supply and wastewater disposal only currently account for around 0.05 percent of the emission relevant to energy consumption of all production areas in Germany, companies and businesses are increasingly being forced to consider the issues of energy saving, energy efficiency and climate neutrality. In addition, increased energy requirements and cost will be incurred through the upgrading of wastewater treatment plants with more advanced purification process and the increased technical water treatment methods needed to achieve the lower concentration thresholds for drinking water. In the transition towards greater efficiency and sustainability in the water industry, large utilities and waste disposal companies have a pivotal role to play as they are able to support smaller companies make the transition.

Reducing methane and nitrous oxide emissions is particularly important in the wastewater sector. Although the formation of nitrous oxide as an undesirable intermediate of biological nitrogen elimination cannot always be completely avoided, it can be largely minimised by adapting operating parameters. Achieving the most climate-friendly operation, in addition to reaching a high water purification with the lowest possible use of operating resources, must therefore be an objective for wastewater treatment. Research is needed to identify the most promising methods to minimize nitrous oxide emissions during biological treatment. In addition to a high methane yield in the digestion process carried out at wastewater treatment plants, it is also important to minimise the escape of methane throughout the entire wastewater treatment process.

In addition, the Technical Regulations must be amended to include standardised methods to monitor and record nitrous oxide and methane emissions from wastewater treatment plants.

An efficient and sustainable water management must constantly optimise its resource and energy requirements, but will always be dependent on materials, energy and chemicals for its construction and operation. Improvements will therefore be found in the use of sustainable building materials and consumables, through the increased use of renewable energies as well as in the expansion of recycling and recovery schemes and transparently presented compensation measures, either by the company itself or by third parties.

Connected to this is the social consensus required on the definition and practice of water management. This is important as, for example, further wastewater treatment inevitably leads to higher greenhouse gas emissions and costs.

Through improved coupling of the “energy”, “water” and “waste” sectors, a technically and economically optimised design becomes possible for the overall “water” system.

It is important to exploit the potential for increasing efficiency at all stages of the water management cycle in order to ensure that the consumption of resources and energy is minimised. This is achieved through operational optimisation, more efficient technologies and systemic redesign.

Expanding the use of renewable energies, increasing the recovery and subsequent use of recovered energy and raw materials can be just as impactful as scaling back end-of-pipe solutions and supporting preventive resource protection.

Based on the aspects above, the following measures have been identified to for achieving resource-efficient and climate neutral water management:

5.1 Resource and energy efficient (re)design of water management systems
5.2 Reduction of greenhouse gas emissions from water management facilities to achieve climate neutrality
5.3 Implementation and expansion of resource recovery from wastewater

Measures in focus area 5

5.1 Resource and energy efficient (re)design of water management systems

Measure	Actors	Timeline
5.1.1 National study on the systematic reorganisation of resource and energy intensive water management systems; This includes technical, political, economic and organisational aspects	DVGW, DWA in co-operation with BMUV and BMBF	2025–2026
5.1.2 Initiate and promote pilot and flagship projects for climate neutral water management based on the previous national study	DVGW, DWA in co-operation with DBU, BMBF, UBA, federal states	2026–2027
5.1.3 Establish funding programmes for the implementation of the studies and their application by operators	BMUV, federal states, municipalities, operators	2027–2030

5.2 Reduction of greenhouse gas emissions from water management facilities to achieve climate neutrality

Measure	Actors	Timeline
5.2.1 Research projects to identify methods to minimise the emission of nitrous oxide during the biological process at wastewater treatment plants	DWA in co-operation with DBU, BMBF, UBA, state governments	2025–2026
5.2.2 Expand rules to account for greenhouse gas emissions in the water supply and wastewater disposal sectors including the ongoing adaptation with regard to the inclusion of scope 3	DVGW, DWA	2023–2030
5.2.3 Initiate campaigns to reduce greenhouse gas emissions in the public sector water supply and wastewater disposal e.g. with position papers, factsheets	DVGW, DWA,with bdew, VKU	2023 – 2024
5.2.4 Develop technical standards for sustainable building materials, construction methods, evaluation of various planning variants for technical structures; if necessary, with consideration of economic efficiency, e.g. further development of KVR guidelines for the consideration of climate aspects in the assessment of the economic efficiency of (construction) projects	DVGW, DWA in co-operation with DGNB, DIBt, main association of the German construction industry	2026–2030
5.2.5 Allow the construction of facilities for the generation of renewable energies on company premises and associated properties as well as in water protection areas, e.g. through the positioning of the associations and the removal of tax barriers	bdew, DVGW, DWA, VKU	2023 (reduction of barriers)

5.3 Implementation and expansion of resource recovery from wastewater

Measure	Actors	Timeline
5.3.1 Initiate and promote research projects for the energy efficient recovery of elements and energy from wastewater	DWA, BMUV, BMBF	2025–2026
5.3.2 Initiating and promoting pilot and lighthouse projects	BMBF, BMUV with support from DWA	2026–2027

Clear links to the following topics of the National Water Strategy: 5 Water infrastructure adapted to the climate ... (A41-A51) and 6 Link water, energy and substance cycles (A52-A56).

Focus area 6

Water conscious society

Background

Vision 2100 states the goal of a water conscious society. On the one hand, this means that water management concerns must be included in municipal planning from the outset. On the other hand, citizens must learn to treat water resources with care and, depending on local conditions, be aware of the dangers of flooding and have the means to take precautionary measures using their own initiative.

Issues related to water are often only reported by the media in cases of extreme floods, flash floods and periods of drought. Given the short-term nature of such events, they are quickly forgotten by the media and society as a whole. The often-adopted viewpoint is that drinking water comes out of our taps 24 hours a day, seven days a week and that wastewater is invisibly removed and the cost, which is rarely seen as a financial burden, is born by the general public.

Given the changing climate, society must focus its attention on water issues and adopt a precautionary approach recognising the value of water for drinking water supplies, the broader environment and sustainable economic activity.

A paradigm shift is needed. The long-established practice of piping bodies of water in areas where they are perceived to be in the way and draining rainwater as quickly as possible must change. The goal must be a transformation towards water conscious cities with lots of greenery and multi-functional areas. Access to water should also be made possible both in urban and rural areas, for example through public swimming areas. If bodies of water are once again used for recreation and leisure activities, then society will learn to appreciate and protect them. Knowledge centres and information services can be used to educate the general public about the diversity and beauty of water and the environment, but also about the dangers that water can pose. This will create an understanding of the importance of pollutants in water and should promote actions that prevent them from entering the water cycle in the first place. Environmental and water-related professions will become more attractive as the esteem of working with water increases. The water associations are forming a strategic alliance to bring together and further develop the large number of existing activities as well as creating places where water can be experienced. The aim is to establish institutional anchoring that is supported by relevant stakeholders, through the creation of a national water foundation or by firmly integrating water topics into an existing foundation or organisation.

The costs of water management must be distributed in a just and socially responsible manner. Finally, “water awareness” must also be reflected in the political arena, which is why “water commissioners” should be appointed in both the federal and state parliaments.

Based on the aspects above, the following measures have been identified to achieve a water conscious society

6.1 Dedicated public relations work to raise awareness of water and water bodies
6.2 Create economic incentives for the conscious use of water
6.3 Prevent damage caused by flooding and heavy rainfall

Measures in focus area 6

6.1 Dedicated public relations work to raise awareness of water and water bodies

Measure	Actors	Timeline
6.1.1 Increase public relations work by initiating a national water foundation or integrating water topics into an existing foundation or organisation	bdew, DVGW, DWA, VKU, Municipal umbrella organisations, possibly DBU and other NGOs	2023–2026
6.1.2 Appointment of water officers at federal and state level	BMUV, Federal Government, environmental ministries of the states on the initiative of bdew, DVGW, DWA, VKU	2023–2025

6.2 Create economic incentives for the conscious use of water (link to 4.3.2)

Measure	Actors	Timeline
6.2.1 Piloting new payment methods and revising the associations' guidelines for calculating fees with the aim of integrating incentives for the conscious use of water. The effectiveness of the new approaches is being determined in living labs as part of research projects	Political decision-makers, municipalities, operators, on the initiative of bdew, DWA, VKU	from 2028

6.3 Überflutungsschäden durch Hochwasser und Starkregen vorbeugen

Measure	Actors	Timeline
6.3.1 Initiate programmes to encourage flood audits and the introduction of the flood label	LAWA, local authorities, property owners, DWA, insurance industry	Start 2023

Clear links to the following topics of the National Water Strategy: 1 Protect a semi-natural water regime, ... water scarcity ... conflicting goals (A_1 - A15), 5 Water infrastructure adapted to the climate ... (A41 - A51) and 9 Raise awareness of water as a resource (A64 - A74).

Implementation requires the cooperation of key stakeholders

The implementation of the Water Management Roadmap 2030 can only succeed if various stakeholders work together. The following list provides an overview of proposed stakeholders responsible for the measures. This list was developed on the basis of joint discussions that have already begun.

Actor	Measure
Stakeholders in urban planning and water management	3.2.4
Provider of software solutions	4.2.4
Architects' Association	3.1.2
Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)	4.1.4
Bildungsträger	3.4.1
Branchenverbände	3.1.3 / 3.4.1 / 3.4.2
Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK)	4.2.5
German Association of Energy and Water Industries (bdew)	1.2.1 / 1.3.1 / 2.3.3 / 2.3.4 / 4.3.2 / 5.2.3 / 5.2.5 / 6.1.1 / 6.1.2 / 6.2
Operators	2.3.1 / 2.3.2 / 3.2.1 / 3.4.1 / 4.1.3 / 4.1.4 / 4.2.2 / 4.2.3 / 4.2.4 / 4.2.5 / 5.1.3 / 6.2
Federal Ministry of Education and Research (BMBF)	4.2.3 / 5.1.1 / 5.1.2 / 5.2.1 / 5.3.1 / 5.3.2
Federal Ministry for the Environment, Nature Conservation, Nucelar safety and Consumer protection (BMUV)	1.1.2 / 1.1.3 / 1.2.1 / 1.2.2 / 1.2.3 / 1.3.1 / 1.3.3 / 2.1 / 4.1.1 / 4.1.3 / 4.1.4 / 4.2.1 / 4.2.3 / 4.2.4 / 4.3.2 / 5.1.1 / 5.1.2 / 5.1.3 / 5.2.1 / 5.2.5 / 5.3.1 / 5.3.2 / 6.3
Federal Ministry for Housing, Urban Development and Construction (BMWSB)	4.1.4
Federal governments	2.3.3 / 2.3.4 / 4.1.2 / 4.2.4 / 4.2.5 / 4.3.1 / 6.1.2
Federal associations	3.1.2
German Federal Environmental Foundation (DBU)	5.1.2 / 5.2.1 / 6.1.1
German Sustainable Building Council (DGNB)	5.2.4
German Institute for Building Technology (DIBt)	5.2.4

Actor	Measure
DVGW	1.1.1 / 1.1.2 / 1.2.1 / 1.2.2 / 1.3.1 / 1.3.2 / 1.3.3 / 2.2 / 2.3.1 / 2.3.2 / 2.3.3 / 2.3.4 / 4.1.1 / 4.1.2 / 4.1.3 / 4.2.1 / 4.2.2 / 4.2.3 / 4.2.4 / 4.2.5 / 4.3.2 / 5.1.1 / 5.1.2 / 5.2.2 / 5.2.3 / 5.2.4 / 5.2.5 / 6.1.1 / 6.1.2
DWA	1.1.1 / 1.2.1 / 1.2.2 / 1.3.3 / 2.2 / 2.3.1 / 2.3.2 / 2.3.3 / 2.3.4 / 2.4.1 / 2.4.2 / 2.5.2 / 3.1.1 / 3.1.2 / 3.1.3 / 3.2.1 / 3.2.2 / 3.2.3 / 3.2.4 / 4.1.1 / 4.1.2 / 4.1.3 / 4.1.4 / 4.2.1 / 4.2.2 / 4.2.3 / 4.2.4 / 4.2.5 / 4.3.2 / 5.1.1 / 5.1.2 / 5.2.1 / 5.2.2 / 5.2.3 / 5.2.4 / 5.2.5 / 5.3.1 / 5.3.2 / 6.1.1 / 6.1.2 / 6.2 / 6.3
Specialised and licensing authorities	2.1
Development banks	3.4.2
Licensing authority	3.4.2
Legislators	3.2.2
Water maintenance associations	2.5.1 / 2.5.2
Appraisers	1.1.1
German Construction Industry Association	5.2.4
IHK and 'Handwerkskammer'	3.4.2
Property owners	6.3
Industry	1.3.3
Municipal umbrella organisations	3.1.1 / 3.4.1 / 3.4.2 / 4.1.1 / 4.3.2 / 6.1.1
Municipalities	3.2.3 / 3.3.1 / 3.3.2 / 3.4.1 / 3.4.2 / 4.1.3 / 4.1.4 / 4.2.2 / 4.2.3 / 4.2.5 / 5.1.3 / 6.3 / 6.2
Agriculture	1.3.3
Federal/State Working Group on Water (LAWA)	1.1.1 / 1.1.2 / 1.1.3 / 1.2.1 / 1.2.2 / 1.2.3 / 1.3.1 / 1.3.3 / 4.1.1 / 4.1.3 / 4.1.4 / 4.2.1 / 4.2.2 / 4.2.4 / 4.3.2 / 6.3
States	1.3.2 / 4.1.2 / 4.2.3 / 4.2.4 / 4.2.5 / 4.3.1 / 5.1.2 / 5.1.3 / 5.2.1/ 6.1.2
State authorities	2.1 / 4.1.3
NGOs	6.1.1
Planners and architects	3.4.2
Regional developers	3.4.2
Trace substance centre of the federal government	2.1
Federal Environment Agency (UBA)	1.1.2 / 1.2.1 / 1.2.2 / 1.3.3 / 2.1 / 5.1.2 / 5.2.1
Association of Municipal Enterprises (VKU)	1.2.1 / 1.3.1 / 2.3.3 / 2.3.4 / 4.3.2 / 5.2.3 / 5.2.5 / 6.1.1 / 6.1.2 / 6.2
Insurance industry	6.3
Water authorities	1.1.1 / 1.2.3 / 2.3.1 / 2.3.2 / 2.5.1 / 2.5.2
Water users	1.1.1

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