OECD Studies on Water

Water Governance in the Netherlands

FIT FOR THE FUTURE?

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Foreword

The OECD has long been a strong advocate for water management that contributes to economic growth, environmental sustainability and social welfare. Solving today's water problems and coping with those of tomorrow requires adaptive, agile and resilient institutions at different levels coupled with a clear understanding of capacity of governments to manage the inter-related risks of too much water, too little water, too polluted water and risks regarding the resilience of freshwater ecosystems.

The Netherlands is a pioneer country in water management. It is widely known for its track record in reclaiming land from the sea, as well as its world-class engineering, strong water industry, and agricultural performance. But are these assets enough to cope with current and future challenges? Or do these challenges call for different organisational settings?

It is the purpose of the OECD-Netherlands water policy dialogue to address this question, by applying a lens to the current state of play in Dutch water management and identifying ways in which the governance framework can be adjusted so that it is "fit for the future". This report on the outcomes of the policy dialogue focuses on the close interconnection between water governance and water security, both now and in the future. It outlines an agenda for future water policies in the Netherlands, which can improve the country's capacity to cope with future trends driven by climate change, economic growth, demographic patterns or innovation.

The report builds on OECD work on water governance that provides policy makers with a range of tools and indicators to diagnose and overcome major governance gaps in water policy design and implementation. This work proposes a set of overarching principles that can support context-dependent and place-based responses to water challenges, rather than one-size-fits-all solutions. Such principles relate to articulating who does what across public authorities and levels of government, considering appropriate spatial and time scales, developing innovative partnerships to engage stakeholders across sectors, monitoring and evaluating progress, fostering integrity and transparency, and allocating human and financial resources in line with responsibilities.

The report is also based on recent OECD work on water security and the use of a risk-based approach that helps governments to address the economic and other impacts of water-related risks, and to unlock the policy puzzle in order to effectively manage those risks. This approach requires that governments appraise the risks, judge the tolerability and acceptability of risks and weigh risk-risk trade-offs, and then calibrate appropriate responses taking into account short and long-term considerations.

This is the second in-depth water policy dialogue that the OECD has undertaken. The first policy dialogue focused on Mexico and was released in 2013. OECD water policy dialogues are demand-driven, tailored to policy makers' needs, and provide a neutral review of a country's water policies. They draw on lessons from international best practice and rely on extensive multi-stakeholder consultations to build a shared understanding of the water policy challenges and the potential ways forward. The policy dialogues help governments to set priorities for future reforms and facilitate the implementation of water and water-related policies that contribute to better lives.

Preface

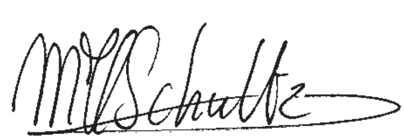
Is Dutch water management fit for the future? This was the principal question discussed by all governing bodies responsible, at their first meeting, shortly after the current government came into office in 2012. All agreed on the need for a future-oriented vision on water management – a vision focused on the challenges ahead, that would enable us to address potential problems in our water management in a well-reasoned way. Such a vision could help us explore possible solutions, anticipate policy changes and equip our governance structures accordingly.

Are we fit for the future? In 2012, my predecessor and Peter Glas, chair of the Association of Regional Water Authorities, commissioned the OECD to conduct an open-minded, independent study, focused on this central question. In commissioning the study, they posed two secondary questions: is Dutch water management sufficiently prepared for the challenges entailed by climate change and socioeconomic trends, and do we need to organise things differently?

The Netherlands clearly has an excellent reputation in water management, flood safety and land reclamation, building on eight centuries of knowledge and experience. But rather than leaning on history, we are a nation that looks to the future. Prevention is at the heart of our water policy, and our thorough approach has paid off. Our knowledge is much in demand. At international level, our Delta programme has put us at the forefront of preventive water management.

This useful report shares both the unique Dutch relationship with water as well as our broad experience. Its findings fill me with pride. Dutch water policy has contributed significantly to our country's economic development, by creating enabling conditions for the Randstad conurbation, for Rotterdam as Europe's largest seaport, for intensive agriculture and a world-class water industry. The OECD is surprised, and rightly so, that so few Dutch people are aware of this. At the same time, the report presents us with a number of issues that need to be addressed. And this is where its main value lies: in encouraging to continue working on further improvements.

In just one year, the OECD has produced a valuable report containing sound recommendations. The onus is now on me – and all my partners in water management – to elaborate on these recommendations.



Melanie Schultz van Haegen
Minister of Infrastructure and the Environment

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This report is an output of the OECD Public Governance and Territorial Development Directorate, directed by Rolf Alter. The co-ordinator and lead author of the report is Aziza Akhmouch, Head of the OECD Water Governance Programme, within the Regional Development Policy Division led by Joaquim Oliveira-Martins. The OECD core team was comprised of Aziza Akhmouch, Claire Charbit, Delphine Clavreul, Anthony Cox, Kathleen Dominique and Xavier Leflaive. The report was a joint endeavour with the OECD Environment Directorate, the contribution of which was co-ordinated by Xavier Leflaive, Head of the Water Unit.

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This report is the result of a one-year multi-stakeholder policy dialogue, spearheaded by Aziza Akhmouch, which involved interviews and policy discussions with more than 150 Dutch stakeholders (see Annex A) from public, private and not-for-profit institutions, which are gratefully acknowledged. The OECD delegation carried out two fact-finding missions to The Hague to collect information (25 February-1 March 2013 and 5-6 June 2013), which also involved field trip visits to the Delfland Regional Water Authority (boulevard enforcement Scheveningen, Schipluiden), the municipality of Dordrecht (urban flood protection of Drechtsteden), the National Water Authority Lelystad (Helpdesk Water, Deltaprogram IJsselmeer area), and the Regional Water Authority Regge and Dinkel (multifunctional project, including Kristalbad). A policy seminar opened by Melanie Schultz-van Haegen-Maas Geesteranus, Minister of Infrastructure and the Environment, was held in The Hague on 23-25 September 2013 to discuss key findings and recommendations with the wide range of stakeholders involved in the policy dialogue. The draft report was peer reviewed (8 November 2013, Paris) in a joint session of the OECD Water Governance Initiative and the OECD Working Party on Biodiversity, Water and Ecosystem*s*, whose delegates are acknowledged for their comments, together with delegates from the OECD Territorial Development Policy Committee.

This report was written by Aziza Akhmouch (Chapters 1, 4, 7), Kathleen Dominique (Chapters 2, 5, 6) and Xavier Leflaive (Chapter 3). In addition to desk research, Delphine Clavreul provided support on institutional mappings and figures. She also provided references to international comparisons, together with Oriana Romano and Ignacio Deregibus, OECD Secretariat. The report includes inputs from the following experts: Bernard Barraqué (CNRS, France); Stijn Brouwer, Roos Den Uyl and Wouter Botzen under the supervision of Professor Dave Huitema (Institute for Environmental Studies, VU University of Amsterdam); Professor Marleen van Rijswick with the support of Professor Remco Nehmelman, Anoeska Buijze, Herman Kasper Gilissen, Wouter Ernst and Nina Bontje (Utrecht Centre for Water Oceans and Sustainability Law); and Mike Young (University of Adelaide, Australia). The report benefited from valuable comments provided by Claire Charbit, Anthony Cox, Julien Hardelin, Céline Kauffmann, OECD Secretariat, and Sylvia Elisabeth Beyer, International Energy Agency. It was submitted twice for consultation to Dutch stakeholders. In this framework, written comments were provided by the National Water Authority, the Ministry of Infrastructure and the Environment, the Ministry of Economic Affairs, the Ministry of Security and Justice, the Association of Regional Water Authorities (*Unie van Waterschappen*),Vewin, the European Environmental Bureau, the VEMW, the Zuiderzeeland Regional Water Authority, the Brabantse Delta Regional Water Authority, the Meuse International Commission, the Association of Dutch Municipalities, Butterfly Effect, LTO Nederland, Natuurmonumenten, the KWR Watercycle Research Institute, UNESCO-IHE and the Utrecht Centre for Water Oceans and Sustainability Law.

The report was edited by Hilary Delage. Jennifer Allain and Erin Byrne prepared the manuscript for publication.

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Acronyms and abbreviations

CBS	Statistics Netherlands (*Centraal Bureau voor de Statistiek*)
COELO	Centre for Research on Local Government Economics (*Centrum voor Onderzoek van de Economie van de Lagere Overheden*)
CPB	Netherlands Bureau for Economic Policy Analysis (*Centraal Planbureau*)
CPI	Consumer Price Index
CTGB	Board for the Authorisation of Plant Protection Products and Biocides (*College voor de Toelating van Gewasbeschermingsmiddelen en Biociden*)
EC	European Commission
EU	European Union
EUR	Euro
FUA	Functional urban area
FRC	Financial Relations Council (*Raad voor de financiële verhoudingen*)
IES	Institute for Environmental Sustainability
IKSR	International Commission for the Protection of the Rhine against Pollution (*Internationale Kommission zum Schutze des Rheins*)
ILT	Inspectorate for Transport, Public Works and Water Management (*Inspectie Leefomgeving en Transport*)
IMC	International Meuse Commission
IPO	Association of the Provinces of the Netherlands (*Interprovinciaal Overleg*)
ISC	International Scheldt Commission
KNMI	Royal Netherlands Meteorological Institute (*Koninklijk Nederlands Meteorologisch Instituut*)
KWR	Water Cycle Research Institute
LCW	National Co-ordination Committee for Water Distribution (*Landelijke Coördinatiecommissie Waterverdeling*)
LOTV	Discharge Open Cultivation and Livestock Farming Decree (*Lozingenbesluit Open Teelt en Veehouderij*)

LTO	Dutch Federation of Agriculture and Horticulture (*Land- en Tuinbouw Organisatie*)
MAO	Manure transfer contracts (*Mest Afzet Overeenkomsten*)
MIE	Ministry of Infrastructure and the Environment (*Ministerie van Infrastructuur en Milieu*)
MINAS	System of minerals accounting (*Mineralen Aangiftesysteem*)
MKB	Organisation of Entrepreneurs (*Midden en Klein bedrijf*)
MNP	Netherlands Environment Assessment Agency (*Milieu en Natuur Planbureau*)
NAO	National Audit Office
NBW	National Administrative Agreement on Water (*Nationaal Bestuursakkord Water*)
NGO	Non-governmental organisation
NRC	New Rotterdam Paper (*Nieuwe Rotterdamsche Courant*)
OECD	Organisation for Economic Co-operation and Development
PBL	Netherlands Environmental Assessment Agency (*Planbureau voor de Leefomgeving*)
RBD	River basin district
RBMP	River basin management plan
RIONED	National Centre of Expertise in Sewer Management and Urban Drainage (*Stichting RIONED*)
RIZA	Institute for Inland Water Management and Wastewater Treatment (*Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwaterbehandeling*)
RWA	Regional water authority
RWS	National Water Authority (*Rijkswaterstaat*)
STOWA	Foundation for Applied Water Research (*Stichting Toegepast Onderzoek Waterbeheer*)
TAW	Technical Advisory Committee for Flood (*Technische Adviescommissie voor de Waterkeringen*)
TME	Institute for Applied Environmental Economics (*Instituut voor Toegepaste Milieu-Economie*)
USEPA	United States Environmental Protection Agency
UvW	Association of Regional Water Authorities (*Unie van Waterschappen*)

Vewin	Association of Dutch Water Companies (*Vereniging van Waterbedrijven in Nederland*)
VNG	Association of Netherlands Municipalities (*Vereniging van Nederlandse Gemeenten*)
VNO-NCW	Confederation of Netherlands Industry and Employers (*Verbond van Nederlandse Ondernemingen-Nederlands Christelijk Werkgeversverbond*)
VROM	(former) Ministry of Housing, Spatial Planning and the Environment (*Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer*)
WFD	Water Framework Directive
WMCN	Water Management Centre of the Netherlands
WTS	Damage Compensation Act (*Wet tegemoetkoming schade bij rampen*)

Executive summary

This report assesses the extent to which Dutch water governance is fit for future challenges and outlines an agenda for the reform of water policies in the Netherlands. It builds on a year-long policy dialogue with over 100 Dutch stakeholders, supported by robust analytical work and drawing on international best practice.

The Netherlands has an excellent track record on water management in several areas: the system has managed to "keep Dutch feet dry" and to develop a strong economy and robust water industry, in a country where 55% of the territory is below sea level or flood prone. A sophisticated "natural infrastructure" has been built and operated through a specific system of water governance, which combines functional democracies (the regional water authorities, established in the 13th century) with central, provincial and local authorities. Stakeholders are engaged in a distinctive "polder approach", which values concerted, consensus-based decision making.

The Dutch system has evolved over time. In particular, national authorities have been reorganised to improve their strategic capacities; regional water authorities have been consolidated into a smaller number of larger entities, and have gained new functions; and water supply companies have been aggregated at the regional level. Legislation was combined into a National Water Act in 2009. In 2012, the Delta Act was passed, to respond to the country's current and future water challenges regarding water safety and freshwater supply.

However, excellence should not lead to complacency. Water management in the Netherlands is faced with persistent and emerging challenges. Water quality and the resilience of freshwater ecosystems recently gained traction in the country, but continue to be pressing issues. Water governance relies on a system of many checks and balances, which presents some limitations, such as the absence of independent monitoring and information on financial performance that can shed light on embedded, dispersed and accepted costs, and disclose it to the general public.

Economic incentives to efficiently manage water are sometimes weak. For instance, water management and spatial development are closely connected, but the actors who benefit from spatial development, such as municipalities and property developers, do not necessarily bear the additional costs related to water management; as a consequence, ongoing spatial development at times increases exposure to flood risk, leading to the escalation of the costs of water management, today and in the future. This raises equity issues.

In addition, future projections generate uncertainty about water management. They can be clustered around four sets of issues: climate change, economic and demographic trends, socio-political trends illustrated by European water policies, and innovation and technologies. These trends concern water demand and availability, water governance and financing in the Netherlands. They call into question current policies and governance arrangements, and point to the need in particular to minimise path dependency and enhance resilience.

There is momentum to develop an agenda for future water policies in the Netherlands. In particular, the Environmental Planning Act is under preparation, with a view to foster policy integration between spatial planning, nature conservation and water. It provides an opportunity to streamline further policies and institutions in these areas.

An agenda for water reform in the Netherlands calls for new approaches in terms of policy, investment, infrastructure and governance to manage "too much", "too little" or "too polluted" water at the least cost for society and in an inclusive way.

A preliminary step is to address the "awareness gap": Dutch citizens take current levels of water security for granted. As a consequence, they tend to be less involved in water policy debates, to ignore water risks and functions when they develop property, and to be little concerned with water pollution. Their willingness to pay for a service they take for granted may erode in the future.

Another important step is to strengthen independent accountability mechanisms for more transparent information and performance monitoring, at arm's length from water institutions. Benchmarking can ensure that a particular investment is managed in an efficient way; it does not investigate whether that particular investment was required. International best practices show different ways to organise regulatory functions. There are ways to deliver key regulatory functions while preserving the distinctive benefits of the Dutch "polder approach", including a national observatory, a regulator, a role for the legislator and contribution of non-governmental organisations (NGOs) and academia, be it only to reflect the interest of the unheard voices (such as the environment). An independent review, commissioned by and reporting to ministers, could also help shed better light on relative and absolute efficiency, accountability and the regulatory framework of the full breadth of water services.

Economic incentives could be strengthened and made more consistent with water policy objectives. In particular, they can ensure that those who generate liabilities with regards to water management (e.g. water users who abstract surface or groundwater or who discharge pollutants into water resources; property developers who build in flood-prone areas) also bear the costs. The allocation of costs across water users can be made transparent and subjected to informed public debate. Abstraction charges could be put in place to provide incentives for efficient use of the resource. A robust water allocation regime that allows for consistently controlling and monitoring abstractions would be a basic step towards managing the risk of shortage effectively. A comprehensive study of the economic costs of water pollution would contribute to policy coherence between water, agriculture and nature.

The water chain could be organised in a way that guarantees optimal co-ordination across water supply, wastewater collection and treatment and related functions. Municipalities could sustain their responsibilities regarding wastewater collection if they effectively combine them with urban planning. Regional water authorities can remain the operators of wastewater treatment facilities if they adopt distinctive governance and financing schemes for this function: the functional democracy set up to mitigate flood risks may not be appropriate to manage wastewater treatment plants; and financing schemes should equitably reflect the costs generated by water users.

The Environmental Planning Act, expected to be adopted by 2018, will set the water agenda in a wider perspective and reach out of the water box. It provides an opportunity to renew the emphasis on freshwater systems, sets a framework to strengthen coherence between water, land use and spatial planning, and can decisively ensure that water governance in the Netherlands is fit for future challenges.

Assessment and recommendations

This report assesses the extent to which Dutch water governance is fit for future challenges and suggests ways to adjust or reform policies and institutions. It is based on a one-year policy dialogue with a wide range of Dutch stakeholders, supported by robust analytical work and drawing on international best practice.

Key findings highlight the long-standing excellent track record of Dutch water governance in several areas: the system has managed to "keep Dutch feet dry" and to develop a strong economy and robust water industry. The findings also signal opportunities to put the system on a more sustainable basis. This is especially the case in the context of an "awareness gap", whereby Dutch citizens take previous achievements for granted, and of European policies that put an increased emphasis on water quality, cost recovery and stakeholder engagement.

An agenda for water policy reform in the Netherlands should explore cost-efficient, adaptive and place-based responses, which minimise path dependency and improve economic incentives to manage "too much", "too little" or "too polluted" water. It requires a renewed focus on governance, with an emphasis on active stakeholder involvement, as well as more transparent information and performance monitoring. It also requires improved coherence between water, land use and spatial planning, and a greater focus on long-term financial sustainability.

Water governance in the Netherlands has an excellent track record in several areas

A global reference for water management

The Netherlands is a delta area where more than half of the territory and population and two-thirds of the economic activity are flood-prone and at risk of submersion, with 29% of the country below sea level and 26% prone to floods from rivers. These conditions make certain dimensions of water management a national security issue, especially the maintenance of the country's complex system of dykes and pumps for primary and secondary defence. This challenging task is further complicated by the country's physical position of being downstream on four international rivers (Scheldt, Meuse, Rhine, Ems), which has consequences for the variability of river discharges and water quality.

Since the 13th century and the creation of the regional water authorities (traditionally known as "water boards"), Dutch water governance has been successful at reclaiming land from the sea and keeping the territory dry through the development of a sophisticated system of dykes and pumping and natural infrastructure. This performance has relied extensively on centuries-old, flexible and evolving institutions that have developed world-class engineering and on-the-ground engagement with stakeholders (the "polder" approach), while playing a central role both as proactive water managers and as platforms to engage water users.

The long-standing performance of water management in the Netherlands has contributed to strong economic development, providing the conditions for a densely populated Randstad, the largest European port, the second largest net exporter of agricultural products and foods in the world (in terms of value) and a leading water industry that is acknowledged as one of the nine "top sectors" in the country. This performance is being achieved at an overall cost of 1.26% of GDP that covers water resources management, flood protection and the tasks of water utilities.

A robust and adjustable institutional and policy framework

The features of Dutch water governance have adjusted over time, in response to changing economic, political and environmental conditions. Over the last 50 years, the Netherlands has witnessed the consolidation of regional water authorities (RWAs; from 2 650 to 24), ministries (the creation of the Ministry of Infrastructure and the Environment in 2010), public drinking water companies (from more than 200 to 10) and municipalities. It has also seen an increasing variety of local arrangements in the wastewater chain and the adoption of successive plans as country-wide instruments for strategic planning to deal with "too much – too little – too polluted water". Other important reforms have included the "modernisation" in 2006 of the *Rijkswaterstaat* (the National Water Authority and the executive agency of the Ministry of Infrastructure and the Environment), and the integration of the water-related legal framework in 2009, with eight water laws combined into the National Water Act. Further cross-sectoral integration between spatial planning, nature conservation and water policy at the national level is being contemplated in the Environmental Planning Act framework, which is under preparation and expected to be adopted by 2018.

The last episode of major floods in 1953 triggered responses that relied on large structural solutions and construction projects (the Delta Works) based on a traditional engineering and "defensive" approach to water management. More recently, a new paradigm has emerged to make "room for the river", combining innovative architecture, urbanisation and landscape solutions to build with nature and live with water. This new adaptive perspective (building with nature, living with water), also called "the Delta Works of the future", partly motivated the adoption of the Delta Act in 2012. The act established the Delta Programme, the Delta Commissioner and the Delta Fund to advance an adaptive governance approach to respond to the country's current and future challenges on water safety and freshwater supply.

Persistent and emerging challenges call for adjustments

The Netherlands is acknowledged as a global reference for water management in terms of ensuring protection from floods and freshwater supply. Regional water authorities and the National Water Authority have played a critical role in keeping Dutch feet dry. Dutch water governance and financing have unique characteristics (including functional democracies, a specific taxation regime, cost recovery) and provide a robust basis for several functions of water resources management, such as water supply, wastewater collection, protection against floods, with limited political interference. The Netherlands has also received wide acknowledgement for the innovative implementation of concepts of integrated water resources management and river basin management, the governance of the Delta Programme (which includes the commitment of regional governments), and the high performance of drinking water supply with respect to quality, reliability and price. However, excellence should not lead to complacency. Some challenges need to be addressed for Dutch water governance to be “fit for the future”.

Persistent challenges

The OECD/Netherlands policy dialogue pointed out several issues that undermine the performance of governance arrangements as well as the financial, environmental and social sustainability of water management today and in the future.

- Concerns about **water quality** and **the resilience of freshwater ecosystems** have recently gained increased attention, and continue to pose significant challenges that require attention and call for a change in water policies and governance.
- Water governance relies on a system of many **checks and balances**, which includes, among many other tools, decentralised assemblies of water authorities, oversight of provinces, and voluntary or mandatory benchmarking. However, that system presents limitations. For example, benchmarking can help assess if an investment was managed in an effective way. It does not help to assess whether that investment was required. Similarly, while water supply companies and regional water authorities are committed to improve efficiency, it is not clear how the efficiency gains reflect the actual potential or contribute to a specific policy objective. The consolidation of service providers in the last 50 years and the reduced number of players increase risks of information asymmetry and monopolistic behaviour.
- There is a striking **“awareness gap”** among Dutch citizens related to key water management functions, how they are performed and by whom. Similarly, the perception of water risks is low. Many people are not aware of the basics about evacuation policy, the origin of the water they drink or whether their property is built on a flood plain. This awareness gap is largely a result of a high level of trust in government and the successful avoidance of major flood disasters since 1953. But the “awareness gap” raises challenging questions for policy makers: how to increase the awareness of the risks, to influence decisions of property owners, businesses and municipalities about exposure and vulnerability to risk, and thereby reduce the expected cost of damages in a flood event? How to make the public more aware of what is needed to keep the country dry and habitable, and to secure willingness to pay for flood safety?
- **Economic incentives** to efficiently manage “too much”, “too little” and “too polluted” water could be strengthened. For instance, those who benefit from spatial development, such as municipalities and property developers, do not necessarily bear the additional costs those developments impose on water management. As a consequence, ongoing spatial development, at times in highly unfavourable locations from a water management perspective, increases exposure to flood risk, leading to the escalation of costs of water management, today and in the future. In addition, there is an absence of incentives for the majority of water users to proactively manage the risk of shortage. Finally, while there are numerous technical measures in place to reduce sources of pollution, the economic incentives to do so are generally weak.

- Current financing arrangements raise issues related to **the allocation of costs** between different categories of stakeholders, both today and for future generations. As mentioned above, those who create liabilities (e.g. building in flood-prone areas or polluting freshwater) do not pay the costs associated with their actions (additional costs for protection against flood or for treating polluted water for subsequent use). In addition, it is not clear how cost recovery mechanisms for water supply, wastewater collection and treatment affect different socio-economic classes and different groups of stakeholders (e.g. large and small families), or encourage water-wise behaviour. In particular, the fact that regional water authorities are functional democracies (democratic representation in governing bodies) with taxation powers and earmarked revenues derives from their initial focus on flood defence; such a governance system and financing scheme is less adequate to invest in and operate wastewater treatment services.

Emerging challenges

In addition to current challenges, four future trends generate uncertainty about future water management and call into question current policies and governance arrangements in the Netherlands.

- **Climate change.** The projected impacts of climate change are well documented in the Netherlands. They are expected to affect flood risk (standards for flood protection are being revised under the Delta Programme), water scarcity (the current allocation regime is not well-equipped to deal with more frequent and severe water shortage), urban drainage (which will have to adapt to heavier rains). Regions will differ in the way they are affected and in their capacity to respond.
- **Regional disparities.** Although regional disparities (in terms of GDP levels, growth rates and unemployment) are currently low in the Netherlands, they are expected to grow, driven by demographics and economic trends. For instance, 500 000 new houses are expected to be built in the Randstad by 2040, while populations in other parts of the country are expected to shrink. This trend has consequences for flood safety standards (which could rise in developing regions and be lowered in regions with shrinking populations) and on the capacity of different regions to finance the infrastructure they need (especially in shrinking regions).
- **Socio-political trends, including European policies.** As exemplified by the Water Framework Directive (WFD) and other EU regulations (floods, nitrates, etc.), European policies put more emphasis on water quality and ecosystems, the reduction of encroachments on rivers and the environment, and inclusive water governance. The Dutch tradition of engineered responses to risk is generally at odds with this policy direction. The Netherlands has displayed a relatively low level of ambition *vis-à-vis* the WFD, claiming that most of its waters are artificial systems and that restoration could only be limited. Further, the distinctively high share of water bodies subject to exemptions in the first river basin management plans and the slow pace of implementation of measures have been the source of concern for the European Commission.
- **Innovation, technical and non-technical.** Innovation in the Netherlands has contributed to water security and a robust water industry. It has also generated a certain degree of path dependency based on conventional infrastructure

approaches, as these cannot readily adapt to shifting conditions. For instance, in shrinking regions, some dikes might still have to be operated and maintained, even though they have become oversized in relation to the new safety standards. More recently, Dutch authorities have explored less capital-intensive green infrastructure options, and green infrastructures (such as wetlands) and spatial planning to deal with flood risks while minimising path dependency.

There is a momentum for a renewed focus on Dutch water policy

The current political context is sensitive in the Netherlands. Historically, administrative simplification and territorial reforms have been adopted to reduce complexity in public administration as well as in different sectors (water, health, security). This was done by contracting the government, decentralising tasks, and merging municipalities and other local and regional governments. In the current context of sluggish recovery from the economic crisis, further provincial mergers are foreseen in the entire country with a first step involving North Holland, Utrecht and Flevoland, not without some resistance. These new entities could possibly take over some of the current functions of the (24) regional water authorities.

The size of municipalities has also long been debated, which has implications for the water sector given their role in urban water management and sewage collection. The number of municipalities has been reduced by more than half following several mergers and reorganisations in the last six decades, and ongoing discussions are targeting a threshold of 100 000 inhabitants per municipality.

Willingness to cut public expenditure has implications for the organisation of the sector, with a search for efficiency gains across the water chain through improved co-ordination and partial reallocation of roles and responsibilities across public authorities and levels of government. The 2011 Administrative Agreement on Water Affairs sets objectives for cost reduction, and improved efficiency and transparency in the water sector.

The recent paradigm towards adaptive water management, which began with the Programme "Room for the Rivers" and culminated with the recent adoption of the Delta Programme, has put thinking about the future and long-term sustainability at the heart of Dutch water policy. It is actively looking for flexible strategies to cope with future challenges related to water safety and freshwater supplies. This requires an integrated approach to allocating tasks and responsibilities across public authorities and the water chain, and reduces the risk of over- or under-investment.

New policies are required, which call for adjustment of water governance and financing

The following recommendations can help to shape an agenda for future Dutch water policies. They call for new approaches in terms of policy, investment, infrastructure and governance and need to be accompanied by the reform of policies which affect water demand and availability, such as land use and urban planning, or policies regarding products that contribute to non-point sources of pollution.

1. ***Strengthening independent accountability mechanisms for more transparent information and performance monitoring.*** This can contribute to bridging multi-level governance gaps in terms of cost efficiency and financial performance, accountability and stakeholders' awareness. A **range of options** can

be considered, some of which can preserve the distinctive benefits of the Dutch "polder approach". All do not necessarily have to be adopted at once. Sequencing and customisation are required, depending on the "regulatory functions" at stake. The following suggestions can help address issues related to tariff regulation, incentives for efficient investment, customer engagement, financial accounts and supervision of utilities.

– Ensure that decisions with significant infrastructural and economic consequences are shielded from short-term political considerations and not captured by specific interests. Such ***independent*** **oversight**, at an arm's length from water institutions, can address the current absence of a third-party mechanism. It could be organised in different ways (e.g. national observatory or committee, a regulator, etc.). It could focus on opportunity costs, assess financial performance and ensure that data produced is guiding policy and operational decisions.

– Facilitate **stakeholders' access to *independent* information on water costs, risks and performance**. Shedding light and greater transparency on dispersed, embedded and accepted costs can help bridge the awareness gap, improve accountability and bring higher visibility (to end users) on performance. This can take different forms, including strengthened prerogatives for the legislator, independent monitoring and evaluation (at an arm's length from water institutions) beyond existing self-assessment. Non-governmental organisations (NGOs) and academia could contribute, be it only to reflect the interests of the "unheard voices" (such as the environment).

– Provide and oversee a **harmonised accounting** of expenditure for water management across water management functions in order to improve transparency in **tracking water management expenditures and cost recovery**. An independent review, commissioned by and reporting to ministers, could help shed better light on relative and absolute efficiency, accountability and oversight for the full breadth of water services.

2. ***Strengthen the economic incentives for managing water risks efficiently and equitably.*** This includes ensuring that those who generate liabilities with regards to water management also bear the costs. The allocation of costs (among households, farmers, industries and government authorities) needs to be more transparent and subjected to informed public debate. Specific measures could include:

– **Abstraction charges** could be put in place to provide incentives for more efficient water use; their impact on the competitiveness of businesses would be monitored. While there is an abstraction licensing system for large abstractions, it is not clear that this is monitored or that sanctions for non-compliance are consistently applied. Putting in place a robust **water allocation regime** that allows for consistently controlling and monitoring abstractions would be a basic step towards managing the risk of shortage more effectively. A bolder option would be to establish water-sharing arrangements in areas vulnerable to shortage.

– A **comprehensive** study of **the economic costs of water pollution** would contribute to policy coherence between water, agriculture and nature. It would inform targeted and tailored approaches to reducing emissions, which would take into account the opportunity costs in specific regions. **Economic instruments** such as water quality trading and pollution taxes could improve the cost-effectiveness of measures to address non-point source pollution, possibly in combination with policies regarding polluting substances.

- The current development of the Environmental Planning Act provides an opportunity to put renewed **emphasis on freshwater systems** and ensure a better balance among various water policy objectives. Recent efforts to re-naturalise waterways, make room for the river and consider the multi-functionality of water management infrastructures that can improve environmental benefits are steps in the right direction. **Valuation of ecosystem services** should be included in the assessment of policy options when possible, as it can ensure ecosystem services are thoroughly considered in planning decisions.

3. ***Strengthen coherence between water, land use and spatial planning, building on the window of opportunities offered by the development of the Environmental Planning Act.***

   - As an instrument to assess the impact of spatial development on water management, the **"Water Assessment"** could be made more effective (e.g. binding) in influencing the spatial planning process and decision making.

   - The current agreements regarding the **financing of mitigation measures** for new developments set out in the National Administrative Agreement on Water and the instruments provided for in the Land Development Act should be evaluated to see how they work in practice.

   - In addition, a **stronger role in spatial planning for provinces** is advocated, to enhance complementarity with water management and ensure alignment with overall policies.

4. ***Organise the wastewater chain in a more coherent way, considering issues of scope and scale.*** This challenge covers two sets of issues, and should be addressed on the basis that form follows both function and territorial specificities.

   - The potential advantage of municipalities in the delivery of **urban drainage** only materialises when this function is well co-ordinated with **urban planning** on the one hand and with management of the **sewage system** on the other. The current monitoring of the 2011 Administrative Agreement of Water Affairs by the Water Chain Visitation Commission provides a unique opportunity to report on the performance targets and efficiency gains achieved, and **make sure opportunities in both areas are fully exploited**, especially as huge investments are foreseen in the coming decades to replace aged sewage infrastructure.

   - As mentioned previously, the governance and financing model of regional water authorities is adequate to manage floods risks. It is less so to invest in and operate **wastewater treatment services**. Regional water authorities can retain the wastewater treatment function, if it is managed and financed in a distinctive way, more in line with the needs for such services.

5. ***More generally, any organisational adjustment of water management functions should consider three principles:***

   – The **voluntary and bottom-up approach** for adjusting the scale at which regional water authorities operate should prevail, to allow for **regional differentiation**, when appropriate. Potential reallocation of tasks and responsibilities in the future, if needed (e.g. wastewater collection, groundwater management), should be pilot-tested in selected areas before nationwide implementation. The river basin concept, cost recovery and the principles of integrated water resources management should, in any case, be respected.

   – Ongoing **decentralisation of nature policies** could pave the way for better integration of water functions with nature management and biodiversity through co-operation platforms, joint agreements and other soft solutions. Conversely, it could compromise sectoral objectives where there is significant policy discretion and where short-term economic considerations prevail.

   – Decisions to reorganise should rely on a **robust assessment of the progress achieved towards efficiency gains across authorities and the water chain**. The monitoring of the 2011 Administrative Agreement on Water Affairs provides an opportunity to determine whether co-ordination efforts and voluntary approaches help reap economies of scale and scope.

6. ***Shore up the financing system to ensure long-term financial sustainability.*** Although the current financing system has a number of strengths, including full-cost recovery for most water services, the OECD framework for financing water resources management can provide guidance to strengthen it:

   – First, those who pollute and those who benefit from water services should pay. This can harness new sources of finance (e.g. property developers) and reduce the burden on public finance. Despite the challenges, the **polluter pays principle** could be more fully applied to cover non-point sources of pollution, in particular from agriculture. Economic instruments, such as abstraction charges or taxes, could be used in accordance with the **beneficiary pays principle**. Since the cancellation of the central government's **groundwater tax**, drinking water companies (along with beverage companies) only pay a provincial tax, that covers the cost of groundwater management, but not environmental or opportunity costs related to the use of that resource.

   – Second, **equity** is often invoked to address affordability or competitiveness issues, when water bills are disproportionate with users' capacity to pay. In the Netherlands, fairness in the allocation of costs could be enhanced in two ways: *i)* those that generate costs for the community should bear them; and *ii)* the distributional consequences of water policies should be assessed thoroughly.

   – **Coherence** between policies that influence water availability, water quality and flood risk (e.g. agriculture, spatial development) should be strengthened (e.g. see the problem of misaligned incentives noted above).

   – Finally, it is not clear how the rise of **regional disparities will affect the financial sustainability** of water management in the long run. If shrinking regions do not have the resources to finance water security in their territory, cross-regional transfers may need to be considered in the future.

7. ***Give room for non-technical innovation, in particular in urban water management.*** Two issues deserve careful attention:

   – On the one hand, the Dutch industry is very good at developing new technologies to address water risks and to make the best use of water resources (including treated wastewater). But it is not clear how this inventive capacity is backed by an institutional framework (e.g. public procurement rules, water allocation regimes) that facilitates the diffusion and deployment of innovation. **Institutional and regulatory** frameworks could be reviewed to assess how they are conducive to the adoption of innovative approaches.

   – On the other hand, non-technical innovation (e.g. making room for rivers, business models for water companies) could be more systematically considered. For instance, there are **opportunities to increase resilience in urban environments without structural works** by fixing limits on rainwater discharge. This may create opportunities for new industries, coming from outside the water box (e.g. architects, urban planners, property developers, construction companies). Again, institutional and regulatory frameworks could be assessed with this aim in view.

Chapter 1

Interlocking water management functions in the Netherlands

This chapter provides an institutional mapping of who does what across levels of government and of the public authorities involved in water management in the Netherlands. It is structured around key water management functions: flood defence; water quantity and drainage; water quality; sewage management and wastewater treatment; and drinking water supply. The chapter identifies linkages and mismatches in the allocation of roles and responsibilities, and sheds light on the mutual dependency of the "sub-national triangle" composed of provinces, municipalities and regional water authorities. It suggests ways forward for better interconnectedness across water management functions, and with related areas such as environmental protection, land use, agriculture and nature conservation.

Introduction

This chapter aims to identify the key water management functions in the Netherlands, who is responsible for performing them, how they interact, as well as potential mismatches in delivering them.

This institutional mapping will provide the framework to objectively discuss whether:

- the allocation of the roles and responsibilities across the water chain and levels of government makes sense against criteria of performance, effectiveness and sustainability
- the current governance and financing frameworks are consistent with water management functions
- the new approaches implemented and/or under development address community safety and environmental protection adequately in a man-made environment
- the issues related to scale (catchments, drainage basins) actually determine the scale (including transboundary) at which given functions need to be undertaken
- the linkages with other environmental functions are sufficiently explored and addressed.

Water management: A multi-level public responsibility

Water management in the Netherlands has been regarded as a responsibility of public authorities, government and public administrative bodies being the best placed to protect public interest (Figure 1.1). The idea that "the dykes make up the state" has long shaped Dutch water policy, and managing water affairs remains essentially a core public activity. This is in part due to the highly specific challenge of maintaining water levels at desired levels in extensive reclaimed areas. However, private enterprise has a role in actually implementing many water management activities, such as dredging and the construction of dykes, pumping stations and wastewater treatment plants.

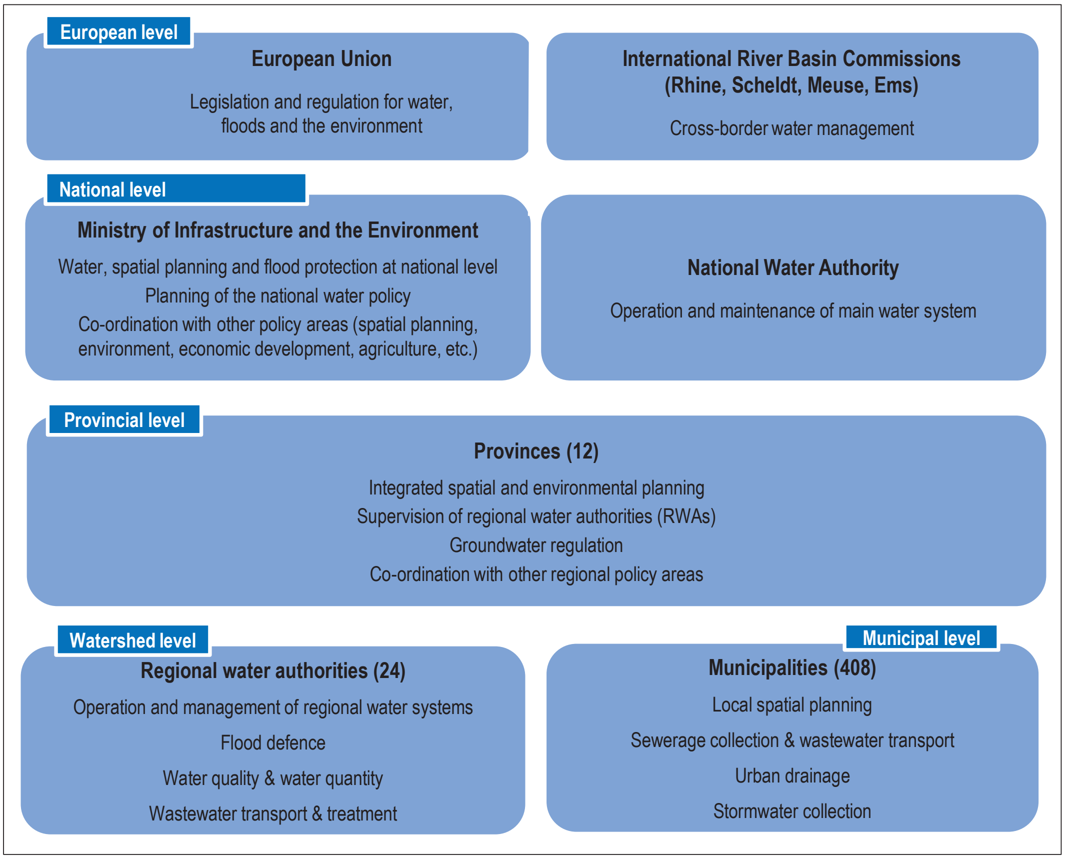
The following sections explain who is responsible for what within water management tasks from the European Union to local level, how decisions are taken and the scope of public responsibility. This overview is important to understand the institutional set-up that has a direct influence on water governance and financing frameworks in the Netherlands.

A decentralised institutional setting

The Netherlands is a decentralised unitary state, and water management implementation has traditionally been highly decentralised from both a territorial and functional perspective. Territorial decentralisation concerns the provinces and municipalities, which have, in principle, a broad responsibility while functional administrative bodies (e.g. regional water authorities) are responsible for one or more specific tasks.

Roles and responsibilities for water management were last updated in the 2009 Water Act, which designates, together with associated secondary legislation,[1] the authorities responsible for the management of water systems as well as the authorities at the international and national level with whom they co-operate. The constitutional revision of 1983 was a turning point in Dutch water governance, as it strengthened regional water authorities as true public administrative bodies alongside provinces and municipalities.[2]

Figure 1.1. **Institutional layers of water management in the Netherlands**



Water management in the Netherlands is carried out at all government levels (OECD, 2011). The 2011 Administrative Agreement on Water Affairs[3] emphasises the common responsibility to get the water system in order, and specifies responsibilities and instruments that will be used to trigger efficiency gains and better co-ordination across involved authorities. Central government, provinces, regional water authorities and municipalities all have concrete tasks and responsibilities in this policy area, though for municipalities, the latter have more to do with public works in general, including urban drainage, than with strictly water-related activities. The country is also required to integrate European Union legislation (water, flood, nitrates and other environmental directives) into the national system, and international river basin commissions managing cross-border water. In addition, the following authorities carry water management responsibilities:

- The central government (Ministry of Infrastructure and the Environment) is responsible for national water policy and the agreement with other policy areas (spatial planning, environment, nature conservation, economic development, agriculture and horticulture)
- *Rijkswaterstaat* (National Water Authority), the executing agency of the ministry, is responsible for operation and maintenance of the main water system (North Sea, Wadden Sea, Lake IJsselmeer and the major rivers and channels) as Box 1.1 shows.[4]

- Regional water authorities (24)[5] manage regional water systems[6] to maintain water levels, water quality and wastewater treatment; they are decentralised public authorities endowed with specific legal personality and financial resources by the Dutch Constitution and operating in areas defined by their physical drainage characteristics.
- Provinces (12), which are in charge of integrated spatial and environmental planning within administrative boundaries that do not coincide with hydrographically determined boundaries, supervise regional water authorities, develop groundwater plans and regulations (they grant permits for the larger groundwater extraction) and are in charge of the agreement with other regional policy areas.
- Municipalities (408), in charge of spatial planning at the local level, deal with sewerage collection system, urban drainage and stormwater collection in urban areas.

Box 1.1. **Role and responsibilities of the Dutch National Water Authority**

The National Water Authority (*Rijkswaterstaat)* is responsible for the design, construction, operations and maintenance of the main infrastructure facilities in the Netherlands. In addition, the National Water Authority develops and operates national roads, waterways and open waters, which includes, among others, maintaining large hydraulic structures (e.g. project VONK), the replacement of which raises significant challenges for the coming decades.

The National Water Authority works to ensure protection from floods by rivers, lakes and the sea, good environmental status of water bodies, reliable and well-co-ordinated water management throughout the Netherlands, clean and ecologically healthy water systems and safe and flowing navigation with constant attention to environmental sustainability.

The National Water Authority advises the Ministry of Infrastructure and the Environment and thus plays a role in water policy development, especially as regards to the development and design of large water projects. For instance, it is actively engaged in the Room for the River project for what concerns policy making, planning and implementation.

In addition to its the operational activities, the National Water Authority has a role in water-related knowledge, which includes advising the Delta Commissioner in building a knowledge network for the Delta Programme, supporting capacity development of knowledge managers and building synergies with other knowledge institutes such as Deltares, universities and the commercial market. The National Water Authority, in co-operation with other parties, initiated and developed the Water Information House and supports the "Water Management Centre of the Netherlands" (WMCN).

Source: Contribution from the Ministry of Infrastructure and the Environment.

In addition to these different government layers, a large number of other actors play a role in water management.

- Drinking water companies (10) provide drinking water supply, operating under private law with public shareholders. Their geographic scope covers on average the area of 2 or 3 regional water authorities and between 20 and 50 municipalities.
- The Delta Commissioner, who leads the Delta Programme, works closely with the ministries, provincial and municipal authorities, regional water authorities, business and other stakeholders.

- A plethora of institutes, advisory committees, and associations complete the institutional landscape of the sector including Vewin, representing the interests of the water companies technically supported by the KWR Water Cycle Institute; the Association of Regional Water Authorities (*Unie van Waterschappen*, UvW) representing the regional water authorities; the Association of the Provinces of the Netherlands (*Interprovinciaal Overleg*, IPO), the umbrella organisation of the provinces; and the Association of Netherlands Municipalities (*Vereniging van Nederlandse Gemeenten*, VNG).
- The presence of NGOs is, however, rather limited in the country's national water policy (see Chapter 7) but more project-based oriented, and very active towards international co-operation and developing countries (e.g. Wetlands International and Bird Life International).

An important triangle "regional water authorities – provinces – municipalities"

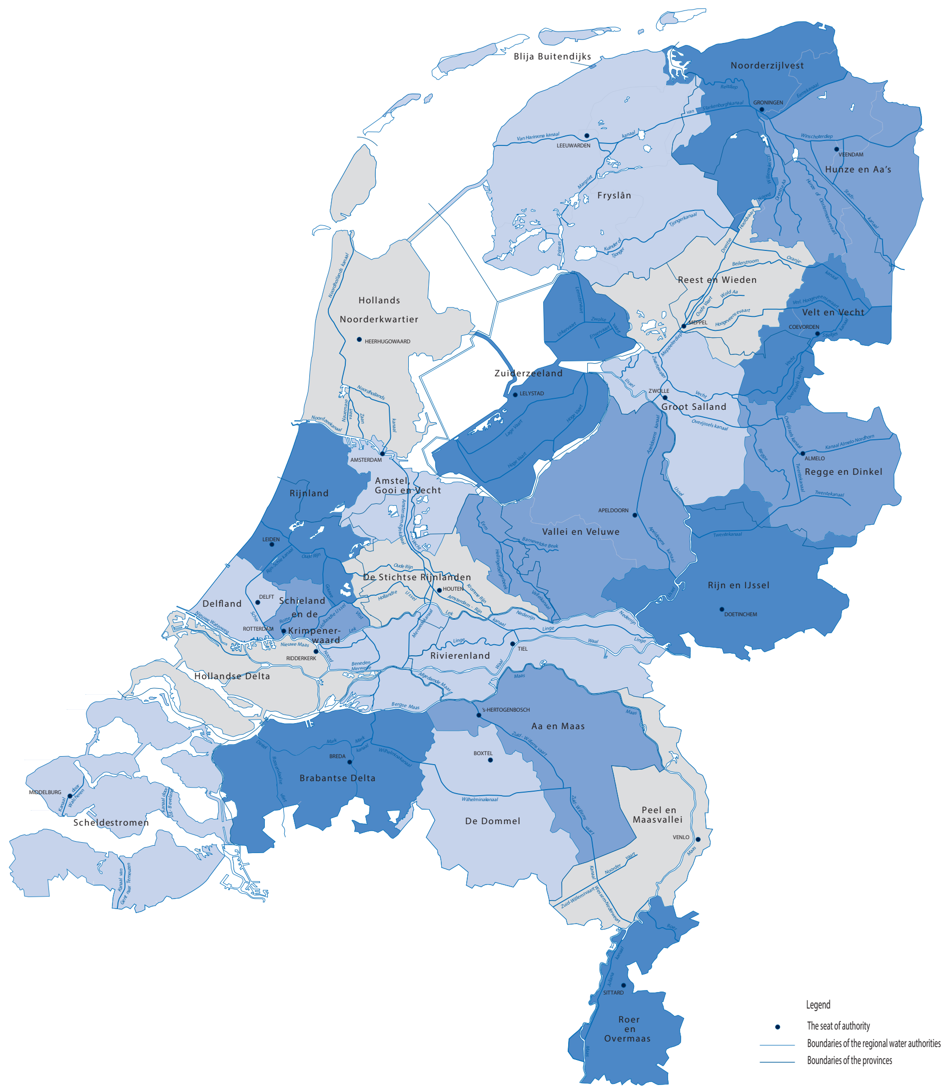
As in many OECD countries, water management in the Netherlands requires effective management of interdependencies between multiple actors and stakeholders, given the high degree of territorial and institutional fragmentation inherent to the water sector, regardless of institutional organisation.

Dutch water governance is in line with the European obligation to provide for appropriate competent authorities and administrative arrangements for river basin management. It is based on a sort of "triangular" relationship between regional water authorities, provinces and municipalities respectively in charge of water management, spatial planning and land use.

Dutch provinces are, in terms of the Constitution, supervisors of regional water authorities, and play a crucial role in setting up, dissolving and regulating the latter, including the composition of their governing boards, which is subject to provincial by-law. The function of, and grounds for, such supervision is to set limits to the autonomy of decentralised functional authorities, in a country that is a decentralised unitary state.

Over time and in recent legislation, the role of Dutch provinces has shifted from a "preventive" supervisory role to a more "positive" and "repressive" supervisory role. Formal decisions with regard to water levels, construction and improvement of water management structures (preventive and supervisory roles) are no longer covered by the prior (provincial) approval requirement. Since the 2011 Administrative Agreement of Water Affairs, provinces' approval of the management plan and the by-law allocating the share of costs is no longer required. "Positive" supervision of provinces applies to, amongst others, all regional flood defences in their boundaries; it includes rules regarding the information to be provided by the regional water authorities' governing bodies and those related to the plans, decisions, as well as agreements to be adopted by the regional water authorities' governing bodies. The Water Act went one step further and allows, if coherent and efficient regional water management requires it, the provincial executive to issue an instruction to the regional water authority governing bodies regarding the exercise of their powers and responsibilities. A key question is to assess to what extent these evolutions in provinces' supervisory role provide the needed regulation of performance to ensure efficiency, effectiveness and accountability of water governance in the Netherlands (see Chapter 7).

Figure 1.2. **Regional water authorities in the Netherlands**



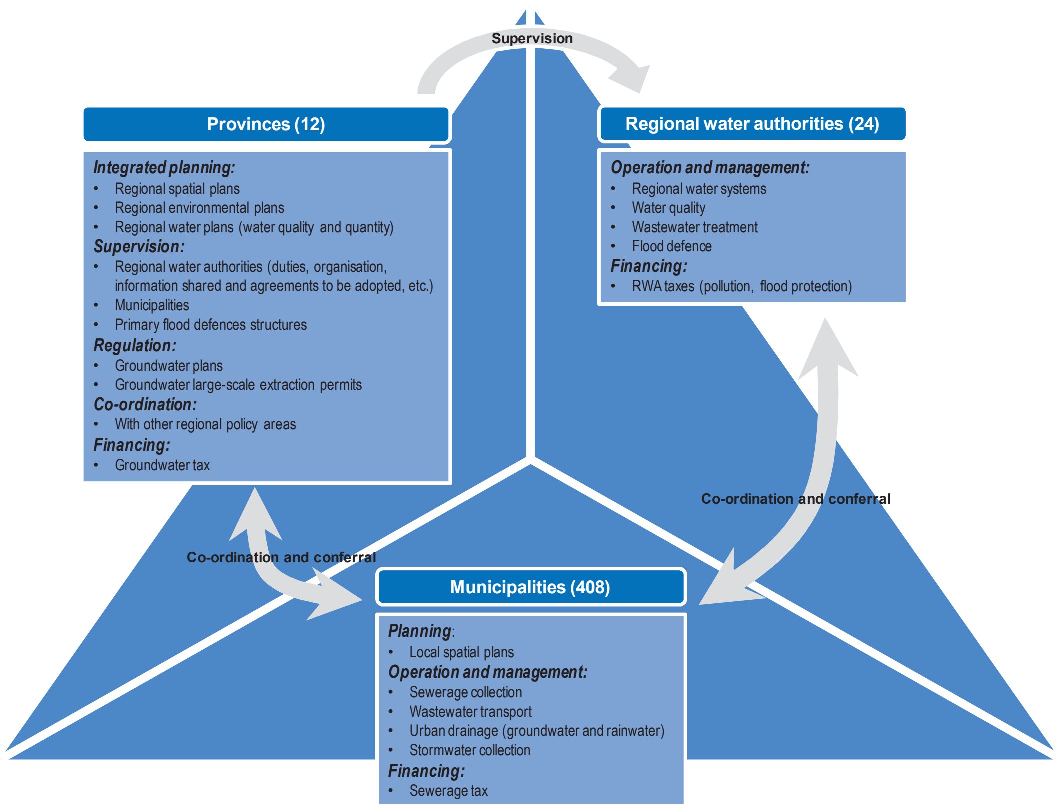
Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: UvW (Unie van Waterschappen, Association of Regional Water Authorities) (2013), *Waterschapsalmanak 2013-2014*, Association of Regional Water Authorities, The Hague, 1 January.

In addition to their supervisory role of regional water authorities, provinces perform a number of duties in the area of regional water management. The Water Act instructs them to draw up regional water plans, supervise the primary flood defence structures and grant permits for "larger scale" groundwater abstraction, and gives them a part to play in drawing up water agreements.

Municipal authorities' responsibilities include the collection and transport of urban wastewater (Environmental Management Act) and duties concerning rainwater and groundwater in urban areas. They should, via the "Water Assessment" instrument, take water management into account in their spatial planning decisions, but in practice it is not binding. They carry out their tasks with their own instruments (Municipality Act), based on legislation in other policy areas (spatial planning and environment), and through co-ordination and conferral with regional water authorities.

Figure 1.3. **Mutual dependency across the three public components of the sub-national "triangle"**



Water management functions: Who does what and recent shifts

Dutch institutions perform and collect charges for the typical water management functions as in any country. They also manage the level of water and "keep the territory dry", which implies a range of water quantity and water quality measures, including operations and maintenance, licensing and enforcement. The need for this function is closely linked to spatial planning decisions, which determine the nature and extent of the drainage and pumping works required. This is a key function of the regional water authorities (RWAs) and is referred to in this report as the management of regional water systems.

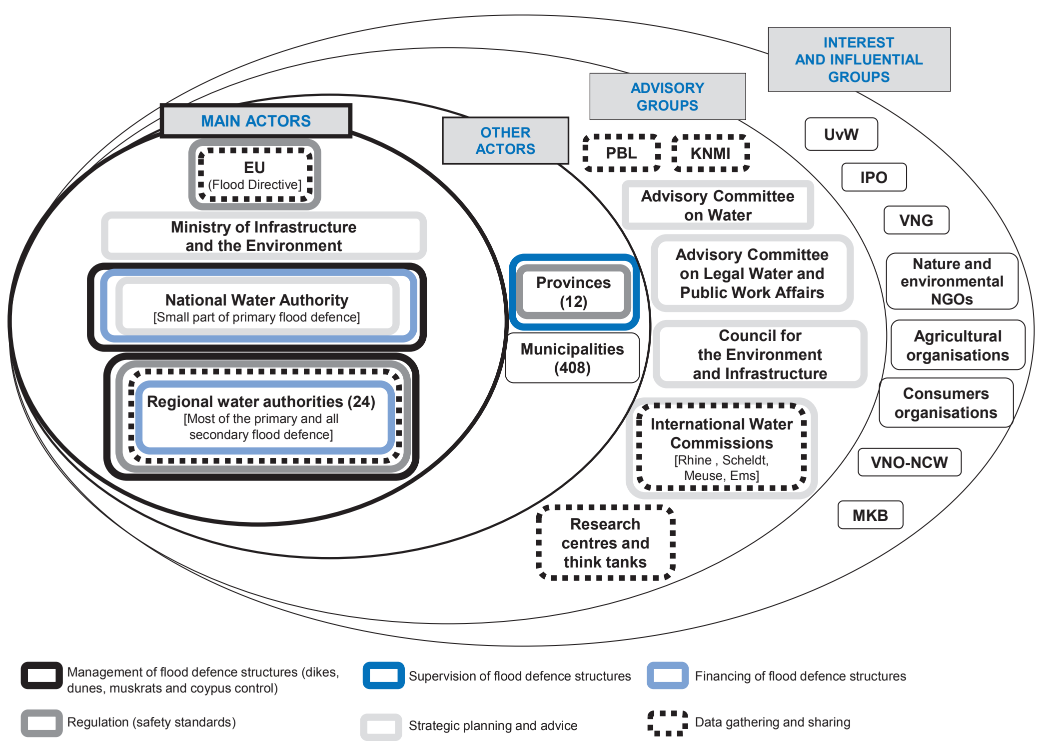
Flood defence

Keeping the country safe from excess water is a critical function, especially when more than half of the territory and population, as well as 60% of the economic activity are flood prone. Not all areas are vulnerable in the same way; some are vulnerable to flooding from external coastal and river sources and others risk flooding unless effective regional water management systems are in place.

The protection of the Netherlands against flooding is the responsibility of the state and regional water authorities (Figure 1.4). The state is responsible for coastal defence (maintaining the coastline), and regional water authorities manage primary dykes (3 400 kilometres) and other dykes (14 000 kilometres). The EU Floods Directive requires member countries to assess if all water courses and coastlines are at risk from flooding, map flood risks and take action to reduce them. Flood protection standards (requirements related to failure probabilities of dykes) are set at the national level, and range between 1/250 along the Meuse in the south of the Netherlands up to 1/10 000 at the coast. They are implemented by regional water authorities with specific functions to promote water safety. This is separate to their regional water management system, which deals principally with the evacuation of water that enters the reclaimed area through rainfall and seepage.

The 2011 Administrative Agreement on Water Affairs introduced some important developments in the field of flood protection and the allocation of related roles and responsibilities across public authorities. First, while the state used to grant a subsidy of 100% to regional water authorities for investment in primary flood defence structures, a new cost-sharing arrangement transferred 50% of the (financing) responsibility to regional water authorities (Box 4.2). Second, the provinces were responsible for the supervision of all primary flood defence structures, including those of the state (Article 3.9, Water Act) and the canal dykes of the regional water authorities, while this responsibility is now carried out by the central government. Third, muskrat and coypus[7] control have recently been transferred to regional water authorities.

Figure 1.4. **Institutional mapping for flood defence**

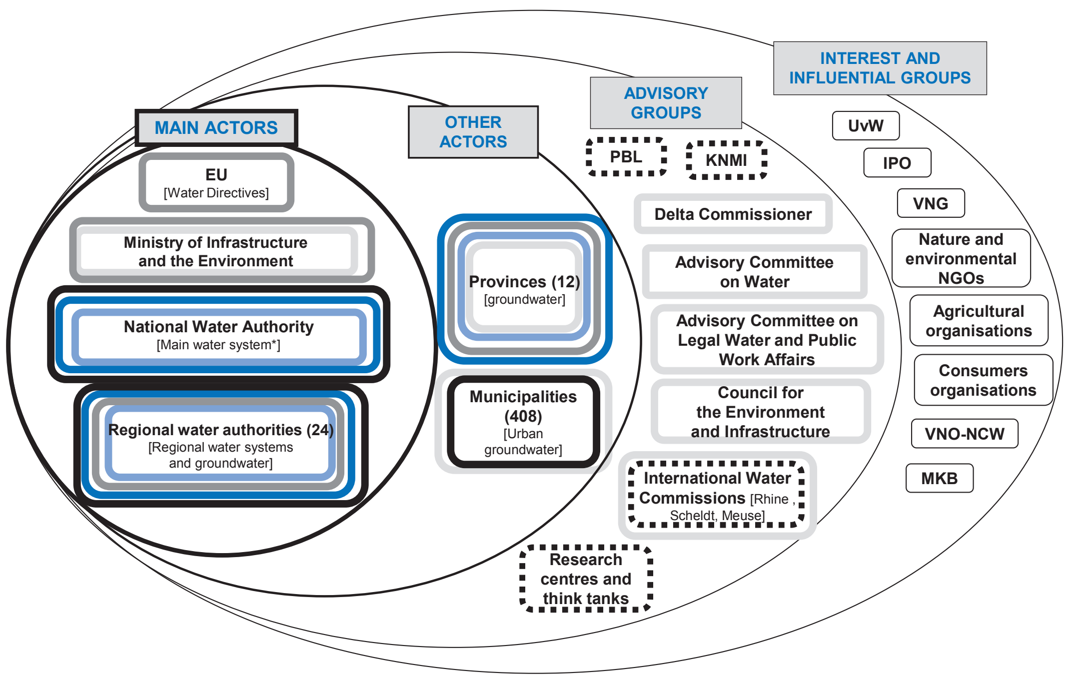


EU	European Union	MKB	Organisation of Entrepreneurs	VNG	Association of Netherlands Municipalities
IPO	Association of Dutch Provinces	PBL	Environmental Assessment Agency	Vewin	Association of Dutch Water Companies
KNMI	Royal Netherlands Meteorological Institute	UvW	Association of Regional Water Authorities	VNO-NCW	Confederation of Netherlands Industry and Employers

Water quantity management for water supply and keeping the territory dry

Ensuring that the right amount of water is available at the right place and at the right time is a critical function, which has to be performed in consideration of international Treaties for the Transboundary Rivers. Following the century-long battle to prevent lands from flooding from sea or rivers, recent decades have witnessed an increasing concern for shortage in freshwater supply (see Chapter 2). Depending on geographical areas, these can be temporary or permanent and have different origins: aridness, changes in groundwater flows, or different chemical composition of groundwater. Managing the quantity of surface water and groundwater, and achieving and maintaining certain water levels is also a shared responsibility across levels of government.

Figure 1.5. **Institutional mapping for water quantity management**



*The main water systems include the main rivers, Lake Ijssel, the Wadden Sea and the North Sea.

- Operational management for water systems
- Operational management for inland waterways
- Regulation (quantitative status and threshold values)
- Strategic planning and advice (groundwater quality policy, spatial functions)
- Financing (general taxes, groundwater tax)
- Data gathering and sharing on ecological status (quantitative)

EU	European Union	MKB	Organisation of Entrepreneurs	VNG	Association of Netherlands Municipalities
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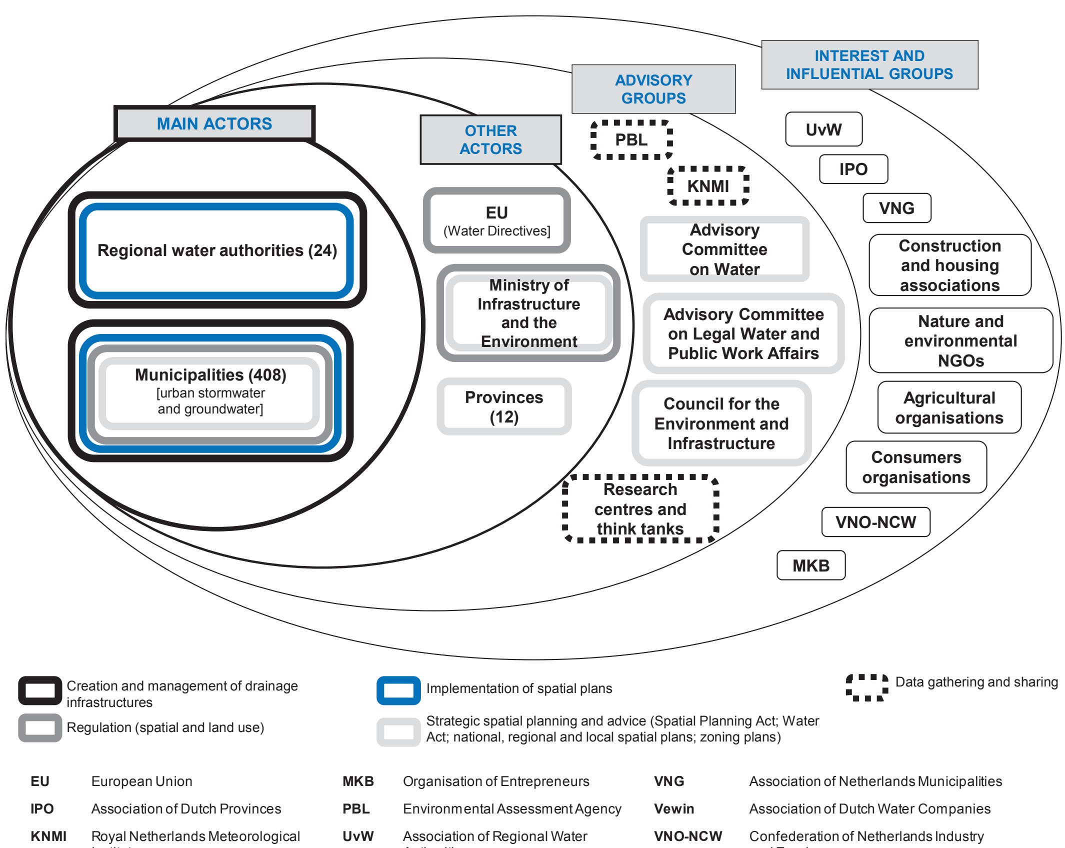
Regarding surface water, the state manages the so-called "main water management system" (the IJsselmeer (Lake IJssel), the Wadden Sea, the river deltas, the major rivers and a number of large canals), while the regional water authorities manage the regional water system (Figure 1.5). The precise boundaries of the main water management system and the regional water systems are contained in maps included in the annex of existing water laws and regulations.

The latest developments relate to groundwater management. In the Water Act, this area falls under the responsibility of the regional water authorities, with some specific duties allocated to the provinces and municipalities. For example, the provinces levy the groundwater tax and issue licenses for three types of groundwater abstraction. Municipalities are responsible for the groundwater level in urban areas to preclude or limit, as far as possible, any structurally adverse influence on the water level (too high or too low).

A unique function carried out by the regional water authorities consists in "keeping the territory dry". This function is at the heart of the Dutch physical "polder – reclaimed land – approach". The Dutch word *polder* refers to areas of ground that are lower than the surrounding waters where the water level is artificially regulated. In a broad sense, it may refer to all areas that have been reclaimed from the water. The Netherlands has 3 891 polders, and half of the total polder surface area in Europe is on Dutch soil.[8]

Intensive and systematic drainage has been critical to protect the Dutch population and economy in reclaimed areas. Such a function is separate but inherently linked to the existential risk of flooding of low-lying areas that the Netherlands faces. Regional water authorities are responsible for this backbone function of maintaining the watercourses, monitoring water levels and pumping to maintain the required level (Figure 1.6). Through this function, they also create the "natural infrastructure" for urban development, economic growth and recreation, effectively enabling, implementing and operating the communities' spatial and land-use decisions.

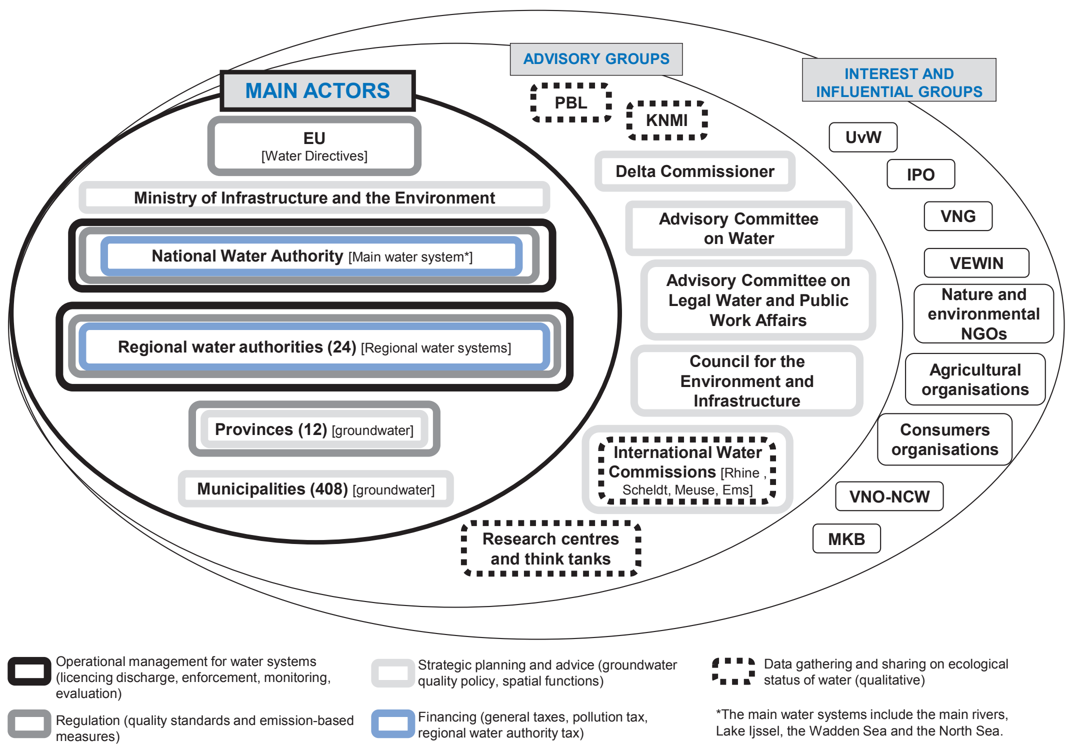
Figure 1.6. **Institutional mapping for drainage**



Water quality management

The protection and improvement of water quality falls under the state (main water management system) and the regional water authorities (regional waters).[9] The national government formally co-ordinates and facilitates the implementation of the Water Framework Directive, and is responsible for national policy (e.g. setting national standards) (Figure 1.7). Regional water authorities are responsible for operational management, including planning, licensing discharges, enforcement and evaluation. They also oversee urban wastewater treatment. Responsibility for groundwater quality is linked to broader soil protection policy, the implementation of which belongs to municipalities and provinces.

Figure 1.7. **Institutional mapping for water quality management**



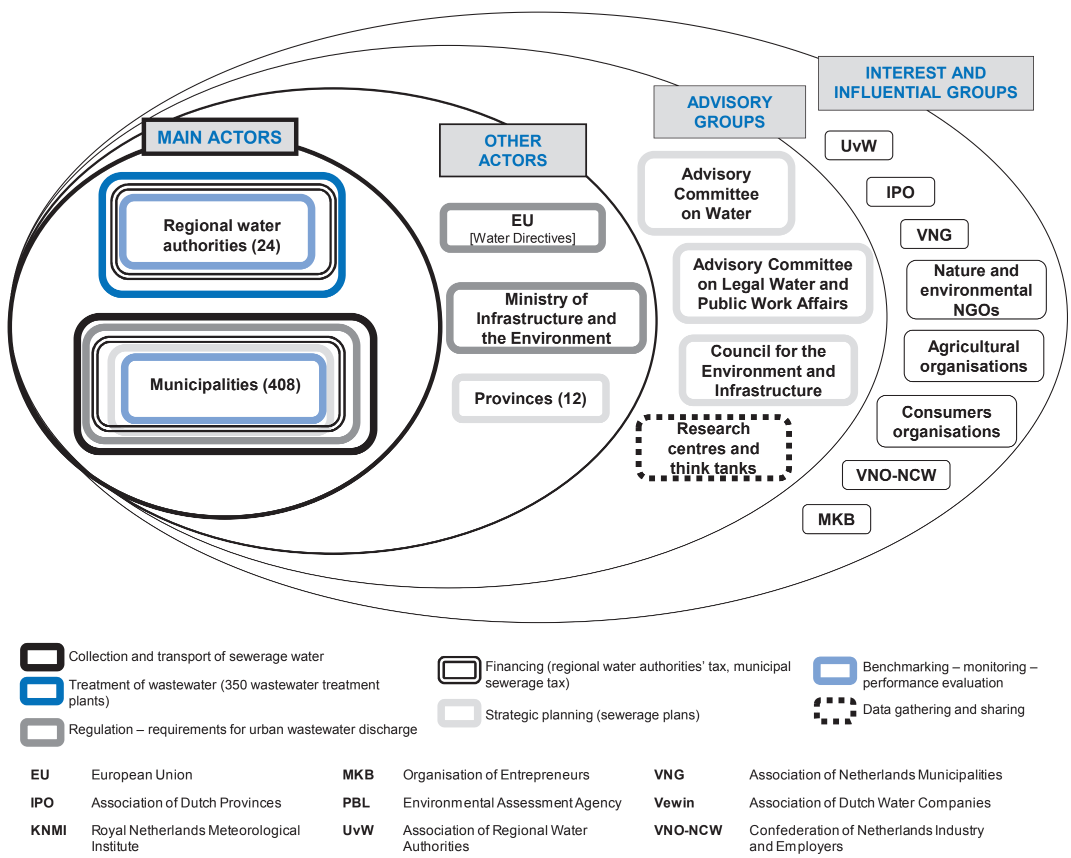
EU	European Union	**MKB**	Organisation of Entrepreneurs	**VNG**	Association of Netherlands Municipalities
IPO	Association of Dutch Provinces	**PBL**	Environmental Assessment Agency	**Vewin**	Association of Dutch Water Companies
KNMI	Royal Netherlands Meteorological Institute	**UvW**	Association of Regional Water Authorities	**VNO-NCW**	Confederation of Netherlands Industry and Employers

Sewerage and wastewater treatment

Wastewater treatment has become a major component of regional water authorities' tasks and revenues in recent decades. They currently manage about 350 wastewater treatment plants for the treatment of urban wastewater coming from households and businesses (van Rijswick and Havekes, 2012). They can contract out services (e.g. operation and maintenance tasks) to the private sector. In one specific case, a wastewater treatment plant has been based upon a BOT (Build, Operate and Transfer) contract. To carry out these responsibilities, regional water authorities charge a wastewater treatment fee, and both regional water authorities and the state charge a pollution tax for direct discharges into surface water.

Responsibility for sewerage is entrusted to the 408 municipalities in the Netherlands, by the Environmental Management Act, compelling them to draw up a sewerage plan, the preparation of which must involve regional water authorities (Figure 1.8). The same regulation obliges each municipality to ensure that wastewater discharged from premises situated within its territory is collected in a public sewer and transported to the wastewater treatment plant. The municipality can cover the costs incurred by means of a sewerage tax. This municipal responsibility is closely linked to the regional water authorities' duties associated with water quality and wastewater treatment as the public sewer is connected to regional water authorities' wastewater treatment plant (the so-called wastewater cycle).

Figure 1.8. **Institutional mapping for sewerage and wastewater treatment**

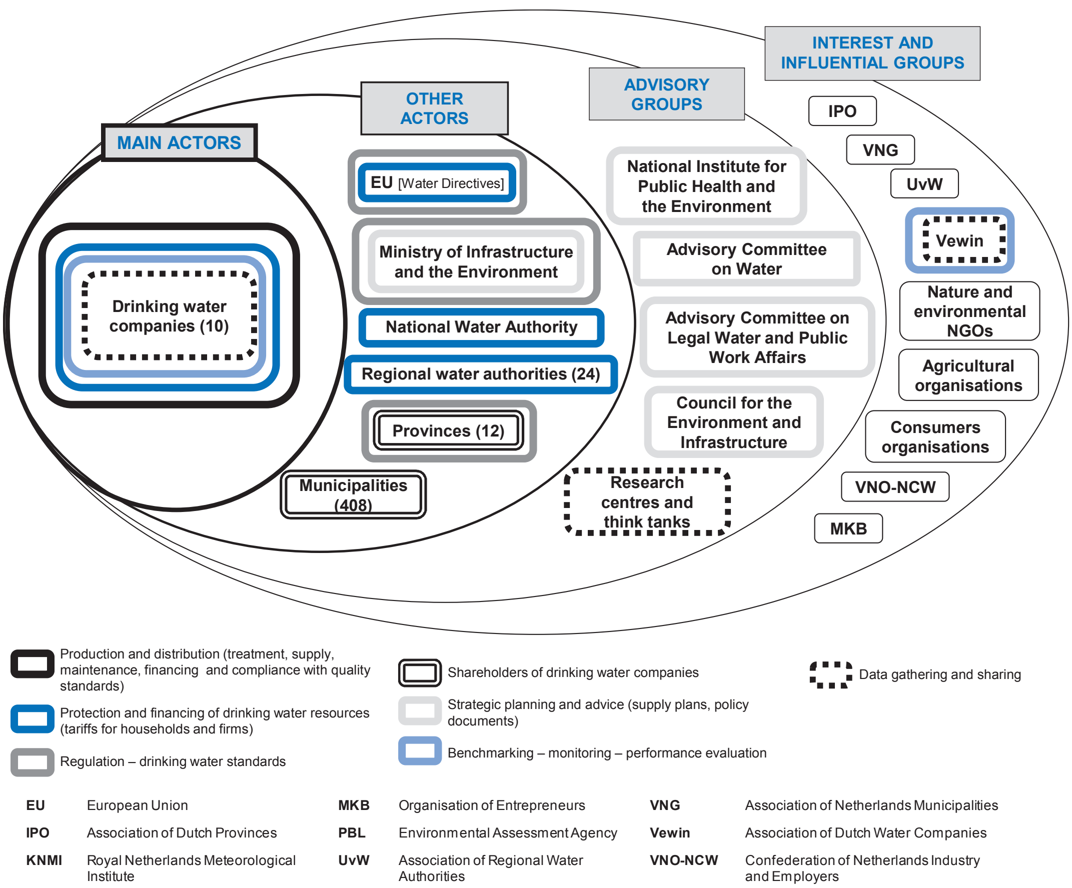


Recently, targets for wastewater treatment have been increasingly influenced by the river basin management plans developed under the EU Water Framework Directive, instead of independent national and provincial policies. The 2011 Administrative Agreement on Water Affairs includes options for a more cost-effective organisation of wastewater treatment, ranging from further co-operation between municipalities and regional water authorities in the collection, transport and treatment of wastewater, to joint collection of taxes. Regional water authorities and municipalities have self-regulated benchmarking for sewage collection and wastewater treatment.

Drinking water supply

The Drinking Water Act sets up the organisation of the drinking water supply in the Netherlands and entrusts government bodies with the responsibility to ensure the sustainable security of the public drinking water supply (Figure 1.9), with the central government playing a central role. The responsibility for supplying drinking water is entrusted to ten drinking water companies (previously more than 200). These are semi-public bodies operating under private law with their shares owned by the provinces and municipalities. Therefore, rather than levy a "tax" they charge a "price" for the drinking water they supply to households and firms. In 2004, parliament banned private sector provision from water supply, but in practice, drinking water companies contract out many services (e.g. customer relations and repairs) to the private sector.

Figure 1.9. **Institutional mapping for drinking water supply**



Linkages across water management functions and beyond

Interdependencies

Water management functions are intrinsically interlinked and mutually dependent and require a systemic approach to the allocation of roles and responsibilities, in particular regarding three main interdependencies:

- Responsibility for the drinking water supply is closely linked to the quality of water resources, and to a certain extent to the management of sewerage and wastewater treatment (tap water is discharged into the sewers and flows to the wastewater treatment plans).

- The relationship between sewage collection and wastewater treatment is important, especially given the links with the effluent receiving treatment plants.
- Sewage collection and stormwater management functions are closely connected, especially in urban contexts, and can have a negative impact on water quality; when no separate systems exist, stormwater is collected in sewerage networks, generating risks of overflow in cases of heavy rain and too little capacity of networks.
- The impact of wastewater treatment plants on receiving surface waters is also worth considering as water quality and water quantity need to be tuned.

In addition, because water management functions are intrinsically linked to other policies, specific attention should be devoted to two areas in particular:

- The first is the connection with land use, in a densely populated territory, with significant spatial limitations for urban and economic development, and important related implications for water management.
- The second is agricultural development, which relies heavily on water supplies and also raises issues of allocation, land use and impact on flood management and quality.

Mismatches

Water management and governance in the Netherlands address today's complex web of issues and demands, but there is still room for improvement. This is especially true in the face of future challenges, such as the trend towards greater integration of water quantity and water quality in the country. This has generated better interconnectedness of water institutions with territories and populations; but some (current) challenges persist, even if they are not considered as structural problems.

In addition to the debates around the scope of regional water authorities' prerogatives, there are uncertainties and discussions relating to the relationship and discrepancies between:

- regional functional organisation of water management and policy design and implementation by the central government, provinces and municipalities
- land-use planning and water management
- nature conservation and protection and water management
- management of the main and regional water systems
- policy formulation, responsibilities, financing
- wastewater collection and transport treatment
- product policies and water management, i.e. substances and products on the market (REACH medicines, pesticides, fertilizers) and their impact on the ecological status of waters, i.e. both sufficient quantity and acceptable quality.

When the responsibility for a specific water management function and/or related financing is allocated to an authority that has to rely on other public, private parties or policy fields to successfully fulfil it, mismatches can arise and effective co-ordination becomes essential:

- Sewage collection (municipalities) and wastewater treatment (regional water authorities) remain largely separate. Regional water authorities have little control over the flow and load to be treated from the municipalities, despite significant improvement in co-ordination and co-operation in recent years. The potential advantage of municipalities in the delivery of urban drainage only materialises when this function is well co-ordinated between urban planning and wastewater treatment. Performance targets could be defined and monitored by a third party to make sure opportunities in both areas are fully exploited.
- The Dutch sewage conveyance is a combined storm and wastewater sewage system. The combined system of sewage and storm water collection is the most expensive part of urban water management as is often the case in many countries. It is also one impetus for urban spatial planning or green infrastructure. In particular, small municipalities with weaker sewer staffing show a higher degree of vulnerability.
- The decentralised nature of land-use planning and the strong prerogatives at the municipal level (binding plans) imply important trade-offs between water security and water management objectives on the one hand, and protection of natural landscape and environment on the other hand. This can create tensions between water, nature conservation and spatial planning and threaten policy coherence and consistency (see Chapter 4). The disconnect between policy design and implementation in relation to spatial planning creates mismatches whereby those taking decisions (municipalities, provinces) do not bear the financial costs of related water management implications (regional water authorities) and vice versa. Mechanisms such as the "Water Assessment" should be further strengthened to be more effective, which may imply making them binding.[10]
- The limited integration of groundwater and surface water management is also noticeable and requires more effective co-ordination mechanisms and incentives. Given the importance of groundwater as a source of supply (and a storage capacity), conjunctive management with surface sources, which is already in use, could be expanded to help address excessive abstraction and deteriorating water quality.

The "all-in" model of regional water authorities, which have increasingly taken up a large number of actions in scope and scale (e.g. wastewater treatment accounts for more than half of their current revenues – see Chapter 6), can undermine the arguments for a specific governance (democratic elections) and financing (taxation powers) setting, justified by the long-standing management of an existential risk (flooding) and their tasks in maintaining water levels. While such a governance system and financing scheme may be justified by the flood protection function of regional water authorities in a country largely below sea level, it is less adequate to invest in and operate wastewater treatment services (see Chapter 7).

Ways forward for better interconnectedness

There are several options to enhance linkages across water management functions as well as between water and other environmental functions (see Chapter 4).

- The **Environmental Planning Act** under development may provide an opportunity to **better integrate water, spatial planning and environmental protection**. But it can also lead to more diffuse policy goals and shifting priorities, and scale down water in the overall environmental agenda.
  - When different authorities have to co-operate in policy fields that have different aims and a different view on public responsibilities, the division of responsibility can get blurred.
  - Taking such synergetic measures requires a clear understanding of who should finance them. The Environmental Planning Act provides a **unique opportunity to integrate planning with environment**, but further understanding of who pays for what is critical to address incentives for inappropriate physical development (see Chapter 5).
- Interlocking water management functions implies **clarifying what falls under the scope of "national security" and hence requires specific functional democracies**, and which functions could be delivered under alternative governance and financing frameworks. This can help reconsider, if need be, the allocation of selected functions on the basis that form follows function and territorial specificities.
- **Combining flood defence with other public interests** is a novel approach to improve ecology, nature and spatial quality, and increase possibilities for economic development and housing. Originally, water safety simply meant building dykes and managing the drainage of the polders.
  - Whether this integrated approach can actually be implemented will depend on the existence of sufficient public support, but also on practical, technical or biophysical possibilities.
  - In practice, several functions can be combined with environmental constraints e.g. by not building hydropower at certain locations or building hydropower respecting ecological constraints (e.g. by building functional fish migration facilities with both upstream and downstream fish migration facilities, including the use of fish friendly, retractable turbines).
  - Retention measures to lower water level in case of heavy rainfall to combat flood risk can be combined with ecology (no concrete lined retention basins but "natural retention areas" with natural banks enabling nature to develop as well).
  - Costs and available finances are the main factors on which the combination of flood defence with other public interests will be further enhanced, as these novel strategies are usually considerably more costly than the traditional ones.
- The 2011 Administrative Agreement on Water Affairs is a **right step towards better interconnectedness** across institutions and water functions. Further interconnectedness can be strengthened along the following lines:
  - The needed renewal of ageing infrastructure in part of the country provides an opportunity to combine networks and think of economies of scale and scope (see Chapter 4).

– Costs and benefits of the options for better integration need to be carefully analysed and linked with national and regional trends in urbanisation, demographic and economic development.

– International comparison of practices on integration across water services can help clarify the potential for economies of scale (see Chapter 4).

Notes

1. Water Decree, Water Regulations, provincial by-laws and by-laws of the regional water authorities.

2. An overview of the historical development of the organisation of Dutch water management is available in van Rijswick and Havekes (2012).

3. See www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2011/06/07/bestuursakkoord-water.html.

4. Since the introduction of the *Rijkswaterstaat* in 1798, the management of the rivers and lakes, at that time especially for inland shipping purposes, there has been a distinction between the Dutch national main water system, operated and maintained by the *Rijkswaterstaat*, and the regional water systems, operated and maintained by the regional water authorities.

5. When this report was finalised, a merger of the Regional Water Authority Velt en Vecht and the Regional Water Authority Regge en Dinkel into a newly created Regional Water Authority Vechtstromen was ongoing. This brings the total number of regional water authorities to 23, starting 1 January 2014.

6. Regional water systems (or regional waterways) correspond to the dense network of ditches, streams and canals in the Netherlands constructed to store or drain sufficient water in the event of an excess of water. They form a network interconnected with the main water system at several locations. In the event of excessive rainfall, regional systems drain into the main system, while regional systems can be fed by the main system in periods of drought. The precise boundaries of the regional water systems are contained in the Water Regulations (*Waterregeling*).

7. The muskrat and coypu are medium-sized to large semi-aquatic rodents (generally referred to as "rats") found in wetlands over a wide range of climates and habitats. Their burrowing behaviour damages habitats, dykes and levees.

8. To date, 18% of the Netherlands has been claimed from the "sea". It started by reclaiming (impoldering) existing silted-up land along the coast and newly emerging tidal flats in the 13th century. In the 17th century, lakes – such as the Beemstermeer – were drained with the use of windmills. Steam engines were then used to drain large lakes– such as the Haarlemmermeer – in the 19th century. The impoldering of the Zuiderzee in the 20th century has been the country's most ambitious project by far.

9. Regional waters correspond to more than 55 000 kilometres of watercourses and 170 000 kilometres of riparian areas, excluding the Ijsselmeer (Lake Ijssel), the Wadden Sea, the river deltas, the major rivers and a number of large canals.

10. Note that the Environmental Planning Act under preparation should incorporate several assessment instruments (such as environmental assessment and cultural heritage assessment) and there is uncertainty on whether the Water Assessment can still be a separate instrument in the future.

Annex 1A.1
Water-related acts and legislation

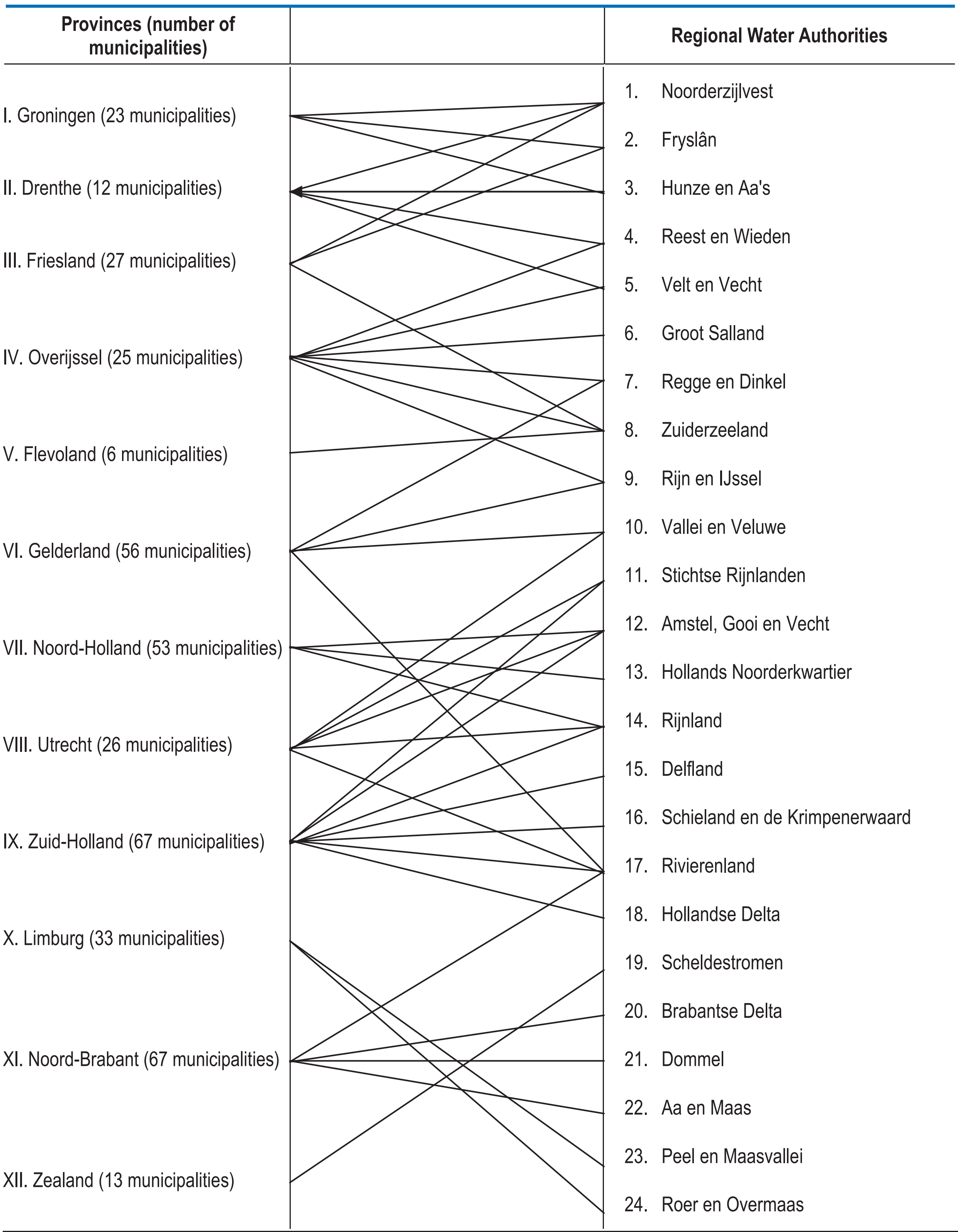
Environmental Law

- 1986 Environmental Protection Act: *Wet algemene bepalingen milieuhygiëne* (*ingetrokken*/withdrawn)
- 1993 Environmental Management Act (revised from 1994 to 2013): *Wet milieubeheer* (*geldend*/in force)
- 2008 Environmental Permitting Act (general provisions)**:** *Wet algemene bepalingen omgevingsrecht* (*geldend*/in force)
- (2018, expected) Environmental Planning Act: *Omgevingswet* (*in voorbereiding*/under preparation)

Dutch Water Law

- 1954 Groundwater (water supply companies) Act: *Grondwaterwet* (*ingetrokken*/withdrawn)
- 1957 Water Supply Act: *Waterleidingwet* (*ingetrokken*/withdrawn)
- 1957 Land Reclamation Act: *Wet droogmakerijen en indijkingen* (*ingetrokken*/withdrawn)
- 1958 Seawater (oil pollution) Act: *Wet verontreiniging zeewater* (*ingetrokken*/withdrawn)
- 1969 Pollution of Surface Waters Act: *Wet verontreiniging oppervlaktewateren* (*ingetrokken*/withdrawn)
- 1975 Seawater Pollution Act (*ingetrokken*/withdrawn)
- 1981 Groundwater Act: *Grondwaterwet* (*ingetrokken*/withdrawn)
- 1983 Act on the Prevention of Pollution by Ships: *Wet voorkoming verontreiniging door schepen* (*geldend*/in force)
- 1989 Water Management Act: *Wet beheer rijkswaterstaatswerken* (*deels ingetrokken, geldt alleen nog voor droge waterstaat*/partially withdrawn)
- 1992 Water Authorities Act:*Waterschapswet* (*geldend*/in force)
- 1996 Flood defence Act: *Wet op de waterkering* (*ingetrokken*/withdrawn)
- 2009 Water Act: *Waterwet* (*geldend*/in force)
- 2010 Drinking Water Act: *Drinkwaterwet* (*geldend*/in force)

Annex 1A.2
Dutch institutional water landscape



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Chapter 2

Knowing water risks in the Netherlands

This chapter sets out the current challenges faced by the Netherlands to manage water risks ("too much", "too little", "too polluted" water and the risk of undermining the resilience of freshwater ecosystems), based on OECD's framework for water security. It examines the extent to which the Dutch "know" the water risks they face, which requires bringing together both scientific risk assessments as well as an understanding of risk perceptions by stakeholders. The chapter then proposes options for improving the knowledge of water risks and raising awareness, which can influence decisions about exposure and vulnerability to water risks as well as secure willingness to pay for the management of water risks.

Introduction

How the Netherlands manages water risks and the level of risk considered "acceptable" has significant bearing on the financial, ecological and social sustainability of the system today and in the future. To manage water risks at the least cost to society and to ensure that policy responses are proportional to the risks faced, the OECD (2013) report *Water Security for Better Lives*[1] promotes an approach that entails to "know", "target" and "manage" water risks.

"Knowing" the risk requires the incorporation of both scientific and technical inputs into risk assessments as well as risk perceptions.

"Targeting" the risk requires determining the level of acceptable risks. The acceptable level of water risk for society should depend on the balance between economic, social and environmental consequences and the cost of amelioration. It also requires weighing "risk-risk trade-offs" that can arise when efforts to reduce a given risk, like flooding, may increase other risks, such as disrupting the resilience of freshwater systems.

"Managing" the risk requires clarity in terms of risk-sharing arrangements between public and private actors. It also means considering all risk management strategies (avoid, reduce, bear or transfer) and applying the full range of policy instruments available.

OECD (2013) sets out four key, inter-related water risks:

- risk of shortage ("too little water"): lack of sufficient water (including droughts) to meet demand (in both the short and long run) for beneficial uses by all water users (households, businesses and the environment)
- risk of excess ("too much water"): overflow of the normal confines of a water system (natural or built), flooding due to the failure or critical flood protection infrastructure, or the destructive accumulation of water over areas that are not normally submerged
- risk of inadequate quality ("too polluted water"): lack of water of suitable quality for a particular purpose
- risk of undermining the resilience of freshwater ecosystems: exceeding the coping capacity of the surface and groundwater bodies and their interactions (the "system"), possibly crossing tipping points and causing irreversible damage or system collapse.

All four risks should be considered at the same time as they can impact on each other given the interconnected nature of water resources. Given the Netherlands' unique geography, flood risk has historically been a primary focus and continues to be a concern and a key cost driver of water management, especially in the light of climate change. Risk of water shortage is an emerging risk, projected to grow in importance in the coming decades, which may require new approaches. The risk of inadequate water quality is both persistent and costly, as a result of a number of factors, including a significant agricultural sector in a constrained spatial context. Finally, the risks to freshwater ecosystems take on a special meaning in a landscape strongly shaped, or even constructed by, human activity.

This chapter provides a broad picture of the state of water risks in the Netherlands. It also provides insight into the extent to which the Dutch "know" the water risks they face. "Knowing" the risk requires building an adequate information base to inform decisions about water risks, bringing together two components: a scientific risk assessment and an understanding of risk perceptions by stakeholders. Assessing water risks can help to calibrate policy action in proportion to the risks faced. The dissemination of information on water risks can help to inform and influence decisions by public and private actors related to their exposure and vulnerability to risks. Raising awareness about water risks can also help to secure buy-in and willingness to pay for the management of water risks.

Risk of floods and excess

The Netherlands has a strong tradition in living with water. Safety against flooding and the management of excess rain have long been the foundation of water management in the Netherlands. Already in 500 BC, in order to protect themselves and their properties against the damaging waters of high tides and storm surges, people living in the northern part of the Netherlands constructed artificial dwelling mounds. This tradition has continued up until the present day. Centuries of concerted action and investment helped build and maintain the country's extensive system of primary and regional flood defences. Despite high vulnerability, the absence of a catastrophic flood event over the past 60 years is testimony to the scale and success of Dutch efforts to prevent disaster.

Recent assessments and risk perception studies provide a broad picture of the current state of the risk of flood and excess. Key findings include:

- The risk of flood in the Netherlands is very well documented. Numerous flood risk (including scientific and economic) assessments have been undertaken and provide a solid basis for informing policy decisions. However, it should be noted that uncertainty about flood risk remains, despite the significant research available on the topic, and this uncertainty is increasing due to climate change.[2]
- Information about flood risks and flood safety standards is publically available, but the extent to which this has contributed to raising awareness of flood risk is not clear.
- The flood defence structures are assessed periodically against standards based on a simulation of future climate, precipitation, discharge and sea level. According to the latest assessment, only 63% of the primary flood defences meet the standards against which they were assessed.
- The perceived probability of flooding by Dutch households is relatively low, but households do perceive that the consequences of flooding could be high were a flood to occur. Dutch citizens tend to express a high sense of safety and generally trust that the government takes care for their safety. Many residents are not aware of the extent of the risk (either the likelihood or potential impact) they are exposed to.

Flood risk assessment

Given its unique geography, the Netherlands is highly vulnerable to flood risk. Twenty-six percent of the territory is below sea level, and an additional 29% of the territory is flood prone and above sea level. Flood-prone areas are home to 9 million people. Two-thirds of GDP is produced in 55% of the land surface area, which is also flood prone. In principle, damages in the case of a flood are large. For example, damages of EUR 400 billion are estimated just for the protected area of the Randstad in the south of Holland (Slomp, 2012).

Dunes, dams, dykes and the Delta Programme enable millions of people to live safely in the low-lying areas of the Netherlands. Currently, the Netherlands has around 3 500 kilometres of primary flood defence structures, such as sea and river dykes, which protect the country against "outside water". In addition, around 14 000 kilometres of non-primary flood defence structures, such as storage basin dykes and canal dykes, offer protection against "inside water".

There are also about 100 000 people (of a population of 17 million) living outside flood defences (Slomp, 2012). These people are not protected by legally set flood protection standards. More modern housing has been adapted to be built higher, but many older houses are more exposed. Although flood risk information is publicly available, many residents are unaware of the flood risk. According to RWS (2012), the main areas outside of the dykes are:

- in fluvial areas: along the Meuse River (4 000 people) and along the Rhine River (5 000 people)
- in the Rhine-Meuse estuary (60 000 people); mainly around the large cities or harbours of Rotterdam, Dordrecht, Sliedrecht and Papendrecht
- on the dunes of the Frisian islands and the coastal cities of Holland and Zeeland (15 000 people)
- in and around the large Lakes Marken and IJssel (5 000 people).

Based on the safety standards, the risk of flooding in areas protected by the primary defences varies from 1:10 000 years in the Randstad to 1:1 250 years along the major rivers and 1:250 years for the dykes along the Meuse in Limburg (safety standards are discussed in further detail in Chapter 5).

The flood defence structures are assessed periodically according to standards related to a simulation of future climate, precipitation, discharge and sea level. According to the latest assessment, only 63% of the primary flood defences meet the standards against which they were assessed. The assessment had taken place once every 6 years, but according to recent changes in the Water Act, this will be once every 12 years going forward. In locations where safety standards are not met, reinforcement of the flood defence structures is necessary. Under the Flood Protection Programme, a great deal of effort is being put into reinforcing the primary defence structures along the coast, the rivers and the major delta waters that were shown not to meet the statutory standards in the last round of tests.

The distinction between different types of flooding is very important for Dutch water policy. Flooding due to a large amount of precipitation and high groundwater levels ("*wateroverlast*") can lead to economic damage, but not casualties. *Wateroverlast* is an issue for the regional water authorities. While there are no national standards, in the first National Administrative Agreement on Water, preliminary standards for inundation of regional surface waters are set out and reference is also made to them in the Water Act, Article 2.8. Flooding from the sea, rivers and large lakes can lead to massive economic damage and many casualties. Protection against these floods is a shared responsibility of the regional water authorities and the National Water Authority, and there are national statutory flood protection standards (see Chapter 1).

Water nuisance problems (water on the street or in cellars) can also be caused by a large amount of precipitation or high groundwater levels. These problems mostly occur in low-lying areas, such as polders, where regional water authorities are responsible for "keeping the territory dry". Problems of excess water can also arise in other areas, for example, in a city or an industrial area where the sewage system may not be able to handle extreme rainfall.

Flood risk perception

While research on flood risk perceptions in the Netherlands is sparse, available studies consistently demonstrate that Dutch citizens perceive the likelihood of flooding to be relatively low.[3] This perception is in line with the actual low levels of the probability of flooding in many areas (given the high level of protection against flood). Available studies suggest that Dutch citizens are generally not worried about their safety and find it difficult to imagine that a flood would actually occur. In other words, the perception of the probability of flooding in the Netherlands is low (Lijklema, 2001; De Boer et al., 2003; Terpstra et al., 2006; Terpstra and Gutteling, 2008; Botzen et al., 2009; Watermonitor, 2010; De Boer et al., 2012). At the same time, when asked about the perceived consequences of flooding, respondents estimated (on average) flood damages to their home and contents at EUR 70 000 (2008 price levels), which is rather high (Botzen et al., 2009).

A study by Terpstra and Gutteling (2008), suggests that the vast majority (85%) of Dutch citizens almost never, or only sometimes, think of floods and consider the occurrence of flooding in the next ten years unlikely. A survey among households along the Wadden Sea coast (n = 658) revealed low scores for personal risk, salience, perceived likelihood of flooding and feelings of fear. Measured on a five-point scale (1 = respondents almost never think of, nor discuss, flood risk with their peers, and 5 = respondents very often think of and discuss flood risk with their peers), the average score was 1.77.

Based on a survey conducted among approximately 1 000 homeowners, Botzen et al. (2009) established that 72% of Dutch citizens regard the probability that they will be affected by floods as (very) small or non-existent.[4] Their research suggests that about 11% of Dutch citizens estimate that they do not face any flood risk; about 31% of citizens consider their flood risk to be very small; and another 31% consider their flood risk small (Table 2.1). Very few citizens regard their flood risk to be high or very high. Botzen et al. (2009) also found the perception of flood risk to be low, as compared to the perception of other risks including storms, burglary, traffic accidents, house fires, car theft, car fire and terrorist attacks.

Table 2.1. **Perceived flood probability**

Responses	% of responses
No flood risk at all	10.5
Very small	30.7
Small	30.8
Not small/not large	19.3
Large	7.4
Very large	0.7
Do not know	0.6

Source: Botzen, W.J.W., J.C.J.H. Aerts and J.C.J.M. van den Bergh (2009), "Dependence of flood risk perceptions on socioeconomic and objective risk factors", *Water Resources Research*, No. 45, W10440, http://dx.doi.org/10.1029/2009WR007743.

Various other studies confirm the observation that Dutch citizens have a low flood risk perception and high feeling of safety. For instance, van Noort and van Dijk (1998) established a low risk perception among the citizens of Amsterdam. Maters (2000), who focused on the feeling of safety, concluded that only 11% of the households in Gennep, a small village along the Meuse in the province of Limburg, feel insecure during periods of high water. Research for the Directorate-General for Public Works and Water Management found that inhabitants in coastal zones also generally feel safe and consider the risk of a calamity very small (van den Berg et al., 2002).

Nevertheless, it is important to note that variation exists among individuals' risk perceptions. Botzen et al. (2009), for example, established that the differences in expected risk are generally, but not always, related to actual flood risk exposure. They found that citizens living in low-lying areas close to the main rivers generally perceive the risks to be higher than the average Dutch citizen. However, they also found that citizens living in floodplains that are unprotected by dykes tend to underestimate their risk of flooding, and have a lower perceived probability of flooding than individuals who live in protected areas. One possible explanation of this finding may be found in the work of Baan and Klijn (2004). They suggest that people living in such unprotected floodplains may be more used to the dynamic of rivers, and therefore be relatively less frightened of flooding.

A study by De Boer (2007) suggests that people living close to the main rivers, in comparison to the average citizen in the Netherlands, believe more strongly that the risk of flooding will increase due to climate change.[5] In addition, Botzen et al. (2009) found some evidence that inhabitants of rural areas generally have a higher perception of risk, whereas more highly educated and older citizens have a lower perception of flood risk. This insight is particularly interesting, as it runs counter to the idea that the older generation that experienced the major floods in 1953 would have a higher level of awareness and risk perception than the younger population.[6]

Previous personal experience with flooding and evacuation is related to a higher perceived flood probability (Botzen et al., 2009). van Duin et al. (1995) come to a similar conclusion in their study in the province of Limburg examining the risk awareness of citizens both before and after a series of floods and near-floods along the major rivers entering the Netherlands from Belgium and Germany in late 1993. Their research shows that prior to the floods, nearly two-thirds of the households were unaware of the flood risk, but that two years later (when floods and near-flood events took place along the main rivers) they were not only more aware of the flood risks but also better prepared.

In summary, although variation exists among individuals, Dutch citizens perceive their probability of flood risk as rather low, while the perception of the potential consequences of flooding can be relatively high. The perceptions are in line with the actual low levels of the probability of flooding in many areas (given the high level of protection against flood). Moreover, the absence of a major catastrophe in recent years and a relatively high degree of trust in the government to provide safety reinforce these perceptions. Various studies suggest that Dutch citizens are confident the government is addressing flood risk well, which demonstrates that Dutch citizens generally trust that the government takes care for their safety (Terpstra and Gutteling, 2008; Watermonitor, 2010; De Boer et al., 2012).

Risk of shortage

The risk of shortage of freshwater supply in the Netherlands is not yet as visible as the risk of flooding. However, the risk of shortage has the potential to become significant in the years to come. Although the government has recognised the importance of this emerging risk, and is working to address it, the risk of shortage still has the potential to be a blind spot for water users.

This section provides an overview of the risk of shortage drawing from recent assessments and risk perception studies. Key findings include:

- The risk of shortage is an emerging risk in the Netherlands that is expected to grow in the future, especially in a changing climate. Shortage arises due to a lack of water in some regions and increasing salinity in others.
- Recent estimates indicate that economic loss to the Dutch agricultural sector due to drought may reach EUR 700 million in a "dry year" (frequency of 1/10 years) and EUR 1 800 in an "extreme dry year" (frequency of 1/100 years), equal to 0.1% and 0.3% of GDP respectively.
- Studies suggest that a slight majority of Dutch citizens consider droughts and water overconsumption to be a serious issue in the Netherlands.

Shortage risk assessment

In the past, water supplies have been abundant and the abstraction regimes used in the Netherlands have focused on ensuring flood safety and protecting water quality. However, there is a growing risk of shortage due to a lack of water and increasing salinity as sea water intrudes into the delta and saline groundwater rises. Possible options to manage the risk of shortage are discussed in Chapter 5.

Climate change can increase the risks of drought and shortage of freshwater supplies in the Netherlands. In a changing climate, the variability of water supply is increasing and slightly reduced availability is projected. Periods of drought and low river discharge occurred in 1976, during the very dry summer of 2003, the dry spring of 2005 and in 2011. Competition among users is intensifying, e.g. increasing demand for electricity, increasing power stations sometimes conflicts with other water interests.

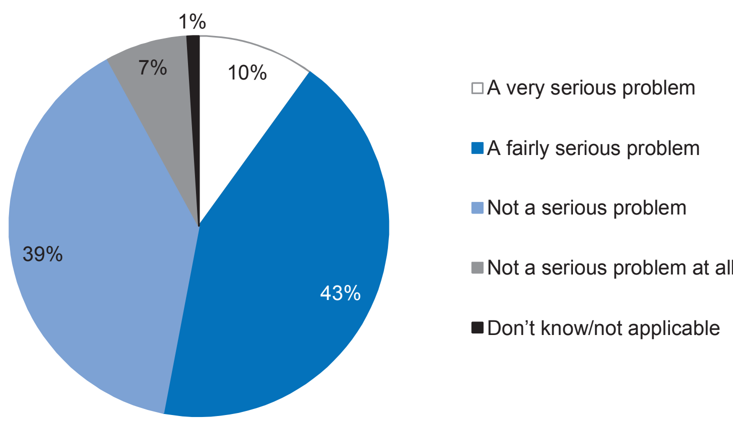
Water shortages inflict costs or result in reduced revenues or benefits for the agriculture, shipping and energy sectors, and for nature conservation and recreational uses. The potential for water shortage in the Netherlands has been assessed by the "Drought study"[7] (*Droogtestudie*) (RIZA, 2005) and recently updated in the Deltares report "Freshwater supply in the Netherlands" (Klijn et al., 2012). According to Jeuken et al. (2012), estimates of economic loss to the Dutch agricultural sector may reach EUR 700 million in a "dry year" (frequency of 1/10 years) and EUR 1 800 in an "extreme dry year" (frequency of 1/100 years).[8] These figures are equal to 0.1% and 0.3% of GDP respectively. These damages could increase significantly due to climate change and socio-economic developments. The Ministry of Economy, of Economic Affairs (2011) estimated that damages could increase fivefold in 2050, translating into a loss for the agricultural sector of EUR 700 million once every two years (Jeuken et al., 2012). Damage can also affect other sectors (shipping and transport) and nature.

Perception of risk of shortage

Research on drought risk perceptions of Dutch citizens is relatively rare. However, a recent Eurobarometer study provides some insight. This study found that 53% of Dutch citizens consider droughts and water overconsumption to be a serious issue in the Netherlands. One out of ten respondents reported that they believe these issues are a very serious problem (European Commission, 2012).

By contrast, respondents in Portugal (96%), Spain (95%), Italy (94%) and Romania (92%) are almost unanimous in their agreement that droughts and water overconsumption are serious issues for their country. Respondents in Estonia (24%) and Finland (25%) are the least likely to say that droughts and overconsumption of water are serious problems (European Commission, 2012).

Figure 2.1. **Perception in droughts and water overconsumption**



Source: Based on European Commission (2012), *Attitudes of Europeans Towards Water – Related Issues Report (Flash Eurobarometer 344 – TNS Political & Social)*, European Commission, Brussels.

Risk of inadequate water quality

This section provides as broad picture of the state of risks to water quality and to the resilience of freshwater ecosystems drawing from recent assessments. Policy responses to manage these risks are discussed in Chapter 5. Key findings include:

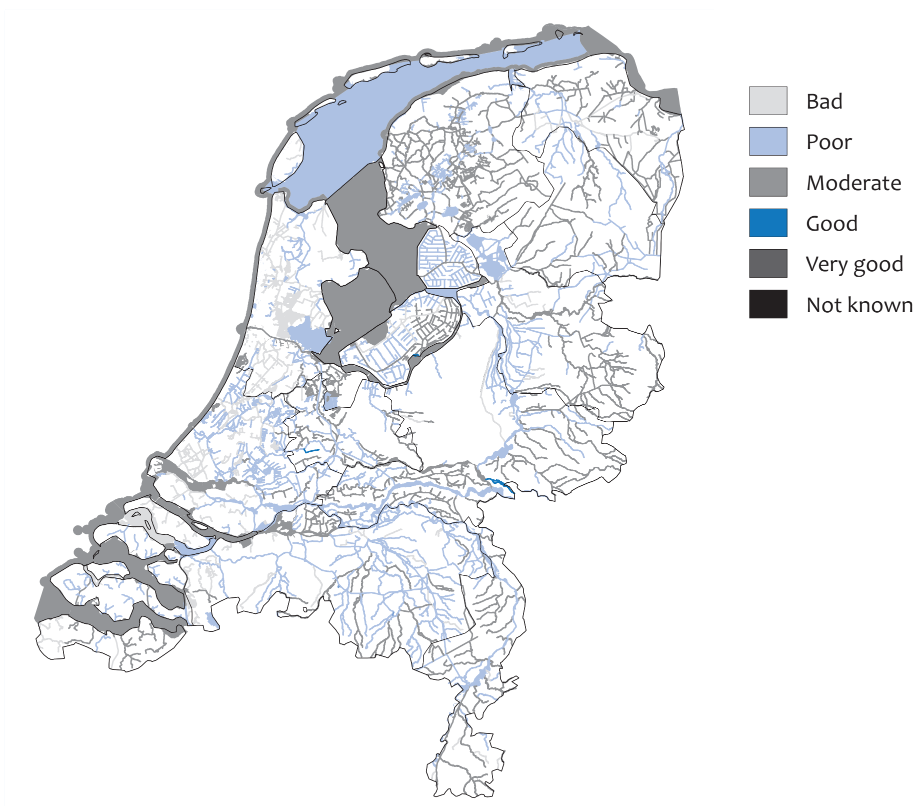
- In general, the standards agreed under the Water Framework Directive (WFD) for water quality of regional surface waters are not achieved, nor will they likely be met in 2015 (as in many other EU member countries).[9] Water quality of the national scale surface waters is, in general, sufficient or approaching sufficient water quality (except for the Meuse River).
- Overall, it is estimated that even after the implementation of the WFD programme of measures, a maximum of 40% of the Dutch water bodies will meet the WFD objectives in 2027 (PBL, 2012).[10]
- Despite significant progress on a number of agri-environmental indicators, emissions from agricultural practices inside the Netherlands also contribute to insufficient water quality, in particular related to reaching the biological objectives of the WFD. Transboundary flows of insufficient water quality are an issue for some water bodies (e.g. the Meuse).
- Risks to ecosystems in the "anthropocene" are significant. In 2009, less than 1% of water bodies met all the goals of the WFD.

- Studies suggest that the Dutch attach value to living in a beautiful natural environment and indicate willingness to pay for improved water quality. Some perception studies suggest that Dutch citizens generally do not consider water quality to be a serious problem.

Assessment of risk of inadequate quality

There are a number of factors that impact water quality, including transboundary flows, urban development and infrastructure, and economic activities such as agriculture. Overall, the Netherlands has made progress on addressing point sources of water pollution and has successfully implemented the European Directive on urban wastewater. It has also made progress on addressing point sources of chemical pollution. Over 99% of the wastewater of households is treated in wastewater treatment plants before being discharged into surface waters. However, despite significant progress, non-point source pollution remains a major issue.

Figure 2.2. **Status of ecological quality of surface water in the Netherlands, 2009**

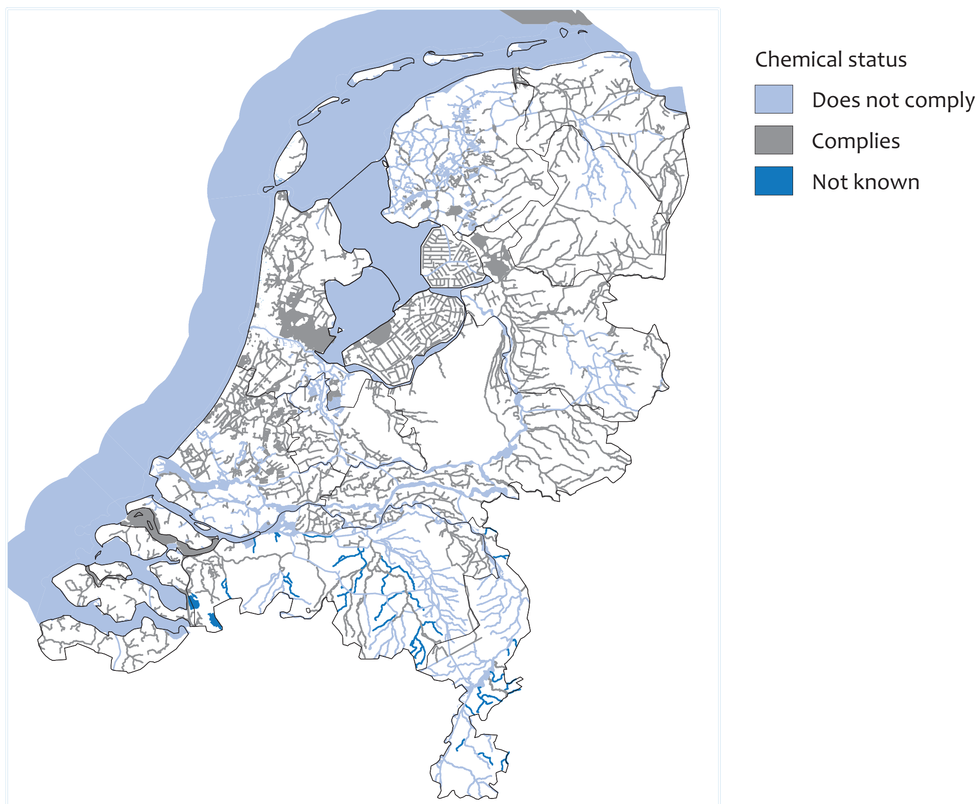


Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: CBS, PBL, Wageningen UR (2012), "Kwaliteit oppervlaktewater, 2009" (indicator 1 438, version 04, 5 December 2012), CBS, The Hague; Planbureau voor de Leefomgeving, The Hague/Bilthoven en Wageningen UR, Wageningen, available at: www.compendiumvoordeleefomgeving.nl/indicatoren/nl1438-Kwaliteit-oppervlaktewater-KRW.html?i=2-76 (accessed 10 June 2013).

In general, water quality of surface waters in the Netherlands is appropriate for the preparation of drinking water, for agricultural uses, swimming and other water recreational activities. However, water quality as agreed under Water Framework Directive[11] is insufficient. For example, the WFD goal of "simple purification" for drinking water is far from realised. Figures 2.4 and 2.5 reflect the results of an assessment in 2009 of the quality of surface water in the Netherlands in terms of "ecological" quality and "physical-chemical" quality (CBS et al., 2012a).

Figure 2.3. **Status of physical-chemical quality of surface water in the Netherlands, 2009**



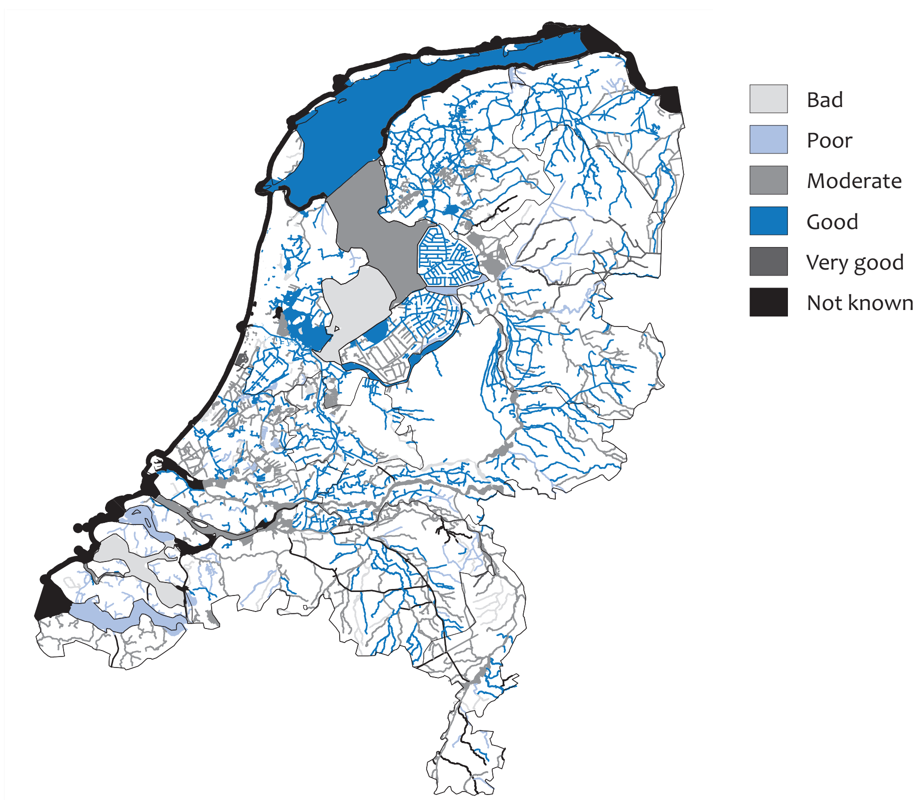
Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: CBS, PBL, Wageningen UR (2012), "Kwaliteit oppervlaktewater, 2009" (indicator 1 438, version 04, 5 December 2012), CBS, The Hague; Planbureau voor de Leefomgeving, The Hague/Bilthoven en Wageningen UR, Wageningen, available at: www.compendiumvoordeleefomgeving.nl/indicatoren/nl1438-Kwaliteit-oppervlaktewater-KRW.html?i=2-76 (accessed 10 June 2013).

Water quality of the national rivers is sufficient or approaching sufficient water quality, with the exception of the Meuse River (CBS et al., 2012b).[12] In general, the water quality of regional surface waters is insufficient (Ligtvoet et al., 2008; van Gaalen et al., 2012). The concentration of pollutants exceeds standards more significantly for regional surface waters, as compared to national surface waters (van Puijenbroek, personal communication, 13 June 2013).

It is estimated that even after the implementation of the WFD programme of measures, a maximum of 40% of the Dutch water bodies will meet the WFD objectives in 2027 (PBL, 2012).[13] It should be noted that PBL (*Planbureau voor de Leefomgeving*, the Netherlands' Environmental Assessment Agency) applies the European Commission's "one-out-all-out" methodology, meaning that if one parameter of the dozens of parameters is negative, the classification of the entire water body fails. The European Commission acknowledges that calculations based on the one-out-all-out methodology "may result in an overly pessimistic view of the progress achieved by WFD implementation, in particular for those member states which have a more developed and comprehensive assessment schemes" (European Commission, 2013).

Figure 2.4. **Nitrogen levels in surface water in the Netherlands, 2009**



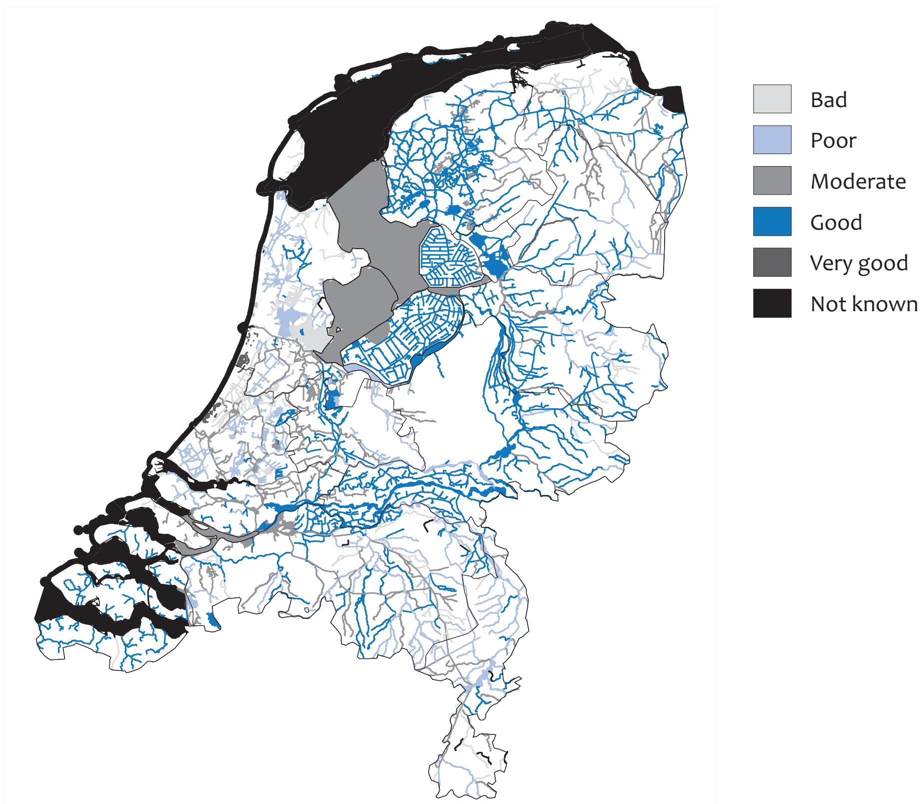
Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: CBS, PBL, Wageningen UR (2012), "Algemene fysisch-chemische kwaliteit van het oppervlaktewater volgens de KRW, 2009" (indicator 0252, version 11, 20 September 2012), CBS, The Hague; Planbureau voor de Leefomgeving, The Hague/Bilthoven en Wageningen UR, Wageningen, available at: www.compendiumvoordeleefomgeving.nl/indicatoren/nl0252-Fysisch-chemische-waterkwaliteit.html?i=25-107.

Overall, the levels of nitrogen and phosphorus levels in regional surface waters are high in the Netherlands (Ligvoet et al., 2008, van Gaalen, 2012). Maps of nitrogen and phosphorus levels in (regional and national) surface water, as reported in 2009, are provided in Figures 2.6 and 2.7 (CBS et al., 2012c).

Although the nitrogen balance in the Netherlands is quite high, the trend to reduce it looks quite good, as compared to OECD countries and the EU15.[14] Figure 2.6, based on the OECD Agri-environmental indicators, sheds light on this trend, relative to the overall nitrogen balance and provides for internationally comparable data.

Figure 2.5. **Phosphorus levels in surface water in the Netherlands, 2009**



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: CBS, PBL, Wageningen UR (2012), "Algemene fysisch-chemische kwaliteit van het oppervlaktewater volgens de KRW, 2009" (indicator 0252, version 11, 20 September 2012), CBS, The Hague; Planbureau voor de Leefomgeving, The Hague/Bilthoven en Wageningen UR, Wageningen, available at: www.compendiumvoordeleefomgeving.nl/indicatoren/nl0252-Fysisch-chemische-waterkwaliteit.html?i=25-107.

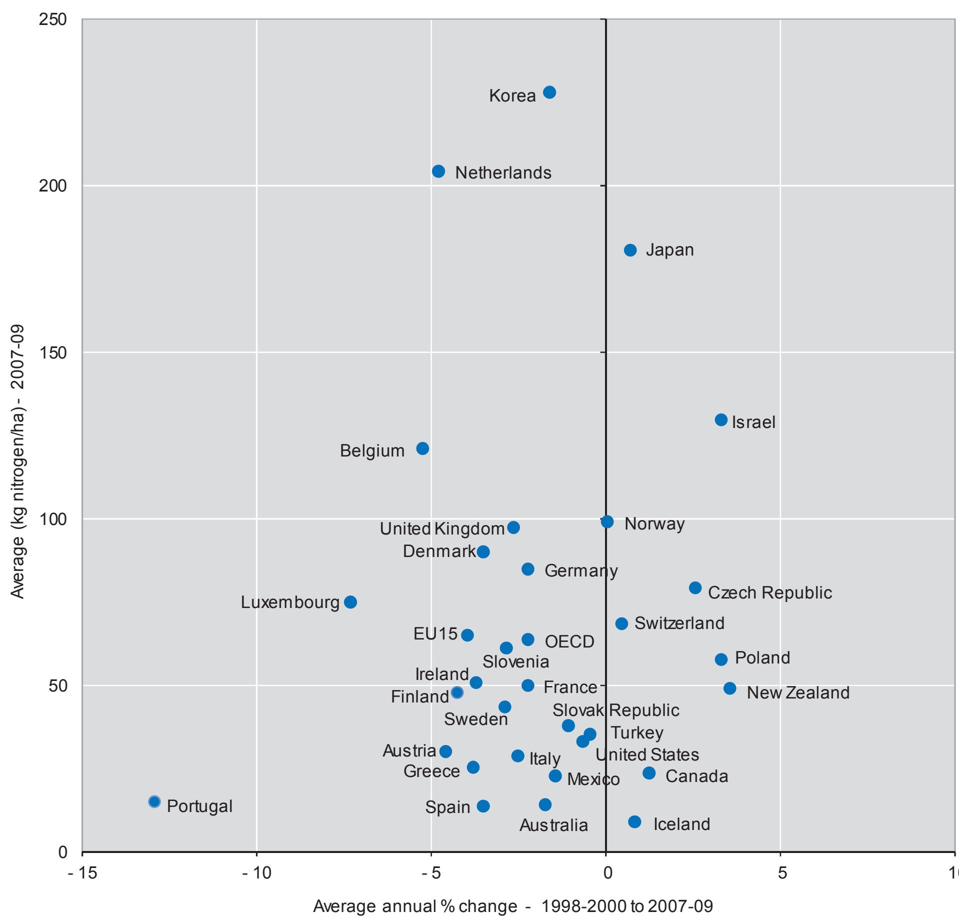
OECD Agri-environmental indicators also provide a view of changes in farmland bird populations across countries. Bird populations are one indicator of ecosystem health. The significant decline in the population of farmland birds of almost 50% in just ten years is cause for concern (Figure 2.7).

Potential benefits of improved water quality

A summary of available studies on the potential benefits of improved water quality in the Netherlands is provided by OECD[15] as follows:

> Ligtvoet et al. (2008) identify potential benefits from improved water quality, but cite a scarcity of relevant valuation studies as a barrier to quantifying such benefits. Similarly, water quality is not monetised in the environmental economic accounts. However, Joosten et al. (1998) estimate treatment of drinking water to remove nitrates to cost USD 35 million (EUR 31 million) to USD 70 million (EUR 62 million) and, whilst noting numerous caveats, Howarth et al. (2001) suggested total damage costs arising from nitrogen and phosphorus might amount to EUR 403 million to EUR 754 million by 2010. More recently, again noting caveats, Brouwer et al. (2007) estimate household WTP [willingness to pay] of EUR 24 to EUR 43 for improvements in freshwater quality. (OECD, 2012a)

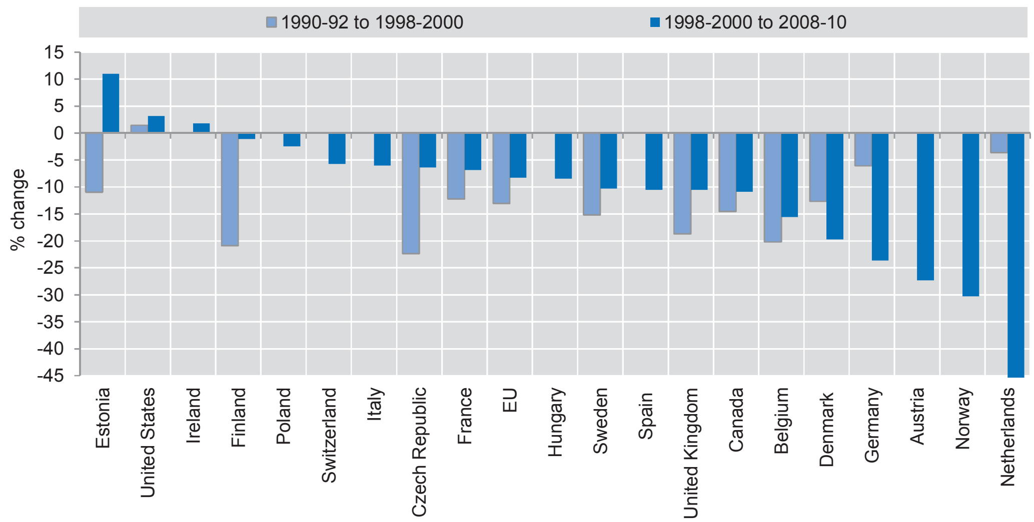
Figure 2.6. **Nitrogen balance per hectare of agricultural land, OECD countries, 1990-2009**



Note: The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Source: Based on the *OECD Agri-environmental Indicators Database*.

Figure 2.7. **Farmland bird index, OECD countries, 1990-2010**



Source: Based on the OECD *Agri-environmental Indicators Database*.

Key drivers impacting on water quality

Water quality in the Netherlands is impacted by a number of factors, including insufficiently treated discharges and sewage overflows, diffuse pollution (this includes emissions from industry and traffic, such as the pollutants found in the exhaust of cars which are then washed into the water by rainfall), legacies from the past (e.g. due to the historical load of phosphorus, a significant amount of land has already been saturated and phosphorus will continue to run off into water for years to come), discharges from factories and sewers, and nutrients and crop protection agents used in agriculture.

Despite progress in reducing the impacts of agriculture on water quality (including the significant reduction of the use of pesticides), the excessive use of manure in agriculture is a significant source of nitrogen and phosphate in the environment (Government of the Netherlands, 2013). Excessive fertilisation is less common since the introduction of fertilisation policy. Pressures on water bodies and related ecosystems from agriculture also arise from maintaining low water levels conducive to agricultural uses of land, which can negatively affect neighbouring nature areas due to an insufficient water level.

Although a comprehensive assessment of the water quality and the contributions of various factors is well beyond the scope of this report, the following section provides further discussion for two key drivers impacting on water quality: agriculture and transboundary waters.

The contribution of agriculture

The Netherlands has a relatively large agriculture and horticulture sector within a limited surface area, with major implications for water quality. Remarkably, with a total surface area of 41 500 km^2 (of which 7 500 km^2 is water and 19 100 km^2 is agricultural area), the Netherlands is one of the largest net exporters of agricultural products and foods in the world (along with France and the United States), exporting EUR 65 billion worth of vegetables, fruit, flowers, meat and dairy products each year. The development of Dutch agriculture and horticulture in recent decades has been characterised by expansion, intensification, increased productivity and farm enlargement. A recent assessment by PBL indicates that policy objectives for water, agriculture and nature are out of balance and states that water and nature objectives for 2027 cannot be realised given the current state of agricultural practices.

Both nitrate and phosphorus are important nutrients for plants; however, not all the applied minerals are removed via the harvest; in fact, a so-called mineral surplus partly ends up in the soil, air, ground and surface water. Given that the Dutch livestock industry is so large that only a portion of the animals can be nourished by home grown feed, to a considerable degree, feed is imported. At the same time, a large part of the cattle farm products is exported to markets elsewhere, mainly within Europe. Depending on the product and sector, the export is between 50% and 90%. The produced manure and minerals, however, mostly remain in the Netherlands. However, there are initiatives underway by regional water authorities to re-use surplus manure for the production of energy and recapture phosphorus from surface water. While the use of manure as an energy source does not eliminate nitrate or phosphorous from it, these initiatives allow for “waste” to be re-captured as an economically valuable resource.

Through the years, this system resulted in a large accumulation of phosphorus in farmlands, and frequently exceeding the maximum allowed limits of nitrate and phosphorus in both ground and surface water (Willems et al., 2012). As a result, nutrients management in agricultural practices is the main source of excess nitrogen and phosphate levels in regional surface waters (Ligtvoet et al., 2008; van Puijenbroek et al., 2010; van Boekel et al., 2012; van Gaalen et al., 2012). For the year 2009, 61% of the nitrogen load and 54% of the phosphorus load on surface waters originated from agricultural sources (van Boekel et al., 2012).

In addition to excess nitrogen and phosphorus loads, insufficient water quality of Dutch surface waters also depends on levels of pesticides. The use of pesticides in agriculture has significantly decreased in recent years and progress towards further sustainability continues. The level of pesticides in surface water has been assessed to be generally low enough to achieve the goals of the Water Framework Directive (Ligtvoet et al., 2008). Recent findings show that pollution from crop protection agents has been decreasing, but that levels are not low enough to meet the standards of the Water Framework Directive (van Boekel et al., 2012; van Gaalen et al., 2012).

Significant progress has been made in reducing environmental impacts from agriculture in recent years, as documented by OECD Agri-environmental indicators (Figure 2.8). Overall, progress in the Netherlands is comparable to the EU15. Progress in the Netherlands has outpaced progress in the EU15 and the OECD for several indicators, including: improvement in the agricultural nitrogen balance, reduction in agricultural ammonia and greenhouse gas emissions, as well as agricultural water use. But, in terms of improvement of the agricultural phosphorus balance, the Netherlands lags behind the EU15, yet outperforms OECD countries as a whole. Finally, while the trend for reducing agricultural pesticide use and agricultural land area is positive for the Netherlands, it has been less substantial than progress made in the EU15 and OECD.

Transboundary aspects

The monitoring of incoming transboundary water (which feeds into the large, national scale surface waters) is focused on the Rhine and the Meuse. The incoming transboundary water of the Meuse has insufficient water quality, as nitrogen and phosphorous levels are too high (according to WFD standards) when passing the Belgium-Dutch border (van Gaalen et al., 2012). Nitrogen and phosphorous levels in the

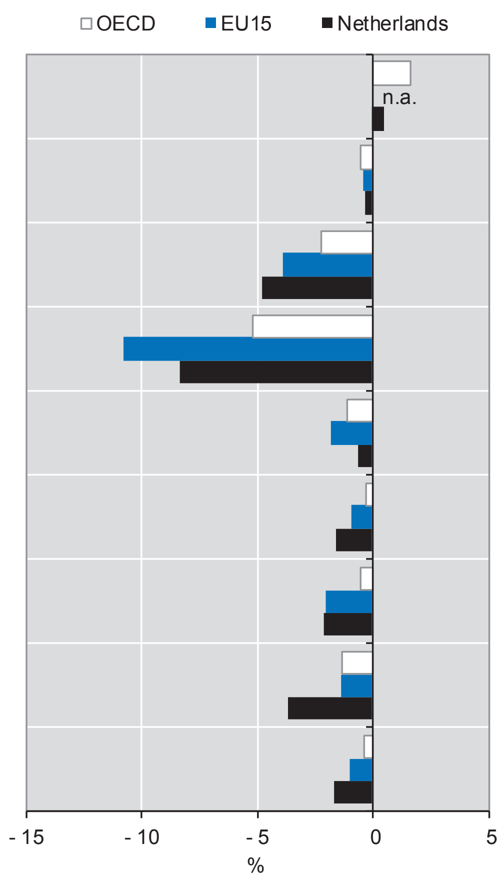
Rhine, however, when passing the German-Dutch border, are low enough (according to WFD standards) (CBS et al., 2012b).

Water quality from the Rhine has a particular significance, as water from the Rhine is used for the supply of water transferred from other water bodies[16] in case of dry periods (i.e. to supply additional water to regional surface waters from other or larger water bodies), and the Rhine River basin covers the largest part of the Netherlands (van Puijenbroek, personal communication, 13 June 2013). Due to the poorer water quality of the Meuse, water from the Meuse is generally not used for water transfers to the polder systems. Yet, in some cases of (very) dry periods, transfer of water from the Meuse is necessary. In the provinces of Brabant and Limburg, water from the Meuse regularly replenishes the regional water system through a system of national and regional canals. In these cases, incoming deteriorating flow from the Meuse is an issue in driving water quality of regional surface water bodies.

The water quality of transboundary waters for the Scheldt and the Ems is not as intensively monitored as in the case of the Meuse and the Rhine (van Puijenbroek, personal communication, 13 May 2013; van Puijenbroek and Willems, personal communication, 14 May 2013).

Figure 2.8. **National agri-environmental performance compared to the OECD average**

Average annual % change 1998-2000 to 2008-10



Variable	Unit
Agricultural production volume	Index (2004-06=100)
Agricultural land area	hectares
Agricultural nitrogen (N) balance	kg N/hectare
Agricultural phosphorus (P) balance	kg P/hectare
Agricultural pesticide use	tonnes
Direct on-farm energy consumption	tonnes of oil equivalent
Agricultural water use	million m^3
Agricultural ammonia emissions	tonnes
Agricultural greenhouse gas emissions	tonnes CO_2 equivalent

Note: n.a. = data not available.

Source: Based on the *OECD Agri-environmental Indicators Database*.

While it is difficult to make the comparison between water quality of national surface waters and the water quality of regional surface waters as well as precisely distinguish between the influence of incoming transboundary flow and agricultural practices (van der Molen, personal communication, 13 June 2013), overall, because nitrogen and phosphorus levels are particularly high in regional surface waters (due to domestic emissions), transboundary incoming deteriorating flow is not threatening the overall achievement of the standards of the Water Framework Directive as much as agricultural practices inside the Netherlands (van Puijenbroek et al., 2010; CBS et al., 2012a; van Gaalen et al., 2012; van Puijenbroek, personal communication, 13 May and 13 June 2013).

Risks to freshwater ecosystems in the "Anthropocene"

Assessment of risks to freshwater ecosystems in the "Anthropocene"

As a stark example of the "Anthropocene", the heavily modified environment of the Netherlands provides a singular example of the growing challenge of environmental management in anthropogenic environments. In essence, much of the Netherlands is an "artificial or at least modified" environment, which is taken into account when assessing progress toward meeting relevant EU directives and other environmental objectives. Only a number of small water bodies are not designated as heavily modified or "artificial". Overall, 3% of 723 water bodies are designated as "natural"; 55% as "artificial"; 42% as "heavily modified". The extent and manner of modification varies, as does the impact on the particular freshwater system – be it a river, a canal or the coast. For heavily modified water bodies and artificial water bodies, the Water Framework Directive defines "good ecological potential" and aims for alternative environmental objectives than "good ecological status". The PBL reports that achievements of ecological Water Framework Directive objectives remain limited in spite of substantial improvements.

As discussed in the previous section, water quality has improved substantially over the last decades, both in chemical and biological terms.[17] However, this improvement stagnated over the last years with regard to nitrogen, phosphorous and pesticides. While the design of water bodies has improved, restoration of natural dynamics has proceeded slowly.

Most ecological objectives are out of reach. In 2009, only 1% of the water bodies met the Water Framework Directive ecological objectives. While an overall picture for 2011 is still being assessed, it is estimated that the percentage will be below 5%. The quality of 10% of bathing sites is not acceptable, because of poor microbiological conditions. Given that the revised EU Bathing Water Directive will, from 2015, lead to failing beaches being "de-designated", a lack of urgency to tackle poor bathing water quality could have a negative impact on local economies and public confidence in water management.

In addition, there are occasional problems with (blue) algae. Due to high levels of dioxins, eel and Chinese crab from many large water bodies may not be consumed. Pesticides are also an issue, with unacceptably high levels at half of the monitoring points. In addition, new substances are an increasing problem for drinking water production and interface with ecosystem functioning.

Perception of risk of inadequate quality and risks to freshwater ecosystems

A review of recent studies indicates that Dutch citizens generally do not consider water quality to be a serious problem in the Netherlands. While research on water quality risk perceptions of citizens in the Netherlands is limited, several studies shed light on the issue. A study by Lijklema (2001) established that, overall, Dutch citizens are not very worried about water pollution. This is despite the fact that 88% of respondents surveyed consider the surface water in their neighbourhood slightly or heavily polluted and only 9% believe the water quality in their neighbourhood is not polluted.[18] Also, Brouwer (2004) established that nearly 40% of Dutch citizens consider surface water in the Netherlands either "not clean" or "not clean at all". The study also found that while roughly 20% of Dutch citizens consider surface water in the Netherlands to be "clean", few consider it "very clean".[19] A recent Eurobarometer study found that 52% of Dutch citizens do not consider water quality to be a serious problem in the Netherlands. The study found that 73% believe that the quality of water has either improved or remained the same over the past ten years (European Commission, 2012).

Studies indicate that Dutch citizens are concerned about clean drinking water, clean bathing water, visually clean and scenic attractive water, and the absence of smell and algae (Brouwer, 2004; RWS, 2008). Studies also show that they attach value to living in a beautiful natural environment and enjoy benefits from freshwater ecosystem services, such as for fishing and recreation. In the perception on the quality of water, visual aspects (such as clarity, the presence of floating litter or dead fish) are especially important (van Noort and van Dijk, 1998). A study by the Association of Dutch Water Companies (Vewin) indicates that Dutch citizens have a high trust in drinking water. On average, customers give water companies a rating of 8.3 out of 10 for water quality. Dutch drinking water complies with all legal standards for both acute and non-acute health parameters, and for operational and customer-oriented parameters (Vewin, 2010).

Public perception of swimming water quality is generally positive, which is at odds with actual conditions in some cases. Even though the bathing water in the Netherlands scores as one of the worst in Europe, and despite the fact that the quality of bathing water has decreased in recent years, surveys among recreational users show that Dutch people are generally satisfied with the quality of water (van Gaalen et al., 2012). Providing information to the public on the quality of bathing water is one of the elements of the new directive. Logos placed near beaches signalling the bathing water quality could help to raise public awareness. It remains to be seen whether the actions being taken to address this issue will improve bathing water quality in time for the new directive.

Ways forward for improving knowledge of water risks and raising awareness

The Netherlands may wish to consider a set of measures to more systematically assess water risks (to help calibrate policy action in proportion to the risks faced) and to encourage the dissemination of available information on water risks. This can help to inform and influence decisions by public and private actors related to their exposure and vulnerability to risks. Raising awareness about water risks can also help to secure buy-in and willingness to pay for the management of water risks.

Proposed ways forward include:

1. **Raising awareness** about **flood risks** seeks to influence behaviour in various ways and can take a number of forms. The focus on emergency preparedness in the **multi-layer safety approach** can make an important contribution, as emergency simulations both raise awareness and identify potential gaps for improvement. Awareness raising can also be used to influence (to a certain extent) decisions about the vulnerability and exposure of households and businesses to flood risk. Although decisions about location can be difficult to

influence solely on account of flood risk (especially in the short term) due to the importance of other factors (e.g. economic considerations, access to infrastructure, etc.), there is still scope to encourage the reduction of vulnerability (e.g. modification of property to avoid damage, installation of valuable property on higher floors). Moreover, explaining these concepts to children at school can have an impact on both children (medium- and long-term results) and their parents (immediate results).

2. In general, the **property market does not currently reflect flood risks** (e.g. via differentiated property prices reflecting various levels of exposure to flood risk), nor are property owners or renters systematically informed about flood risk in the course of property transactions, as is common practice in some other OECD countries. In addition to current efforts to raise awareness (e.g. information provision and awareness-raising campaigns) of flood risk, the government could put in place **policy instruments that systematically inform citizens** about the flood risk they face and thereby influence their decisions related to exposure and vulnerability. An example of such instruments are regulations requiring flood risk information to be provided by notaries in **real estate transactions** or requirements that real estate agencies and/or prospective property sellers disclose flood risk information **as a routine part of a property assessment** (as is often done for energy efficiency).

3. The fact that one-third of primary **flood defences fail to meet standards against which they are assessed** deserves attention. The results of periodic assessments of flood defence structures could be used to inform the general public about the actual level of protection from flood risk and help to raise awareness.

4. In order to track the emerging risk of shortage, the **"Drought study" could be updated periodically** (e.g. for example every five years) in order to reflect the most recent climate change and socio-economic scenarios and provide a valuable basis for informing policy decisions about the risk of shortage.

5. **Targeted awareness raising** and information provision about the risk of shortage could be aimed at **large water users** and **users with a low level of priority for the allocation of freshwater** (as they bear the greatest risk of shortage), many of which remain unaware of the emerging risk of shortage and stand to suffer the most significant losses when drought occurs.

6. While the scientific assessment of water quality is already quite substantial, a comprehensive **economic assessment of the cost of inaction on water quality** could be undertaken to build the case for stepping up action to address the problem. Such a study would aim to make more visible the value of improved water quality (e.g. quantifying benefits to various water users as well as the avoided costs of remediation and/or sanctions for not achieving the Water Framework Directive objectives). This would also include estimating the **economic value of well-functioning freshwater ecosystems**.

7. An economic assessment of the cost of inaction on water quality should examine the **distributional aspects** related to the **costs of inadequate water quality**. For example, poor water quality increases the cost of purification of drinking water, which is borne by water consumers rather than by the water polluter (or the beneficiaries of polluting activities).

8. The **understanding and visibility of risks to freshwater ecosystems** could be improved. Bringing together existing studies could improve the understanding of the risks to freshwater ecosystems in a heavily modified environment. For example, concrete examples of risks to freshwater ecosystems could be identified and mapped to delineate ground and surface systems at risk, **trends in terms of risk drivers and possible tipping points**. This mapping could then be used to prioritise actions to avoid crossing potentially irreversible tipping points and inform an analysis of risk-risk trade-offs. More evidence on the costs and benefits of the further re-naturalisation of waterways could also inform such analysis.

9. Overall, the **role for the private sector** in improving the evidence base for understanding water risks (in addition to efforts by government) could be further explored. For example, the private sector could contribute to information collation, presentation and dissemination.

Notes

1. Further detail on the economic rationale for the risk-based approach is provided in this report (see Chapter 5).

2. See, for example, de Moel (2012).

3. For an extended explanation on how risk perceptions can be measured, see Botzen et al. (2009).

4. At the time that study was conducted (2008), it was known that about 20% of the in total 3 500 kilometres of the primarily flood defences did not comply with the safety standards as required by Dutch law. At present, it is known that about one-third (1 305/3 500 kilometres) of the primarily flood defence system is not up to standards (UvW, 2012).

5. A recent study by De Boer et al. (2012) suggests that today the Dutch are relatively less convinced of the negative consequences of climate change than they were some years ago.

6. In February 1953, a major North Sea storm surge caused 1 836 deaths in the Netherlands.

7. The Drought study was launched as a consequence of the Water Management Policy in the 21st century. It was commissioned by the Dutch central government and has been executed by RIZA, which is a research and consultancy institute for the government. Government, provinces, district water boards and municipalities were jointly involved in the execution of the study.

8. A “dry year” has a precipitation deficiency of more than 220 mm in the summer. An “extreme dry year” has a precipitation deficiency of over 360 mm in the summer.

9. The “one-out-all-out” methodology used to assess the status of water bodies can mask progress in improving water quality.

10. The European Commission acknowledges that calculations based on the one-out-all-out methodology "may result in an overly pessimistic view of the progress achieved by WFD implementation, in particular for those member states which have a more developed and comprehensive assessment schemes" (European Commission, 2013).

11. Standards for the Water Framework Directive are referred to in terms of "chemical quality" and "ecological quality" for surface water. "Chemical quality" depends on a group of dangerous chemical substances with EU-wide objectives. "Ecological quality" depends on "biological quality", "physical-chemical quality" (among which oxygen, temperature and nutrients), and various pollutants (among which copper, zinc and polychlorinated biphenyls, or PCBs). Standards for the Water Framework Directive are referred to in terms of "chemical quality" and "quantity" for ground water.

12. In the monitoring and evaluation of surface water quality, a distinction is made between regional surface waters and national scale waters. The National Institute for Public Health and the Environment monitors the quality of shallow groundwater and the relation with the application of manure. There is a nationwide network to monitor the effects of manure policy (*Landelijk Meetnet Effecten Mestbeleid*). There is also a nationwide network for deeper groundwater (*Landelijk Meetnet Grondwater*).

13. These conclusions are based on data from the period 2009-11. Recently, regional progress reports per river basin show that the implementation of the WFD measures for the period 2010-15 are on schedule.

14. EU15 area countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

15. A background paper prepared for the OECD project "Water Quality and Agriculture: Meeting the Policy Challenge".

16. For example, surface water that is artificially and deliberately transported from a certain surface water body to the water system in area with low or dropping water levels.

17. Nitrate concentration in the water leaching from the "root zone" of agricultural parcels to the ground- and surface water decreased significantly between 1992 and 2010. The environmental pollution by pesticides has dropped. The Environmental Balance 2012 states that the quality of the environment, including water quality, has improved considerably since 1990.

18. Three percent (3%) of the respondents in Lijklema's (2001) study did not know of any surface water in their neighbourhood.

19. A significant proportion of the respondents (between 6% and 15%) answered "don't know" on the question how clean they consider the water in the Netherlands (Brouwer, 2004).

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Chapter 3

Key future trends for Dutch water governance

Four broad categories of long-term drivers affect water risks and the capacity of the current water management system to adequately respond to them today and in the future: climate change, economic and demographic trends, socio-political trends illustrated by European water policies, and innovation and technologies. This chapter synthesises projected effects of these drivers on water demand and water availability, water governance and financing in the Netherlands. It explores consequences for Dutch water management, in particular with regard to path dependency and resilience. Potential consequences are discussed, on governance and institutions, infrastructure design and financing, and policies that affect water risks.

Introduction

A range of long-term drivers affect water risks and the capacity of the current water management system to adequately respond to them today and in the future. They can be clustered into four broad categories:

- Climate change will affect water availability and the resilience of water infrastructures. Regions will be hit differently.
- Economic and demographic trends will drive water demand and exposure to several water risks and affect the capacity to respond at national levels (in particular, the availability of public funds to finance water management) and in selected regions.
- Socio-political trends. They are illustrated by recent developments in European water and related policies, which are at odds with the prevailing Dutch approach to water management.
- Innovation and technologies. The challenge will be to stimulate the take up of new approaches to water management and to avoid building new path dependencies.

Projections in this chapter rely on scenarios produced by Dutch institutions. Key findings include:

- The Netherlands enjoys well-developed capacities and resources to look ahead and anticipate future trends. These resources are connected to policy-making institutions, which build on scenarios and outlooks. In particular, the Delta Programme has put thinking about long-term trends at the heart of its vision and is actively linking it to decision making.
- Projections used are conservative when it comes to climate change and macroeconomic trends. Less favourable trends could be explored to inform policy making. Past experience and recent decisions regarding water-related funds suggest that under unfavourable conditions, the level of public finance available for water policies and services is at risk.
- Although different drivers will affect water resources and territories differently, the Dutch capacity to respond will depend on:
  - the exploration of new policies that engage directly with the general public
  - enhanced consistency across policy areas (e.g. land use and urban planning) to avoid building future liabilities
  - the capacity to harness diversified sources of funding, as prevailing ones may be at risk
  - the development of flexible policies and infrastructures that can adjust to shifting conditions, minimising path dependency; ecosystems and green infrastructures are parts of the answer (in accordance with EU policies), as are technical and non-technical innovations.

Climate change

Dutch water management takes into consideration and is adapting to the potential implications of climate change. Current policies are based on the 2006 climate scenarios developed by the Royal Netherlands Meteorological Institute (KNMI, *Koninklijk Nederlands Meteorologisch Instituut*). These scenarios are periodically updated, with new scenarios expected in 2014. The climate change scenarios, combined with socio-economic scenarios, are used to develop the Delta scenarios that inform the Delta Programme.

The KNMI 2006 climate scenarios build on European and global models, downscaled to project impacts on the Netherlands and its surroundings. The scenarios are intended to span a major fraction of the range of projected global mean temperature changes by the scientific climate modelling community, and for 2050 scenarios for +1°C and +2°C are developed. The high value of the KNMI range seems conservative in light of recent assessments at global level. The rationale for this "limited" range is that scenarios should be useful as a possible benchmark for a wide range of adaptation applications and not focus exclusively on the worst case conditions that may be more relevant for specific sectors. More extreme scenarios of global mean temperature were used as a basis to estimate the upper range of possible sea level rise in 2100 as commissioned by the Veerman Deltacommittee. For these extreme scenarios, +6°C was used as an underlying assumption (Katsman et al., 2011). However, projected shifts in global mean temperature are subject to large uncertainty in applied global climate models and underlying emission scenarios, and therefore are not a very solid base for policy making.

In addition, and more importantly, they only provide a limited view of the range of potentially significant impacts on water risks. In contrast to the fairly gradual change in global mean temperature, risk patterns at the local, more relevant, scale may shift substantially in ways that cannot be fully anticipated and are not necessarily strongly linked to global climate change. Extreme conditions that provide a challenge to local water managers emerge from variability in weather patterns that are a combined result of natural (random) and anthropogenic (forced) variability. A non-stationary future climate implies that the changing statistical distribution of extreme events makes it increasingly difficult and costly to maintain very stringent flood safety standards such as "1 in 10 000 years". It also means that new risks are emerging, such as the risk of shortage, which have not been the focus of significant attention in the past.

The Netherlands is particularly vulnerable to climate change for two main reasons. First, it is a low-lying country situated on the delta of the rivers Rhine, Ijssel and Meuse, with around 24% of its land below sea level. Without water defences, 60% of Dutch territory is vulnerable to flooding from either the sea or rivers. Second, the adaptive capacity of the freshwater supply is limited in the current setting. Further warming and an increasing deficit of precipitation could cause considerable problems as early as 2050.

The projected climate change impacts on the Netherlands were compiled by the OECD from a variety of Dutch sources (OECD, 2013) and include:

- Increase in the likelihood of floods due to an increase in sea level.
- Increase in precipitation (and decreasing contribution of snow) in winter will contribute to higher discharges in the flood basin of the Rhine and Meuse. This can result in an increase in flooding in rural areas during the winter and more frequent flooding in urban areas as heavier summer storms may exceed the capacity of sewage systems designed to cope with less violent downpours.

- Increase in freshwater demand in summer due to higher temperatures and evaporation. This is expected to combine with a decrease in levels of surface water and groundwater in the summer.
- Greater penetration of saline water into surface water bodies. Potential salination of groundwater resources.
- Longer periods of drought.

Climate change scenarios are integrated into water policies and periodically updated in the Netherlands as part of the country's National Adaptation Strategy, which was developed in 2007. They are also included in the country's National Adaptation Action Plan, which was developed in 2011. The scenarios are used to develop concrete measures, such as the Room for the River Programme and the Meuse projects, which aim to improve flood protection by increasing the peak discharge level that the rivers can handle. Climate buffers serve to reduce the risk of flooding by temporary storage and thus simultaneously reducing the effects of prolonged drought. The Delta Programme was set up to ensure that present and future generations are safe from water and will have sufficient freshwater in the centuries ahead. The programme takes an "adaptive delta management" approach, taking measures in the short term that will expand capacity to adapt to long-term changes and withstand extreme situations.

Considering the country's vulnerabilities and projected impacts, the following policies will be affected by climate change:

- Long-term scenarios for protection from sea level rise. Some experts have already questioned the economic sustainability of the prevailing policies if sea levels rise above a certain threshold. The costs may become prohibitive and alternative options may be considered. Does it make sense to aggregate population and assets in the Randstad? Or could other, less vulnerable locations be considered for some people and/or activities?
- Long-term scenarios for protection from other floods (rainwater, rivers). One particular issue is urban drainage. How can existing systems cope with harder rains? Can innovation in urban planning, building and water infrastructures provide cost-effective solutions? Do institutional and regulatory frameworks promote innovation in these areas?
- Management of episodes of freshwater shortage. Policies in place to respond to short episodes (e.g. banning some agricultural uses) may be maladapted to more frequent and longer droughts in some regions.

Economic and demographic trends

This section focuses on several trends: macroeconomic development, demand for energy, demography and regional development.

Macroeconomic development

Long-term economic trends are well documented in the Netherlands. The *OECD Economic Survey of the Netherlands* (OECD, 2012a) expects the country to see growth resume only slowly. Current fiscal targets imply a pro-cyclical stance for the next couple of years. In the medium term, economic performance will be affected by continued globalisation and ageing of the labour force. In this perspective, structural fiscal consolidation measures are necessary to secure fiscal sustainability.

Great uncertainty remains regarding the scale of future bottlenecks and the economic conditions under which they will occur. A recent study by the Netherlands Bureau for Economic Policy Analysis (CPB, *Centraal Planbureau*) offers four scenarios with potential developments for the Dutch economy at the macro and sectoral levels until 2040. Across the range of scenarios, the level of GDP per capita in 2040 is projected to be between 30% and 120% higher than the current level. While significant uncertainty regarding economic scenarios is acknowledged, all of the scenarios considered reflect positive GDP growth. More pessimistic scenarios of flat or declining growth over the long run are not considered. Potential shocks or crises, which are very difficult to model, are not considered either. This may lead to a misconception of the financial sustainability of water management in the Netherlands. While the overall cost of maintaining dykes and operating water-related services seems affordable in the moderate growth perspective, willingness to pay may change and competition for limited public funds would be exacerbated by unfavourable macroeconomic trends.

Macroeconomic decline would jeopardise not only the Netherlands' ability to manage flood risk to its preferred standards but all other aspects of water management as well. There would be less money for leakage control and resource development (demand could increase even in a recession), prejudicing security of supply. Capital maintenance of wastewater systems and effluent treatment would be at risk, which could result in deteriorating water quality and an inability to support growth.

In addition, the effects of the crisis among Dutch regions during the first shock (2007-09) have been quite asymmetric, with some regions showing resilience and others vulnerability (see OECD, forthcoming). In particular, not all Dutch regions contributed equally to the recovery. Among regions, the effects have been quite asymmetric. On the one hand, the economy of Groningen province grew by 11%, followed by Overijssel (3.1%) and North Holland (2.2%), and on the other hand, the economy of Drenthe contracted by close to 7% followed by Flevoland 6% and South Holland (2.6%).[1] The recovery in 2010 was below the OECD and EU averages, with some regions dragging down the recovery, particularly Drenthe, Utrecht and Gelderland (OECD, forthcoming). These figures shed light on regional disparities in terms of available funding to cope with future water challenges at the sub-national level.

Water and energy

Energy supply is expected to only moderately increase up to 2030. The Netherlands is currently experiencing an overcapacity in electricity generation thanks to substantial additions in the past with new high-efficient gas and coal-fired plants, replacing older plants.

The International Energy Agency does not expect there to be any new planned capacity for the coming years. There are no new nuclear plants scheduled for the coming decade, and with conventional gas production declining, the Netherlands has achieved its ambitions to become a gas-trading hub as indigenous production declines. The possibility for exploring shale gas was put on hold, pending an in-depth assessment of the potential environmental consequences. If an acceptable level of risk is agreed, the Netherlands may start exploring these resources.

The Netherlands has ambitious plans for the development of wind (on- and off-shore) and other renewables. However, these new facilities may need to be built in locations that will conflict with other water users (including the environment). These developments are not expected to directly affect water demand or water availability. However, there are times of low river water levels, for instance during the summer, when water needed to cool power plants may conflict with other users.

To sum up, no major additional pressure on water is projected from the energy side. In fact, water supplies are ample, and the shale gas reserves are expected to be rather small. Things may change, if the ongoing impact assessment and environmental review concludes that shale gas can be explored in the Netherlands.

Demography

The Dutch population is expected to grow in the next 20 years, with a sharp increase in the number of households due to a decline in the number of persons per household. Growth in highly populated urban areas is expected to continue, with 500 000 new houses in Randstad by 2040, which will be the largest functional urban area (FUA)[2] and experience the strongest growth rate.

However, in a growing number of areas, population and household numbers are projected to decrease rapidly from 2010 onwards. There will also be a rapid decrease in the size of the potential labour force due to the decrease in the number of young people and the ageing of the population. This will not only take place in the three regions already experiencing population decline (Parkstad Limburg, Eemsdelta and Zeelandic Flanders) but it will also affect many other municipalities and regions elsewhere in the Netherlands.

Contrasted demographic trends will have implications for regional development. They will have consequences on the demand for protection (this already informs the revision of flood safety standards by the Delta Programme) and water-related services, the capacity to raise funds to finance investment, and the operation and maintenance of water infrastructures.

Regional development and disparities

The *OECD Territorial Review of the Netherlands* (see OECD, forthcoming) notes that the Netherlands is one of the countries with the lowest inter-regional disparities in the OECD in terms of GDP levels, growth rates and unemployment, but disparities are increasing. Indeed, the weighted Gini Index – measuring inequality in GDP per capita among regions – was lower in the Netherlands than on average in OECD countries in 2010. The OECD notes that inter-regional inequality in the Netherlands has been increasing marginally since 1995 and at a slightly higher rate since 2004. Such an increase is consistent with that observed in Canada, Finland and the United States. Territorial inequalities can be driven by positive externalities of agglomeration economies occurring in specific regions and operating as drivers of the national economy.

Similarly, the dichotomy between urban and rural areas in the Netherlands is limited. Fifty percent of the Dutch population live in small and medium urban areas, showing a relatively balanced settlement pattern and well-established polycentric urban networks. It follows that inequality between regions is relatively limited and every area can be considered to have fair access to public and private services.

Looking ahead, three trends need to be highlighted (see OECD, forthcoming). First, although inequality in the GDP per capita amongst regions (provinces) in the Netherlands is not particularly high in OECD standards, inequality is expected to rise in the near future as a result of the global financial crisis and the difficulties more vulnerable provinces are experiencing in the recovery process. Second, contrary to the general OECD trend, population in the Netherlands tends to grow faster in the core than in the periphery of functional urban areas (except when above 1.5 million inhabitants).[3] Third, regional differentiation is expected to become larger in rural areas according to closeness to cities: the proximity to cities determines to a large extent the challenges that rural areas face in the Netherlands. This can affect water management: *i)* farmers will increasingly have to provide services requested by the urban population, including landscapes and nature values; and *ii)* there will be an increasing pressure on rural land to satisfy demands for rural housing, economic activity, recreation, water retention and biodiversity.

A number of regional disparities currently exist with regard to water risks (see Chapter 2):

- Half of the population and two-thirds of economic activity are located in flood-prone areas.
- The risk of water shortages increases when summer weather becomes more variable. The most vulnerable regions are the elevated sandy soils in the central, eastern and southern parts of the country.
- Salinisation also poses a threat to freshwater supply, a particular problem in the western part of the country.
- The risk of inadequate water quality derives from water pollution upstream (in the Netherlands and in upstream countries) and is a concern at both the basin and national levels.
- Urban and rural areas are exposed to specific risks and require different responses; their respective financing capacity is also contrasted.

Trends in regional development are likely to exacerbate these disparities and also affect the capacity of regions to respond to the challenges they face. Provinces and municipalities have little fiscal autonomy, which could create a funding gap that may hamper the capacity of sub-national governments to effectively perform their duties (see Chapter 6 for further developments). In addition, there are considerable disparities in provincial and municipal budgets across the country. For provinces, budgets vary significantly as the transfers from the central government are determined predominantly by the population size, which puts the provinces with shrinking populations at a disadvantage compared to the ones where demographic trends are more favourable (OECD, forthcoming). For municipalities, the continuous decentralisation of an increasing number of public services to the local level, combined with the current economic crisis, exacerbates the risk of a funding shortage. This casts doubts on the capacity of the municipalities to efficiently fulfil their new tasks, including sewage collection, and adds to the pressure on municipalities to up-scale or engage in collaborative arrangements to jointly deliver those policies (see Chapter 4).

Relevance for water management

The capacity and willingness to pay for water security may be affected by unfavourable economic trends and their differentiated impacts at regional (provincial and municipal) level. There is historical precedence to economic stagnation resulting in sluggish maintenance of flood defences and leading to catastrophic consequences: in the first half of the century, a ten-year depression and a further ten years of war drove underinvestment in dyke maintenance, which contributed to the catastrophic floods of 1953.

This may be particularly acute where the capacity of so-called "anticipating regions" to maintain existing infrastructures and protect against floods is at stake. It is noteworthy that the ongoing revision of flood safety standards by the Delta Programme may lower security in some (shrinking) regions (as fewer assets will be at risk). However, the cost of operating and maintaining the infrastructure will remain the same, as these are not flexible.

Other regions may be building future liabilities. Where urban and economic developments continue in vulnerable areas, the cost of achieving water security is projected to increase. The capacity to cover such costs may depend on how the burden is spread across stakeholders, in particular on how the ones who generate the risk contribute to foot the bill.

It follows that economic and demographic trends call for alternative ways to manage water risks: limiting exposure, sharing the risk and looking for responses that adapt to shifting conditions. The governance structure will need to manage the linkages noted above between urban and rural areas as regards water management and land use (see Chapter 4).

Socio-political trends

This section explores how fiscal consolidation and European policies may affect water management in the Netherlands.

Trajectory of fiscal policy

Sizeable fiscal consolidation is under way in the Netherlands. The *OECD Economic Survey of the Netherlands* (OECD, 2012a) noted that the government's 2012 budget was an important step in the implementation of its plan to reduce the deficit by a cumulated 3% of GDP by 2015, which in the Coalition Agreement was expected to almost close the sustainability gap (Rijksoverheid [Central Government of the Netherlands], 2011). The fiscal sustainability gap was estimated by the European Commission to be 9.25% of GDP in 2010, which is high in the EU context. The CPB's estimate is 4.5% of GDP in 2015 (before implementation of the 2010 Coalition Agreement). The lower estimate reflects lower expected costs of ageing, expected structural improvements arising from pre-2010 measures, and a recovery of the corporate tax elasticity (OECD, 2012a). Moreover, these estimates do not take into account higher future flood protection costs associated with global warming, pointing to a need for a more cost-efficient water management system.

There is concern that persistent pressure for fiscal consolidation and shifting political priorities could threaten the stability of funding for flood safety. As noted above, there is a historical precedent for such a situation, in the period leading up to the catastrophic flood of 1953. In 2012, annual expenditures on water management in the Netherlands by public authorities as well as drinking water companies were at around EUR 6 670 million, i.e. 1.1% of GDP. The cost is mainly borne by the regional water authorities (42%), followed by drinking water companies (21%) and municipalities (20%), the Ministry of Infrastructure and the Environment (15%) and provincial governments (2%). The current expenditure for water management, sources of financing and future projected costs are discussed in detail in Chapter 6.

The Delta Fund was set up under the Delta Act to secure the necessary finance to implement the Delta Programme charged with keeping the Netherlands safe and guaranteeing sufficient freshwater supply. The additional policy agreement laid down by the Balkenende IV Cabinet stipulates that effective from 2020, the Delta Fund would be funded with a minimum of EUR 1 billion a year. However, recent decisions call into question the sustainability of this level of financial commitment. In 2012, the Delta Fund budget was reduced by EUR 600 million in the period up until 2028 due to budget cuts. The government also recently cut EUR 150 million for implementation of the 2009-15 action programme for Water Framework Directive in the main water system (Parliament papers No. 27 625 189) and cut EUR 250 million of the budget for the period 2016-20. So, from 2016 onward, and currently, there are no funds available for the implementation of planned measures in the main water system. In 2013, an amount of EUR 100 million was added for the period 2016-18 for WFD measures in the main water system.

Moreover, current financial arrangements may also be facing issues with European Commission rules regarding Economic and Monetary Union debt levels. Financial stability is one of the arguments used in support of dedicated charges levied by the regional water authorities. While earmarking funds may secure financing flows over time and help to insulate financing from political agendas, earmarking can also undermine incentives for cost efficiency and tend to ignore opportunity costs. The OECD argues that earmarking can be appropriate when done against clearly defined objectives and recurrent assessments (OECD, 2012b).

Trends in policies from the European Union

Several European directives (nitrates, floods, etc.) affect water management in the Netherlands. Here, the focus is on the Water Framework Directive (WFD) and the related Blueprint to Safeguard Europe's Water Resources. The WFD is a well-established landmark in European water policies. It sets particular emphasis on water quality and ecosystems, and aims to restore ecological status of water and reduce hydromorphological pressure in river basins, relying on green infrastructures as appropriate. Noting difficulties and possible delays in the implementation of the WFD, the European Commission developed the Blueprint to help member countries implement and mainstream this approach.

The traditional Dutch approach to water safety, based on built infrastructures to remedy liabilities and institutionalised stakeholder consultation, is at odds with this new perspective on water management. The Netherlands has shown a low level of ambition in this domain, claiming that most of its waters are artificial systems and that restoration possibilities are limited. Despite significant progress achieved in recent years, there is a risk that the European Commission challenges such a claim and calls for a revision of Dutch policies in this domain.

In the short to medium term, a more ambitious attempt to align with the shift in European policies regarding water may require some adjustments in Dutch water governance. These policies call for increased reliance on place-based, territorial water management that takes into account regional differentiation (in terms of impacts and capacity) when coping with water-related risks, and active participation of water users. At the same time, there may also be some pressure for European policies to better acknowledge diversity.

Equity as a rising issue

Equity is becoming an issue in the Netherlands' water management on two grounds.

First, families finance wastewater treatment on a rough "three persons basis". The three-person rule may be inappropriate to pay for investment and operating costs of wastewater treatment, which are driven by environmental regulation and other variables. The distributional effects of that model have to be documented.

Second, analyses show that those who generate high costs for water protection (e.g. cities and property developers) do not foot the bill: costs of protection against flood risks are borne by the community at large, whereas benefits accrue to a smaller set of stakeholders (e.g. in rich areas where development continues in flood-prone areas and requires protection by dykes). This can become an issue when costs escalate and public funding to cover them becomes scarcer.

Dutch water policy makers need to analyse the distributive effects of the ongoing cost-recovery systems between categories of users to determine if the prevailing system is equitable.

Technological drivers

The Dutch response to water challenges relies on a sophisticated set of technologies, dominated by engineering and construction expertise, and fuelled by a capacity to innovate. Water has been acknowledged by Dutch authorities as one of nine top sectors for further economic and industrial development. This sector includes water and delta technology (eco-engineering, water safety, smart dykes and liveable Delta), maritime construction (clean and cleverly designed ships), water as a resource and water purification.

The government rolls out a "golden triangle" approach to support the development of top sectors. A golden triangle is represented by three stakeholders – businesses, knowledge institutes and the government – in a new form of public-private co-operation, focused on the development of a common vision, multi-year agreements, the financial commitment of all parties, the linkage of education and the private sector and the close links between entrepreneurs and research (see Ministry of Economic Affairs, Agriculture and Innovation, 2011). This approach is geared towards the production of knowledge and innovation.

Public authorities must reach agreement with each other to reserve a part of investments made in large water projects for the realisation of good business cases. For instance, in the Delta Programme, ministries, provinces, municipalities and regional water authorities work closely together to find the right solutions. They actively solicit input from knowledge institutes, the private sector, non-governmental organisations (NGOs). Ecoshape is an example of a business case in which knowledge institutes and the private sector, with partial government funding, work together on the development of the concept of "Building with Nature", in which natural processes are used to combine ecological goals with water safety, water security and water quality objectives (www.ecoshape.nl/topsector-water.html).

This policy continues a Dutch tradition for excellence in water technologies, which are seen as the answer to the country's water issues and risks. This approach, however, is at odds with the current trend in European policies towards prevention and conservation of ecosystems. Moreover, it created strong path dependencies. For example, flood safety requirements may diminish in shrinking regions, where fewer assets will be at risk of floods, but prevailing flood defences cannot be downsized.

Alternative responses exist. They rely on such technologies as small-scale, distributed urban infrastructures; adaptable design; water-wise building codes; economic incentives or insurance policies; as well as a review of historic land-use decisions which may no longer be relevant or appropriate. Some have been explored in the Netherlands, for instance in the Room for the River Programme. It remains to be seen if and how they are systematically explored. This may require a review of institutional and regulatory framework. In particular, water allocation regimes can promote innovation and private investment when they are well designed; pricing schemes stimulate markets for innovative water systems when they reflect pressure on the resource; business models for water services can stimulate the take-up of innovative techniques when the revenues of water companies, municipalities and regional water authorities depend on their capacity to manage water well.

Previous OECD work on alternative ways to supply water and sanitation services argues that innovation can only be deployed when water-related institutions and regulations are transformed into technology neutral enabling frameworks (OECD, 2009). Such frameworks would share common features:

- public involvement, because public acceptance is essential, especially in cases of water reuse
- clear responsibilities between municipalities, water companies and regional water authorities, as well as property owners (who may invest in decentralised systems), technology suppliers (who provide the equipment) and service providers (who operate and maintain this equipment)
- a regulatory framework (including planning regulation, norms for the quality of the product or service, standards for grey water reuse and for the techniques to be used) that allows exploring the benefits of alternative water systems and that can monitor water quality from a variety of different sources (e.g. freshwater abstraction, harvested rainwater and reclaimed water)
- water prices that reflect pressure on the resource and stimulate markets for alternative water systems when they are needed.

The above features can be used to assess how Dutch water governance is conducive to innovation deployment and use.

Notes

1. Data on the effects of the crisis among Dutch TL3 regions (2007-10), based on a calculation from the *OECD Regional Database* (2013) and data provided by the Dutch National Statistical Institute. See OECD (forthcoming).
2. OECD (2012c) has brought about a definition that better fits the dynamism of urban contexts, categorising them in “functional” terms. Four groups of – small, medium,

metropolitan, large metropolitan – functional urban areas (FUAs) are thus defined using population density to identify urban cores and travel-to-work flows capturing the hinterlands whose labour market is highly integrated with the cores.

3. The OECD, in collaboration with the EU, has recently defined functional urban areas (FUAs) which extend beyond administrative boundaries, reflecting the economic geography of where people live and work. FUAs are self-contained economic units characterised by high levels of labour linkages and other economic interactions (OECD, 2012c).

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Chapter 4

Multi-level water governance in the Netherlands

This chapter assesses the performance of Dutch water governance against a set of generic principles and the OECD Multi-Level Governance Framework. It analyses how institutional fragmentation and interdependencies are managed across multiple administrative scales and spatial dimensions. It seeks to understand whether water management goals are clearly defined and reached; how they are connected with related policy areas (spatial planning) and whether they deliver the expected outcomes. The chapter also discusses recent policy responses towards cost-effective water governance and reallocation of roles and responsibilities, and the effectiveness of policy instruments such as the Delta Programme. It concludes by suggesting ways forward to bridge identified governance gaps and foster greater integration across levels of government and policy areas.

Introduction

As in many countries that have largely decentralised their water policy making, water governance in the Netherlands involves different administrative scales and spatial dimensions. Water is both a local and global public good, which is managed at different levels, and has externalities on many policy areas (energy, agriculture, urban/rural development, etc.). Hence, regardless of their institutional organisation (unitary, federal), all countries face a certain degree of institutional and territorial fragmentation in water policy, due to the intrinsic characteristics of the sector. In that context, the institutional setting of water management is all the more important since it determines the performance of water management in reaching policy goals.

This chapter aims to assess the performance of Dutch water governance against a set of generic principles and the OECD Multi-Level Governance Framework. The objective is to analyse the way water complexity and interdependencies across multiple scales and spatial dimensions are managed and whether they deliver the outcomes of water policy for today and in the future. The chapter provides insight on recent and ongoing policy responses towards cost-effective water governance and reallocation of roles and responsibilities, as well as international comparisons and tentative ways forward.

Important policy questions to address when assessing the performance include: are the goals of water management clear? Are needed measures to reach these goals defined? Do these measures connect to policy on different fields, especially spatial planning? Are the goals being reached? Is it clear what public or private organisations are responsible for? Is enough money available to carry out assigned responsibilities? Are legal arrangements with respect to water in place, and enforced? Are stakeholders, such as citizens, farmers, fishermen, companies and environmental activists, adequately involved in water management, be it at policy or project level?

Principles for assessing the performance of Dutch water governance

Most governance principles for managing water resources and services are based on common pillars. They have been variously combined in different frameworks, thus emphasising certain universal aspects of governance (Lockwood et al., 2008; OECD, 2011):

- **legitimacy** in complying with international and European Union requirements
- **subsidiarity** in performing tasks allocated in the framework of a decentralised unitary state
- **effectiveness** in delivering policy outcomes in a transparent way and achieving expected results
- **efficiency** in doing it at the least cost
- **equity** in ensuring fairness in the service delivery and allocation of uses.

These requirements are of general nature and should be taken into account regardless of any spatial, temporal, institutional, political or other circumstances. The following section assesses the current status of these principles in Dutch water governance to set the scene for a more in-depth evaluation of multi-level governance gaps and ways forward in terms of accountability of actors and their responsibilities, integration of water policy making at horizontal and vertical levels, capacity of organisations and individuals managing water, and adaptability to a changing environment.

Legitimacy

Dutch water management complies with international and European requirements. International requirements include human rights, which can be a source of positive obligations in water management (e.g. to secure citizens from the risks of flooding), but also agreements within transboundary river basins (Helsinki Treaty; Rhine, Meuse, and Scheldt Treaties). European requirements come from EU Water, Flood, Wastewater and other Directives as well as secondary EU environmental and water legislation that have framed strategic thinking and planning in the Dutch water sector in recent years. Hence, analysing Dutch governance arrangements also requires assessing how the country abides by this supranational regulation. Box 4.1 provides an update of the status of the Netherlands in the implementation of the Water Framework Directive (WFD) and identifies remaining challenges.

Box 4.1. **EU Water Framework Directive implementation in the Netherlands**

The 2000 EU Water Framework Directive (WFD) (2000/60/EC) established a number of objectives, such as preventing and reducing pollution, promoting sustainable water use, environmental protection, improving aquatic ecosystems, and mitigating the effects of floods and droughts. Its ultimate objective is to achieve "good status" for all Community waters (inland surface, transitional and coastal waters, as well as groundwater) by 2015.

Requirements of the WFD	Status of implementation in the Netherlands as of 2012
Identify all river basins lying within the national territory and assign them to individual river basin districts (river basins covering the territory of more than one member country will be assigned to an international river basin district).	In 2004, the Netherlands were the subject of a legal infringement case by the European Commission for "non-communication" regarding the legal transposition of the WDF into national legislation. After resolving the case, four river basins were created and are all part of four international river basin districts: Rhine, Scheldt, Meuse and Ems, together with seven sub-basin districts.
Designate a competent authority for application of the rules provided for in this Framework-Directive within each river basin district.	The Ministry of Infrastructure and the Environment and the regional water authorities are indicated to have direct water management responsibilities for implementing the WFD. Other responsible authorities for the WFD implementation include the provinces (regional level) and municipalities (local level) that have prerogatives linked to water management and hence contribute to the WFD implementation.
By 2004 at the latest, produce an analysis of the characteristics of each river basin district, a review of the impact of human activity on water, an economic analysis of water use, a register of areas requiring special protection, and a survey of all bodies of water used for abstracting water for human consumption and producing more than 10 m³ per day or serving more than 50 persons. This analysis must be revised in 2013 and every six years thereafter.	The Netherlands conducted a comprehensive national work of costs and benefits of the WFD implementation. The categorisation of water bodies has shown that the Netherlands has the highest percentage of heavily modified water bodies (40% of total national surface water bodies) and artificial water bodies (50% if total national surface water bodies) on a total of surface water bodies in the European Union.
By 2009, produce management plans for the period 2009-15 for each river basin district, taking account of the results of the analyses and studies carried out.	River basin management plans (RBMPs) were adopted by the government on 27 November 2009. They consist of RBMPs for four national parts of four international river basin districts (RBDs), i.e. the districts of Rhine, Meuse, Ems and Scheldt. A national approach has been followed in the implementation of the WFD. All RBMPs have the same structure. The Ministry of Infrastructure and the Environment is the ultimate body responsible for the drafting of the RBMPs, and has a role of overall co-ordination. However, there are a large number of plans and strategies at different levels (national, regional, local), which results in a complex matrix of plans and competences across the different authorities and the co-ordination of all these plans is not always clear.

Box 4.1. **EU Water Framework Directive Implementation in the Netherlands** (*cont.*)

Encourage participation by all stakeholders in the implementation of this Framework-Directive, specifically with regard to the management plans for river basin districts (RMBPs must be submitted to public consultation for at least six months).	The National Water Consultation falling under the Minister of Infrastructure and the Environment plays an important role in implementing the WFD. Representatives of the other competent authorities (provinces, regional water authorities, communities, other relevant ministries, etc.) take part in the consultation process. A national framework was set up for the consultation of the drafting of the four RBMPs and also for the establishment of the monitoring programmes. Consultation with the public (see Chapter 7) was done through various ways (e.g. media, via the Internet, printed material, sending information to all relevant stakeholder groups, etc.). A description is included in the annex to the RBMPs concerning the main changes that the consultation process has brought about (adjustments and clarifications). In the RBMPs a short description is given of the international RBDs and on the co-operation with the neighbouring countries for drafting the international RBMPs.
From 2010, ensure that water pricing policies provide adequate incentives for users to use water resources efficiently and that the various economic sectors contribute to recovery of the costs of water services, including those relating to the environment and resources.	The RBMPs have a chapter describing the economic analysis of water use. This contains a sub-chapter on cost recovery of water services. The Netherlands has distinguished five water services, and cost recovery rates are calculated for all of them: – production and supply of water including self-service (100% cost recovery) – collecting and discharging of rain and wastewater (95% cost recovery) – wastewater treatment (100% cost recovery) – groundwater management (95% cost recovery) – regional water management (dyke management, water quantity management, water quality management). In the cost recovery calculations, the following costs have been included: financial costs, including investment, operating and maintenance costs, costs for research and implementation of groundwater measures (e.g. measures to counter dry-up).
River basin district management plans covering the period 2000-15 must be implemented in 2012, with the objective to prevent deterioration, enhance and restore bodies of surface water; achieve good status of such water by 2015 at the latest and reduce pollution from discharges and emissions of hazardous substances; protect, enhance and restore the status of all bodies of groundwater; prevent the pollution and deterioration of groundwater; ensure a balance between groundwater abstraction and replenishment; and preserve protected areas. These plans shall be revised in 2015, and then every six years thereafter.	The 2012 progress report submitted to the EU Parliament provided quantitative data on the ecological and chemical status for natural surface water bodies, artificial or heavily modified water bodies, and groundwater bodies in 2009, as well as progress scenarios for 2015.
Protect, enhance and restore the status of all groundwater bodies; prevent pollution and deterioration of groundwater; ensure a balance between groundwater abstraction and replenishment; and preserve protected areas.	In total, there are nine different groundwater bodies that are at risk of failing to reach a good chemical status in 2015. Groundwater protection zones have been established nationally in order to protect drinking water abstraction areas. In addition to these areas, other measures have been adopted specifically to safeguard the drinking water, such as diminishing nutrient emissions from agriculture. These measures are described very generally in the RBMPs, and no details on their implementation have been provided.

Source: European Commission (2012), "Working document for member state: Netherlands", accompanying the document: Report from the Commission to the European Parliament and the Council on the implementation of the Water Framework Directive (2000/60/EC) – River Basin Management Plans, European Commission, Brussels.

The Netherlands is up-to-date with enforcing the WFD and has correctly transposed the WFD provisions. Nevertheless, one cannot ignore the rather low level of ambition in achieving the ecological status objectives as 86% of water bodies in the Netherlands are subject to an exemption at present. In the future this may be challenged by the European Commission.

Justifications for the application of the exemptions (in particular in the Rhine River Basin District) relate to technical feasibility, the disproportionate costs that the necessary measures would entail, as well as natural conditions (historic pollution) and the long time need for recovery in an antropocene environment. Hence, the government has phased the timeline for improving water quality until 2027 (European Commission, 2009). It was argued that the full achievement of all chemical and ecological objectives with the necessary measures would not be possible, and that the objectives should be lowered in some cases. However, given the high level of uncertainty, it was decided that objectives would not be lowered in the 1st cycle but rather that a step-wise approach would be implemented up to 2027. In 2021, a decision will be taken as to which parameters require a lowered objective.

The WFD regime raises challenges for non-designated bodies in the Netherlands. When actually defining water bodies, the Netherlands considers the size of a water body important to determine to what extent a water body qualifies as a WFD water body. This means that part of a stream can be a water body while another part is not due to size. A direct consequence is the limited incentives to set goals and standards and to take measures concerning waters which do not belong to a WFD water body (e.g. the water management plan of the regional water authority Vallei en Eem 2010-15). The WFD applies to all waters which for administrative purposes are assigned to geographical and administrative units, in particular the river basin, the river basin district and the water body. Therefore the “water body” is a coherent sub-unit of the river basin (district) to which the environmental objectives of the directive must apply. Hence, the main purpose of identifying “water bodies” is to enable the status to be accurately described and compared to environmental objectives. The classification should be based on category (river, lake) and type (shallow, deep) to determine the status. The fact that the directive acknowledges that water bodies need to be a “certain size” from the perspective of administrative burdens actually only means that small water bodies should be assigned to larger ones of the same category or be grouped. This should be considered when developing the next generation of water plans.[1]

A positive sign for the Netherlands is its frontrunner position among the EU15 in the implementation of the EU Urban Wastewater Treatment Directive. Along with Austria and Germany, the Netherlands has largely implemented this directive, which aims to protect the environment from the effects of discharges of urban wastewater from settlement areas (i.e. cities and towns) and of biodegradable industrial wastewater from the agro-food sector (e.g. milk-processing industry, meat industry, etc.). The directive requires the appropriate collection of sewage and regulates discharges of wastewater by specifying the minimum type of treatment to be provided and setting maximum emission limit values or the major pollutants (organic load or nutrients). The full implementation of the Urban Wastewater Treatment Directive is a pre-requisite for meeting the environmental objectives set out in the WFD and the Marine Strategy Framework Directive. According to the 7th report on the implementation of the Urban Wastewater Treatment Directive by the European Commission published in August 2013, the Netherlands complies with Article 3 on collection, Article 4 on secondary treatment and Article 5 on the more stringent treatment. The reports concludes that a key challenge for the Netherlands will be to maintain and renew existing wastewater treatment infrastructures to keep meeting the highest wastewater treatment standards.

According to the informal Floods Directive scoreboard developed by the European Union, the Netherlands has thus far submitted all reporting obligations outlined in the 2007 Directive 2007/60/EC on the assessment and management of flood risks. These include: *i)* notifying the transposition in national law in 2009 (Article 17); and *ii)* setting up the competent authorities or units of management in 2010 (Article 3). A preliminary Flood Risk Assessment (Articles 4 and 5) was expected from member countries in 2012 to identify areas in which potential significant flood risks exist or could be expected to arise in the future based on available or readily derivable information. However, the Netherlands did not conduct the assessment, relying on the discretionary provision of Article 13 of the Floods Directive, which allows member countries to not undertake the preliminary Flood Risk Assessment for those areas where they have decided before 22 December 2012 to prepare flood hazard and flood risk maps. Upcoming milestones for the implementation of the directive include submitting flood hazard and flood risk maps (Article 6) by 2014 and drawing-up flood risk management plans (Article 7) by 2016.

Effectiveness

Effective water governance means that: *i)* responsibilities are clearly allocated and discharged and based on the rule of law; *ii)* public and private parties are able to enforce them politically and before the court; *iii)* citizens can rely on legislation that guarantees a certain level of protection; and *iv)* legal instruments are designed to ensure this can be effectively enforced.

The Water Act is the backbone legislation allocating roles and responsibilities of regional water authority governing boards (representatives), executive committee and chair, and ensuring a system of checks and balances. The executive committee and the chair can be held accountable before the governing board. Provinces have a legal responsibility to oversee regional water authorities, and the Minister of Infrastructure and the Environment is responsible and accountable to the Dutch parliament for central water management tasks.

Under this overarching framework, there is room for some regional differentiation when necessary and most effective. In the Netherlands, supplying drinking water (10 drinking water companies) and granting a minimum level of safety (National Water Authority and 24 regional water authorities) are publicly held responsibilities, though some of these responsibilities can be contracted out to the private sector (see Chapter 1). This approach was formalised in the Third Delta Programme (2013),[2] which proposes a policy strategy where private parties have some responsibility to create water retention capacity and which stimulates (private sector) innovation towards water-use efficiency.

Subsidiarity

The Dutch Constitution is based on a democratic decentralised organisation. It incorporates a general duty of care for all governmental bodies to ensure the habitability of the land and the protection of the environment (Article 21), and guarantees the existence of decentralised water authorities (Article 133). Subsidiarity is an organising principle of decentralisation, stating that a matter ought to be handled by the smallest, lowest or least centralised authority capable of addressing that matter effectively. In this context, regional water authorities can be considered the purest example of functional decentralisation, as they are entrusted with a specific task to manage regional waters (see Chapter 1). The central government implements national legal frameworks and designs a strategic policy. Regional water authorities can be established or dissolved by the provincial governments and the central government, both of which supervise the bodies.

The application of the subsidiarity principle in the Netherlands ensures a close connection between the interest of the regional water authority, the duty of payment for their activities and participation in the governing bodies, under the "interest-pay-say" triplet. The functionally decentralised character of the regional water authorities results in bodies with an executive composition that is institutionally and financially completely separate from the provinces and municipalities as they rely on their own governance frameworks and revenues coming (directly) from taxes.

Democratic legitimacy is also guaranteed through the representation of various categories of stakeholders in the governing bodies of regional water authorities, which perform their duties on the basis of the "beneficiary pays" principle. Those who benefit from the activities of the water authority have to pay a tax for its services, but receive a proportionate say in the assembly in return. Those who have an interest in the activities bear the costs (see Chapter 6) and have influence on the functioning of the regional water authority, via elected representatives (farmers, households, business, industries and property owners). In this sense, the regional water authority is an "interest group democracy".

Efficiency

In a context of severe fiscal austerity and sluggish recovery from the economic crisis, important steps have recently been taken in the Netherlands towards cost efficiency of water policy. The 2011 Administrative Agreement on Water Affairs was signed by the provincial authorities (IPO, Association of the Provinces of the Netherlands), the municipalities (VNG, Association of Netherlands Municipalities), the regional water authorities (UvW, Association of Regional Water Authorities) and the drinking water companies (Vewin, Association of Dutch Water Companies) with a view to encourage transparency and important savings across the water chain up to EUR 750 million across the water sector, and EUR 450 million across the water chain from 2020 onwards (Box 4.2).

The first so-called "National Administrative Agreement on Water" was signed in 2003, focusing on the impacts of climate change with the objective to anticipate sea level rise, the subsidence of the land and an increase in hard surface (among others, due to streets and housing developments). Its update in 2008 emphasised the common responsibility to get the water system in order and gave more attention to the implementation of the EU Water Framework Directive. In parallel, an "Administrative Agreement on the Water Chain" was signed to enhance collaboration between actors involved in the water chain, benchmarking, and transparency on costs, innovation and public participation.

The 2011 agreement assumes that structural savings are possible by a more efficient co-operation and co-ordination between organisations and levels of government, learning and knowledge sharing, and clear agreements about the division of tasks, including transfers of roles and responsibilities when other organisations are able to perform the same tasks better or at a lesser cost for society.

Box 4.2. **Efficiency gains in the 2011 Administrative Agreement on Water Affairs**

The agreement foresees total savings of EUR 750 million[1] annually by 2020; with the following breakdown:

- EUR 450 million of savings in the production of drinking water, sewage and wastewater purification. Regional water authorities and municipalities are responsible for EUR 380 million and drinking water companies for EUR 70 million.
- EUR 300 million of savings in the management of dykes, surface water and the provision of sweet water by the central government, provinces, regional water authorities and municipalities.

Of these total efficiency gains, EUR 200 million should be used to reduce central government expenditures on water safety:

- The transfer of muskrat and coypus control from the provinces to the regional water authorities: EUR 19 million (from 2011).
- The partial decentralisation of the financing of construction and improvement of the primary flood defences from the central government to the regional water authorities:[2] EUR 81 million annually (in the period 2011-13); EUR 131 million (in 2014); and from the year 2015, annually EUR 181 million. From 2015, the regional water authorities will then contribute EUR 181 million to the construction of the primary defences.

The other efficiency gains of EUR 550 million will structurally benefit the water system and the water chain in the form of increased investment and better quality of service through more effective co-operation across the water chain.

Note: 1. The underlying calculations of the annual savings of EUR 450 million in 2020 (whereby regional water authorities and municipalities are responsible for EUR 380 million and drinking water companies for EUR 70 million) are provided in the report "Doelmatig beheer Waterketen: eindrapport commissie feitenonderzoek" published in 2010. 2. It is worth noticing that this is not a decentralisation of task (but a new cost-sharing arrangement), as regional water authorities already had the task to operate and maintain the flood defences and supervise/implement the necessary improvements.

Source: Rijksoverheid (2011), 2011 Administrative Agreement on Water Affairs, *Bestuursakkoord Water*, available at: www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2011/06/07/bestuursakkoord-water.html.

Besides the shift of tasks and responsibilities across levels of government (transfer of muskrat and coypus control and cost-sharing arrangements related to primary flood defences), the agreement reduces some control, planning and supervision functions across levels of government. For instance, the central government used to supervise the provinces, and the provinces the regional water authorities (and the central government the regional water authorities in case of national concern or European legislation). The new arrangement foresees that:

- Where it concerns primary flood defence, the central government supervises the National Water Authority (*Rijkswaterstaat*) and the regional water authorities (in other words, the provinces no longer have a role).
- Where it concerns secondary flood defence, the provinces supervise regional water authorities. For matters related to water quality, the central government supervises the National Water Authority, and the provinces the regional water authorities.

- The central government and provinces will no longer make separate water plans, but rather aim to develop integrated plans (water, environment and spatial planning).

The new cost-sharing arrangement for the primary flood defences as part of the High Water Protection Programme deserves particular attention. The rationale is that regional water authorities (in the long run) should bear the costs for the construction and financing of primary flood defences that are already maintained by them today. Those maintained by the central government today will remain financed by the central government.[3] In all cases, the central government remains responsible for setting the flood protection standards. In addition, the High Water Protection Programme contains approximately 100 measures to strengthen dams, dykes and weak links along the coast that do not meet the standards for safety and have not been included in other programmes.

The 2011 agreement aims to maintain water management standards in the Netherlands (flood safety, good water quality, sufficient freshwater) while ensuring that costs for citizens and businesses do not increase more than moderately. In 2010, the total annual costs for the management of the water system and the water chain were EUR 7 billion. If no measures are taken, it is expected that they will increase to EUR 8-9 billion in 2020 (see Chapter 6).

Progress towards efficiency is annually monitored and published by the Ministry of Infrastructure and the Environment (in co-operation with the partners of the agreement) in the publicly available report *Water in Beeld*. Although the 2012 progress report (published in May 2013)[4] states that savings have been made and that the sector is on schedule, the exact amount and origin of such savings achieved through improved collaboration are yet unknown. An important indicator is that the difference seems to be growing downwards between the actual costs of the overall water management and the predicted "autonomous" costs, i.e. costs without the measures of the 2011 administrative agreement (Ministry of Infrastructure and the Environment, 2013).

The current administration supports a bottom-up approach to mergers and argues that efficiency gains are to be realised through increased collaboration in the water chain. But the parliament required a new study on the possible efficiency gains from the establishment of water chain companies in which drinking water provision, wastewater collection (sewerage) and wastewater treatment are integrated. The study carried out in 2013[5] concluded that regarding an optimum scale "It is clear that very small companies have disadvantages comparing to larger companies. However up-scaling above a certain level has disadvantages too." A number of 500 000 households seems an optimum level for drinking water companies. International literature, however, is showing a variable picture with regard to the optimum scale of companies. Much depends on the tasks carried out and how processes are organised. Besides the optimum scale, the study also looked at the possible efficiency gains of integrated waste and drinking water companies. Combining drinking and wastewater activities seems profitable for relatively small companies. On the other hand, very large companies show efficiency losses, too. The general conclusion of the study was that literature gives directions but no clear answers on efficiency gains of water chain companies. Much is determined by culture and how work is organised. In everyday practice, organisations (e.g. municipalities) follow a so-called "multi-scale approach": organisations look for an optimum scale for each task. The minister concluded that the study does not lead to changes in the current bottom-up approach for the water chain (House of Representatives , 2013). The independent visitation committee was set up by the minister in June 2013 to look at whether (enough) progress is being made by voluntary co-operation across the water chain to realise the agreed savings of EUR 450 million a year in 2020.

These developments highlight the capacity of different agencies involved in water management in the Netherlands to reflect on their performance and to set objectives for efficiency gains by improved collaboration.

Equity

As a basic need, water raises important equity considerations. No human being can live without a basic volume of freshwater of sufficient quality and access to safe and clean water is a human right as recognised by the General Assembly of the United Nations on 28 July 2010 (Resolution 64/292). In addition, safeguarding (Dutch) citizens against water risks also raises equity issues related to flood protection and water quantity management.

Due to regional disparities regarding water risks in the Netherlands (see Chapter 2), in particular *vis-a-vis* water safety, the principle of equity means that every Dutch citizen has to pay taxes managing these water risks. In that sense, equity links to the fact that each citizen takes on a share of the burden, combined by solidarity whereby all pay, regardless of living in the above-sea level areas (e.g. south/east) or under-sea level areas (e.g. north/west). In addition to flood protection taxes, the system also relies on pollution taxes to protect water quality. Two underlying questions remain: *i)* is the burden equitably shared among users or groups affected by water risks?; and *ii)* do these economic instruments properly address affordability concerns in terms of who pays for what and set enough incentives for water security at large to manage “too much”, “too little” and “too polluted water”, including for environmental protection functions (see Chapters 5 and 6)?

Despite the above provisions, Dutch water management raises equity issues (see Chapter 3), as within the current system those who create future liabilities (e.g. building in flood-prone areas or polluting freshwater) do not pay the costs associated with their actions (additional costs for protection against flood or for treating polluted water for subsequent use). Equity is expected to become more pressing, as fiscal consolidation gains traction and regional disparities in terms of economic and demographic development grow (especially in rural areas).

Summary

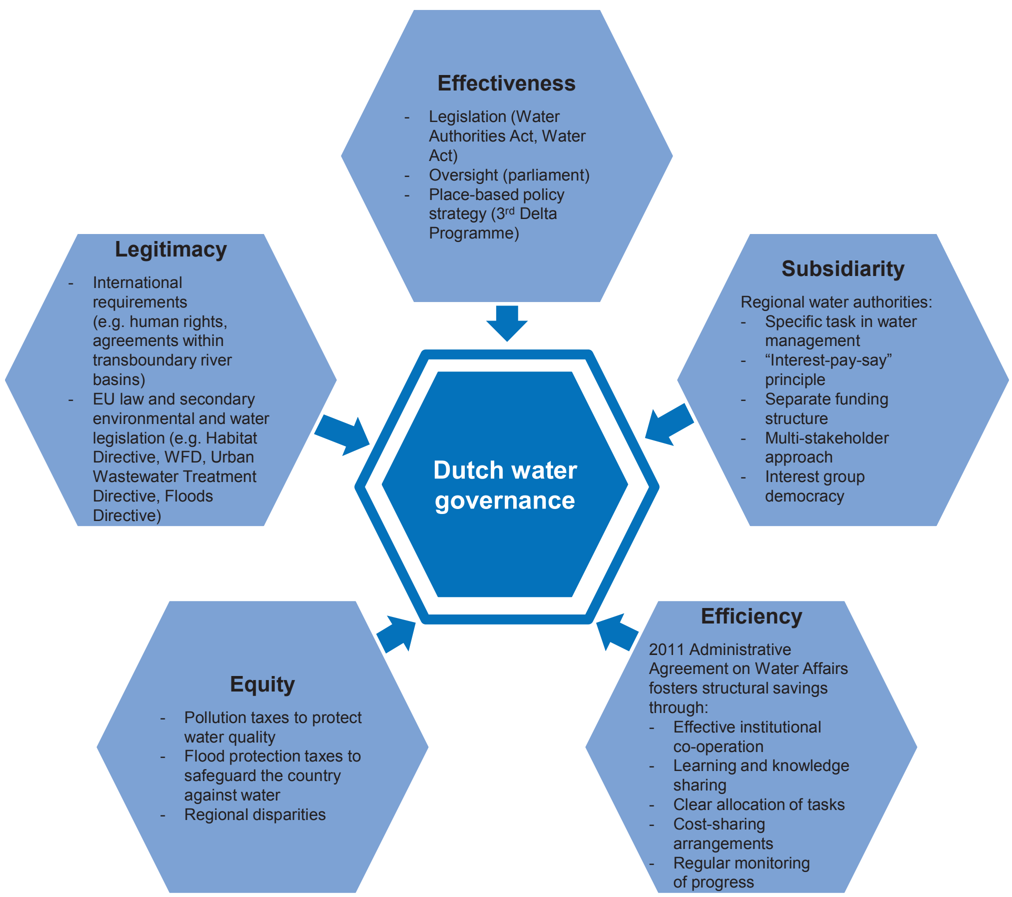
Overall, Dutch water institutions meet the different principles of good governance. Water governance in the Netherlands fulfils the requirements of human rights, equity, international and EU regulations; takes the general and environmental principles mentioned as its basis; ensures democratic representation in governing bodies; and fits within the state’s institutional characteristics and constitutional setting. Water financing (see Chapter 6) is based on the recovery principle (costs for water services are recovered from the various stakeholders) and exceptions (e.g. solidarity provisions) are justified (e.g. guaranteeing equitable and affordable access to clean water for all).

However, some challenges may threaten the performance of water governance in the short and medium term.

- The low level of ambition of the Water Framework Directive could be challenged by the European Commission. Despite substantial improvement to date in water quality, progress is stagnating with regards to nitrogen, phosphorous and pesticides, and restoring of natural dynamics lags behind (see Chapter 5). These challenges should be addressed in the new generation of river basin management plans.

- Rising regional disparities (see Chapter 3) will pose equity challenges in the near future: distributional effects of the cost recovery system need to be assessed; affordability of the lowest decile of the population may be compromised; and the mismatch between those who generate costs for water protection and those who foot the bill can escalate the costs at a time of limited public funding.
- Recent efforts towards cost-savings and efficiency gains in water management should be pursued and monitored against indicators that can help track progress more systematically and identify remaining opportunities to be seized by reallocating roles and responsibilities where needed.

Figure 4.1. **Key characteristics of Dutch water governance**



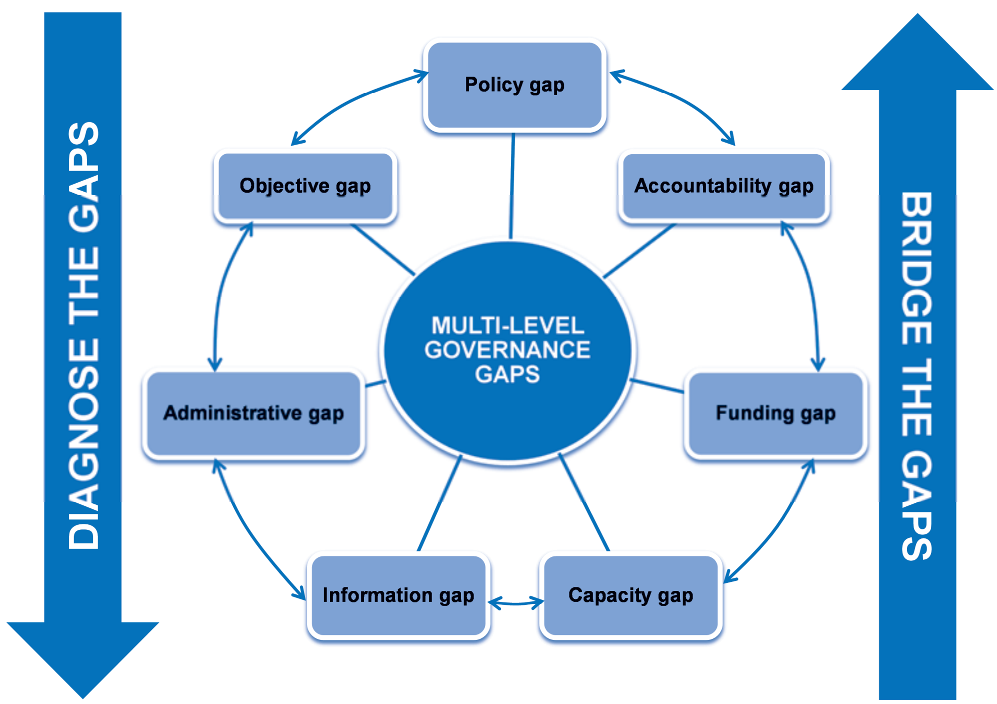
Addressing multi-level governance gaps in water policy

A framework to diagnose governance gaps in managing multi-level interactions

Although Dutch water governance is in line with good governance generic principles (see the first section of this chapter), in practice a number of multi-level governance gaps persist and can hinder water policy today and in the future. OECD (2011) defines multi-level governance as the explicit or implicit sharing of policy-making authority, responsibility, development and implementation at different administrative and territorial levels, i.e.: *i)* across different ministries and/or public agencies at central government level (upper horizontally); *ii)* between different layers of government at local, regional, provincial/state, national and supranational levels (vertically); and *iii)* across different actors at the sub-national level (lower horizontally).

OECD (2011) suggests that governments, regardless of countries' institutional features and organisation of the water sector, often face seven categories of "gaps" when designing and implementing water policy. The OECD Multi-Level Governance Framework "Mind the Gaps – Bridge the Gaps" (OECD, 2011) offers a framework to diagnose vertical and horizontal co-ordination bottlenecks between levels of government, across policy areas (ministries and public agencies), and between local and regional actors at the sub-national level. These should be diagnosed and bridged in a systemic way as they are strongly inter-related and may reinforce each other.

Figure 4.2. **The OECD Multi-Level Governance Framework**



Source: OECD (2011), *Water Governance in OECD Countries: A Multi-Level Approach*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264119284-en.

Assessing how Dutch water governance minds and bridges multi-level governance gaps requires an analysis of achievements and remaining challenges on several fronts.

- Dealing with institutional and territorial fragmentation of water policy across multiple actors and identifying success stories and incentives for effective cross-sectoral co-ordination (see Chapter 1).
- Securing hard (infrastructure) and soft (expertise) capacity at central and sub-national level. This implies identifying and addressing potential gaps in knowledge, human capital, technology and other capabilities to design and implement sustainable, efficient and effective water policies.

- Fostering accountability mechanisms to engage stakeholders and protect consumers through inclusive and transparent decision making. This implies analysing enforcement, monitoring and evaluation mechanisms in place in the water sector and their effectiveness (see Chapter 7).
- Addressing any funding mismatch between the responsibilities and resources available to carry them out. This implies assessing whether the current financing framework fits for the future and pointing out needed adjustments (if any) (see Chapter 6).
- Developing physical, socio-economic, financial and institutional water information systems in support of decision makers, with specific attention to their coherence, consistency, reliability and public disclosure as well as to their costs and benefits.
- Aligning objectives, diverging interests and priorities looking at existing trade-offs for policy coherence (e.g. land use, spatial planning, agriculture, energy) and incentives to foster synergies and complementarities at the right scale.
- Reconciling administrative and hydrological boundaries to manage water resources and supply water service at the relevant scale, taking account of the benefits and pitfalls of integration across the water chain.

Bridging the policy gap

Cross-sectoral integration of water legislation

In the last two decades, significant efforts towards cross-sectoral integration have been undertaken by consolidating the water legislative framework, which used to be scattered and to encourage silos.

The first policy document to draw attention to integrated management of water systems was the 1985 "Coping with Water" strategy. It made the point that water safety, the prevention of water nuisance and scarcity, and the improvement of water quality should be addressed systemically rather than separately. It also considered water management linkages with spatial planning, environmental and nature management, and agricultural policy due to the harmful consequences of the use of fertilizers and pesticides. Stemming from this rationale, the 2009 Water Act aimed to unify the piecemeal legislation and provide policy instruments for integrated water management. The legislation regulated formal decisions on target water levels, and included notification and permit requirement for water discharges and extraction. It was backed up by an integrated, multi-level and somewhat complex planning system (see Figure 4.3).

The Water Act was a significant first step towards a bold ambition to go beyond sector-specific legislation, to be completed with the adoption of the Environmental Planning Act (expected in 2018). The Water Act provided an adequate, modern and robust set of instruments and put in place fragmented legislation under which each individual task had its own statute. It aimed to reduce the administrative burden for private individuals and business and to facilitate the implementation of European legislation. It replaced eight former statutes in the areas of water management – concerning the pollution of surface water and sea water, groundwater, water systems, land reclamation, flood defence, water management works (except for roads)[6] – as well as provisions concerning the remediation of river and canal sediment contained in the Soil Protection Act.

The Water Act regulates all aspects of the water system management and use, and covers the totality of interconnected water surface and groundwater bodies as well as storage areas, flood defence structures and ancillary structures. It excludes water supply, wastewater collection and transport, which are regulated by the Environmental Protection Act and the Drinking Water Act (see Chapter 1).

Although there has not been a formal evaluation of the Water Act, many concur that this piece of legislation is easier to work with, has improved the accountability of decision makers, and serves the goals of integrated water management. A few examples of how the Water Act instruments helped to improve the internal coherence of water legislation and to provide a clear framework of interests to be protected are given below.

- The Water Act sets incentives to combine the effects of discharges of polluting substances and the effects on fish when taking cooling water.
- It allows flood protection and improvement of the ecological status of waters to be combined.
- Fish ways, which serve water quality purposes, are now included with locks to regulate water quantity.

However, despite recent integration of water legislations, some mismatches remain:

- Regional water authorities no longer have control over discharges on the sewerage system, despite their responsibility for wastewater purification and the quality of surface waters. This creates a challenging situation whereby some actors will bear the consequences of decisions or actions taken by others. At present, this is addressed by increased co-operation between municipalities and regional water authorities as part of the 2011 Administrative Agreement on Water Affairs, as well as by a burgeoning of local *ad hoc* arrangements. It is not clear how much this co-operation can deliver a more integrated approach.
- It is unclear who is responsible for the execution and financing of joint measures, although the mantra is co-operation between municipalities and water authorities to reduce costs.
- In addition, regional water authorities have limited influence on the quality and volume of effluents, despite their connection with households and businesses that generate them.
- Combined systems may not have the capacity to deal with housing growth, more short-term extreme rainfall events and increased infiltration of groundwater as networks are ageing and deteriorating.
- It is not clear how standards are enforced and infringements dealt with, other than by self-policing. The absence of an oversight regulation is a challenge, e.g. pollution incidents from sewer blockages, sewage pumping station failure, persistent Combined Sewer Overflow (CSO) spills, and wastewater treatment works failures.
- Further transparency of assets and better oversight of operators’ performance, at an arm’s length of institutions in charge, are needed to enhance accountability,

trust in public bodies managing water and confidence regarding water security (see Chapter 7).

The Environmental Planning Act

In July 2013, a proposal for further integration of environmental law (land-use planning, building, water and public works, but excluding nature conservation [except for the Natura 2000 Programme, environmental vision and environmental permits]), was sent to the Council of State for advice. This ongoing legislative process, which is expected to be completed with the adoption of an Environmental Planning Act in 2018, is of great importance and raises both opportunities and challenges in terms of encouraging vertical and horizontal co-ordination. The rationale for such a development is that environmental law is considered too complex and difficult for citizens and authorities to cope with. Against the recent liberal political background, the government sees environmental policy as a public task to enable private parties to be resourceful, and to ensure economic development is not hampered by overly strict and sectoral legislation.

The Environmental Planning Act is based on "co-actorship" and shared responsibilities for efficient and effective environmental management. It introduces a duty of care for all competent authorities to work together and to take each other's responsibilities into account. It considers the municipality as the most important competent authority to deliver most environmental outcomes, and proposes far-reaching possibilities for higher authorities (provinces and central government) to regulate environmental issues. To that effect, the Environmental Planning Act (under discussion) introduces six core instruments clustered around strategic vision documents, plans and programmes; decentralised regulations; rules of the central government for certain activities; the environmental permit; and the project decision. The underlying regulation of the act will integrate the assessment framework and the conditions for activities that need to be regulated (general rules, permits).

Ongoing discussions across Dutch stakeholders related to the forthcoming Environmental Planning Act oscillate between scepticism and enthusiasm, which makes it a politically sensitive project. There is a consensus that environmental law is complex and that integration is legitimate. But living in a small, highly developed and densely populated country leads to pressures on the environment and conflicting interests, which will not be solved by integration of legislation alone.

So as to facilitate the development of projects protecting the environment, the Environmental Planning Act argues that there is a need for more flexibility and more room for policy discretion for central and local governments, as well as better co-ordination of tasks and responsibilities that can prevent economic considerations from trumping environmental (and water) interests. In that framework, shifting tasks and responsibilities to other authorities requires specific mechanisms to ensure accountability. To that effect, the Environmental Planning Act aims at efficiency (fewer rules, more opportunities for economic development and "better regulation"); protection supporting the positive development of integrated water management; and integration in line with economic development keeping a balance between long-term environmental goals and short-term economic interests. In a country where managing water is critical to national security, these trade-offs are essential to ensure that vulnerable values are not threatened and that shifting priorities are dealt with.

Box 4.3. **Portugal's 2005 Water Law and Administrative Simplification: Lessons learnt**

In December 2005, the Portuguese parliament approved a new Water Law initiating an important and long-awaited water reform in the country. The preparation and discussion of this law started in 2000 (soon after the adoption of the EU Water Framework Directive) and has involved three governments of different political orientations since then. It was approved by a large majority of the members of parliament in 2005.

This new Water Law, complemented afterwards by more detailed legislation, launched an extensive reform of the water sector gradually implemented from 2006 until 2008. The main cornerstones of this reform were:

- the creation of five river basin administrations (ARHs) at almost no additional cost because they were detached from other pre-existing regional structures
- the creation of five river basin councils with a cross-cutting representation of stakeholders
- the implementation of the polluter pays principle and the user pays principle generating income to be invested primarily in the same river basin
- a user-friendly reform of the licensing system largely based on e-government procedures and with several degrees of requirements
- the launching of a participatory process for the preparation of the river basin plans and programmes of measures required by the WFD
- the clarification of the duties and jurisdiction of the "water authority" at the national and regional levels (National Institute for Water [INAG] and ARHs respectively)
- the consolidation of the jurisdiction of national and regional water authorities over coastal areas and sea bathing waters
- the clarification and modernisation of the concept of "public water domain", including beds and margins of water bodies, rooted in Portuguese water legislation and instrumental for environmental protection.

Following the economic crisis of 2007, interest rates have escalated, which has put a burden on the public debt and created an adverse environment for investors and enterprises, especially small and medium-sized enterprises, leading to recession and unprecedented rates of unemployment. Portugal was put under financial assistance with the commitment of adopting very profound reforms in various sectors, including administrative simplification measures that could bring cuts in public expenditure and a reduction of transaction costs.

To comply with these commitments, the new government reduced the number of ministries from 17 to 11 and merged institutions inside each ministry. The Ministry of Environment was merged with the Ministry of Agriculture and nine pre-existing institutes or general-directorates were integrated into the Environmental Agency (APA), together with the additional responsibility of four integrated projects of coastal improvement previously managed together with several municipalities.

This radical simplification of the administration had a significant impact on the water sector causing the slow-down, and even dismantling, of several initiatives that were being implemented. For example, the National Institute for Water and the five river basin administrations were amalgamated into the new Portuguese Environmental Agency (APA). While this merger could reinforce the environmental management of water bodies and give a more robust and stronger "muscle" to the environmental administration, it also reduced focus and specialisation in a country where water is (more than a natural resource) a key factor for development. During their brief existence, the ARHs proved to be very efficient and able to implement a policy of proximity with the citizens, the water users and the local authorities.

To a certain extent, the Portuguese experience shows how a financial crisis can become "political alibi" for pushing administrative simplification in view of cutting public expenditures. The sense of "social emergency" induced by the crisis can then discard environmental policy reform under the pretext of revamping the economy.

Source: Contribution from Francisco Nunes Correia, Professor at IST, former Minister of Environment, Portugal.

Conclusions and ways forward

The 2009 Water Act has been the quintessential integration of national water management legislation to date. Tackling remaining mismatches in Dutch water governance implies further effectiveness of water management. This means clear definition of responsibilities accompanied by sufficient financial means.

Since 2009, the relationship between water management and other policy fields has increasingly been recognised, and the ongoing development of the Environmental Planning Act is a right step towards better interconnectedness and complementarities across water-related policies. In moving forward the integration agenda, a few observations should be considered:

- **Costs and benefits of past legislative reforms** in environmental and water law have not been assessed. A thorough stock-taking and evaluation of previous attempts to bridge the "policy gap" is needed to draw lessons from and better scope future action.
- The **Environmental Planning Act** can be an instrumental policy tool for integration, especially between water and spatial planning, as it will help clarify the allocation of roles and responsibilities. But taking such synergetic measures also requires a clear understanding of who should finance them. Hence, further understanding of who should finance what is critical to address incentives for inappropriate physical development (see Chapter 5).
- When reallocating environmental responsibilities, **the principle of subsidiarity** should also be taken into account. An increasing role of municipalities (given their strong prerogatives on land use) should be combined with clear prerogatives for provinces (supervisory) and regional water authorities (implementation), as well as independent accountability mechanisms, at an arm's length from these three institutions, to monitor enforcement and compliance (see Chapter 7).

Managing trade-offs related to the "objective gap"

In many OECD countries, contradictory interests, stakes and priorities in water policy often hinder the adoption of convergent targets. In the Netherlands, linking spatial planning and water policies is particularly crucial given the high density of the population and geographical constraints. In the past, elected officials and land planners used to select building locations based on criteria such as accessibility, proximity and availability, neglecting potential dangers of major housing development in flood-prone areas. But in the last decade, significant efforts have been made for connecting water management and spatial planning through the improvement of legal instruments ("space for water"), better co-ordination of tasks related to the "Water Assessment", impact assessment, and better knowledge and information exchange. Local taxation of regional water authorities also sent signals about the potential costs of specific land-use proposals.

Planning as a horizontal and vertical co-ordination vehicle

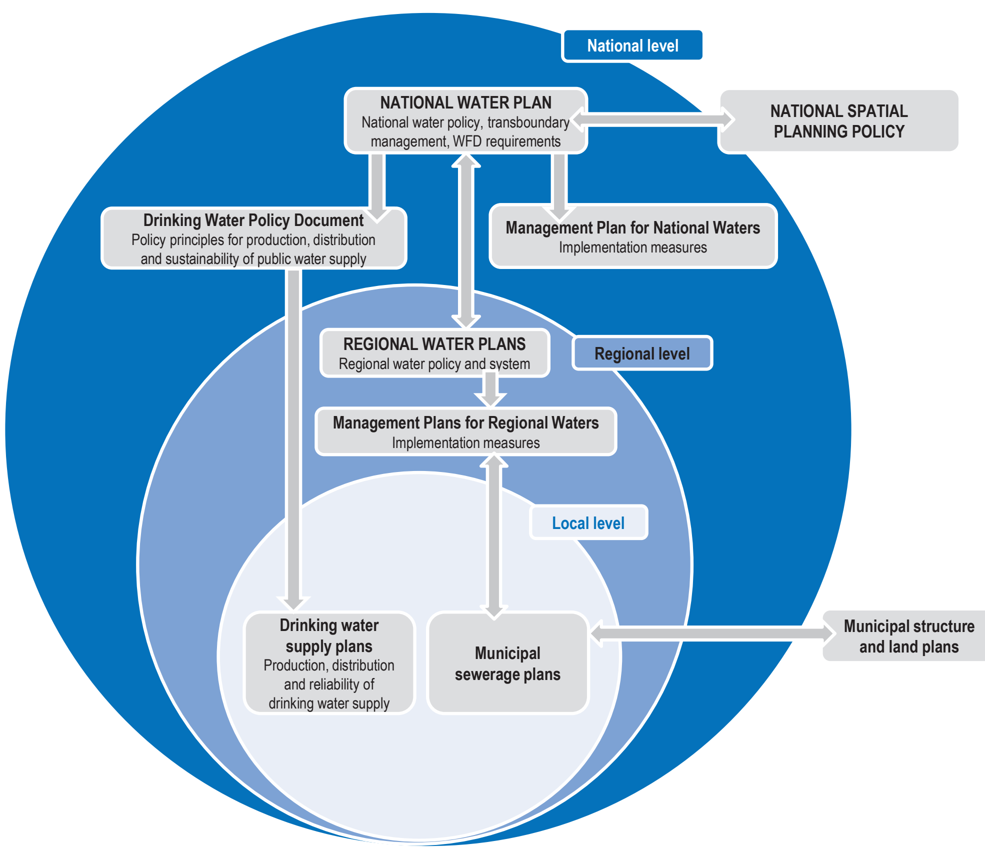
Several plans, both statutory and non-statutory, are used in the Netherlands, like in other countries, as policy instruments (Figure 4.3). Their current design and implementation at different levels is complex and requires multi-level co-ordination between the state and provinces, across regional water authorities and with municipalities.

The National Water Plan (prepared by the Ministry of Infrastructure and the Environment) provides for the main elements of national water policy and the associated aspects of national spatial policy. The spatial aspects of the plan also constitute a "structure plan" as referred to in the Spatial Planning Act. The National Water Plan includes the Dutch parts of the four international river basin management plans as well as the summary of the programme of measures required by the Water Framework Directive.

The regional water plans (drawn up by the provinces) are similar to the national plan, but focus on regional policy and the regional water systems. Like the national plan, they also have the status of "structure plan" as regards spatial aspects as intended in the Spatial Planning Act and contain objectives and parts of the programmes of measures for regional waters.

National and regional water plans are drafted, presented for consultation and adopted at the same time. National and regional plans feed each other and have both "implementation vehicles" called management plans for the national waters (drawn by the Ministry of Infrastructure and the Environment) and management plans for the regional waters (issued by regional water authorities), which also contain relevant programmes of measures required by the Water Framework Directive within their respective boundaries.

Figure 4.3. **Dutch water planning system**



In addition, the sector counts municipal sewerage plans and drinking water plans.

Provinces and regional water authorities (as competent authorities for surface waters and wastewater treatment plans) are involved in the preparation of municipal sewerage plans.

The Water Assessment plays an important role in the co-ordination of water plans on the one hand, and municipal structure plans and land-use plans on the other, as a process instrument by means of which account is taken of water (quality, quantity, safety) management interests in the spatial planning process and decision making.

A policy document on the supply of public drinking water (prepared every six years by the Ministry of Infrastructure and the Environment) contains the main elements and policy principles for the production and distribution of good quality drinking water and sustainable service provision. Drinking water companies have to prepare a drinking water supply plan, in which they indicate how they meet the requirements in terms of reliability of supply, covering the future need for drinking water and the supply of emergency drinking water.

Given the interdependence of these plans, co-ordination is ensured during their preparation and the processing of the responses to consultation. The National Water Plan does not have a mandatory impact on the regional plans; it is assumed that this impact will be achieved during the process of the elaboration of the plans. However, regional water authorities do have to take account of regional water plans when drawing up their management plans, and management plans also require the approval of the provincial executive.[7] In addition, the central government and the provinces may use their power to issue instructions and employ other control mechanisms (see Chapter 7).

Horizontal co-ordination with plans in other policy areas is not formally regulated, except between water and spatial planning policy.[8] Where national or regional water plans involve spatial aspects of water policy, they become "structure plans" and are implemented by the shared interdepartmental responsibility for the National Water Plan (co-signature by the infrastructure, environment and agriculture ministers) in the former case and, by the efforts of the provincial councils in the latter case. Agreements with administrative organs that are responsible for policy areas other than water management may also be included in the plans as needed.

The Environmental Planning Act should replace all these strategic plans with one integrated plan from the central government and provinces, including aspects of spatial planning, the environment, water, landscape, agriculture, cultural heritage and energy infrastructure. Under this framework, planning would no longer be mandatory for municipalities. This development may raise co-ordination challenges between wastewater collection, transport and treatment, which involve regional water authorities and municipalities. An advantage of the current legal framework (although not yet working perfectly) is the obligation for municipalities to draw sewerage plans co-ordinated with the regional water authorities responsible for wastewater treatment.

Water and nature management

Nature policies are currently being decentralised in the Netherlands and fall outside the scope of the forthcoming Environmental Planning Act. Recent developments show increasing co-operation between provinces and regional water authorities in this field. As water management policies and nature conservation policies become intertwined, so do the responsibilities of their respective institutions at the sub-national level.

This can lead to win-win situations when a smart combination of financial means is used to align nature conservation and water management goals, but it can also create tensions due to misaligned incentives whereby those taking decisions are not holding their financial implications. In practice, for example, provinces can draft plans constraining regional water authorities to raise water levels in favour of provincial nature conservation policies, and finance-related measures. The opposite can also happen, as regional water authorities may be reluctant to implement provincial nature conservation measures when these cause harm to land-use functions and do not serve a core water management goal.[9] Similarly, if regional water authorities can, in practice, include nature conservation measures in the regional water plan relying on promised co-financing by provinces, those may be put on hold by changes in nature conservation policies and related investments.

Linkages between water (regional water authorities) and nitrogen emissions (provinces) are a good example of complementary and beneficial water and nature management. Research has shown that nitrogen emissions can be reduced when the level of (surface or ground) water is raised in certain areas. Recently, debates started in the province of Overijssel requesting the regional water authority in the eastern part of the Netherlands to set certain target levels for designated bodies of surface water and groundwater in order to reduce nitrogen emissions in the province. Such a decision is a cost-driver; the question being therefore which authority (the province or the regional water authority) should pay and compensate individuals for related costs (see Chapters 5 and 6).

In addition, in some cases, shifting priorities between the moment when decisions are taken and the moment when projects are actually implemented can generate "unfunded mandates" and delay implementation. This situation occurred between the Vallei en Eem Regional Water Authority and the provinces of Gelderland and Utrecht in the framework of a project aiming to connect natural areas. While all partners agreed on the goal, financing and the implementation process towards eco-friendly river banks, financial constraints suddenly faced by provinces (due to the reduction of the state's financial contribution to ecological restoration which resulted in the decrease of its investment in the fund for improving rural areas) compromised the financing of the project. This led to a situation whereby the project, which had been included in regional water plans to restore ecological quality as requested by the Water Framework Directive, had to be postponed because it could not be funded (Keessen and van Rijswick, 2011).

Water and spatial planning

Flood protection and the prevention of water nuisance are ever-present concerns in a delta which is below sea level. Even in the last few decades, major engineering projects have been undertaken to improve flood safety in the Netherlands. These include, in particular, the Delta Works in the south-west of the Netherlands, and the strengthening of river and canal dykes, which prepare the Netherlands for the consequences of climate change.

Current legal frameworks foster linkages between water and spatial planning. The 2009 Water Act regulates co-ordination of the National Water Plan, regional water plans and spatial planning by designating spatial aspects. National and regional water plans are at the same time a water plan and a spatial plan. Land-use plans must meet the requirements of "good spatial planning", which include taking account of water-related public works.

The last decade has witnessed a number of conflicts between spatial planning and water quantity management, which mostly benefited agriculture and housing, but could also lead to severe damage to nature and private property. Many urban developments and infrastructure projects were forced in physical planning process that had a negative impact on water systems. Many low-lying polders have been fully covered by greenhouses or have been developed without taking into account the effects on the water system. When agricultural land is developed, the safety standards for water nuisance become stricter. However, further incentives are needed to prevent the negative consequences of new development on water management. Regional water authorities have no competence to stop harmful developments or to encourage municipalities to take adequate measures to safeguard water interests. The responsibility for financing measures aimed at reducing water nuisance and flooding in such cases is also unclear (Box 4.4). It may lie with a regional water authority, a municipality or a private entity (e.g. owners, project developers) depending on the causes of damage and the exact legal responsibilities.

Box 4.4. **Water quantity management in greenhouses areas**

The western part of the Netherlands is particularly vulnerable to rainwater nuisance, as its ground surface is a densely built-up area, with high concentrations of greenhouses and residential areas. Since the early 1990s, it has been subject to small-scale flooding or saturation due to heavy precipitations, and this trend is expected to intensify.

As rainwater cannot easily infiltrate the soil and due to insufficient storage capacity, urgent questions arose as to how to manage this water nuisance problem, who should (legally) be responsible for doing so and which compensation regimes should be applicable for damages to individuals from inundation and construction of water retention areas. The "communal water plan" aims to facilitate co-ordinated action between municipalities and regional water authorities, and specifies that beyond public entities, private parties (mainly the agricultural sector) can also play an important role in managing the problem by preventing damage to their properties. Although all parties may reach an agreement on the measures to be taken (mainly on increasing the water storage capacity) in these plans, their implementation can be challenging.

In particular, political disputes on a plan's financial provisions can cause major delays and impasses, and put consultation and co-operation on standby. Research has shown that managing water quantity in greenhouse areas could not be solved only by increasing the water storage capacity given resistance around spatial measures. Recently, strategies relying on widespread public support through so-called "*gebiedsprocessen*" have been tested and proved successful. They consist in inviting all interested parties to contribute to the decision-making process with decisions only formally taken if at least a vast majority is satisfied.

Source: Gilissen, H.K., H.F.M.W. van Rijswick and A.A.J. de Gier (2010), "De kwantitatieve wateropgave in sterk verharde gebieden", research report on responsibilities for water quantity management in urban areas, Utrecht University, Utrecht, Netherlands, www.centrumvooromgevingsrecht.nl.

Green infrastructures can help mitigate the negative impacts of water quantity management on spatial planning and flood risks. The national initiative "Space for Rivers" and similar initiatives in other countries, such as "Making Space for Water" (England and Wales), or Hungary's Improvement of the Vásárhelyi Plan, have largely encouraged a re-appraisal of land management options for floodplain areas. Agricultural land in washlands, polders and flood retention basins may also be used for floodwater storage (reservoirs) to mitigate flood risk elsewhere in the catchment (OECD, 2010). Experiments such as "Building with nature" (on the Dutch coastline; see Box 4.6), climate-proof dykes (nearby Kampen; see Box 4.5) and water retention in urban areas (Rotterdam) are closely related to building constructions (green roofs, water squares). These innovative solutions, however, still need to articulate interests and responsibilities in the project implementation.

Box 4.5. **Flood management and spatial planning: The case of Kampen Bypass**

The Dutch government considered a bypass of the River IJssel near the city of Kampen as a necessary measure against flooding. A Strategic Environmental Assessment (SEA) was conducted to answer important questions about the way in which the bypass could be realised, and fuelled several discussions.

A "spatial reservation" was proposed to forestall other spatial developments in this area, which hindered the housing projects of provincial and local authorities and triggered debate. The "natural area" south of Kampen is the domain of dairy farmers, and encompasses what is considered a historical, unique and vulnerable landscape around Zwartendijk, a dyke that functioned as a coastal defence mechanism from the 15th to the early 20th century. The inhabitants organised in an interest group (*Werkgroep Zwartendijk*) to prevent the development of houses, and mobilised a lot of media and political attention. As a result of the worsening economic context, the total number of to-be-built houses was significantly reduced from 4 000 to 1 300. There had been different forecasts with regard to the future need for additional houses, heavily criticised by citizens' groups because they were perceived as too ambitious.

Another debate arose about the form in which the bypass should be realised. The SEA concluded that a so-called blue (navigable) bypass with a direct connection between the River IJssel and Lake Vossemeer had the most beneficial consequences and the fewest negative external effects. However, this was difficult to accept for the regional water authority because of its duty of care in relation to the region's hydrological regime and the groundwater levels. The project was delayed because of concerns about the safety consequences of the bypass and discussions about the short-term and long-term measures that should be taken. To date, the riverbed still has to be deepened to meet the current safety norms in time. However, new calculations have revealed that such a deepening had to be further adjusted so as not to hamper the freshwater supply in the floodplain. These adjustments would, however, also diminish the effectiveness of the deepening and thus the regional water authorities requested the (partial) realisation of the bypass to be brought forward. The latest developments on this case happened during the summer of 2013 when the government changed the PKB Room for the River, with a combination of 7-kilometre deepening of the summerbed with a first phase bypass. This combination will meet the requirements from the PKB. Later the bypass will be finalised to contribute to the goals of the Delta Programme 18 000 m^3/s).

Source: van Buuren, Arwin, Peter Driessen, Geert Teisman and Marleen van Rijswick (2013), "Towards legitimate governance strategies for climate adaptation in the Netherlands, Combining insights from a legal, planning, and network perspective", *Regional Environmental Change*, Springer, Berlin, http://dx.doi.org/10.1007/s10113-013-0448-0.

The relationship between water quality, urban development and nature conservation has also been subject to improvement in the Netherlands, as the case of Markermeer/IJmeer shows (Waterhout, 2013). In this designated "Natura 2000 area", large infrastructure and urban development projects must meet strict criteria from the EU Water, Birds and Habitat Directives. The area suffers from an autonomous negative trend, meaning that the water quality will degrade naturally if no measures are taken. Debate continues on the further reclamation of Lake Marken (former Zuider Zee) after the city of Amsterdam built a new residential area in IJmeer. There are many objections to further reclamation, despite the recognition that closing off the Zuider Zee has resulted in a sharp decline in the ecological quality of the water in Lake IJmeer and Lake Marken. The potential for a further intensification of use combined with ecological improvement are outlined in the National Water Plan and is subject to scientific research within the NWO Versus research programme, "CONTEXT". To reconcile the desire for development of the area and related needs, it has been decided to create a "robust ecological system" whereby the quality of the area is to be increased above and beyond the minimum required standard. In this way, future developments in the surrounding area, which are meant to function as an ecological reserve, can be realised without compensation measures.

Box 4.6. **Noordwijk case: A successful example of co-operation for flood defence along the coast**

The Dutch coastline has been intensively monitored with regard to its weak spots, given the expectations concerning climate change and sea level rise. In early 2003, a strategic policy document identified weak links in the Dutch coastline, including Noordwijk. This was mainly based on a large-scale assessment of current safety levels by the Regional Water Authority of Rijnland, which stated that safety standards could no longer be fully guaranteed if no measures were taken in the near future. It also stated that the possibilities for spatial, economic and recreational development in Noordwijk were about to reach their limits.

As the territory of the province of South Holland contained six out of ten "weak links", the province took the lead in drafting general strategic policy outlines on planning reinforcement measures. For each weak link, "project groups" were established and involved all public parties. Rijnland, as the Regional Water Authority, bore the final responsibility for executing reinforcement measures in Noordwijk.

The process of planning and decision making within the project group went smoothly and became a nationwide example of successful co-operation. Several optional reinforcement measures were discussed by interested parties and the measure agreed upon was to build a wall inside the dune to raise the dune's height by 2 metres and to broaden the dune by 30 to 50 metres in a seaward direction. This was mainly to avoid unnecessary nuisance and damage, but also to create public support for the rather far-reaching spatial measures to be taken. The construction measures took place during the autumn of 2007 and the early winter of 2008, to prevent disproportionate damage to the tourism sector (beach cafés, hotels, restaurants, etc.).

Source: Gilissen, H.K. (2013), "Adaptatie aan klimaatverandering in het Nederlandse waterbeheer. Verantwoordelijkheden en aansprakelijkheid", PhD thesis, Utrecht University, Utrecht, Netherlands.

Box 4.7. **The Case of Kennemerstrand: Water management, nature conservation and tourism**

The Kennemerstrand is a natural area in the municipality of Velsen with beaches and dunes, where plans to develop tourism and recreation have been subject to opposition by interest groups. Discussions (early 2000s) mainly consisted in defining which part of the area should be designated for nature and which part for touristic purposes, and related implications for coastal and water management. At the time, the Coastal Vision 1999 plans did not comply with strict regulations on building outside the dyke ring zone.

This was solved in 2006, when the revised Coastal Vision 2006 designated the whole area around the Kennemermeer as a "Natura 2000 area", which enhanced co-operation between the municipality of Velsel and nature organisations, hence putting an end to discussions between stakeholder groups. This development is being closely monitored by nature organisations (checking possible violations of the zoning boundary) and the development of the touristic area has been slowed down.

Source: Research conducted by the Erasmus University Rotterdam and Utrecht University for the Delta Programme Fresh Waters, Water Governance Centre.

Box 4.8. **The Case of Westduinpark: Combining flood protection, urban development and nature conservation along the coast**

The Natura 2000 area of Westduinpark is a former city park along the coast of The Hague, subject to restoration plans by the municipality of The Hague in order to stimulate natural dune processes such as sand drift and to return to the coast dynamics and other socio-economic interests such as water security (the dunes form a primary seawall), recreation and urban development (residential areas and sewage installations). As from 2011, there have been regular consultations between the municipality, the province and other stakeholders to realise the nature goals and align divergent interests, which have been slowed down because of several challenges until the plans were adjusted in 2012.

- Water and nature interests clashed. The stimulation of sand drift was considered a threat to water safety policies of the regional water authority, which needed to be changed to enable the municipality to stimulate sand drift. Both parties finally converged, after intense stakeholder consultation: the regional water authority has changed its water safety policy; the governmental bodies have provided a monitoring plan, certain conditions and calculations; and management plans have been adjusted to the possibilities and impossibilities of the plan for Westduinpark.
- Co-ordination gaps and insufficient communication led to confusion about how water safety should be taken into account. Internal agreement had to be reached before a permit could be granted. Also, it was unclear what the Natura 2000 aims meant for the policies of other departments of The Hague municipality, even though parts of the management plan for Westduinpark had already been executed. Lastly, it was considered that works to improve nature would disturb protected species in the short term and it was unclear how to deal with it.

Source: Research conducted by the Erasmus University Rotterdam and Utrecht University for the Delta Programme Fresh Waters, Water Governance Centre.

Integration of the decision-making procedures for projects with spatial planning consequences remains a challenge. Dutch planning legislation tends to be structured by sector. The spatial planning instruments in the Spatial Planning Act entailed what was termed as a “dual-track” system. This referred to the fact that decisions about activities with spatial planning consequences had to follow two different tracks simultaneously: the spatial planning track and the sectoral track (e.g. water or environmental). This entailed co-ordination problems and also led to long drawn-out decision making, not least because judicial protection could be sought along both tracks.

Recent years have seen a development towards more integrated decision making for large-scale projects of better quality and smoother implementation. For example, the Infrastructure Planning Act integrates sector-specific and spatial considerations in relation to the construction of infrastructure. Another example is the central government projects procedure, based on the Spatial Planning Act.

Problems still arise with integrated project procedures, especially in cases where spatial planning and water goals clash. A possible solution, as shown in a range of research studies, is to allow the regional water authority to retain full responsibility for the design of dykes (van Rijswick et al., 2013) in cases where flood defence works are the primary and main goal. In cases where the policy is to combine different sets of goals, policies are most effective when there are clear priorities and responsibilities defined.

Integrated projects can be hindered by the mismatch between long-term safety goals, short-term economic profits, and development and land-use goals. The case of Rijnenburg shows the shortcoming of limited institutional co-operation (Buijze, 2013). Rijnenburg is an area of 850 hectares in the municipality of Utrecht, located at the intersection of two important highways that connect Amsterdam with Maastricht and The Hague with Arnhem. Presently, the area is used primarily for agriculture and recreational purposes. Its position makes it highly attractive for housing and business development, which are hindered by two main barriers. First, the area is located just outside of the dyke ring that protects the Randstad and faces an increasing flood risk, in particular from the nearby River Lek. Second, this peat land area puts high demands on water management. Heavy rainfall will cause the area to flood, whereas a low level of groundwater will result in dehydration and further subsidence. Still, it was decided to develop Rijnenburg into a sustainable residential and business neighbourhood with a high quality of living. But the project failed due to limited funding available from developers as compared to the municipality's high level of ambition.

Ways forward

By Constitution, municipalities and regional water authorities rank equally; this means that their interdependencies are managed through **consultation and co-ordination** instruments rather than oversight supervision and sanction mechanisms.

Thus far, the management of trade-offs between water, spatial planning, coastal defence, urban development, nature conservation, tourism and recreation has been largely relying on a **project-based approach** (see Annex 4.A1). But the current development of the Environmental Planning Act provides a unique opportunity to have a **more systemic approach to intersectoral complementarities** and synergetic possibilities.

The current **multi-level planning structure** is rather complex and requires sound co-ordination, co-operation and consultation throughout the project cycle, as well as clear incentives (be they financial or others) align divergent objectives. Several ways forward can be envisaged to reduce this complexity and boost an integrated vision of environmental policy at different government levels, especially given the importance of water in spatial planning.

- **The Environmental Planning Act should replace all strategic plans by one integrated plan** to be made by the central government and provinces, including aspects of spatial planning, the environment, water, landscape, agriculture, cultural heritage and energy infrastructure. Implications for wastewater collection, transport and treatment, which involve regional water authorities and municipalities, should be thought through close co-ordination with municipalities' sewerage plans.
- **Planning systems should also incorporate information about water costs and risks** inherent to different proposals and projects. Specifically, parts of the costs imposed by land-use decisions should accrue to the decision-making agency as well as to the land users (see Chapter 5).
- Recent efforts towards legal integration of the Water Act and the National Spatial Strategy to align water, environmental and spatial planning objectives, are a step in the right direction. Similar transversal strategies should be scaled-up and developed in other water-related sectors such as **agriculture and energy**.

Bridging the "administrative gap" and managing water at the relevant scale

The river basin scale – a physical and institutional "integrator" for water management

The functions that constitute water resource management vary significantly between and within countries as a consequence of different geographies, hydrologies and water uses. One jurisdiction may be primarily concerned about flood protection while another will face challenges in accessing reliable supplies. But in all contexts, the basic principles of integrated water resources management and river basin management should be fostered. A specific challenge is that hydrological boundaries often do not coincide with administrative boundaries, whether at national or sub-national levels. A further challenge is that both administrative systems and water use are dynamic. The institutions of water management have to reflect and adapt to this complexity and dynamism. An administrative gap (OECD, 2011) hence occurs when this disconnection between administrative and hydrological frontiers complicates the relationship between elected representatives, local authorities, water agencies, resource managers and end users.

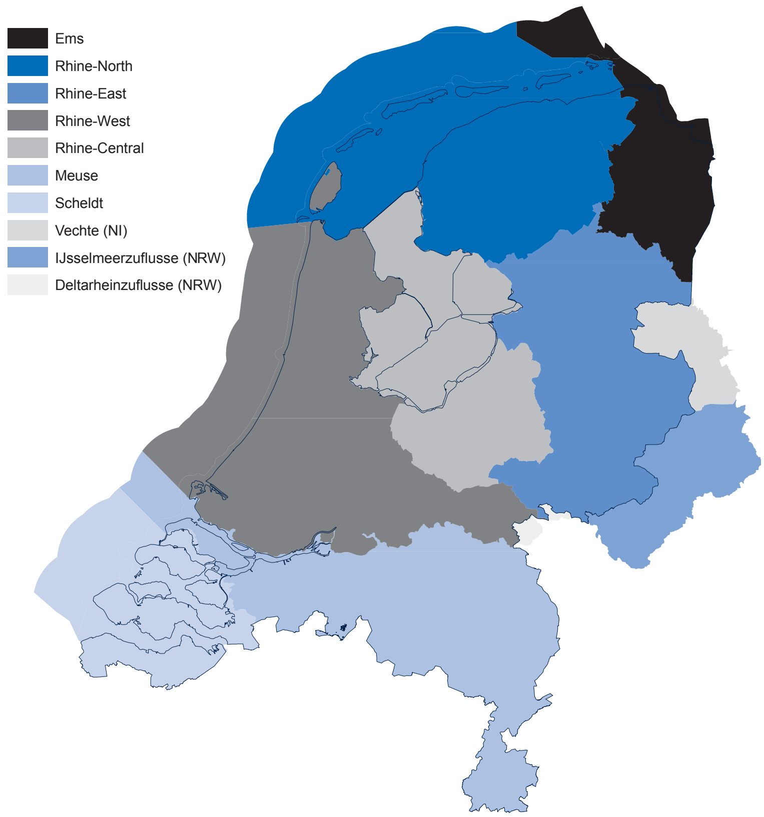
The Water Framework Directive considers the river basin, sub-river basin or smaller unit defined on the basis of hydrological criteria, as the appropriate unit for managing (physically) and governing water. Integrated river basin management or integrated water system management[10] are considered as the best territorial scale for managing interdependencies between land use and water and sediment flows; water bodies and its immediate surroundings (namely bed and margins); water quality and quantity; surface and groundwater; inland, transition and coastal waters; flood risk management and flood defence; and water allocation for various uses, especially in situations of water scarcity and drought.

Exercising public authority over water is better accomplished in a context of proximity, with the "feet on the ground" and close interaction with the water users and all involved in participatory policy-making and decision-making processes. River basin administrations play a central role in this type of proximity approach, as they can promote interaction and synergies at an appropriate physical scale, adding an institutional dimension to the natural dimension of that scale. In fact, the river basin is an area of "natural solidarity", in the sense that whatever is done upstream has consequences downstream and therefore conditions what can be done in a quite broad sense:

- water quality standards achieved in inland water have a direct impact on the quality of coastal waters
- land-use practices throughout the watershed are largely responsible for water quality and sediment production in the rivers
- dams and other hydraulic structures have a direct impact on the downstream ecosystems and may contribute to coastal erosion, among other upstream-downstream connections.

The dynamic processes throughout the river basin create links and interdependencies that are better addressed and managed jointly. This is why the river basin is the most adequate scale for integrated water management from a physical point of view and also from a governance point of view. The same reasoning obviously applies to polders or relevant dyke-protected areas in a country with the peculiar characteristics of the Netherlands.

Figure 4.4. **Sub-basins in the Netherlands**



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: National Water Authority (2009), *Waterdienst*, Ministry of the Infrastructure and the Environment, The Hague.

The 2009 Water Act divides the country in four basins that are those of the Ems, Meuse, Rhine and Scheldt, as required by the Water Framework Directive. In order to facilitate international co-ordination of the river basins, the Water Framework Directive allows for the subdivision of watersheds into smaller "working areas". For instance, certain sections of the River Rhine can be designated as "sub-watersheds" according to natural junctions, i.e. the outflow of a lake or the confluence of two major tributaries. In the Netherlands, it was therefore decided that the four river basin districts would be further subdivided into the seven sub-basins: Ems, Meuse, Central Rhine, Northern Rhine (Groningen, Drenthe, Nedereems and Fryslân), Eastern Rhine, Western Rhine and Scheldt. The central government and regional water authorities are responsible for national and regional waters respectively. Given their responsibilities in the field of water management, municipalities and provinces are also largely relevant for effective water governance. The fact that their administrative boundaries do not coincide with those of the (sub-)basins requires good co-operation and co-ordination.

While questions on the "relevant scale" are still acute for water services management, they have long been addressed, in line with international and EU call for a river basin management approach. The remaining challenge today is to clarify the contribution of the seven river basin units in the overall governance system, especially given the prominent role of regional water authorities in the implementation of the Water Framework

Directive (see Chapter 7). There is ample room for river basin units, currently acting as co-ordinating platforms, to become new (stronger) planning units that could align interests at the river basin scale. Alike, they can remain co-ordination instruments to prepare river basin plans in support of the Water Framework Directive implementation.

Box 4.9. **Water management in the context of the "administrative gap": The experience of South Africa**

The fundamental constitutional status of South Africa's economic heartland has changed four times over 120 years. Over the same period, the region's water sources progressed from local private farms to a multinational system involving interbasin transfers between four rivers, three of which are shared with other countries. The only institution that remained constant during this process was the Rand Water Board, but it relinquished its role as developer of supply infrastructure and is now responsible primarily for distributing bulk water from the growing range of sources to a changing and expanding set of users.

Such complexity can confuse the public and irritate politicians, who may seek to simplify the system, as appears to be happening in several OECD countries at present. It may also isolate the technocrats who understand the systems they operate but are unable to explain them convincingly. As a consequence, unless there is a crisis or a major investment decision to be taken, water management functions are not a high public or political priority at national level. At a more local level, water users, stakeholders from broader civil society engage with the technocrats to address their specific concerns and, occasionally, call on politicians to mediate.

South Africa's early efforts to establish regional catchment management agencies have not been fully realised because it proved difficult to craft organisations that reflected and balanced all interests in a very fractured society. Yet, there is deep, practical and effective co-operation between large water users, municipalities and the regional bulk supply utility in the annual process of reviewing system constraints, setting water use rules for the year and identifying the need for new infrastructure.

Nobel prize-winning economist Elinor Ostrom believed that this approach was appropriate. Complex problems involving public or semi-public goods like water tend to be resolved better by those directly involved. But they depend on higher (often national) authorities, providing an enabling and supportive framework within which they can work. This is the challenge for national governments, which should perhaps note Ostrom's key advice, which was not to try and simplify complexity; rather recognise and respond to it.

Source: Muller, M. (2012), "Polycentric governance: Water management in South Africa", Proceedings of the ICE, *Management, Procurement and Law*, Vol. 165, Issue 3, pp. 193-200, http://dx.doi.org/10.1680/mpal.11.00018.

Water services management: The search for economies of scale and scope

There has long been a discussion on economies of scope and scale in the Dutch water sector, given the singularity of its institutional set-up as compared to other OECD countries (separate drinking water and wastewater treatment, functional democracies with taxation powers, interdependence between municipal sewage collection and regional wastewater treatment, etc.). The 2011 Administrative Agreement of Water Affairs seeks to achieve efficiency gains through improved co-operation across the water chain, including with drinking water companies.

In particular, two issues are at stake:

- the fragmentation of wastewater management across municipalities (sewerage) and regional water authorities (wastewater treatment)

- the scope for integration between drinking water supply (drinking water companies) and wastewater management (municipalities and regional water authorities).

A review of literature shows mixed results on the benefits of integrated water and sanitation services and no clear evidence that such an organisational setting increases the overall performance.

Box 4.10. **Benefits and pitfalls of the integration of water and sanitation services**

The water sector is prone to proliferating public service delivery chains which entail extra costs for citizens in coping with complexity. During the last decade, there has been a push towards thinking about local public services in a more joined-up way.

Aggregation reforms are usually considered when there are perceived inefficiencies in the management of water supply and sanitation services, either because service providers are too small to provide an efficient service or because they are too large, but decentralising to the lowest level of government is not appropriate or not deemed efficient. Such situations can emerge because of factors outside of the water and sanitation sector, e.g. a fragmented water supply and sanitation services market may be the consequence of a broader process of decentralisation of public services.

The main factors driving the consideration of consolidation reforms include:

- increased efficiency through economies of scale
- enhanced professional capacity in larger scale of operation
- access to water resources and integrated water resources management
- broader decentralisation processes
- access to finance or to private sector participation or both
- cost sharing between higher and lower cost service areas.

However, the variety of options and their variability from one area to another have made the benefits of such associations difficult to assess and evaluate. In some cases, they add to institutional complexity in the public sector rather than simplify it, and it is difficult to attribute policies organisationally and understand how they might be changed, not only for citizens but also for public sector decision makers themselves (Dunleavy, 2010).

Many presumptions about economies of scale and the lack of central co-ordination are false. Ostrom's research about the value added and benefits of consolidation and ambulation movements has also shown that polycentric arrangements with small, medium and large departmental systems generally outperform cities that had only one or two departments (Toonen, 2010).

After reviewing international experiences in aggregating water and sanitation services, the following policy lessons can be drawn:

- Aggregation can provide opportunities for improved efficiency of service delivery through economies of scale and scope: larger systems will deliver services at a lower unit cost, all else being equal, and increased efficiency means lower costs to customers or better services for the same cost.
- Aggregation facilitates enhanced professional capacity in service providers: larger, aggregated service providers have the need for, and financial resources to support, specialist skills and thus will benefit from overall improvements in professional capacity.
- Cost sharing through aggregation can mitigate the impact of high-cost systems: aggregation can be used to mitigate the impact on customers of living in areas with high-cost water supply and sanitation systems, but the extent of such cost sharing is a sensitive issue and may require central government intervention to be resolved.

Box 4.10. **Benefits and pitfalls of the integration of water and sanitation services** (*cont.*)

- Central governments can assist, mandate or provide incentives for the aggregation process: to support and encourage voluntary aggregation, central governments can provide guidance about potential forms for aggregated structures, basic rules for internal management, governance structures, tariff-setting arrangements, or entry and exit rules.
- Aggregation can take many forms and is not static over time: an aggregated structure may incorporate all or a small number of water and sanitation services. It may be temporary or permanent, involve the aggregation of all functions or only a subset (e.g. securing financing). Every form of aggregation has its own characteristics, and it is unlikely that a solution applied in one situation can be applied elsewhere without tailoring it to suit the needs of the specific situation to be addressed.
- Aggregation can take place without transfer of asset ownership: the issue of asset ownership is often very sensitive because it determines which level of government has ultimate control over service provision. In all cases, it is important to clarify which institution owns the assets and whether an ownership transfer takes place with aggregation.
- Aggregation can fail if benefits are not clearly understood and there is no adequate process in place to implement it: due process and political will are key to the success of the aggregation initiative. Aggregation needs a "champion", either in the form of a strong individual or an entire institution to drive the process through.
- Aggregation of service provision often creates the requirement to reform mechanisms for oversight of the service provider: aggregated entity can harmonise tariff and service levels, but it can also maintain differentiated tariffs and service levels at the local level.

Sources: Dunleavy, P. (2010), "The future of joined-up public services", 2020 Public Services Trust, London; World Bank (2005), "Models of aggregation for water and sanitation provision", *World Bank Water Supply and Sanitation Working Notes*, World Bank, Washington, DC.

An interesting feature of the Dutch case is that it should facilitate the coherence between land use and urban water management, as municipalities are in charge of wastewater collection and drainage. How this coherence materialises in practice should be more explicitly documented and monitored.

Box 4.11. **Aggregation and consolidation of water services in Portugal and Italy**

Several OECD countries recently went through aggregation processes, especially as a remedy to capacity challenges faced by operators.

In **Portugal**, the water and sanitation sector was reformed in the 1990s with the aim of reinforcing the professional capabilities of water companies and guaranteeing their capacity to self-finance operations and investments. The reform created two layers of water management institutions, one for "retail" service (drinking water distribution, wastewater collection) and one for "wholesale" service (bulk water supply and wastewater treatment). The "retail" level is still the responsibility of the municipalities, as in the past. The "wholesale" level can now be organised as multi-municipal systems. The national holding, Aguas de Portugal, fully owns the company operating in Lisbon (as a historically justified exception) and participates in shareholding agreements with municipalities, holding 51% of shares in the multi-municipal companies.

Box 4.11. **Aggregation and consolidation of water services in Portugal and Italy** (*cont.*)

In 2012, further reform was initiated toward the merger of these bulk and retail water services and Aguas de Portugal was asked to ensure its future financial sustainability and cut debts accumulated in modernising the country's water supply and wastewater infrastructure. In this framework, the 18 state-owned regional bulk water and wastewater utilities are planned to be merged into 4 regional companies – North, Central, Tagus Valley-Alentejo and Algarve, and a fifth separate region under consideration – to bring economies of scale, allow tariffs to converge in a narrower band across the country, and to better absorb EU Cohesion and Regional Development Funds. The division between state-managed bulk water operations and municipally managed retail water services is under revision with the possibility of favouring integrated water cycle operations, at least in some regions, being considered. A direct consequence is that municipalities will lose direct responsibility for water and wastewater provision, although their participation in the new integrated systems is not clear yet.

These plans are very controversial and municipalities from all political orientations are criticising it. The outcome is still very unpredictable. Until 2012, 85% of municipalities had joined the multi-municipal systems for bulk water supply and wastewater treatment while the largest ones maintained their own water operators and others signed concession contracts with private utilities.

With the 1994 Galli Law, **Italy** launched an ambitious reform of the water supply and sanitation system, which used to be fragmented into more than 13 000 undertakings operating at the municipal scale. The whole system had been entirely subsidised by the public budget for capital expenditure, and operational costs were hardly recovered. The reform attempted to create financially self-sufficient bodies. Municipalities were obliged to associate into compulsory inter-municipal bodies (called AATOs), having statutory responsibilities to provide the service. The delegation scheme was supposed to follow the concession model, i.e. all investments under the responsibility of the water company, which was supposed to borrow from the market at its own risk, with the sole guarantee offered by the delegation contract and its corporate solidity. The law delegated the task of individuating the territorial units, clarifying the governance of inter-municipal agencies and complementing national regulations to regions.

Regions have created approximately 100 units which have chosen to delegate water supply and sanitation management to publicly owned companies, to mixed-venture companies with public-private partnership (PPP), or fully to private companies. Price regulation was inspired by the full-cost recovery paradigm. Both the AATO plan and the related financial plan, with a detailed outline of tariff time-series for the contract, had to be incorporated into the delegation contract.

Despite some success, the reform has not delivered, and the expected results are far behind schedule. One remarkable cause for this is the credit crunch suffered by most water companies, which has been attributed by many observers to the fuzzy regulation and to the incomplete contracts. Popular discontent has been high because of public perception that price increases – which have been notable, although not sufficient to achieve financial self-sufficiency of operators – have not led to significant improvements, while fostering the transformation of utilities into commercial – if not truly "private" – companies. This concern has led to massive support for the June 2011 popular referendum mandating that operation should be kept public and no undue profit should be allowed on the provision of a service that fulfils a social right.

Sources: Global Water Intelligence (2012), "Aguas de Portugal maps out its future", Vol. 13, Issue 6, (June); OECD (2013), *Environmental Performance Reviews: Italy 2013*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264186378-en; completed by Francisco Nunes Correia, Professor at IST, former Minister of Environment, Portugal.

Another set of issues relates to the comparative advantages of regional water authorities to manage wastewater treatment services which have grown to the largest share of their revenues and costs at present.

- The first issue is scale: some adjustments may be required to make sure regional water authorities manage wastewater treatment services at the right scale (and reap economies of scale); recent developments in the combination of municipalities and regional water authorities show some flexibility in this area.
- The second issue is that of governance: regional water authorities are functional democracies and the added value of such a governance mode for wastewater treatment services deserves a thorough analysis as the current governance framework finds its core arguments under the "national security umbrella" (flood safety and water resources management functions) that regional water authorities have ancestrally been in charge of.
- The third issue is the business model of wastewater treatment services: regional water authorities collect revenues for wastewater treatment based on the family structure of households (single person versus three person basis) and industries. It is not sure how this model: *i)* provides a solid basis to finance future expenditures (which are expected to rise in the case of wastewater treatment); and *ii)* equitably shares the burden across water users.

Ways forward

In the Netherlands, questions related to the **costs and benefits of aggregation across the wastewater chain** cause some controversy. Upscaling and downscaling should not be a goal in itself, but a policy response to better fit form with functions and place-based needs Any reform in this area should build on a thorough assessment of the issues mentioned above in a pragmatic way:

- Do municipalities actually exploit the potential synergies between urban planning, drainage and wastewater collection, to deliver a better service at the least cost?
- Do regional water authorities operate wastewater treatment services at the right scale?
- What is the added value of regional water authority governance model for the management of wastewater treatment services?
- What is the distributive performance of regional water authorities' business model *vis-à-vis* wastewater treatment?

Information systems for consistent decision making

The capacity to take effective decisions in water management depends on the availability of informed and transparent data related to hard and soft infrastructure, e.g. how old are the dykes? Which ones should be maintained in priority? Determining accurate information needs is therefore a crucial step in the information lifecycle. It constitutes the groundwork for an efficient and effective monitoring network and contributes to choosing more wisely which parameters are used, the required measurement frequency and the locations to be measured.

A wealth of water information systems and data

Data collection and production is an important part of the Dutch water policy and operational management. These data are used to identify trends and can be tested against standards and projected targets. They help water managers and policy makers to formulate and evaluate water policy, and are used in reports to evaluate compliance with (inter)national agreements.

Several centres provide relevant information on water to decision makers and to the general public in the Netherlands.

- The Water Information House was set-up in 2010 as a partnership between the national government, the Association of the Provinces of the Netherlands (*Interprovinciaal Overleg*, IPO) and the regional water authorities. Its task consists of producing uniform, accessible and useful information for water management institutions and interested parties, and defragmenting water quality information by working in close co-operation with water managers.
- The Water Management Centre-Netherlands provides daily information concerning water system to users on water levels, flood risks and (bathing) water quality. In extreme situations, including water shortages, water pollution and the threat of flooding, the Water Management Centre provides advice to the national and regional water authorities. The Helpdesk Water is available to answer questions related to water policy and water management.

Challenges and ways forward

Information systems in place face important challenges induced by the fragmentation and inconsistency of methodologies used across institutions. Dozens of agencies are engaged in collecting data on the state of national and regional waters, raising important issues of comparability and interchangeability. In addition, despite the large amounts of data collected, relevant data can be difficult to find, ascertain or aggregate, which creates costly integration issues for authorities in the water sector. Solving these challenges is an important step towards better water management.

In recent years, however, the government has made significant efforts to standardise water-related information. In preparation of the first river basin management plans for the Water Framework Directive, the Water Information House developed standards and streamlined information. However, its scope was limited to water quality, and several issues are still pending as regards the strengthening of physical, socio-economic, financial and institutional water information systems in support of decision makers. Also, responsibilities for analysing information should be allocated as far as possible from the ultimate user of the information.

The recently launched "Digital Delta Initiative" is a step in the right direction. This innovative programme aims to harness and collate vast and currently dispersed datasets to support better management of flood control and water resources in the country (Box 4.12).

Box 4.12. **Using Big Data for better water management: The Digital Delta Initiative**

In June 2013, the Dutch National Water Agency (*Rijkswaterstaat*), the Delfland Regional Water Authority, Deltares Science Institute and the University of Delft launched Digital Delta initiative, an innovation programme led by IBM.

The Digital Delta Initiative investigates how to integrate and analyse water data from a wide range of existing sources including precipitation measurements, water level and water quality monitors, levee sensors, radar data, model predictions, as well current and historic maintenance data from sluices, pumping stations, locks and dams. The new management system will address concerns ranging from the quality of drinking water to the increasing frequency and impact of extreme weather-related events to the risk not only of floods but also droughts. The Digital Delta Initiative will maintain a catalogue of frequently used data and converting data formats to a standardised form, providing a unified view of the data needed to make more accurate flood predictions. It will also explore the potential for sharing and managing water data in new ways, using the latest technology and deep industry expertise.

The National Water Agency, the Delfland Regional Water Authority, Deltares Science Institute, the University of Delft and IBM will combine data and technology from several new and existing water management projects. By modelling weather events, the Digital Delta Initiative will also help the Netherlands to determine the best course of action for storing water, diverting it from low-lying areas, avoiding saltwater intrusion into drinking water, sewage overflows and water contamination. It will provide water experts with a real-time intelligent dashboard to harness information so it can be shared immediately across organisations and agencies. Using data visualisation and deep analytics, these insights can help prepare for imminent difficulties, enabling authorities to co-ordinate and manage response efforts and, over the longer term, to enhance the ongoing efficiency of overall water management. With better integrated information, regional water authorities will be able to prevent disasters and environmental degradation, while reducing the cost of managing water by up to 15%.

Source: IBM (2013), "IBM harnesses power of Big Data to improve Dutch flood control and water management systems", IBM Newsroom, www-03.ibm.com/press/us/en/pressrelease/41385.wss (accessed 8 July 2013).

A worldwide known capacity and knowledge base in water management

The Netherlands is internationally well-known for its long-standing expertise in water management. The country counts a plethora of scientific, academic and professional organisations providing educational tools and programmes. These have contributed to build a robust knowledge base which has provided the needed capacities and expertise to support water policy development in the country:[11]

- Infomil is a knowledge centre for environmental legislation and policy.
- Stichting Wateropleidingen develops and delivers practical and technical courses for a wide range of water related topics.
- Knowledge Platform Water (*Kennisplatform Water*) gathers water professional and experts to best articulate knowledge needs and co-ordinate research programmes for the development and implementation of water policy. The platform developed the National Knowledge and Innovation Agenda for Water by means of a broad-based consultation of knowledge consumers and providers, such

as the government, social organisations, knowledge institutes, engineering agencies and market parties.

- Deltares is an independent institute for applied research in the field of water, working on smart solutions, innovation and applications for society and the environment, with a focus on deltas, coastal regions and river basins.
- Koninklijk Nederlands Waternetwerk is a network of more than 4 000 water professionals aiming to pool and share knowledge and experiences.
- UNESCO-IHE, based in Deflt, carries out educational, research and capacity development activities that complement and reinforce each other in the broad fields of water engineering, water management, environment, sanitation and governance.
- Netherlands Centre for River Studies is a co-operation between Alterra, Deltares, Delft University of Technology, Radbout University Wageningen, Rijkswaterstaat Watyerdienst, University Twente and UNESCO-IHE.
- The Helpdesk Water is a depository centre for requests from professionals working on water policy, water management (shortage, drought, etc.) and water safety issues in the Netherlands. The Helpdesk Water was created through collaboration between the Dutch government, provinces, municipalities and the Association of Regional Water Authorities.
- STOWA (*Stichting Toegepast Onderzoek Waterbeheer*, Foundation for Applied Water Research) provides scientific knowledge and practical instruments (publications, computer programmes, databases) to water managers on wastewater collection, transport and treatment; quality and quantity management for surface and groundwater; urban water management; prevention against flooding and maintenance of water barriers.

These centres are important hubs to enhance better long-term strategic planning for research. Large savings were also made possible by centrally co-ordinating and planning research needs. Water managers have also been closely involved in the design and conduct of training tools, which enhanced their ability to communicate and share lessons learnt and good practices, in particular among themselves.

The main challenge is to connect more effectively all these activities conducted in the various centres with water managers, central and sub-national authorities. Networks of professionals such as Koninklijk Nederlands Waternetwerk (4 000 members) contribute to pooling and sharing knowledge and experience on water management. Another example is Water Meets Water, a platform of various water management organisations which organises and promotes the national meeting of water managers from government, to provinces, municipalities, port authorities and regional water authorities as an opportunity for experience sharing and co-operation.

However, some disconnect remains between science and society, especially about the impacts of climate change on natural ecosystems, which deserves particular attention and interaction between science and water institutions. The Integrated Vision on Climate Mitigation and Adaptation, which has recently been released by the Ministry of Infrastructure and the Environment, is a good example of the form such a co-operation could take in the water sector.[12] A larger-scaled assessment of gaps in terms of knowledge, human capital, technology and other capabilities will be necessary to design and implement sustainable, efficient and effective water policies, especially given the expected shortage of 20 000 water professionals in the Netherlands over the coming decade (personal communication with STOWA).

The Delta Programme: A response to multi-level water governance gaps

The Delta Programme is a national planning instrument that aims to achieve two priority goals for a country "safe now and in the future": protect the Netherlands against flooding and ensure freshwater supply. It is a joint endeavour between the central government, the provinces, municipal councils and regional water authorities, in close co-operation with social organisations and business. The implementation of the Delta Programme consists of a series of short- and long-term flexible projects to be carried out up to 2015 and beyond.

The first Delta Programme was presented to the House of Representatives in 2010 and introduced a new flexible approach to water management, based on measurements and scenarios carried out by the Royal Netherlands Meteorological Institute (KNMI, *Koninklijk Nederlands Meteorologisch Instituut*) in 2006. The second edition of the Delta Programme was presented in September 2011 with a new important element: the definition of five Delta Decisions, or priority areas for action in flood risk management and freshwater supplies. Building on multi-stakeholder dialogues, and technical calculations and assumptions, these decisions structure the Delta Programme and provide direction for the measures to be taken in the following areas:

- water safety: updating safety standards and developing regionally oriented safety strategies
- freshwater strategy: elaborating a strategy for the sustainable supply of freshwater
- water level management in the IJsselmeer region: a decision regarding the long-term water level management of the IJsselmeer, focused on water safety and freshwater supply
- Rhine-Meuse delta: a strategy for the protection of the Rhine-Meuse delta and solutions for the freshwater supply
- spatial adaptation: a national policy framework for the (re)development of built-up areas and recommendations regarding flooding and heat stress.

The Delta Act on Flood Risk Management and Freshwater Supplies that came into effect in January 2012 as an amendment to the Water Act is the backbone of the Delta Programme. It mandates a Delta Commissioner, appointed by the government, to lead the Delta Programme and submit a yearly proposal for action to the Cabinet, in consultation with the relevant authorities, social organisations and the business community. This annual report provides an overview of all measures, facilities, studies and ambitions related to flood risk management and freshwater supplies.

The Delta Act also enshrines a Delta Fund, separated from the Infrastructure Fund, to finance the implementation of the Delta Programme and related projects and reduce the risk that too much or too little is invested in water safety and freshwater supply. The Delta Fund is split across five budget articles (Arts. 1-5) related to:

- investing in flood risk management
- investing in freshwater supplies

- management, maintenance and replacement
- experimenting
- network-related costs and other expenses.

The Minister of Infrastructure and the Environment bears final responsibility for the expenditures under the Delta Fund. The first official Delta Fund budget was sent to the Dutch House of Representatives together with the third Delta Programme report in 2013. As of 2020, it is expected that at least EUR 1 billion will be made available for the Delta Fund, and a total of EUR 10.5 billion for the 2013-28 period in order to cover the costs of measures and provisions for flood protection and freshwater supplies; however, cuts have already been announced in this overall amount (see Chapter 3).

The third Delta Programme currently being implemented focuses on the implementation of the Delta Decisions with programmed measures, facilities and studies for the next six years, in line with the Delta Fund budget, studies and progress reports. All flood risk management projects currently in place are part of the implementation programme, three of which the Dutch House of Representatives has classified as "major projects": the Second Flood Protection Programme, Room for the River and the Meuse Projects. In 2014, the Delta Programme will yield proposals on Delta Decisions from the Delta Commissioner to provide further guidance for implementing measures launched after 2015, once the current programmes (Second Flood Protection Programme, Room for the River and Meuse Projects) are completed.

The Delta Programme helps bridge a number of multi-level governance gaps analysed earlier in this chapter:

- The Delta Fund provides the Delta Programme with a legally guaranteed budget to cover the costs of planned measures and provisions and therefore addresses the risk of a funding gap. It ensures that sufficient financial resources are dedicated to effectively implement the objectives of the Delta Programme, and, in addition to the regional water authorities' taxation system, frees resources to cover the costs of regular improvement projects.
- Advocacy groups and the business community are closely consulted and involved in the very same process behind the Delta Programme. Multi-stakeholder dialogues in decision making contribute to bridge the accountability gap. By engaging various actors and their interests, the Delta Programme contributes to better transparency and public participation.
- As defined in the Delta Law, the Delta Commissioner is appointed by the central government to play a pivotal role across ministries, provinces, regional water authorities, municipalities, social organisations, businesses and citizens. Part of his prerogatives are to ensure that all actors involved are well informed and aware of the ins and outs of political decisions and projects, and have access to data, studies and climate-change scenarios. Doing so helps bridge the information gap. It is also an important instrument to bridge the "awareness gap" of Dutch citizens about water institutions, risks and functions.
- The Delta Programme makes use of scientific and technical expertise to design and implement projects. Universities, knowledge institutes and implementation agencies are closely involved and help diagnose knowledge gaps. In turn, they participate in developing "knowledge agendas" and strategies, in close co-

operation with the responsible governments, to target specific qualification needs and help bridge the capacity gap.

- The Delta Programme was designed jointly with the central government, the provinces, regional water authorities and municipalities, the co-ordination of which is a powerful tool to prevent segmented working methods and scattered responsibilities between the different levels of government. Co-operation among these actors and jointly designed projects for the implementation of the Delta Programme are important mechanisms that bridge the policy gap and create a meaningful convergence for decision making.
- The collectively agreed-upon objectives of the Delta Programme, as well as the secured allocation of dedicated financial resources through the Delta Fund, play an important role in bridging the objective gap. They help align priorities across policy areas and political agendas, and allow for continuity of public policy at provincial and municipal levels. The consultation of advocacy groups, academics and the business community also ensures all motivations are aligned.

Hence, the Delta Programme is a powerful policy instrument to cope with selected pressing or emerging challenges in Dutch Water management. It relies on a multi-stakeholder process, combines technical, scientific and political drivers for change, and leads to pragmatic decisions meant to be backed-up by financed projects to ensure implementation. However, it focuses on water safety and freshwater supplies (with a much higher emphasis on the former than the latter), and pays less attention to other pressing issues such as water quality and ecosystems.

Water safety measures for the implementation of the Delta Programme tend to take the bigger share of financial resources at hand, leaving projects related to securing freshwater supply under-funded or on hold. One could therefore suggest that improvement is needed to allocate expenditures more fairly between projects and reprioritise some of the Delta Fund to emphasise freshwater supply measures and help address risks of shortage (see Chapters 2 and 5).

The Delta Programme cannot address, alone, the magnitude of the challenge but needs to be complemented with other robust instruments addressing water quality, which may soon be challenged by the European Commission. Especially, most Dutch water bodies are currently exempted from compliance in achieving the Water Framework Directive’s objectives, hence a policy agenda aiming to cope with the future needs to also embrace the question of water quality in addition to building on water safety and freshwater supplies as addressed in the Delta Programme.

Conclusions and ways forward

Conclusions

Building blocks of water governance include a powerful administrative organisation for water management; a legally embedded system of water law; a specific financing system (protecting from short-term political issues) and economic analyses of water measures, including at river basin level; a systemic planning approach to water-related policies; and institutionalised mechanisms for the participation of stakeholders (Havekes, 2013). These are crucial assets that should not be lost when attempting to reform water governance.

The features of Dutch water governance have adjusted over time in response to changing economic, political and environmental conditions. Over the last 50 years, the Netherlands has witnessed the consolidation of regional water authorities (RWAs; from 2 650 to 24 in 2013), ministries (the creation of the Ministry of Infrastructure and the Environment in 2010), public drinking water companies (from more than 200 to 10) and municipalities. It has also seen an increasing variety of local arrangements in the wastewater chain and the adoption of successive plans as country-wide instruments for strategic planning to deal with "too much – too little – too polluted water". Other important reforms have included the "modernisation" in 2006 of the *Rijkswaterstaat* (the National Water Authority and the executive agency of the Ministry of Infrastructure and the Environment), and the integration of the water-related legal framework in 2009, with eight water laws combined into the National Water Act.

Dutch water governance has evolved towards cross-sector integration and clearer allocation of roles and responsibilities. Standards, responsibilities and costs are all informed by the "polder approach", which is a very effective way to go but which may have limited capacities to set and achieve strict levels of ambition and to reflect the interest of parties not directly involved in the process (e.g. the European Commission, non-domestic water users). Further cross-sectoral integration between spatial planning, nature conservation and water policy at the national level is being contemplated in the Environmental Planning Act framework, which is under preparation and expected to be adopted by 2018.

Recent adaptive water management innovations, such as the Delta Programme, have pushed for result-oriented action towards bridging governance gaps for a country "safe now and in the future". They help link long-term trends and pragmatic decision making, phasing implementation measures in the short and long terms, taking into account future development uncertainties, and connecting various investment agendas, which need to be pursued and further incentivised.

Ways forward

The 2011 Administrative Agreement on Water Affairs and the ongoing development of the Environmental Planning Act both offer opportunities to strengthen multi-level governance in Dutch water management, building on the concepts of integrated (and river basin) water resources management principles. The following developments could be explored:

- **Strengthening coherence between water, land use and spatial planning**, building on the window of opportunities offered by the development of the Environmental Planning Act:
  - Recent, mostly project-based efforts to **align water, environmental and spatial planning objectives, are a step in the right direction**. Similar transversal strategies should be scaled-up and developed in other water-related sectors, such as agriculture and energy. EU funds (EFRO, INTERREG, CAP/RDP3) provide incentives for **regional tailor-made solutions** fostering co-ordination between water, nature, regional economic policy, innovation.
  - The ongoing **decentralisation of nature policies also provides opportunities** for more co-operation at the sub-national level to integrate strategic water functions with nature management and biodiversity through voluntary platforms, joint agreements and other soft solutions.

  - The Effectiveness of the Environment Planning Act depends greatly on its capacity to develop an **“integrated plan”** including spatial planning, the environment, water, landscape, agriculture, cultural heritage and energy infrastructure. It should be carefully co-ordinated with municipalities’ sewerage plans, and **incorporate information about water costs and risks** inherent to different proposals and projects. It is also advisable to specify **who should finance what** regarding expected synergies and to **make the authority that has taken a specific decision responsible for its financing** to the extent it is possible, so as to lay down the costs at the appropriate level and at the appropriate party, group or stakeholder, rather than shifting costs to groups that are not fully beneficiaries from measures in adjacent policy fields.
  - As an instrument to assess the impact of spatial development on water management, the **“Water Assessment”** could be made more effective (e.g. binding) in influencing the spatial planning process and decision making.
  - In addition, a **stronger role in spatial planning for provinces** is advocated, to enhance complementarity with water management and ensure alignment with overall government.
- **Organising the wastewater chain in a more coherent way, considering issues of scope and scale.** This challenge covers two sets of issues, and should be addressed on the basis that form follows both function and territorial specificities:
  - The potential advantage of municipalities in the delivery of **urban drainage** only materialises when this function is well co-ordinated with **urban planning** on the one hand, and with management of the **sewage system** on the other. The current monitoring of the 2011 Administrative Agreement of Water Affairs by the Water Chain Visitation Commission provides a unique opportunity to report on performance targets and efficiency gains achieved, and **make sure opportunities in both areas are fully exploited**, especially as huge investments are foreseen in the coming decades to replace aged sewage infrastructure.
  - The governance and financing model of regional water authorities is adequate to manage floods risks. It is less so to invest in and operate **wastewater treatment services**. Regional water authorities can retain the wastewater treatment function if it is managed and financed in a distinctive way, more in line with the needs for such services.
- **Pursuing voluntary and bottom-up approaches for organisational adjustment of water management functions:**
  - This will allow adjusting the scale at which regional water authorities operate, to allow for **regional differentiation**, when appropriate. Potential reallocation of tasks and responsibilities in the future if needed (e.g. wastewater collection, groundwater management) should be pilot-tested in selected areas before nationwide implementation.
  - Decisions to reorganise should rely on a **robust assessment of the progress achieved towards efficiency gains across authorities and the water chain**. The monitoring of the 2011 Administrative Agreement on Water Affairs provides an opportunity to determine whether co-ordination efforts and voluntary approaches helped reap economies of scale and scope. The river

basin concept, cost recovery and the principles of integrated water resources management should, in any case, be respected.

- **Upscaling and downscaling should not be a goal in itself**, but a policy response to better fit form with functions and place-based needs. Any reform in this area should consider new developments with potential **implications for wastewater** including energy capture, re-use of nutrients, combining waste and water treatment, synergies between urban planning and wastewater should be considered.

- Recent efforts to foster **conjunctive use of surface and groundwater management** are a step in the right direction, but any transfer of groundwater (quantity, quality) management to regional water authorities should be assessed; regional water authorities' tasks to fully integrate surface water management with management of shallow groundwater can be challenging given the role of provinces.[13]
- The **private sector** can also contribute to better water governance if it is aware of where its responsibilities begin and end. New governance approaches should aim to increase citizens' awareness about water management and empower them to carry out their responsibilities in this field.

Notes

1. For more development on this, see Keessen and van Rijswick (2011), and Robbe et al. (2011).
2. See www.deltacommissaris.nl.
3. Though it is suggested that regional water authorities will in the long run bear 100% of such costs, it has not been decided yet and this is subject of discussion, including from the regional water authorities.
4. Water in Beeld (2012).
5. See WaterForum Online 2013.
6. The Surface Water (Pollution) Act, the Seawater (Pollution) Act, the Groundwater Act, the Water Management Act, the Land Reclamation and Tidal Flats Act, the Flood Defence Structures Act, water-related parts of the Public Works (Management) Act, and the Water Management and Public Works Act.
7. Although recent plans for new legislation no longer contain this obligation for approval. These plans have not yet come into force.
8. See van Buuren et al. (2010).
9. See, for example, Gilissen et al. (2009).
10. Integrated river basin management refers to the joint management of river basins by several EU member countries, whereas integrated water system management refers

to the integrated management of surface water bodies, groundwater bodies, dykes, retention areas and public water works.

11. Dutch core team background report presenting the main trends and current policies and data (January 2013).

12. www.government.nl/ministries/ienm/news/2013/10/04/climate-agenda-mitigation-adaptation-and-business-sense.html.

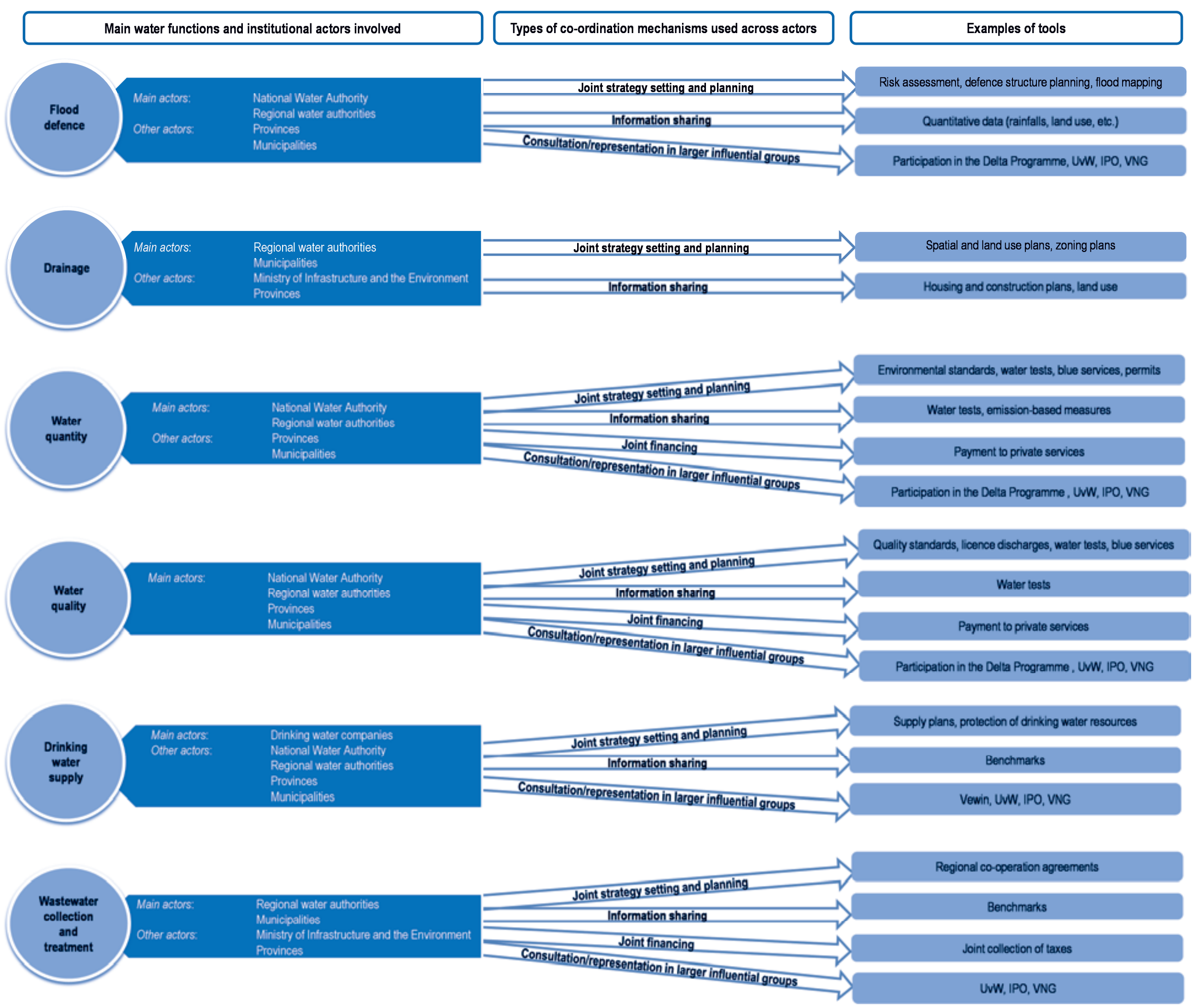
13. Note that since the 2009 Water Act, regional water authorities have been responsible for the integration of groundwater and surface water, thus especially for the groundwater level. Regional water authorities are responsible for the shallow groundwater. Provinces' tasks after the Water Act mainly consist in looking after the deep groundwater, in the form of licenses for drinking water extraction, but also for the management of the groundwater bodies according to the Water Framework Directive. These tasks were not decentralised to regional water authorities because of the lack of competence and knowledge at that time.

Annex 4.A1

Examples of inter-institutional projects for integrated water management in the Netherlands

Name of project	Province concerned	Regional water authority (ies) concerned	Other actor(s) involved	Project objectives	Project considerations		
					Water management	Spatial planning	Ecosystem management
Dynamic Brook Valley Project (approved in 2006)	North Brabant	Aa and Maas	– Dutch Department of Transportation – 2 municipalities – Farmers – Interest groups (land owners)	– Water retention – Stream restoration – Improvement of ecological corridors – Improvement of water-related recreation	Removal of embankment and reconnection of meanders to: *i)* restore natural process in the Aa Valley; *ii)* meet water retention goals; *iii)* decrease the amount of runoffs during extreme events	Co-operative agreements with farmers and land owners, including compensation system to periodically flood their lands In some cases, arrangements to construct dykes around sensitive properties	Award of special status "wet nature pearl" by the province
Tongelreep Valley Project (approved in 2006)	North Brabant	Dommel	3 municipalities	– Increase water retention capacity – Restoration of natural dynamics – Reduction of drought in the Brook Valley – Preservation of cultural and historical values of the Hatchery pond	– Restoration of meanders – Creation of a floodplain alongside the Brook Valley – Reconstruction of fish ponds	– Revision of zoning maps – Project area was designated for water retention and nature development in the provincial reconstruction plan	Project area is part of the national ecological infrastructure and EU Habitat Framework area
Hondsbroeksche Pleij Project (approved in 2003)	Gelderland	Rijn en IJssel	– EU (as part of the INTERREG SDF Sustainable Development of Floodplains Project) – Central government (as part of the Room for the River Project) – German counterparts (RWS-ON, RPK, NABU) – Landowners	– Maintain base flood elevation – Meet future goals for water discharge capacity and regulation	– Displacing and removal of dykes	– Relocation of homes – Revision of zoning plans	– Enlargement of an old stream to increase natural value – Issue of protection permits for flora and fauna

Annex 4.A2
Co-ordination mechanisms for water management



Note: IPO (Association of the Provinces of the Netherlands, *Interprovinciaal Overleg*); UvW (Association of Regional Water Authorities, *Unie van Waterschappen*); VNG (Association of Netherlands Municipalities, *Vereniging van Nederlandse Gemeenten*).

Annex 4.A3

Water functions in the Netherlands: Threats, responsible authorities and co-ordination mechanisms

Task/function	Threats	Responsible authority	Legal instruments	Other governments and policy fields involved	Financial responsibility	Solidarity/profit principle	Co-ordination mechanism
Flood defence	– Climate change – Subsidence – Increasing population – Increasing economic investments	– Central government – Regional water authorities	– Safety norms – Plans – Risk maps – Project plans and project procedures – Permits – Periodical assessment and independent review	– General governments: central government – Provinces – Municipalities – Spatial planning, infrastructural works, nature conservation, urban development	Central government: 50% for large investments Regional water authorities: 50% large investments, total regular maintenance	Solidarity Profit	Planning
Water quantity	– Climate change – Subsidence – Rapid drainage – Spatial planning, more buildings and solid soil	Central government Regional water authorities	– Planning – Standards for water nuisance – Water-level decision – Storage areas – Project plan – Permits	– Central government – Provinces – Municipalities – Spatial planning/land use, nature conservation	Central government Regional water authorities	Solidarity Profit	– Planning – Water test – Payments to private parties (PPP) – Blue services
Water quality chemical	– New and dangerous substances – Transboundary pollution	– Central government – Regional water authorities	– Planning – Environmental quality standards – Permits – General rules	– EU – Central, provincial and municipal governments – Agriculture, air pollution, traffic, medicines, product policies	– Central government – Regional water authorities	– Solidarity (diffuse pollution) – Profit (polluter pays for some discharges and water system tax in regional waters)	– Planning – Co-ordination between permits from several policy fields (limited effect) – Water test (which does not work well when it comes to water quality)

Task/function	Threats	Responsible authority	Legal instruments	Other governments and policy fields involved	Financial responsibility	Solidarity/profit principle	Co-ordination mechanism
Water quality ecological	– Nitrates – Phosphorus – Biocides – Pesticides – New substances – Hydro-morphological changes	– Central government – Regional water authorities	– Planning – Environmental quality standards – Water-level decision – Project plan (ecologically friendly river banks, meandering) – Permits – General rules	– EU – Central, provincial and municipal governments – Agriculture, nature conservation, land use	– Central government – Regional water authorities	– Solidarity (diffuse pollution) – Profit (polluter pays for some discharges and water system tax in regional waters)	– Planning – Co-ordination between permits from several policy fields – Water test – Payments to private parties (PPP) – Blue services
Freshwater supply	– Climate change – Overuse – Salination	– Central government – Regional water authorities	– Planning – Permits – Project plan – Water hierarchy in case of scarcity	– Central, provincial and municipal governments – Agriculture, nature conservation, drinking water, industry	– Central government – Regional water authorities	Solidarity	– Planning – Co-ordination between permits from several policy fields – Water test
Wastewater collection	– Old infrastructure – Heavy rainfall	Municipalities	– Wastewater plan – Permits – General rules	– Regional water authorities – Spatial planning	Municipalities	Profit	– Water test – Co-operation obligation
Wastewater transport	– Old infrastructure – Heavy rainfall	Municipalities	Wastewater plan	– Regional water authorities – Spatial planning	Municipalities	Profit	– Water test – Co-operation obligation
Wastewater treatment	– New substances (dependent on regulation and enforcement by municipalities)	Regional water authorities	– Permits – General rules	– Municipalities – Industry	Regional water authorities	Profit	Co-operation obligation
Drinking water supply	– Pollution – New substances – Land use – Climate change – Salination	Drinking water companies	Contracts	– Agriculture – Nature conservation – Environment (pollution) – Spatial planning	– Drinking water companies – Consumers	Profit	– Co-operation – Shared duty of care for resources

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Chapter 5

Managing water risks in the Netherlands at the least cost to society

This chapter provides an overview of the current Dutch approach to determining an acceptable level of water risks and managing them at the least cost to society. Drawing on the OECD's framework for water security, it examines how an acceptable level of water risks is determined (either explicitly or implicitly) in Dutch water management. The chapter then proposes options for achieving a better balance between the economic, social and environmental consequences of water risks and the cost of amelioration. The chapter also provides an overview of the current approach to managing water risks. Some limitations of current approaches are illustrated by case studies, which document the weakness of some economic incentives and a lack of consistency across policy areas, which drive up the cost of water management today and in the future. Policy options to improve the incentives for public and private actors to better manage water risks are proposed.

Introduction

Achieving water security requires maintaining an acceptable level of water risks for society and the environment, today and in the future (OECD, 2013a). The setting of water security targets can be guided by several economic characteristics and equity considerations. In many cases, decisions about the acceptable level of water risks (whether via flood safety standards, target levels of security of freshwater supply, or water quality standards) are made implicitly, and are not the subject of informed public debate, despite their importance as cost drivers to achieve water security. Moreover, it is often (natural or man-made) disasters, rather than the careful assessment and management of risks ahead of time that prompts countries to worry about their level of protection against water risks.

Once set, targets for water risks should be achieved as cost effectively as possible. Strategies for managing risks should consider not only risk reduction, but also look for opportunities to avoid risk (by reducing vulnerability and exposure), transfer risk (through insurance schemes, for instance), and, in some cases, bear risks, when it is cost-effective to do so. The policy toolkit to manage water risks includes direct regulatory measure, market-based instruments and public financial support. When considering the design and selection of instruments, an assessment should be made of how each instrument, or mix of instruments, is likely to contribute to the goals of water security, economic efficiency and equity. Explicitly considering the distribution of water risks (and costs), can help to ensure equitable distribution of risks (and costs) amongst stakeholders and can help to prevent the imposition of one group's risk preferences on others. Moreover, it can allow for assigning risks to the actors that are likely to be able to manage them most efficiently and improve the incentives to do so (OECD, 2013a).

This chapter provides an overview of selected issues related to determining an acceptable level of water risk ("targeting" the risk) and "managing" water risks at the least cost to society in the Netherlands. It proposes possible ways forward to improve the financial, ecological and social sustainability of the Dutch water management system.

Determining an acceptable level of risk: Targeting water risks

The setting of targets for water risks is a complex but necessary art (OECD, 2013a). Indeed, determining an acceptable level of a given water risk is one of the most challenging and controversial risk governance tasks (Klinke and Renn, 2012). This process relies on both evidence-based and values-based judgements. A risk is considered acceptable if the likelihood of exceeding a given risk threshold (e.g. health standard, tipping point of a freshwater system) is low and the impact of exceeding that threshold is low. The acceptability and tolerability judgement process enables policy makers to prioritise risk management decisions when risks exceed acceptable levels (OECD, 2009).

Complex decisions regarding the acceptable or tolerable level of risk to freshwater systems are routinely faced in decisions about water risks, such as setting flood safety standards or determining minimum environmental flows. Whether implicit or explicit, the judgement regarding the acceptability of a given risk strongly influences the risk management strategy, the response adopted, the role of public policy, and the current and future cost of managing water risks (OECD, 2013a).

The level of acceptable risk is also a key cost driver of water management. Society's preference for safety or security of water supply is reflected in the level of acceptable risk and should be in line with their willingness to pay for measures to secure it. For instance, high flood protection standards can drive up costs of flood management. However, in light of significant (even catastrophic) flood risks, high safety standards can be justified, both from an economic and social point of view. On the other hand, sometimes marginal improvements in water security can be disproportionately costly. In principle, the acceptable level of water risk for society should depend on the balance between economic, social and environmental consequences and the cost of amelioration. The point of making the discussion about an acceptable level of water risks explicit is to ensure that these decisions are informed by both a robust evidence base as well as an informed public debate in order to ensure that policy responses are proportional to the risks faced.

This section provides insight into how acceptable levels of water risks are determined in the Netherlands. Key findings include:

- Current flood safety standards are among the highest in the world. However, given that only 63% of the flood defences currently meet those standards, the actual level of protection is lower. Safety standards for regional flood defences ultimately remain an administrative decision by the provinces.
- The principle of differentiated levels of flood protection is sound, while maintaining a uniform minimum standard of protection against the loss of life, as reflected in the new proposal by the Delta Programme.
- There is currently no explicit definition of an "acceptable" level of risk of shortage. However, specific trigger points have been identified that invoke a risk management response.
- There is a relatively low level of ambition for achieving water quality standards under the Water Framework Directive.
- Acceptable levels of risks are essentially set by administrative decisions. It is noteworthy that the current revision of standards for primary flood defences involves consultation and an assessment of the costs associated with different safety levels.

Targeting the acceptable level of flood risk

The Netherlands currently benefits from a robust system of water management with a high level of protection against flood risk. Renewed interest in flood defence standards was prompted by Hurricane Katrina in 2005 as well as an unexpected dyke break occurring in 2003 under abnormal weather conditions. At the same time, growing concerns about the cost of maintaining the system have arisen in the light of sluggish economic growth, fiscal consolidation and the looming cost of adapting to climate change.

The level of flood protection varies depending on the location in terms of population and the assets vulnerable to flood as well as the nature and level of flood risk in a given area. The approach to safety standards for the primary flood defences and regional flood defences is distinct and each is discussed separately below.

Primary flood defences

The current acceptable level of flood risk for the primary flood defences can be seen in the current statutory standards for flood protection set out in the Water Act of 2009 (Table 5.1). The act indicates the safety standard for each dyke ring (the system of primary flood defence structures that, either alone or in combination with high ground, provides protection against flooding) as the average annual overtopping probability of the highest high-water level that the primary flood defence structure erected as direct defence against external water must be designed to withstand (Ministry of Transport, Public

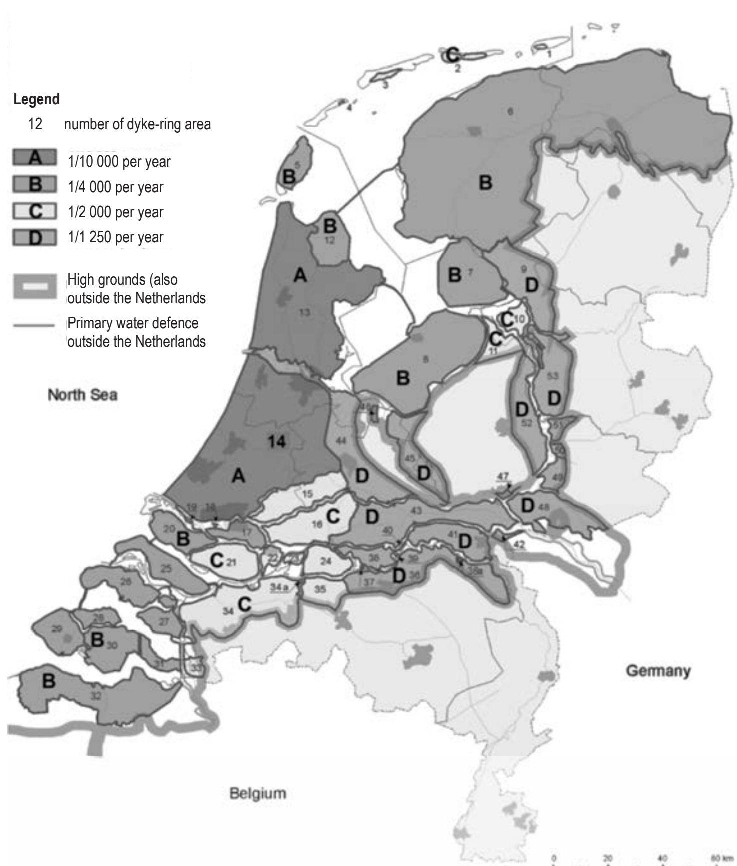
Works and Water Management, 2009). Figure 5.1 provides a map of the safety standards per dyke-ring.

Table 5.1. **Safety standards for the primary flood defence structures**

Average overtopping probability per year	Region
1/250	Dyke rings and primary flood defence structures along the Meuse south of Nijmegen
1/1 250	Rivers (e.g. Mass Valley in Limburg)
1/2 000	Transitional zones between the rivers and the coast and the Dutch West Frisian Islands
1/4 000	The delta region, the north of the Netherlands, the island of Texel and the IJsselmeer region
1/10 000	The coast of the provinces of South and North Holland

Source: based on Ministry of Transport, Public Works and Water Management (2009), *Water Act*, Ministry of Transport, Public Works and Water Management, The Hague.

Figure 5.1. **Safety standards of dyke-ring areas in the Netherlands**



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: adapted from TAW (2000), *From Probability of Exceedance to Probability of Flooding: Towards a New Safety Approach.* Technische Adviescommissie voor de Waterkeringen, Dienst Weg- en Waterbouwkunde, Rijkswaterstaat, Delft, Netherlands.

Although absolute safety can never be achieved, the current flood safety norms in the Netherlands are the highest in the world (Botzen et al., 2009). As a point of comparison, New York City is protected against only a 1 in 100 year flood, while London and Shanghai are protected against a 1 in 1 000 year flood. However, given that a significant portion of the Netherlands is below sea level (while New York, London and Shanghai are above sea level), the potential for catastrophic damage is much higher. The very low level of acceptable risk for certain areas is comparable with the values used in the design of large dams, when a dam break could cause the flooding of urban areas. These values are 1 in 10 000 years in the United States. In Portugal, the design of large dams upstream of inhabited areas is usually based on a flood risk between 1 in 5 000 and 1 in 10 0000. However, urban flooding protection considers values between 1 in 25 years or 1 in 100 years, depending on potential damage.

The current flood safety standards are largely based on the recommendations and outcomes of a cost-benefit analysis carried out in the 1950s and 1960s by the Delta Commission, established after the disaster of 1953 (Ministry of Transport, Public Works and Water Management, 2008; Jonkman et al., 2011). Since then, the population of the country has grown by around 6 million inhabitants (population 16.6 million in 2012) and GDP has grown by roughly five-fold (around EUR 600 billion in 2012). Also, new knowledge has been gained about the ways in which dykes can fail and how they can be improved.

Safety standards vary throughout the country. Safety norms near coastal dyke-ring areas are higher (Western Netherlands) due to higher economic values and population density. Dykes at the coast also have higher safety norms because storm surges are more difficult to predict, which increases the probability of casualties. Moreover, seawater floods are likely to cause more damage than freshwater floods. This explains the lower safety norms of the dyke-rings in the river area (of 1/1 250). Coastal dyke-ring areas are designed at standards between 1/2 000 and 1/10 000.

Flood standards for the primary defences are currently being reassessed in the context of the Delta Programme, and new standards will be proposed in 2015. The Minister of Infrastructure and Environment recently announced three key principles for determining new standards: *i)* a basic security for everyone living behind the dykes (the probability of mortality as a result of a flood may not be more than 1:100 000 years); *ii)* the prevention of societal disruption (additional protection for areas with possible large groups of causalities and a high economic damage; and *iii)* the protection of vital and vulnerable infrastructure, including hospitals and utilities.

The new standards will be informed by several new studies, including a societal cost-benefit analysis on the economically efficient level of flood safety (Deltares, 2011). Analyses shows that higher safety levels are probably needed around the city of Almere, some parts of the Rijnmond-Drechtsteden and the River District (in Dutch, *Rivierengebied*) (Delta Commissioner, 2013). A shift will be made from the current standards based on overtopping probability, to new risk-based standards based on a flooding probability. The national government will retain the responsibility for setting the standards of the primary flood defence system.

Regional flood defences

The provinces are responsible for setting the safety standards of the regional flood defence structures in the Netherlands (consisting of about 14 000 kilometres of defences). Safety standards for regional flood defences are not stipulated under Dutch law, but the manner in which the standards can be set is described in various guidelines, including the 1999 guidelines set out by the provincial authorities (IPO, *Interprovinciaal Overleg*, Association of the Provinces of the Netherlands) whereby the expected damage is related to the overtopping probability. There are five norm classes distinguished with an overtopping probability ranging from 1:10 per year to 1:1 000 per year. In areas where expected flood damage is low (ranging from EUR 0-8 million), the safety standard is the least stringent, with an overtopping probability of 1:10 per year. The highest safety standard of an overtopping probability of 1:1 000 per year applies in areas where expected damage from floods is greater than EUR 250 million.

Despite the above standards and the different guidelines, it is important to note that the setting of safety standards for regional defence structures, ultimately, is an administrative decision by the province. Accordingly, provincial administrators are open to deviate from these general guidelines (van Bree et al., 2011).

Monitoring flood safety standards

Although statutory standards are high in the Netherlands, the most recent assessment indicated that only 63% of the flood defences currently meet those standards. Until recently, the monitoring system of the primary defences was a three-step approach. For example, in the latest assessment report (Inspectorate for Transport and Water Management, 2011), the flood defence managers (regional water authorities and the *Rijkswaterstaat*) first reported their assessments to the province, whereby the province would review these assessments. Based on this review, the provinces then came to an independent judgement on the condition of the flood defences, which they reported to the State Secretary of the Ministry of Infrastructure and the Environment. Finally, on behalf of the State Secretary, the Inspectorate for Transport, Public Works and Water Management reviewed the provincial assessment.[1]

The 2011 Administrative Agreement on Water Affairs simplified this procedure. It was agreed that for the assessment of the primary defences, the central government directly supervises the *Rijkswaterstaat* and the regional water authorities (i.e. there is no longer a role for provinces) and for the secondary defences, provinces supervise regional water authorities (see Chapter 1).

Targeting the acceptable level of risk of shortage

Unlike in the case of flood risk, where the "acceptable" level of risk is reflected in the safety standards, there is currently no explicit definition of an "acceptable" level of risk of shortage. However, specific trigger points have been identified that invoke a risk management response. These could be understood as indicating when circumstances are no longer considered "acceptable" and require a specific risk management response.

Trigger points signalling risk of shortage

When the risk of shortage in the River Meuse or the Rhine crosses certain threshold, this triggers the convening of the National Co-ordination Committee for Water Distribution (LCW, *Landelijke Coördinatiecommissie Waterverdeling*).[2] Specifically, this occurs when the level of discharge of the River Meuse (at Maastricht) is less than 25 m^3/s. For the River Rhine, the trigger point depends on the water demand of the agricultural sector and varies by season (ranging from 1 000 m^3/s between September and April, to 1 400 m^3/s in May). In addition, the LCW can gather when there is a high risk of shortage in several regions (Rijksoverheid, 2013).

The National Co-ordination Committee for Water has no formal decision-making power, but advises the Director-General of *Rijkswaterstaat* or the minister when the situation becomes critical. The LCW consists of representatives from the Ministry of Infrastructure and the Environment, the Association of Regional Water Authorities (UvW), and the Association of Provinces (IPO) (RWS, 2013).

Sequence of priorities establishing differentiated levels of risks for user categories

The central government sets the standards for the national freshwater supply and the "sequence of priorities" (in Dutch, *verdingingsreeks*) to determine the allocation of freshwater water to specific categories of users during times of shortage. It is applied during problematic situations of shortage (exceptional circumstances). Generally, the allocation system functions as intended, but it is not always possible to meet all the demands of the human uses in the higher categories. This can result from the physical impossibility to divide the available water resources or because the water temperature (for cooling water) or salinity (for agriculture) is too high.

There are four user categories in the sequence of priorities. Category 1 takes precedence over all others. It includes freshwater use for safety and the prevention of irreversible damage (e.g. ensuring the stability of flood defence structures, settling and subsidence of peat bogs and moorland, nature dependent on soil conditions). Category 2 includes drinking water supply and power supply. Category 3 includes small-scale, high-quality uses, such as temporary spraying of capital-intensive crops and process water. Finally, Category 4 has the lowest precedence, and thus the highest exposure to risk of shortage. It includes shipping, agriculture, nature (as long as no irreversible damage occurs), industry, water recreation and lake fishing (RWS, 2011; 2013). Within Categories 1 and 2, the sequence of priorities cannot be adjusted. However, within Categories 3 and 4, the priority of uses within categories can be established and specified by the regional water managers. The minimisation of economic and societal damage is the basic principle to inform these decisions.

Table 5.2. **Sequence of priorities for water shortage**

Category 1	Category 2	Category 3	Category 4
Safety and the prevention of irreversible damage	Utilities	Small-scale high-quality use	Other (economic considerations, also in terms of nature)
1. Stability of flood defence structures 2. Settling and subsidence of peat bogs and moorland 3. Nature dependent on soil conditions	1. Drinking water supply 2. Power supply	1. Temporary spraying of capital-intensive crops 2. Process water	1. Shipping 2. Agriculture 3. Nature, as long as no irreversible damage occurs 4. Industry 5. Water recreation 6. Lake fishing

Source: Based on RWS (National Water Authority, Ministry of Infrastructure and the Environment) (2011), *Water Management in the Netherlands*, Directorate-General Water and Rijkswaterstaat, Centre for Water Management, Ministry of Infrastructure and the Environment, The Hague.

The sequence of priorities as it currently stands was set out in response to the exceptional drought of 1976, and updated after the drought in the summer of 2003 (RWS, 2011). The most significant changes in the recent update include the current prominent position of nature (including the division between the prevention of reparable and irreparable damage), the integration of utilities (including the provision of energy), and allowing for more tailored adjustments at the regional level within Categories 3 and 4 (Ministerie van Verkeer en Waterstaat, 2004).

Box 5.1. **Nature's place in the sequence of priorities: Determining "irreparable" damage**

In the "sequence of priorities" that determines the allocation of water among water uses during times of shortage, nature is taken into account at two levels. A distinction is made between the prevention of irreparable damage to nature (accounted for the first category of uses that takes precedence over all others), and the prevention of damage to nature "as far as this damage is not irreparable" (part of Category 4).

As defined for the purposes of the sequence of priorities, irreparable damage to nature has two dimensions: *i)* damage to the habitat (abiotic damage); and *ii)* damage to the flora and fauna (biotic damage).

Irreparable abiotic damage can appear in a number of ways. In the Netherlands, the two main mechanisms are the settling of peat and the intake of water containing (high) salt and/or nutrient levels. There is a high risk of biotic damage when "artificial" ecosystems run dry due to human influence and when sudden changes in water quality occur. A change in water quality can relate to salt, toxic substances and/or a sudden algae bloom (blue algae, in particular). Besides artificial ecosystems, fragmented and stressed nature areas are vulnerable to drought, as they barely have any reserves to draw on. Given that it is more difficult to precisely establish when biotic damage becomes irreparable (in comparison with abiotic damage), water managers have more freedom of interpretation in this case.

Source: RWS (National Water Authority, Ministry of Infrastructure and the Environment) (2006), *Factsheet Natuur in de Verdringingsreeks*, Ministry of Infrastructure and the Environment; Helpdesk Water (2013), "Natuur in de verdringingsreeks; wanneer is er sprake van onomkeerbare schade?", Helpdesk Water, Lelystad, Netherlands, www.helpdeskwater.nl/onderwerpen/gebruiksfuncties/werkwijzer/kennis_uit_de/map/n/natuur_in_de (accessed 21 May 2013).

Setting targets for allocation limits

A risk-based approach can be used not only to trigger responses to exceptional conditions, but also to inform decisions about allocation limits and licensing rules. Explicit balancing between water risks (e.g. risk of shortage and risks to the resilience of freshwater ecosystems) should be encouraged to minimise negative externalities of risk management. Setting targets for water risks does not necessarily require sophisticated risk characterisation and evaluation techniques (OECD, 2013a). Box 5.2 provides an example on how this has been done in Western Australia to inform allocation planning for a groundwater system (see the section on "Managing the risk of shortage" for further discussion on using economic instruments and a risk-based approach to allocation).

Targeting the acceptable level of risk of inadequate quality and risk to freshwater ecosystems

Standards for the chemical and ecological quality of surface water in the Netherlands are agreed under various EU directives, including the Water Framework Directive and the Directive on Priority Substances. In terms of monitoring the compliance of objectives, the central government is responsible for the national waters and the provinces are responsible for the regional waters.

Box 5.2. **Setting targets for risk-based groundwater allocation planning**

The risk-based groundwater allocation planning process has two steps:

- assess whether risks identified in the risk appraisal process can be managed through licensing rules
- set allocation limits (the amount of water available for consumptive use) and licensing rules.

First, there is a need to assess the capacity to manage the risks identified in the appraisal stage. For example, for some aquifers, a high risk to groundwater-dependent ecosystems can be reduced to a medium level if the risk is managed through appropriate buffer zones. Licensing rules are defined at this stage and might include:

- establishing buffer zones
- managing abstraction in relation to recharge events (e.g. reducing abstraction during droughts)
- establishing triggers for additional management actions (e.g. groundwater levels).

Then the defined licensing rules are considered. If appropriate, the final ratings in may be revised based on proposed mitigation measures. If risk mitigation strategies reduce the overall risk to *in situ* values, then the reduced risk value is used in the risk matrix instead. A risk matrix is then used to convert the (final *in situ* and development) risks into a proportion of recharge (see table below). To set the allocation limit, this proportion is applied to the estimated recharge volume defined in the initial step of the risk-based groundwater allocation planning process ("identify and define the groundwater resource"), which sets the volume ("target") that can be allocated for consumptive use based on an acceptable level of risk. The risk matrix allows consideration of the trade-offs between the two groups of risk.

	Proportion of recharge		
High *in situ* risk	5%	25%	50%
Medium *in situ* risk	25%	50%	60%
Low *in situ* risk	50%	60%	70%
	Low development risk	Medium development risk	High development risk

Source: Government of Western Australia (2011), *Groundwater Risk-Based Allocation Planning Process*, Department of Water, Water Resource Allocation and Planning Series, Report No. 45, Perth, January, www.water.wa.gov.au/PublicationStore/first/96735.pdf.

This completes the target-setting process with the outputs being:

- an allocation limit
- a set of licensing rules to manage risks.

The maximum allocation from this process is up to 70% of recharge. This allows for any uncertainty, given the limited information on aquifer properties such as recharge. Setting aside at least 30% of the estimated recharge protects the resource from potential over-allocation. It also protects aquifer integrity, including through reducing the risk of saltwater intrusion. The allocation limit can be revised as additional information becomes available.

Source: OECD (2013), *Water Security for Better Lives*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264202405-en.

During the preparation of the first river basin management plans, the government undertook several cost-benefit analyses for the programmes of measures for the Water Framework Directive on a national scale. These included a first rough estimate of potential costs in 2005, to guide discussion about feasibility and affordability. In 2006, a strategic cost-benefit analysis was undertaken to support a national strategic discussion on the level of ambition. In 2008, an *ex ante* evaluation was performed to inform policy makers of costs and benefits of measures that were proposed. Overall, it was considered more appropriate (more cost effective and more beneficial) to give priority to ecological status measures rather than to chemical status measures.

Some studies suggest that agricultural and business interest groups have been very successful in influencing the implementation of the Water Framework Directive in the Netherlands (Behagel and Turnhout, 2011; van der Arend and Behagel, 2011). Behagel and Arts (2012) report that as a result of this pragmatic approach, more than 50% of the Dutch water system consists of non-WFD water. In addition, around 95% of water in the Netherlands is designated modified or artificial. Designating water bodies as heavily modified or artificial does not result in the lowering of the ambitions for water quality as such, yet it gives regional water authorities the possibility to set, and thus lower, standards for each water body individually (Behagel and Turnhout, 2012). The implementation of measures to meet the objectives has been slow. A large number of exemptions to meeting the objectives by 2015 have been applied in the first cycle of the river basin management plans (see Chapter 4), which has been cited as a "cause for concern" by the European Commission (European Commission, 2012).[3] Overall, this has resulted in a relatively low level of ambition for achieving water quality standards under the WFD and a tolerance for lower quality water.

Ways forward for better "targeting" water risks

1. The acceptable level of flood risk is a **key driver** of current and future **costs** for flood protection. It should balance society's preference for safety with its willingness to pay for it. A process to **revise the current flood protection standards** is currently underway. To date, decisions about safety levels have been largely a technical exercise that has not been the subject of widespread public debate. In addition to a sound evidence basis, these decisions also merit public discussion and informed debate about the trade-offs, benefits and costs that flood protection standards imply. A mechanism to provide for **informed public debate about the acceptable level of flood risk** could be established. It could serve multiple purposes, including raising public awareness of flood risk, solidifying the willingness to pay for current and future flood protection to achieve high levels of safety in recognition of the associated costs, and reinforcing the social contract to commit to a safe Netherlands today and in the future that can secure steady financial flows for flood protection.
2. Recognise that the pace of implementation of flood protection measures **determines the *de facto* level of safety at any point in time**. The programme of measures to improve defence structures that do not meet the standards and the timeline for implementation should be determined in light of what is considered by society as an acceptable level of risk.
3. Prevention is the main thrust of risk management for catastrophic and severe flooding, while less severe floods can be tolerated periodically. Based on recent economic assessments, there is a solid case for **allowing flexibility in safety**

standards for certain primary and regional defences (e.g. changing safety standards where justified). This could achieve flood safety more cost effectively overall, while still allowing for a universally high level of protection against the loss of human life. At the same time, it should be noted that climate change increases uncertainty about flood risk, making it more difficult to assess economically efficient levels of protection with a reasonable degree of accuracy. Overall, there is still a good economic case for lowering safety standards in certain situations, but this needs to be done prudently, considering future changes.

4. Shifting towards a risk-based approach to managing freshwater supply by **maintaining "target supply levels"** in vulnerable areas could provide a more cost-effective approach over the long term to managing the risk of shortage than mainly focusing on structural measures to augment supply. This would entail allowing for a certain degree of freshwater shortage for some users at some times. The establishment of "target supply levels" should be informed by the social cost-benefit analysis currently being undertaken as part of the Delta Programme and build on the findings of the "Drought study" (RIZA, 2005). In addition to the scientific and economic evidence basis, an informed public debate on the **level of acceptable risk of shortage** could contribute to a better understanding of the **potential impacts** and **costs of shortage** (e.g. expected damages) for both periodic seasonal shortages as well as sustained drought. This can help to secure the willingness to pay for the cost of potential mitigation measures.

5. Decisions regarding the acceptable level of risk for floods, shortage and inadequate quality have an impact on the level of risk to freshwater ecosystems. For instance, increasing flood protection may negatively impact on the resilience of freshwater ecosystems, or managing the risk of shortage. When considering the acceptable level of water risks, a **risk-risk trade-off analysis** could be useful to shed light on these interactions and highlight the **impacts on risks to freshwater ecosystems**.

Managing water risks at the least cost to society: Economic principles and instruments

Decisions about managing water risks should be informed by the previous steps of the risk governance process "knowing" the risk and "targeting" the risk. There are a number of strategies to manage risk, including to avoid, to reduce, to transfer or to bear the risk. This can be done by altering risk drivers, by limiting exposure or enhancing the resilience of the community, physical assets and the environment by making them less vulnerable to potential harm. Establishing clear responsibility for managing the risk is essential. A lack of clarity regarding who (public or private actors, or both) bears (or shares) the risk undermines incentives to proactively manage risks.

There are two key principles underlying the economic management of water – efficiency and equity. Efficiency aims to maximise the welfare that is obtained from a resource by allocating it to its most valuable economic use. Equity concerns the distribution of resources across a given population (OECD, 2013a). In light of uncertain future trends, such as climate change, adaptive efficiency is also important (OECD, 2013b). Adaptive efficiency addresses the least cost path to maximise social welfare over the long term in the context of complex resources, unpredictability, feedback effects and path dependencies (Marshall, 2005).

An appropriate policy mix employing a combination of regulatory, economic and information-based instruments is required to adequately address water risks. Table 5.3 provides examples from this policy toolkit. While only one part of the policy toolkit, economic instruments can be particularly effective in contributing to achieving the dual objectives of efficiency and equity. These are policy tools that influence behaviour through their impact on market signals rather than explicit regulation. Economic instruments can also be used to achieve adaptive efficiency required for dynamic, decentralised and flexible responses to changing circumstances and deal with increased variability, risk and uncertainty (OECD, 2013b).

Table 5.3. **Examples of water policy instruments to address water risks**

	Regulatory	Economic	Information-based
Risk of water shortage (including drought)	– Restriction on water use (e.g. hosepipe ban) – Administrative allocation of water – Abstraction limits	– Water pricing – Water trading (e.g. water markets, water banks, dry year options) – Payments for ecosystem services (PES) – Microfinance schemes (e.g. to invest in rainwater tanks)	– Information and awareness campaigns to promote water saving – Drought warning and information
Risk of inadequate quality	– Water quality standards – Pollution discharge permits	– Pollution taxes, charges – Tradable pollution permits – PES	– Information and awareness campaigns – Technical assistance for improved farming techniques (to minimise negative impacts on water)
Risk of excess (including flood)	– Land-use planning, zoning restrictions – Building codes, standards	– Flood insurance – Public private partnerships (e.g. for flood defence structures) – PES	– Flood risk maps – Early warning systems
Risk to the resilience of freshwater systems	– Minimum environmental flows	– "Buy backs" of water entitlements from the water to ensure adequate environmental flows	– Promoting awareness of the value of freshwater ecosystem services

Source: OECD (2013), *Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264200449-en.

This section provides insight into how water risks are currently managed in the Netherlands and provides suggestions for improving the effectiveness, efficiency and equity of policy responses based on OECD analysis and international experience. Key findings include:

- The current strategy for flood risk management relies significantly on structural protection to reduce risk (both the likelihood and potential consequences of a flood event). Managing flood risk is seen as a government responsibility.
- Currently, there is an absence of incentives to change the trend of increasing exposure to flood risk. The trend of increasing exposure to flood risk is driven by ongoing spatial development, at times in highly unfavourable locations, from a water management perspective. This leads to the escalation of costs, today and in the future.

- The distribution of the costs and benefits of spatial development perpetuates the "snowball" effect, driving up the long-term cost of water management. Once spatial development has taken place, path dependency restricts the available risk management options, as alternatives to risk prevention become increasingly less feasible, either economically or politically.
- For the risk of shortage, the current risk management response is focused on periodic short-term responses and a focus on structural solutions.
- Under the current priority regime, there is an absence of incentives for water users to proactively manage the risk of shortage. The risk of shortage is largely borne by low-priority users.
- While numerous measures are in place to manage risks to water quality from non-point source pollution from agriculture, they are currently not sufficient to meet water quality objectives under the WFD. Economic incentives to reduce pollution are generally weak.
- Efforts to manage the risks of flood and shortage often increase risks to freshwater ecosystems. In weighing such "risk-risk trade-offs", the value of ecosystem services is often overlooked and not taken explicitly into account.

The following sections explore options to manage the four water risks identified in Chapter 2, namely: too much, too little or too polluted water, and the risks to freshwater ecosystems.

Managing risks of too much water

The dynamics of safety, spatial development and long-term financial liabilities

In general, the management of flood risk in the Netherlands is seen as a public responsibility. By setting standards for flood protection and implementing projects to meet those standards, the government bears flood risk up to a level set by the standards. Flood protection is financed by taxes paid by water users to the regional water authorities, along with general taxation (this also contributes to the relatively low willingness to pay for flood insurance documented in several studies). Currently, the government is moving towards a new system of improvement of security standards for dykes, referred to as the multiple layer safety approach (Box 5.3).

The government also has a role in off-setting economic losses in the case of major flood events through the Damage Compensation Act (WTS). However, under the current arrangements, the amount and coverage of such compensation is left to political discretion and not determined in advance. There is currently no insurance for flood risk in the Netherlands. In effect, the residual risk is borne by the private sector – households, landowners and businesses.

Current risk-sharing arrangements are the subject of debate and alternative options are being explored. There is also an ongoing debate about risk-sharing arrangements for those living outside of the dykes. There are some trends toward encouraging private actors to take on more of the responsibility, for instance, by making structural changes to their property. Another option for adjusting risk-sharing arrangements is to introduce some form of insurance. If flood insurance is financed by (partly) risk-based premiums, then the costs of residing in flood-prone areas are ultimately paid by the businesses and households that settle in such areas. This can encourage location in safe areas and the flood-proofing of buildings (Botzen et al., 2009).

Box 5.3. **Multiple layer safety approach**

Several key changes are being proposed to move towards a new system of improvements of security standards for dykes. These include:

- A new type of flood standard involving the actual strength of levees, instead of the ability of structures to withstand a certain water level. This more precise method will allow for the minimising of "false negatives" (levees falsely considered weak).
- A more differentiated level of flood standards along the length of primary defences (as opposed to a uniform standard per dyke ring) will be proposed.
- Adjustments in the level of flood protection will be proposed, this will include higher levels of protection for levees protecting more people and significant assets, as well as lower levels where few people and assets are protected, so long as basic safety for the protection of human life is assured (using a precautionary standard).

Protection against flood takes place using a multiple layer safety approach. Safety can be enhanced by measures in:

- layer 1: by enforcing levees or reducing water levels (increasing the discharge capacity of the river). These measures reduce the probability that flooding occurs (e.g. likelihood of an event)
- layer 2: measures in spatial planning, reducing the consequences in the event of flooding (e.g. expected damages)
- layer 3: disaster management, reducing the consequences in the event of flooding (e.g. expected damages).

Projected costs of future flood protection in response to future trends (e.g. climate change) are discussed in Chapter 6. A number of elements of the multiple layer safety approach can help to ensure the affordability of flood protection for years to come. The policy changes related to the multiple layer approach are expected to result in improved efficiency and effectiveness. Future levels of protection will be based (at least partly) on cost-benefit analyses. While investments will always be necessary in order to reinforce levees, once reinforcement takes place, it is relatively inexpensive to increase the dimensions of the levee. As such, a robust investment strategy is key to maximising the cost-benefit ratio, combined with spatial planning, reducing the consequences in the event of flooding (e.g. expected damages).

Split incentives escalate costs – today and in the future

The current high level of safety provides a fertile environment for spatial development to accommodate a growing economy and population. This development provides the justification for maintaining a high level of safety, producing a "virtuous", or perhaps "vicious", cycle of increasing safety, encouraging development, justifying possibly higher levels of safety and thus, increasing costs. This dynamic, along with the highly path-dependent nature of flood protection, means that once financial liabilities for flood protection are taken on, they are difficult to abandon and have the tendency to grow over time. This "snowball" effect is at the heart of the financial sustainability of the Dutch system of flood risk management and calls into question the long-term sustainability and affordability of the system.

Water and flood management functions in the Netherlands support spatial management development by making them possible and keeping them safe. At the same time, decisions about spatial development have direct consequences for water and flood management and the associated cost. At present, residential and commercial developments continue to expand their claims to public space in low-lying areas. These spatial developments are among the key cost drivers for water management, locking in future financial liabilities.

The distribution of the costs and benefits of spatial development perpetuates the "snowball" effect. For example, spatial developments may bring significant added value for a specific municipality or region, but may drive up the costs of flood protection for the Netherlands as a whole. Municipalities and provinces reap the benefits of spatial developments, while the regional water authorities and the central government bear the costs. This situation of split incentives drives up the costs of water and flood management. The way in which tradeoffs are made when conflicts arise between water management objectives and spatial development currently occurs on an *ad hoc* basis.

Once spatial development has taken place, path dependency tends to restrict the available risk management options, as alternatives to risk prevention (e.g. avoidance of risk) become increasingly less feasible, either economically or politically. This dynamic also works at counter purposes to the "adaptive delta management" approach at the heart of the Delta Programme, which aims to retain options open for the future.

To illustrate the snowball effect and shed light on the complex dynamics that perpetuate it, the case study on Westergouwe provides an in-depth look at how decisions about spatial development influence the cost of water management, today and in the future. It illustrates the significance of spatial planning decisions for water management, and their impact on the long-term financial sustainability of the system. It also shows how short-term economic concerns can undermine long-term financial sustainability and how the distribution of costs and benefits influences decision making. The case provides valuable lessons for considering how incentives to manage flood risk via spatial planning can be improved.

Case study: The "snowball" effect in Westergouwe

Following the completion of the closed dyke rings many years ago, the possibility of flooding played a less important role in spatial planning. In fact, for several decades, the consequences of possible floods were not considered prominently in urban planning decisions. The role of regional water authorities in spatial planning discussions was primarily a technical one, finding practical measures at the operational level to mitigate possible negative impacts of spatial planning decisions, such as a location choice.

Yet, the renewed attention to flood risk in spatial planning shot up the political agenda when an urban extension project of the municipality of Gouda called Westergouwe became the focus of a national public debate on how to anticipate the potential impacts of climate change (Pieterse et al., 2009; van den Brink et al., 2010; van Dijk et al., 2011).

Westergouwe is located in the Zuidplaspolder, in the western part of the Netherlands, and lies more than six metres below mean Dutch sea level, which makes it one of the deepest polders of the country.[4] In addition to being a very deep polder, it also is a polder characterised by weak peaty soils, hence providing poor conditions for urban development. Nevertheless, the Gouda municipality planned the construction of about

4 000 new homes in this area, by designating this polder as urban extension area (Neuvel and van den Brink, 2009; van den Brink et al., 2010). To gain a better understanding of why a city could plan a new residential area in such an exceptional unfavourable location (at least from a water management perspective), the next section briefly discusses the background and context of the Westergouwe planning process.

Six metres below sea level: A short history of the urban extension decision

The decision to build about 4 000 houses in Westergouwe was a municipal decision. The Gouda Municipal Executive purchased the lands west of Gouda in the 1970s. For a variety of reasons, including a conflict with the adjacent municipality of Moordrecht and due to a restrictive national spatial policy for the Green Heart,[5] opposition from the national government (the Ministry of Housing, Spatial Planning and the Environment, in particular), the planning process for the development of the land was delayed for decades. In the meantime, the municipality of Gouda focused on the realisation of other planned residential areas, such as Bloemendaal (northwest of Gouda, constructed in the 1970s and1980s) and Goverwelle (east of Gouda, constructed in the 1980s and1990s).

Around the year 2000, the conflict with the neighbouring municipality was resolved, and the restrictive policy for the Green Heart was loosened (van den Brink et al., 2010). At the same time, the city was facing rapid population growth and had the ambition to attract a new (and prosperous) segment of inhabitants. These conditions encouraged Gouda to create room for new developments. As the Zuidplaspolder was the only space left for expansion, this polder was considered the right place for urban extension (Pols et al., 2007).

At the time when the first plans for Westergouwe were developed, water was less prominent on the agenda than it is today. The consequences of possible floods were practically disregarded in urban planning and a number of other new urban extension projects in deep polders were developed. In addition, at that time, municipalities did not consider it to be their responsibility to address flood risks, but instead the responsibility of the regional water authorities and project developers (Pols et al., 2007; Neuvel and van den Brink, 2009).

These factors help to examine not only why an urban development in such unfavourable conditions was proposed, but also why the initial plans did not include measures for reducing the possible flood consequences. The first concrete plans of Westergouwe were received with severe resistance by both the Schieland en de Krimpenerwaard District Regional Water Authority and the water sector of the province of South Holland. Eventually, both the regional water authority and the water sector of the province of South Holland advised negatively on the proposed urban extension project. Despite these negative recommendations, all of the pros and cons considered, the province of South Holland nevertheless agreed with the proposed Westergouwe development (Pols et al., 2007).

Up to this point, the case was hardly unique. It was not uncommon that infrastructure projects, including the development of new housing areas, were approved by the province, despite negative recommendations from water management specialists (Hofman, personal communication, 28 May 2013). However, when the tensions escalated and the Minister of Housing, Spatial Planning and Environment became involved, the case became exceptional in the level of political attention it attracted. The involvement of the ministry was due, in part, to Gouda's "section 12-status" (in Dutch, *artikel 12-status*). As a result of Gouda's negative financial situation (due to a large extent by the management and maintenance of the city's weak peaty soils), the national government had put the Gouda Municipal Executive under legal and financial restraint. In return for additional public resources, for a long time, Gouda was obliged to ask permission for large spending expenditures. For this reason, Gouda was also required to ask to approval of the national government for the development of Westergouwe (van den Brink et al., 2010).

The Minister of Housing, Spatial Planning and the Environment showed concern about the project's (financial) sustainability and its robustness in light of flooding risks. As a result, the ministry ordered the province and the municipality to develop an integrated vision for the development of the Zuidplaspolder and to pay more attention to water issues, and in particular, to explain the soundness of the proposed residential development in the light of water management (Pols et al., 2007; Smits et al., 2006; Neuvel and van den Brink, 2009).[6]

A working group (the "3W Working Group") was tasked to study how the planned residential extension project could be designed in a responsible and "water-proof" manner (van den Brink et al., 2010). It concluded that "given the choice for the location, from a water management perspective, it is both possible and safe to develop a residential area on the location as laid down in the regional plan". The most important and innovative element of the advice of the 3W Working Group was their recommendation to use spatial planning to reduce potential flood consequences by reducing vulnerability.

In reaction to the 3W Working Group recommendations, the Minister of Housing, Spatial Planning and the Environment approved, under strict conditions, the development and construction of Westergouwe (Pols et al., 2007; van den Brink et al., 2010).

Besides the discussion on the approval of Westergouwe, a debate took place on the question of who had to bear the additional costs of implementing the spatial measures to reduce potential flood consequences in this new residential area. Baan et al. (2004) roughly estimated the costs of the elevation of the building parcels in the new construction site alone to be about EUR 25 per m^2. Initially the municipality of Gouda refused to foot the bill, claiming that they could not have factored in these extra costs (Hofman, personal communication, 28 May 2013). In a certain way, these additional costs could indeed be perceived as unforeseen. After all, as mentioned above, it was because of the administrative and societal controversy surrounding Westergouwe that the design of this project (unlike in many other urban extension projects) integrated the vulnerability-reducing measures such as raising the site in preparation for building, to reduce the impact of potential flooding (Pols et al., 2007; Pieterse et al., 2009).

The municipality accepted the responsibility with regard to off-setting additional costs. However, the exact costs involved in pursuing the development and the additional measures have never been revealed publicly. In fact, even after it became clear that a transfer of the additional costs to the regional water authority, and hence to the community as a whole, was not possible and the city, along with the project developers, would have to bear the expense, the Westergouwe project organisation never disclosed the additional costs. The Westergouwe project organisation, however, did report that all additional costs will eventually be passed on to the future property owners, either via the price of the building parcels and/or the prices of houses (Marshall, personal communication, 3 June 2013). Accordingly, except for the regular costs related to the protection of the area against high water levels, no costs are passed on to the regional water authority. At the same time, as soon as new households move into the

Westergouwe, the regional water authority will receive additional revenues from their levies. Box 5.4 discusses the issue of the transfer of costs in a broader perspective.

Box 5.4. **The transfer of costs in a broader perspective**

Although the involvement of the national government in Westergouwe is rather unusual, concerns about the transfer of water management costs are not (Fiselier, 2002). Apart from individual instruments, which public authorities have at their disposal (such as the sewerage charges and the water system levy), nowadays there are two frameworks in which the financing of water measures is arranged: the 2003 National Administrative Agreement on Water (NBW) and the Land Development Act.

Within the National Administrative Agreement on Water, the parties agreed that when there is a new situation (that is to say, when something new is built or developed), the municipality (the initiator) is responsible for the costs that have to be made for the necessary adjustments in the water management system (including measures that result from the Water Assessment process).

In addition, the Land Development Act states that the initiator of a spatial development is responsible for arranging the financing for (compensatory) water management measures. The parties involved (including the water manager) make arrangements regarding who pays for what. The initiator, subsequently, has to put these financial agreements down in the water paragraph or in the financial paragraph of the spatial plan (Boekhold and Kroes, 2008).

The Land Development Act gives municipalities instruments to, thereupon, pass on these costs to the developers, either via a private law development agreement (in Dutch, *exploitatieovereenkomst*) or via a public law development plan (in Dutch, *exploitatieplan*). All costs that may be retrieved via the development plan are included in a specific list such as laid down in the Land Development Act. The costs on this list include, among others, the costs of preparing the land for building; the costs of green areas and water amenities; and the cost related to the compensation for the loss of nature values, green areas and water amenities in the area (VROM, 2007). Only when the water system is not in order at the point of departure will the regional water authority have to bear the costs related to the overdue maintenance of the system (Boekhold and Kroes, 2008).

Due to the current economic crisis and the difficult housing market, the future of Westergouwe seems less bright than it did a few years ago. Initially it was planned that the implementation would start in 2011, and last until 2020. Today the ambitions have been lowered. Expensive private property plans are replaced by less expensive houses, and the time-planning has also changed dramatically. Whereas initially the construction of about 4 000 houses was planned before 2020, construction will now proceed on a step-by-step basis. In the first phase, between 2016 and 2019, the construction of only about 500 houses is planned (Cobouw, 2013).

Lessons learnt from Westergouwe

The Westergouwe case illustrates the significance of spatial planning decisions for water management, and in the end, the overall cost. Box 5.5 also provides insights from experience in Portugal in managing the relationship between spatial planning and flood risk, while Box 5.6 provides specific examples from OECD countries policy responses to manage flood risk in a changing climate. Several lessons can be drawn, which can be used to identify opportunities to improve incentives to manage flood risk at least cost.

The case sheds light on the issue of divergent incentives in decisions about spatial planning and the impacts on water and flood management. While municipalities and property developers primarily reap the benefit of spatial development, the costs related to flood and water management to make those developments possible are borne by regional water authorities, and hence society at large. The case highlights the importance of considering the allocation of costs for water and flood management. In this case, there was a lack of transparency about the marginal costs for water management related to this development. Furthermore, while instruments are available (e.g. via the Land Development Act) to better align incentives for spatial development, it is not clear that they are consistently applied or effective.

Box 5.5. **Spatial planning and vulnerability to flood risk: Experience in Portugal**

Often it is necessary that society goes through dramatic disasters to understand the need to be prepared for such events and, above all, to do whatever can be done to prevent them from happening. This was the case of the dramatic flash floods in the Lisbon metropolitan area that occurred on 25 and 26 November 1967.

During that night, one fifth of the mean annual precipitation fell during a short period of five hours. The return period of this event was estimated as 1 in 500 years. Furthermore, it coincided with the high tide, aggravating the situation in coastal urban areas. This tragic event caused around 500 deaths and extensive devastation in the proximity of the small rivers that cut across several villages in the region.

To make things worse, civil defence proved to be largely unprepared to cope with such a situation and it was necessary for spontaneous groups of citizens, groups of students organised in many schools and church-based brigades to go to the tragedy zones in the following days to help people rescue whatever could be saved, provide relief to an anguished population and recover dead bodies from the mud.

Such a tragic event and the recognised unpreparedness and fumble from the authorities triggered a large debate in the Portuguese society. A fruitful one indeed! Why had this tragedy happened? Why were the consequences so devastating? What should be done in the future to prevent this type of deadly event?

It became immediately clear that beyond the extreme value of the rainfall intensity, several manmade causes had aggravated tremendously the consequences of those flash floods in the affected suburban areas. Basically, very incorrect land use and poor or inexistent spatial planning were at the core of the identified problems.

In the early 1960s there had been a strong flux of population from rural areas to the metropolitan area of Lisbon. This was caused by economic crisis, especially in rural areas, while some timid industrial development was taking place in the Lisbon area. This process of "de-ruralisation" was very strong for two or three decades and has since become the demonised enemy of a balanced regional development.

This migratory process caused an urban sprawl and a typical "leap-frog" growth of suburban areas. Land-use planning was practically inexistent and municipal and central authority over territorial development was extremely weak. Still more serious, probably, was the complete lack of a "flood culture" of these new inhabitants that were attracted by cheap or virtually abandoned land in the flood plains. In a few years, legal and illegal construction spread over watercourses, dramatically narrowing the river paths and creating man-made barriers to the free flow of high waters. Tragedy was there to happen.

Box 5.5. **Spatial planning and vulnerability to flood risk: Experience in Portugal** (*cont.*)

The situation nowadays is completely different and it is only regrettable that the lesson was learnt at such a high cost in human lives. An important concept introduced by 1971 legislation (Decree-Law no. 468/71), and reinforced in 1987 (Decree-Law no. 89/87), is the concept of "adjacent area". This is a strip of land on each side of the river and contiguous to it, that is subject to strict public jurisdiction even though it is private property. In Portuguese legislation this is called "compliances and restrictions of public interest" impending over private property. Law no. 54/2005, "on the Property Rights over the Water Domain", and Law no. 55/2005, "Water Framework Law", modernised and consolidated this and other related concepts.

The "adjacent area" is a *non aedificandi* area, in which construction, changes in topography, and deposits and landfills are forbidden, except in a few pre-defined cases with an explicit authorisation given by the water authority (for instance, parks and playgrounds used only during the day). The objective of the "adjacent area" is to allow for easy access to the river margins and to provide a buffer for flood events. The minimum width is 50 metres in areas potentially affected by sea surges and in the reaches of rivers affected by the sea tide, 30 metres in navigable rivers and 10 meters in small rivers. However, in regions threatened by floods, the width is based on the 1 in 100 years flood or the major flood experienced in the region, whatever is the largest. If these values are not known, or while they are not yet officially determined, a minimum width of 100 metres must be considered.

In 1989, important steps forward were made in the legal framework of land-use planning and territorial management, incorporating these and other precautionary measures in the planning procedures. Municipal master plans (PDMs) were made compulsory and municipalities that do not comply with this obligation risk having access to national and EU funds blocked. The planning exercise starts with a "Map of Enforceable Conditionalities" in which several constraints to land use are taken into consideration from the very beginning. Among these enforceable constraints, the adjacent areas including the areas threatened by floods have to be taken into account. This legislation has led to a systematic consideration throughout the country of the flood risk areas and the protection of those areas from undesirable human occupation.

The implementation of the EU Directive on Floods (2007/60/EC), transposed to the Portuguese law by Decree-Law no. 115/2010, reinforced and substantiated this legal framework to cope with flood risk, although it really did not add much to the pre-existing Portuguese legislation.

Of course, reality is never as nice as the written legislation would lead us to imagine. There are a few flaws in the system. Pre-existing construction rights that are legally protected have made it practically impossible to avoid some controversial urban developments that had been formally approved a few decades ago. Some negotiation with the promoters is still possible, but authorities enter those negotiations in a rather fragile situation. Also the fact that some municipalities can neglect or overlook the areas threatened by floods, coupled with some limitations of the water authorities in terms of supervision and inspection, have led to a few undesirable situations. However, progress has been immense and recent serious flood events (1983, 2008) proved that all these policies had a significant positive impact on the ground. Last but not the least, public awareness has improved and the sense of responsibility of local authorities has increased, which can be seen as a major achievement.

Source: Contribution from Francisco Nunes Correia, Professor at IST, former Minister of Environment, Portugal.

Box 5.6. **Managing flood risk in a changing climate: Examples from OECD countries**

Climate change is expected to increase the frequency and severity of floods in many areas. As a result, incorporating climate change considerations into flood risk management constitutes an important aspect of many countries' adaptation response. The OECD Survey of Policies for Water and Climate Change Adaptation captures the challenges for freshwater in a changing climate and documented the emerging policy responses across all 34 member countries and the European Commission. Drawing on this information base, a number of specific examples to improve flood risk management in a changing climate can be identified. The examples below focus on the use of legal and regulatory approaches (e.g. spatial planning and building codes), but there are also a number of examples of using economic instruments (e.g. insurance schemes and revising compensation mechanisms).

Denmark

- Law providing the municipalities with a legislative foundation for local city planning directly connected to climate change adaptation. The new law (passed by the Danish parliament on 29 May 2012) allows municipalities to ban construction in certain areas solely due to climate change adaptation reasons.

Ontario, Canada

- The Building Code is an important policy tool in responding to the direct and indirect effects of climate change. Work is underway by the Ministry of Municipal Affairs and Housing (MMAH) on the development of the next edition of the Building Code to make new buildings in Ontario resilient to climate change impacts and to enhance their ability to conserve water and energy.

France

- The acceleration of the plan to prevent flood aims to limit the impact of floods by restricting the construction of buildings in risk-prone areas and by protecting construction areas from flooding, as well as stipulating measures to reinforce existing buildings.[1]
- National Flash Flood Plan (*Plan submersion rapide*, PSR, released in July 2012): proposes actions to ensure the safety of people facing several types of flood hazards. The plan comprises national actions (regulations, information-based instruments) shared across levels of government, as well as local projects.
- Integration of the impacts of climate change on natural risks into the urban planning process: in the implementation of the Flood Directive, climate change adaptation will be included as a strategic component in local strategies.

Germany

- Revision of the Federal Regional Planning Act: in 2008, adaptation to climate change was introduced into this legislation as one of the principles of spatial planning. This put in place a framework that will allow the spatial plans of the *Länder* and regions to be gradually supplemented with the aspect of provision for the spatial requirements of climate adaptation during their redrafting process. In every revision of spatial plans, sectoral environmental plans will be incorporated.

Box 5.6. **Managing flood risk in a changing climate: Examples from OECD countries** (*cont.*)

- Revision of physical planning law: in June 2011, the decision was taken to emphasise climate-friendly urban development (climate protection and adaptation to climate change) as a guiding principle for the planning process.

Sweden

- Amendment of the Planning and Building Act (2008): requires that buildings may only be erected at suitable places and account has to be taken of the risk of accidents, flooding and erosion in municipal comprehensive plans and detailed development plans.
- Climate change is considered in the new edition of the Swedish guidelines for flood design standards for dams.

Note: 1. www.developpement-durable.gouv.fr/L-acceleration-des-Plans-de.html (in French).

Source: OECD (2013), *Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters*, Country Profiles, www.oecd.org/env/resources/waterandclimatechange.htm.

The case also illustrates how the Water Assessment can serve as an instrument to make transparent the impacts on water management of spatial development and to help to discourage urban development in unfavourable locations. However, the Water Assessment can best be understood as a communicative process in which water managers advise on the consequences of land-use developments for the water systems, and vice versa and it is only advice, limiting its impact. Moreover, the 2006 evaluation of the Water Assessment (Werkgroep Evaluatie Watertoets, 2006) concludes that this process instrument is less effective on exactly the issue of finding new locations.[7] As such, it has limited or no impact on strategic spatial development decisions.

This illustration also highlights the importance of considering the path dependency and long-time horizons in decisions about spatial development. Once the land is developed, the majority of benefits will be reaped in the short term, while the costs are incurred in both the short term as well as generating long-term liabilities. This is a critical point for the discussion of financial sustainability, today and in the future, which needs to consider not only the ability to secure finance, but how decisions affect long-term liabilities. It is also an example of how a "poldering approach" to decision making can achieve consensus over time, but may result in escalating costs for water management – today and in the future.

Improving incentives to manage flood risk at the least cost: Ways forward

1. To date, the primary thrust of the risk management approach for flooding has been to reduce the risk through structural protection. Greater emphasis on **avoiding the risk** via spatial planning measures would help to avoid building future financial liabilities. Also, additional measures could be used to ensure that **building standards** in flood risk areas require properties to be "flood resilient", either to reduce the risk of water entering the property or to reduce the cost of damages in a flood event.
2. The current system of financing flood risk management in the Netherlands **does not provide incentives to change the trend of increasing exposure** to flood risk. In general, short-term profits from spatial development tend to prevail over

long-term water management objectives. This can result in both increased cost of water and flood management, but also increased expected damages in the case of a flood event. There is a need to **align incentives**, so that those who **benefit from spatial development also pay the associated costs**. A closer link between residing in flood-prone areas and payments for flood risk management costs could help to overcome this problem. The current agreements regarding the **financing mitigation measures for new developments** set out in the National Administrative Agreement on Water and the instruments provided for in the Land Development Act should be **evaluated** to see how they work in practice and if they are effective.

3. As an instrument to assess the impact on water management of spatial development, the **Water Assessment** could be **strengthened** and made more **effective in influencing spatial development decisions**. For example, the water effects of spatial plans could be given more weight (e.g. by strengthening its status beyond being just a mandatory "advice"), the assessment should occur earlier in the planning process to better influence strategic siting decisions (not only mitigation of negative impacts), and it could be applied more consistently. In addition, the financial implications of additional water management activities required by spatial development decisions should be made more transparent. However, the water test has limitations in terms of its potential to influence spatial planning at a strategic level. **Impacts on water management should also be considered at the strategic level**, at the appropriate stage where they can influence location decisions.
4. The relationship between water policy and spatial planning needs to be clearly articulated in terms of its impact on the financial sustainability of the Dutch system. **Transparency regarding the costs for water management of spatial development** is needed.

Managing risks of too little water

An emerging risk of shortage requiring increasing flexibility

Currently, a priority regime is used to limit abstractions during periods of water shortage. As shown in Table 5.2, flood safety and the prevention of irreversible damage to the environment has top priority. The second priority is given to drinking water and power supply needs. The third priority is given to capital-intensive crops and process water. The last category is broad and includes general irrigation, maintenance of water levels for navigation and recreation and, also, the provision of non-essential water to nature. In areas where salinity poses a problem for the availability of freshwater, some technical prevention measures are used (e.g. management of water levels, storage of rainwater *"regenwaterlens*", flushing). Also, drinking water inlets in certain locations (e.g. Gouda and Bernisse) are closed when specific chloride standards are exceeded. During periods of drought, such as happened in the summers of 2011 and 2012, the abstraction of water for "Category 4" purposes was banned. Box 5.7 provides a brief summary of the current administrative arrangements for addressing water shortage.

Adverse climate change, including potential decreases in the mean annual rainfall, has also been identified as a long-term risk that could comprise the integrity of the Dutch water management system. Given the nature of this risk, it would be wise to ensure that any new regime is designed to adjust water allocation arrangements as the climate changes and minimises path dependency that can increase the cost of course correction

Box 5.7. **Current administrative arrangements for addressing water shortage**

An examination of the Water Act suggests that the development of administrative arrangements for the management of water shortage is still in its infancy. At present, the Water Act only contains two references to water shortage. However, this does not imply that the responsible regional water authorities (mainly the regional water authorities) have adequate means to manage shortages. In addition to the Water Act, there is also a specific law addressing regional water authorities.

The current references to water shortages in the Water Act are as follows:

Section 2.1

1. The purpose of this Act shall be to:

   – prevent and, where necessary, limit flooding, swamping and water shortage; while simultaneously

   – protecting and improving the chemical and ecological status of water systems; and

   – allowing water systems to fulfil societal functions.

Section 2.9

2. The priority of social and ecological needs that shall determine the distribution of available surface water in the event or threat of a water shortage shall be laid down by administrative order.
3. Further rules shall be laid down by or pursuant to that order or, in cases designated in such order, by provincial order, regarding the priority referred to in subsection 1. These rules may also provide for application *mutatis mutandis* of that priority to the available surface water.

The primary responsibility for the development and enforcement of shortage management arrangements rests with the regional water authorities and to a certain extent also with provincial authorities. Formally, provincial authorities were responsible for groundwater; surface water has always been the responsibility of regional water authorities. Since 2009, all groundwater administrative arrangements have been transferred to the regional water authorities, except for industrial extractions, public drinking water supply, etc. (referred to in Section 6.4).

Regional water authorities and provincial authorities are also responsible for the management of the permitting regime and are thus able to limit water use. It may be possible, however, to do this under Section 6.13 "by virtue of water board by-laws" and under section 6.14.

Under section 6.14

1. Extraction of groundwater or recharge of water without a permit from the Provincial Executive shall be prohibited:

   – for industrial purposes, if the quantity of water to be extracted exceeds 150 000 m^3 per year

   – for the public drinking water supply or geothermal energy storage.
2. By provincial order, subsection 1 may be declared not applicable to extractions where the amount to be extracted does not exceed 10 m^3 per hour.

In time, Section 6.4 is supposed to be cancelled, so that the regional water authorities will be responsible for all extractions.

Source: Ministry of Transport, Public Works and Water Management (2010), *Water Act*, Ministry of Transport, Public Works and Water Management, The Hague.

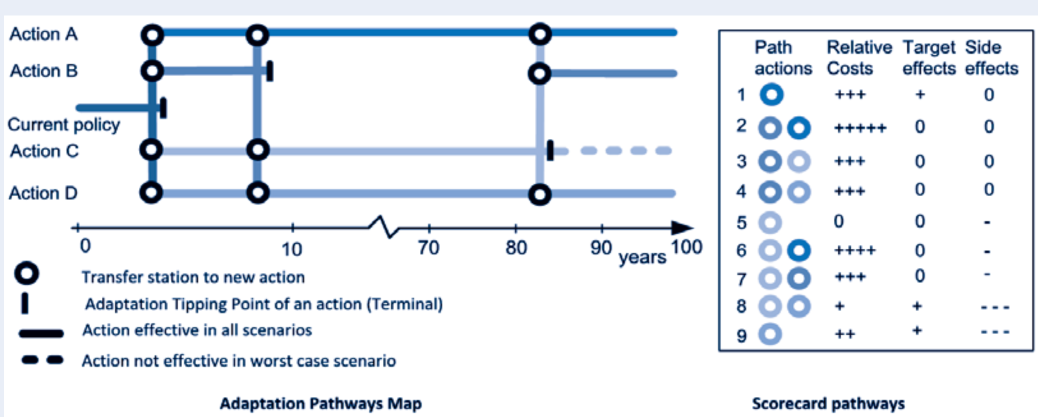
(see Box 5.8 describing a flexible approach to planning under uncertainty). In particular, any regime used should not assume that the average amount of water available for use will remain the same. In regions where climate change is expected to adversely affect development opportunities, early consideration of the merits of introducing a water-sharing regime is worthy of consideration. If implemented now, the likelihood of business making inefficient investments is reduced.

Box 5.8. **Adaptive policy pathways: A flexible approach to planning under uncertainty**

Pervasive uncertainty related to climate change (as well as socio-economic trends more broadly), poses challenges for long-term water management planning, especially when considering significant policy changes or investments in water infrastructure, which are typically capital intensive and long-lived, often with high sensitivity to climate (OECD, 2013b). Flexible, dynamic approaches to planning and investment can improve the timeliness, efficiency and effectiveness of policy decisions and investments under uncertainty, especially as historical references become an increasingly unreliable guide to future conditions (OECD, 2013b).

Haasnoot et al. (2013) set out such an approach – the Dynamic Adaptive Policy Pathways approach (DAPP) – which can support the development of adaptive policies and plans based on an analysis of possible alternatives over time, under a range of possible future scenarios. The approach considers the performance of each alternative over time and under various future scenarios and identifies opportunities to switch between alternatives ("transfer station"). It also identifies the point in time when the magnitude of change is such that the current management strategy no longer performs "acceptably" as it no longer meets the specified objectives (Kwadijk et al., 2010). This is called the "adaptation tipping point" (ATP) (Kwadijk et al., 2010). There are a number of possible causes of an ATP. For example, when the investment needed to sustain an action exceeds the economic benefits, or when a shift in the physical boundary conditions occurs (e.g. shift in aquatic habitats in the case of sea level rise) (Haasnoot et al., 2013).

The figure below provides an illustration of an adaptation pathways map and a scorecard providing an indicative view of the relative costs and benefits of the various pathways. This type of map can support decision makers in identifying opportunities, no-regret actions, possible lock-in, as well as the timing of actions under changing conditions (Haasnoot et al., 2013). This approach has been applied to explore policy and technical options for several cases of water management (e.g. freshwater supply, flood control) in the Netherlands (Haasnoot et al., 2013; Kwadijk et al., 2010).



Source: Haasnoot, M., et al. (2013), "Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world", *Global Environmental Change*, Vol. 23, No. 2, pp. 485-498.

Box 5.8. **Adaptive policy pathways: A flexible approach to planning under uncertainty** (*cont.*)

The approach is particularly valuable in highlighting the path dependency of various alternatives, as well as those actions that provide additional flexibility by providing numerous opportunities to shift among alternative actions. From an economic perspective, adaptation pathways that have a number of such opportunities to change course could provide an additional "option" value, by increasing flexibility and minimising path dependency.

Sources: Haasnoot, M., et al. (2013), "Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world", *Global Environmental Change*, Vol. 23, No. 2, pp. 485-498; Kwadijk, J.C.J., et al. (2010), "Using adaptation tipping points to prepare for climate change and sea level rise: A case study in the Netherlands", *WIREs Climate Change*, John Wiley & Sons, Ltd., http://dx.doi.org/10.1002/wcc.64; OECD (2013), *Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters,* OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264200449-en.

Policy options to manage increasing risk of shortage

There are a number of policy options available to address the increasing risk of shortage, including:

1. technical and structure measures, including increasing storage and pumping of water from another part of the country
2. renegotiation of international water-sharing agreements so that more water flows into the Netherlands during dry periods
3. continuation with Priority Regime Banning
4. adjusting the current water allocation regime to introduce a permitting arrangement and water sharing that provides incentives to encourage water saving
5. the use of scarcity pricing.

Technical and structural measures are being considered in the context of the Delta Programme (e.g. augmenting the use of Lake IJssel as a strategic freshwater supply; technical measures to reduce saline intrusion in low-lying areas). Certain structural measures to address water shortage may be cost effective in the short run, but they may, in fact, increase vulnerability to shortage over the long term. In the case of the renegotiation of international agreements, this would likely be politically difficult to achieve and have a marginal impact on augmenting freshwater supply.

Priority regime banning is a pragmatic approach and works as a short-term strategy in cases where shortage incidents occur infrequently. One of its merits is the relatively low cost of implementation. Little investment in the development of sophisticated administrative arrangements is needed. To the extent that the priority ranking generally reflects the ranking of marginal value of water across various users, it can provide a reasonable "second best" solution to an economically optimal one. However, priority regime rankings are often influenced by a number of political economy considerations, so they often do not necessarily reflect the relative ranking of marginal value of water.

However, the blunt nature of priority ranking regimes means that there are few incentives for water users to proactively manage the risk of shortage. Further, the risk of shortage is largely borne by "low priority" users, insulating higher priority users from risk and hence undermining incentives for these users to improve the efficiency of use. There may be good reasons to insulate certain users from the risk of shortage (e.g. due to the high costs of foregone water use) and there are other ways besides increasing exposure to risk to improve the incentives for efficient use (e.g. pricing and charging structures). However, overall, in this type of regime, risk sharing is unbalanced, water for nature is often used as an adjustment factor, and economic efficiency objectives are compromised.

When shortage occurs in such a priority regime, the introduction of a ban is often sudden and final. Users within a given priority category are treated uniformly, even if there are significant differences in their water needs, the value they assign to water, or their risk preferences (e.g. willingness to pay to avoid the risk of shortage). They have few or no options to respond when shortage occurs. For example, irrigators have no opportunity to decide how much water to use and when to use it. There is no opportunity to change watering regimes or to encourage users in higher priority categories to become more efficient water users. This can result in extreme measures for those irrigators wishing or needing to continue to apply water to their crops, for instance, by resorting to trucking in water from other locations, a costly way to manage shortage.

Priority regime bans can be satisfactory when droughts occur only rarely. However there is an expectation that Dutch water shortages will become more frequent in the future, so the limitations of the current approach are likely to become more evident. While priority regime banning may seem adequate as a short-term emergency measure, if regions need to limit and/or periodically ration water abstraction on a regular or even permanent basis, then development of a more sophisticated control regime is vital. A more sophisticated control regime is worthy of serious consideration, especially as it can complement the other options.

In countries where water shortages are a more common event, abstraction licenses and permitting arrangements are used to limit the total amount of water that can be abstracted from a water resource pool. Establishment of a water licensing or permitting regime that covers most agricultural forms of water use is the first step in transitioning to a regime designed to limit access. The second step is to introduce a means to reassign opportunities to use water. In theory, opportunities to reassign permits can be achieved by issuing permits only for a short period of time. In practice, this approach is fraught with political difficulty and few countries have been able to use it as a means to reallocate opportunities to use water. In recognition of the political difficulties associated with this approach, Australia, Chile, the People’s Republic of China and the United States have gone one step further and introduced arrangements that allow users to trade entitlements and allocations with one another.

Sometimes called “temporary” trading, allocation trading allows users to adjust quickly to changing weather and market conditions. When allocation trading is introduced, users soon become skilled in optimising water use on a daily basis. Considerable innovation follows and, as a result, the impact of water shortages on productivity is reduced. In well-designed regimes, local allocation trades can be completed within one or two days and, if conducted in a manner consistent with pre-agreed rules, are not subject to appeal. Entitlement trading, often called “permanent” trading, allows efficient planning for long-term changes in demand and supply conditions. In practice, most trading schemes (but not all) support trading among irrigators.

Finally, scarcity pricing is another economic instrument to manage water shortage. Basically, scarcity prices work by triggering higher prices during periods of drought-induced excess demand. Higher prices make investments in water supply infrastructure more economically attractive, thus providing an incentive for the augmentation of water supply and evening out supply and demand for water. However, despite these theoretical arguments, putting scarcity pricing into practice has faced resistance even in chronically water scarce situations (OECD, 2013b). In practice, however, this approach is rarely acceptable as it imposes much higher costs on users at the very time that incomes are falling and new investments are required.

England is currently examining options for a more flexible and dynamic allocation, as explained in Box 5.9.

Box 5.9. **Water resources allocation in England**

Current approach

In 1963, a piece of water legislation (the Water Resources Act 1963) was passed which was, for its time, innovative and far-reaching. It required a comprehensive and systematic approach to hydrometric monitoring, resource assessment and management, abstraction licensing and water resource planning. This statute, although amended several times over the intervening 50 years, is still the basis for water allocation in England.

It required all water abstraction (with some minor exemptions) to have a licence. The licence had to specify the volumes of water abstracted, the location of the abstraction and the purpose, together with any conditions to protect the rights of existing abstractors and the needs of the environment. Although the act required every licence to be assessed according to its reasonable need and its impact on the aquatic environment, over time the former has changed and the latter is now much better understood. In addition, changing patterns of demand have left many licences under-utilised, with no straight-forward mechanism for trading resources.

It is the role of the Environment Agency to manage and regulate the allocation of water resources in all catchments in England.

State of water resources and the environment

Despite its reputation as a wet country, the east and southeast of England have very low resource availability, with as little as 300 mm per annum of effective rainfall. Many rivers are of high ecological sensitivity and of international importance for their conservation value. Perversely, population density is highest in these areas of lowest rainfall and so demand is greatest where resources are the scarcest. This has led to many rivers, particularly chalk (limestone baseflow-fed) streams of iconic environmental and fisheries value, being damaged or threatened by unsustainable abstraction. The Environment Agency has a major programme to address these damaging abstractions. However, because abstraction licences are deemed to be a property right, compensation may be payable when licences are forcibly changed or revoked. This means that the process of achieving a sustainable flow regime, or reacting to changing patterns of resource availability or demand, can be slow and expensive.

Future pressures and approach

The Environment Agency has modelled a range of climate change scenarios to understand their potential impact on river flows and water availability out to the 2050s. It has also matched these with scenario planning using different socio-economic models in order to understand how demand for different purposes (public water supply, energy and agriculture) might change over a similar time horizon. This work has demonstrated that under some scenarios, water availability could decrease significantly and that demand – driven in particular by projected population growth – might also increase in a way which would mean widespread impacts on rivers and ecosystems together with risks to security of supplies.

Box 5.9. **Water resources allocation in England** (*cont.*)

Although there is a structured approach to public water supply planning which takes account of changes in demand and the impacts of climate change over a 25-year horizon, the Environment Agency and UK government were concerned about the long-term risks to the environment and water supplies. The Environment Agency developed a "Case for Change" which supported a government White Paper ("Water for Life") in 2011. This set out a range of proposals for the reform of the public water supply industry and the abstraction licensing system.

It was recognised that the current system is too inflexible to be able to cope adequately with changes in demand and resource availability, and potentially could act as a drag on economic growth. The government launched a consultation in December 2013 on proposals for a more flexible and dynamic system which would be able to react to future uncertainties and allow access to resources in a reformed regulatory system. At its heart, any new system would ensure that there was sufficient water for the environment, adequately protected at all flow states, and that above this threshold, water would be available for allocation. As long as all abstraction licences have a sustainable basis, there is then the potential for greater trading and economic benefit from more efficient use.

In parallel, water companies are responding to the need to improve the connectivity of their supply systems in order to increase their resilience, and also to seek opportunities for sharing water across company boundaries. There is also work in hand by the Environment Agency, which is taking a more strategic approach to the long-term water demands of the agriculture sector and energy generation so as to drive a more integrated approach to resource management across the water-food-energy nexus.

Sustainable water management demands an inter-generational approach. The use of scenario planning, and the development of a compelling case for change, will ensure that legislative and regulatory changes are made in good time to allow a transition to a more flexible and dynamic regime.

Source: Input from Ian Barker, Head of Water, Land and Biodiversity, UK Environment Agency.

Benefits of increased flexibility in water allocation

The main advantage of the water-sharing approach discussed here is that it would prepare the Netherlands for a suite of emerging problems and does so in a manner that can be expected to bring significant economic and environmental benefits. There is a significant future risk to the Dutch economy if water is not well managed during drought periods and the impacts of salinity are not addressed in a timely manner. Agriculture is only one area that would benefit from an environment where water has a value and there is flexibility to allow users to respond according to their needs. In a sharing regime, water users would find the threat of periodic bans and uncertainty replaced with a clear incentive-based structure. Decisions would be based on consideration of the full suite of opportunities available to all users.

One of the most significant benefits would be a transition to an allocation regime that would ensure that increased water shortages can be managed in a timely manner and without compromise to the environment. One of the most important features of this approach is that the attention of all water users is drawn to the need to plan for and deal with water scarcity. This would encourage the development and adoption of water-saving technology. A mechanism for management of long-term risk and also to ensure the efficient use of water at any point in time is introduced.

Once implemented, all users, including utilities, would have to plan for water shortage and not simply assume that the risk would be borne by Category 4 users. Under a sharing regime, if a Category 2 user, for example, wanted access to more water, they would need to either purchase shares from another shareholder, access water from a different source and/or become a more efficient water user. In all but extreme situations, the downside supply risk would be assigned to them and they would need to find a robust way to manage it. Much more efficient investment would be the result. The management of risk by all water users would be encouraged and, as a result, less administrative burden would be placed on government. Over-investment and mis-investment in water infrastructure would be discouraged.

Category 3 and 4 users can be expected to benefit the most from the introduction of a share-based allocation regime. At the moment, when shortages emerge, they have little option but to accept the losses that water use bans impose on them. Under a water-sharing regime, they are given the option to manage the associated investment risk themselves. In times of extreme shortage, each and every water user would be faced with the choice of selling valuable allocations or using it to produce even more valuable crops. In such a financial environment, some irrigators can be expected to use the money gained from selling shares to pay for the cost of installing more efficient irrigation systems.

In Australia, one of the early benefits of the introduction of water-trading regimes was the voluntary movement of irrigation away from highly saline areas. Irrigation using saline water is barely profitable. Irrigation in non-saline areas can be very profitable. With the opportunity to move away from a problem and profit from doing so, it did not take long for the industry to restructure. Similar responses could be expected in the Netherlands.

Possible application to the Netherlands

While simple in its structure, adoption of water-sharing arrangements in the Netherlands would require some significant administrative changes. The timeliness of the current Delta Programme means that there is an opportunity to introduce water-sharing regimes gradually. Currently, water shortage and salinity problems are emerging problems and are acute in only a few areas. This means that it is possible to work with key stakeholders and gain experience in the development of water-sharing regimes in a few trial areas. Trading in entitlements and in allocations would be allowed and encouraged. Once experience is gained and the capacity to manage the transition from the current regime to a more flexible one is improved, the approach could then be rolled out across all regions in the Netherlands where water use needs to be limited, as appropriate.

One of the great advantages of water management arrangements in the Netherlands is that many of the country’s water resources are well connected. Amongst other things, this means that it should be possible to develop trading arrangements that operate over long distances and which can be executed in days rather than months or years. The elements of an effective water-sharing regime and how they could be applied in the Netherlands are further explored in Annex 5.A2.

Improving incentives and flexibility in allocation: Ways forward to manage risk of shortage

1. Currently, there is an **absence of incentives** for water users to improve their efficiency of use or to consider freshwater supply in their location decisions. There is a need to establish **clear boundaries** in the roles of public authorities and

private actors in **managing risk of shortage**. An important building block would be to establish "target levels of supply". This is clearly linked to the need for informed public debate about the acceptable level of risk of shortage and affordable levels of service. Economic instruments, such as **abstraction charges**, can provide incentives for more efficient use, as well as provide financing for measures related to freshwater supply.

2. While there is an existing abstraction licensing system for large abstractions, it is not clear that this is monitored or that there are sanctions for non-compliance. Putting in place a **robust allocation regime** that allows for consistently controlling and monitoring abstractions would be a basic step towards managing the risk of shortage more effectively.

3. Currently, the system of **water allocation** to control water use during periods of shortage relies on priority regime banning. The **flexibility** and **efficiency** of the current allocation regime could be improved through the progressive establishment of **water-sharing arrangements** in areas vulnerable to shortage. The **potential benefits** of such a system include providing incentives for more efficient water use, lowering the overall cost of managing shortage risk, spurring innovation and providing for more equitable distribution of risk of shortage across water users. The licensing system should be associated with the **"user pays principle"**.

4. **Comprehensive drought planning** would ensure that all major water users are aware of risks, have action plans in place and know how they could work together to conserve resources. Also, in extremes, it would set out the circumstances under which they would have limited or no access to water (either through the mains distribution system or direct abstraction).

5. Short-term solutions to the risk of shortage will become increasingly costly over time, especially if changes in climate occur more quickly or are of a higher magnitude than current climate scenarios suggest. A focus on mainly structural solutions to water shortage may be cost-effective in the short run, but also increase path dependency, and may increase vulnerability to shortage over the long term. It is vital to ensure that a **long-term approach** to managing the risk of shortage is taken that accounts for the possibility of permanent shifts or step changes in the availability of freshwater. Applying an **"adaptive policy pathways"** approach developed by Deltares could be used to map the various options to address freshwater supply, the tipping points where these options begin to perform "unacceptably", and the links between various options to show how transitions could be made between them. Such an approach could help to avoid closing off promising strategies prematurely, monitoring the emerging risk of shortage periodically, and adjusting the response accordingly.

Managing risks of too polluted water

From curative to preventive approaches: Managing the risk of inadequate quality

This section provides an overview of the policy responses currently in place to address the risk of inadequate quality from agricultural practices as well as transboundary aspects of each of the four international rivers.

Transboundary aspects

For all four transboundary river basins in the Netherlands (Rhine, Meuse, Scheldt and Eems), the implementation of the Water Framework Directive contributes to improving the quality of incoming water. The Netherlands Environmental Assessment Agency expects progress will be substantial for the Meuse, when Belgium and Luxembourg improve their implementation of the Water Framework Directive (van Puijenbroek and Willems, personal communication, 14 May 2013). International river committees and deliberative structures to co-ordinate water management (including water quality) are in place and briefly summarised below. Agreements and measures to address water quality issues vary per river basin. Overall, measures to address water quality issues as proposed and/or scheduled within these international configurations are in all four river basins at a rather general level and are not very concrete. This is relatively striking for the Meuse, considering the poor quality of the incoming water.

Rhine

Improvement of water quality in the Rhine river basin is addressed by a policy agreement with management measures from 2009 between the involved countries (nine countries, including the Netherlands, France, Germany, Luxembourg and Switzerland). This agreement (the Internationally Co-ordinated Management Plan for the International River Basin District of the Rhine) proposes several measures to reduce diffuse inputs impacting surface water (and groundwater) of nutrients and pesticides (and metals, noxious substances from historic pollution, and classical pollution of industrial and municipal origin). However, the current implementation status of these proposed measures is not yet clear, nor is how upstream management measures affects or improves downstream water quality.

These proposed measures comprise various options such as: stimulating "good agricultural practice" with information on and the introduction of certification systems; prohibition of fertiliser distribution in autumn or winter or on water-saturated, frozen soil or soil covered with snow; keeping bank areas free of fertiliser or cultivation; prohibition of grassland ploughing during autumn and winter; cultivation of swamp areas and helophyte fields; extensification of livestock breeding; and improvement of the rate of implementation and fertilisation.

Meuse

Management of water quality in the Meuse river basin is addressed by a policy agreement (from 2009) between the five involved countries (Netherlands, Belgium, France, Germany and Luxembourg), which includes a focus on implementation and achievement of the Water Framework Directive. Measures to manage and improve water quality in the Meuse River basin are proposed to reduce nitrogen and phosphorus levels due to agricultural practices, and to reduce heavy metals (like zinc and copper) and PCBs. The quality of the Meuse largely depends on measures taken in Belgium, in particular. Improvement in wastewater collection and treatment started relatively late in Belgium (especially in Wallonia). Because of lagging progress, the tasks of the International Commission for the Protection of the Meuse initially restricted itself to the main river, thus leaving all the tributaries out of discussion. This has now changed with the change to the International Meuse Commission, which deals with the whole river basin and drainage area.

Scheldt

Similar to the Rhine River basin and the Meuse River basin, there also is an international policy agreement for the Scheldt River basin, which includes water quality, the Water Framework Directive and management measures (ISC, 2009). The Netherlands, Belgium and France are involved in the management of the Scheldt River basin. The document states that the Water Framework Directive should be implemented, but the management measures mentioned in this document concerning water quality are not very concrete (ISC, 2009). Since 2008, water quality in the Scheldt River is monitored annually. According to the 2011 monitoring report, nitrogen, phosphorus and pesticides levels were assessed to be low enough in the Dutch part of the Scheldt River in meeting the agreed standards under the Water Framework Directive (ISC, 2011).

Eems

A management programme, set up by government representatives from Germany and the Netherlands, to address water management in the Eems River basin, explicitly mentions upstream excess nutrients and pollutants wash-off from agriculture as an issue of attention. For the Eems River basin, relatively concrete standards for water quality were agreed in 2008 and scheduled to be monitored. Achievement of these standards is proposed via legal regulation and formal policy decrees (UIH, 2008).

The contribution from agriculture

As discussed above, there are a number of factors influencing water quality, among which emissions from agriculture are a significant driver. Despite significant progress on a range of agri-environmental indicators (see Chapter 2), absolute levels of nitrogen and phosphorous surplus per hectare of agriculture are around three times higher than in the EU15 and OECD countries. More than 60% of the total surface area of the country is covered by agricultural land, most of which is managed intensively and intersected by a dense network of ditches (around 300 000 kilometres), streams and lakes (Oenema et al., 2005).

Agriculture is also an important economic driver. Recent figures from Statistics Netherlands (*Centraal Bureau voor de Statistiek*, CBS) indicate that the Netherlands is the world's second largest exporter of agricultural products, following the United States. In 2012, the total value of Dutch agricultural exports was EUR 75.4 billion. The Dutch agri-food industry contributes EUR 52.5 billion of added value to Dutch GDP, accounting for some 20% of the country's total export value (CBS et al., 2012). The sector is also very heterogeneous, from horticulture to crops and livestock. This means that the marginal cost of reducing emissions varies significantly. The opportunity cost of reducing emissions from agriculture can also be high in some cases. This calls for targeted and tailored approaches to reducing emissions from agriculture (which may vary per region and type of production).

There are various policy measures in place aiming to reduce nitrate and phosphorus emissions, and ultimately, to better protect water, soil and air quality. There are also a number of relatively small groups of leaders in the sector active in advancing sustainable production process. Key questions for the future development of the environmental sustainability of the sector include the extent to which these leading practices will be more broadly diffused and whether the pace of progress in reducing negative environmental impacts will be sustained or if it will slow, as the easiest and least costly opportunities are already exploited.

The Netherlands has sought to reduce the load of nitrate and phosphorus emissions since 1987. Currently, there are a great number of legislative acts, directives and instruments that directly or indirectly relate to water quality and agricultural policy, including, but certainly not limited to, the EU Nitrate Directive (91/676/EEC), the EU Water Framework Directive (200/60/EC), the Plant Protection Products Regulation (1107/2009), the new EU Regulation (528/2012)[8] replacing the Biocides Directive (98/8/EC), the Sustainable Use of Pesticides Directive (2009/128/EC), the Machinery (for applying pesticides) Directive (209/127/EC), the Dutch Water Act, the Soil Protection Act, the Environmental Management Act and the Regional Water Authorities Act. This section provides an overview of the most important generic policy measures that directly relate to agricultural policy and water quality to provide an overview of the current situation.

Minerals accounting

In 1998, the system of manure bookkeeping (which was introduced in 1987) was replaced by a system of minerals accounting at farm level. Under this so-called MINAS system (in Dutch, *Mineralen Aangiftesysteem*), limits were set for the permitted levels of the nitrate and phosphorus surpluses on farms. In the period 1998-2005, these so-called MINAS loss standards have gradually been tightened (Fraters et al., 2011; Baumann et al., 2012). MINAS did not regulate inorganic fertiliser and fixation separately, but performed accounting for the overall flow of minerals (including feed, livestock, animal products and so forth). Provided that they kept to the loss standards, farmers could therefore switch between the various components. In this way, the system regulated the nitrate and phosphorus surplus of farms (farm gate balance). Furthermore, a certain nitrate and phosphorus surplus was considered acceptable and free of levy. However, if a farmer had a surplus exceeding the loss standard, a levy had to be paid, with the levies increasing progressively between 1998 and 2003.

The MINAS system was implemented in stages. When it was introduced in 1998, it initially applied to livestock farms with a high animal density. In 2001, MINAS was extended to all farms. In addition, lower loss standards were set for cultivated land on soils vulnerable to nitrogen leaching, i.e. sand and loess soils (Baumann et al., 2012). On 1 January 2002, to effect compliance with the application standards stipulated by the EU Nitrate Directive (91/676/EEC), the Manure Transfer Contracts (in Dutch, *Mest Afzet Overeenkomsten*, in short MAO) system came into force. Livestock farmers who produced too much manure were obliged to enter into manure transfer contracts with, for example, arable farms, less-intensive livestock farms or manure processors. Farmers unable to enter into manure transfer contracts for their excess manure had to reduce their livestock numbers.

This system of tradable rights to manage manure was the first market-based trading mechanism for managing agri-environmental issues (Shortle, 2012). While the MINAS Programme had been considered effective in decreasing nitrate and phosphorus surpluses and in improving the nitrate and phosphorus use efficiency at farm level (Oenema et al., 2005), in 2005, based on a decision by European Court of Justice, the Dutch government decided to abandon MINAS and MAO. In fact, already by the end of 1999, the European Commission brought the Dutch government to the European Court of Justice, as it considered the responses of the Dutch government in the implementation of the EU Nitrate Directive to be insufficient. The judgement of the European Court (2003) found that the establishment of "loss standards" (upon which the MINAS systems was based) appeared incompatible with the directive. The loss standards were applied at a later stage of the nitrogen cycle, while “use standards”, such as those required by the directive, are applied at an earlier stage and appear to be necessary to reduce and prevent pollution (European Court of Justice, 2003).

While *ex post* assessment of the trading system indicates contributions to environmental improvements, potential efficiency gains were limited due to design features that made compliance complex, raising transaction costs (Shortle, 2012). Despite this, experiments suggest that for regions with intensive animal production, market-based approaches are still a promising tool, if well-designed (Shortle, 2012; Fisher-Vanden and Olmstead, 2013).

Box 5.10. **EU Nitrates Directive**

The 1991 Nitrates Directive (91/676/EEC) is one of the earliest pieces of EU legislation aimed at controlling pollution and improving water quality by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices.

The directive obliges member countries to take a number of measures to realise this objective, including the designation of vulnerable areas in their territory (nitrate vulnerable zones). These zones drain into fresh surface waters and/or groundwater that contain more than 50 mg/l of nitrate, or might have this concentration if the measures described in the directive are not taken. This applies to freshwater bodies, estuaries, sea and coastal waters that are now eutrophic or that might become eutrophic in the near future if the measures described in the directive are not implemented. In addition, the directive obliges member countries to prepare action programmes for the designated nitrate vulnerable zones so that the objective of the directive can be realised, as well as to conduct suitable monitoring programmes to determine the extent of nitrate pollution in waters from agricultural sources and to assess the effectiveness of the action programmes.

The Netherlands has not designated any nitrate vulnerable zones. Instead, in conformity with the Nitrates Directive, it informed the European Commission in 1994 that it would prepare an action programme for its entire territory. Accordingly, in the Netherlands, the Nitrates Directive action programme is applied throughout the country. Even so, legislation distinguishes between soil fertility and types (in the Netherlands, the most important main soil-type regions are sandy, loess, clay and peat).

Sources: Fraters, B., M.H. Zwart, L.J.M. Boumans, J.W. Reijs and M. Kott (2011), “Developments in monitoring the effectiveness of the EU Nitrates Directive action programmes: Approach by the Netherlands”, in: Fraters, B., K. Kovar, R. Grant, L. Thorling and J.W. Reijs (2011), *Developments in Monitoring the Effectiveness of the EU Nitrates Directive Action Programmes: Results of the Second MonNO3 Workshop*, 10-11 June, RIVM Report 680717019/2011, National Institute for Public Health and the Environment, Bilthoven, Netherlands, pp. 291-313; Baumann, R.A., et al. (2012), “Agricultural practice and water quality in the Netherlands in the period 1992-2010”, *RIVM Report 680716008/2012*, Research for Man and Environment, National Institute for Public Health and the Environment, Bilthoven, Netherlands.

New manure policy

In January 2006, the Netherlands adopted a manure policy based on application standards instead of mineral loss standards. This new manure policy, including its application limits for nitrogen in manure and fertilisers, is in line with the requirements of the EU Nitrate Directive (91/676/EEC). Indeed, in the Netherlands, the implementation of the Nitrate Directive largely took place within the Fertilisers Act and the related implementing order and implementing arrangement (Willems et al., 2012; Rijksoverheid, 2013).

Box 5.11. **EU Water Framework Directive and the van der Vlies Resolution**

Even if current Dutch manure management is primarily focused on the realisation of the objectives derived from the Nitrate Directive, it is also intended to contribute to the realisation of objectives related to other EU directives, particularly the Water Framework Directive (WFD; Directive 2000/60/EC). The WFD is one of the most influential pieces of European water legislation, and establishes a framework for the protection of inland surface waters (including rivers, lakes, transitional and coastal waters) and ground waters.

In the Netherlands, the agricultural sector is a sensitive topic at the political level. In 2007, this was reconfirmed by the adoption of the so-called van der Vlies Resolution. In this resolution, it is laid down that the Dutch agricultural sector shall not be burdened with an increase in costs when measures have to be taken for the implementation of the WFD, i.e. has made it impossible to force farmers to incur additional costs when implementing the WFD. However, it is important to note that in addition to the country's more generic manure policy, the regional WFD river basin management plans (that should include a programme of measures) may include separate measures that intervene with high nutrient concentrations within surface waters.

*Sourc*es: Jolink, A. (2010), *Legal Implications of Introducing Economic Instruments in the Field of European and Dutch Water Management*, Science Shop of Law, Economics and Governance, Utrecht, Netherlands; Willems, J., et al. (2012), *Evaluatie Meststoffenwet 2012: syntheserapport*, Planbureau voor de Leefomgeving, The Hague.

The 2006 Fertilisers Act, including its application limits for nitrogen in manure and fertilisers as required by the EU Nitrate Directive, sets tighter limits on the use of nitrogen and phosphorus compared with the previous MINAS, and applies to all manure from animals kept for professional purposes or for profit. The application standards for total-nitrogen and total-phosphorus apply to both livestock manure and other types of organic and inorganic fertilisers. Furthermore, the new manure policy has a wider scope of application and encompasses new regulations governing the application methods for manure and inorganic fertiliser, mainly concerning: *i)* the time of year when the application of manure is permitted; *ii)* the ploughing up of grassland; and *iii)* the obligation to grow a catch crop after the cultivation of maize, to prevent nitrogen leaching (Fraters et al., 2011; Baumann et al., 2012). The 2006 Fertilisers Act introduced three different manure application standards, providing for different limits on the use of nitrogen from livestock manure, on the use of total nitrogen and on the use of total phosphorus.

Livestock manure

The application standard for nitrogen from livestock manure is 170 kg N per ha. In December 2005, the European Commission granted the Netherlands a derogation. During the period 2006-09, under certain conditions, farms with 70% or more grassland could apply 250 kg N per hectare to their land as manure when it originates from grazing livestock (cattle, sheep and goats). Around 25 000 farms (31% of the total number of farms) benefited from this derogation. Together, they cultivate about 900 000 ha, about 50% of the total cultivated area in the Netherlands (Baumann et al., 2012; Fraters et al., 2011). In 2009, the Netherlands submitted a request for extension of the derogation to the

European Commission referring to the Netherlands Action Programme (Box 5.13) related to the Nitrate Directive (2010-2013). Based on a re-evaluation of the situation in the Netherlands, the policy measures in place, as well as the application of the previous decision, the European Commission granted an extended derogation until 31 December 2013 (Rijksoverheid, 2013).

Box 5.12. **US market-based incentives in water quality controls**

Across the United States, regulatory agencies increasingly look to market-based incentives, rather than direct regulation, as a more politically viable and less costly means to bring about the sweeping private sector changes needed to meet environmental objectives and, at the same time, address green economy and growth strategies. A couple of the mechanisms that have been considered are water quality (or nutrient) trading and green infrastructure (or stormwater crediting), with the aim of controlling water pollutants at an overall lower cost to society.

Water quality or nutrient trading can, in an appropriate setting, create revenue opportunities and reduce costs. The opportunity for nutrient trading arises because of the large differences in the cost to reduce a pound of nitrogen among various sectors and practices. Trading that involves non-point sources can have ancillary benefits, such as controlling multiple pollutants and improving the health of aquatic ecosystems, and has the potential to spur innovation that can further reduce the cost of pollutant controls. Additionally, pollution sources not traditionally regulated, most notably non-point pollutants from agriculture, are the primary source of water quality impairment in many watersheds. The United States' Federal Clean Water Act requires that states establish total maximum daily loads (TMDLs) for all water bodies that do not meet minimum State Water Quality Standards. Once the state establishes a TMDL, federal law requires that the TMDL be reviewed and approved by the federal Environmental Protection Agency (EPA). A TMDL sets limits on nutrient loads to a watershed and its tributaries for the agricultural, wastewater, municipal stormwater and other sectors.

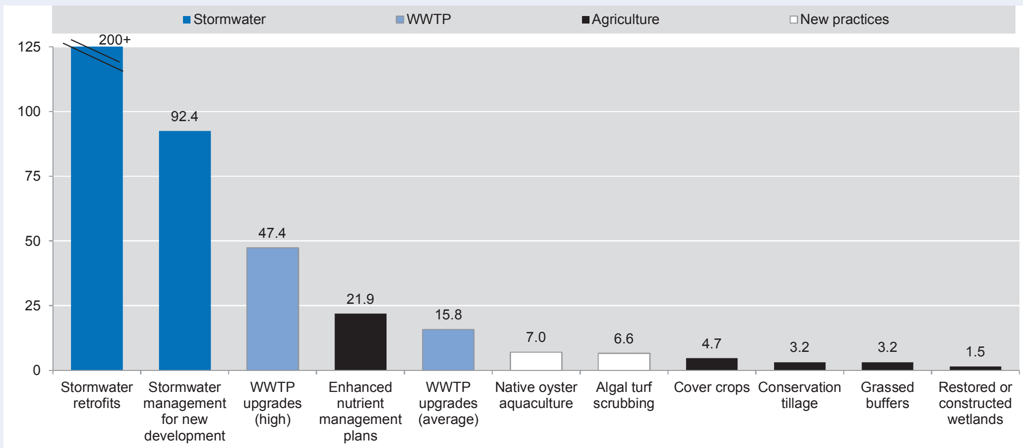
Water quality trading provides a framework wherein pollutants can be voluntarily reduced by non-point sources more cost effectively than imposing additional treatment controls on point sources. This approach allows those that can reduce nutrients at a low cost to sell credits to those facing higher cost nutrient reduction options (see the figure below). Nutrient trading, therefore, could allow sources of pollution such as wastewater treatment plants (WWTPs) and municipal stormwater programmes to meet their pollution targets in a cost-effective manner and could create new revenue opportunities for farmers, entrepreneurs and others who implement low-cost pollution reduction practices.

Studies done on the nation's largest estuary, the Chesapeake Bay, show that nitrogen credit trading could generate USD 45-300 million per year in revenue, an amount comparable to current agriculture conservation cost-share programmes in the Chesapeake Bay. Farmers could earn additional revenue if they sell nutrient credits generated by implementing practices that reduce fertilizer or manure runoff. In addition, nutrient trading could yield nearly 60% cost savings for those WWTPs facing expensive upgrades because of nutrient issues. Trading could benefit water utility ratepayers by savings in their utility bills when public-owned WWTPs meet nutrient reduction obligations at lower cost through nutrient trading.

In terms of green infrastructure mechanisms, public works officials are increasingly looking for new ways to leverage private investment through incentives and crediting programmes, particularly as they face budget shortfalls. Although stormwater credit programmes have been around for two decades, in Philadelphia, PA, the city's Water Department (PWD) is exploring a new stormwater incentive system that is testing the opportunities and limits of incentive-based approaches to stormwater compliance, such as the introduction of green infrastructure. Philadelphia's new parcel-based billing and stormwater crediting programme provides a potentially potent new set of incentives for property owners to invest in technologies that treat and filter stormwater.

Box 5.12. **US market-based incentives in water quality controls** (*cont.*)

Nitrogen reduction costs differ among sectors and practices, creating economic opportunities for credit trading



Source: Jones, C., et al. (2010), "How nutrient trading could help restore the Chesapeake Bay", *WRI Working Paper*, World Resources Institute, Washington, DC, www.wri.org/stories/2009/12/how-nutrient-trading-can-helprestore-chesapeake-bay (accessed 25 January 2014).

The PWD recently released a plan, "Green Cities, Clean Waters", that outlines an investment of USD 2 billion to reduce combined sewer overflows (CSOs) over the next 25 years, and is paying property owners, in the form of a water bill credit, for helping soak up the billion gallons of unmanaged runoff that lies at the heart of the city's water quality problems. For each acre of runoff managed privately for stormwater credit through a range of practices, including bio-retention systems, green roofs, sub-surface detention systems and extended detention basins, the city may save up to USD 250 000 in avoided infrastructure costs. Although each practice earns equal credit per unit of stormwater managed, practice costs vary widely, from less than USD 1/ft² of impervious area treated to USD 20-30/ft² of impervious area modified to enhance filtration.

In looking ahead to improve uncertainties and reduce risks to the PWD's stormwater credit programme, the PWD may consider putting in place a credit-trading framework within which property owners could buy and sell stormwater credits on an open market. Property owners unable to implement retrofits on their own properties because of high construction costs could purchase credits from property owners in other locations that have more favourable property conditions and choose to over-manage stormwater on their site to generate salable credit. Under this model, the PWD would create a project registry of pre-approved, low-cost retrofit projects on the city's public properties (e.g. schools, parks) and would implement these projects through a privately funded trust. The concept would allow private owners to earn credit either by directly mitigating their own impacts or by off-setting their impacts. This model may also be a more palatable option for regulators who are looking to the PWD to ensure the long-term viability of green stormwater management systems used to mitigate CSO impacts.

Source: Contribution from Sasha Koo-Oshima, Senior Water Policy Advisor, United States Environmental Protection Agency.

The use of total nitrogen

The application standards for the total amount of available nitrogen per hectare vary for different combinations of crops and soils (sand, clay, peat, loess). These standards are primarily based on agricultural fertilisation standards, but are adjusted downwards when this is necessary to achieve the goal of 50 mg nitrate in the root zone. These adjustments are based on the maximal nitrate surplus on the soil surface balance that is allowable to achieve this goal. The nitrogen application standards were gradually tightened during the period 2006-09 and afterwards. The proposed nitrogen application standards in 2010/11 vary between 30 kg nitrate for peas on all soil types and 350 kg for grassland on clay soils (Fraters et al., 2011).

Box 5.13. **The Netherlands Fourth Action Programme**

In accordance with the EU Nitrates Directive (91/676/EEC), each member country is obliged to put in place a Nitrate Action Programme concerning the protection of waters against pollution by nitrates from agricultural sources every four years. To provide an illustration, some of the additional measures listed in the Fourth (2010-13) Netherlands Action Programme are briefly explained below. These measures primarily relate to a closed period and the storage capacity for manure:

- The closed period for fertiliser application is from 16 September to 31 January. In this period, with a few exceptions, it is not allowed to add any fertilizer to the soil.
- For slurry manure application, the closed period starts on 1 August for grassland on both sandy and loess soils. For grassland on peat and clay soils, the closed period for slurry manure starts on 1 September. For arable land (all soil types), slurry manure application is not allowed from 1 August onwards.
- From 2006 onwards, the storage capacity of manure has to be equal to six months of manure production (minus net manure removal). From 2012 onwards, this has increased to seven months.

At present, the Nitrate Action Programme is being discussed with the European Commission. From 2014, a new (Fifth) Netherlands Action Programme (2014-17) will be in place. In addition, hydrological restoration of N2000 areas will be among the measures implemented in 2014 within the framework of the Programmatic Approach to Nitrogen (under development).

Source: Ministry of Economic Affairs (Ministerie van Economische Zaken) (2013), Brief naar de voorzitter van de Tweede Kamer over de inzet vijfde actieprogramma Nitraatrichtlijn van Sharon A.M. Dijksma, State Secretary of Economic Affairs (8 May 2013), available at: www.rijksoverheid.nl/bestanden/documenten-en-publicaties/kamerstukken/2013/05/08/kamerbrief-over-inzet-5e-actieprogramma-nitraatrichtlijn/kamerbrief-over-inzet-5e-actieprogramma-nitraatrichtlijn.pdf (accessed 20 June 2013).

The use of total phosphorus

In 2006, standards of 110 kg phosphate per ha on grassland, and 95 kg phosphate per ha on arable land were introduced. These standards were gradually decreased to 100 kg and 85 kg phosphate per ha respectively in 2009. From 2010 onwards, the phosphate application standards are also be related to the soil phosphorus fertility level, whereby a distinction is made between a low, neutral and a high level. The proposed phosphate application standards in 2015 on grassland land vary between 80 kg per ha (high soil fertility status) to 100 kg per ha (low soil fertility status) (Rijksoverheid

2009; Fraters et al., 2011; Willems et al., 2012). On arable land, the proposed phosphate application standards in 2015 vary between 50 kg phosphate (high soil fertility status) per ha and 75 kg phosphate per ha (low soil fertility status) on arable land (Rijksoverheid, 2009).

The implementation of the manure policy was evaluated in 2012. Sector and regional differences were observed: cattle farming contributed about twice as much as pig farming (and about three times as much as chicken farming) to phosphorus surpluses. In addition, in central, eastern and southern Netherlands (i.e. areas with the intensive livestock farming), nitrogen and phosphorus surpluses are about two to four times higher than in the west and north of the Netherlands (Willems et al., 2012).

Plant Protection Products and Biocides Act

Pesticides may constitute danger to humans, animals and the environment. Nevertheless, in many locations within the Netherlands, the concentrations of pesticides in surface water are too high. In fact, the use of pesticides is one of the country's most important problems for the quality of water. Research shows that the environmental impact of pesticides on surface water in the Netherlands is primarily caused by the agricultural sector; the contribution of households and industry is less than 5%. The exception to this is the use of weed killers on hard surfaces, as this use can result in a considerable emission to surface water.

EU regulations provide the legal basis for all national authorisations of pesticides and biocides.[9] To protect humans and the environment, before being used, traded or stocked, the Board for the Authorisation of Plant Protection Products and Biocides (in Dutch, *College voor de Toelating van Gewasbeschermingsmiddelen en Biociden*, CTGB) is responsible for the authorisation of all pesticides. Pesticides not only include the crop protection products but also biocides, including products for disinfestation (such as cooling water and flush water for drilling), wood preservation and antifouling (to protect ships).

Products may not be placed on the Dutch market before the CTGB has decided that the possible risks of pesticides are acceptable, hereby paying attention to various interests, including agriculture, health, occupational exposure and the environment. Accordingly, the Board for the Authorisation of Plant Protection Products and Biocides takes decisions based on the policy of four ministries: the Ministry of Economic Affairs; the Ministry of Infrastructure and the Environment; the Ministry of Health, Welfare and Sports; and the Ministry of Social Affairs and Employment. Within the authorisation procedure, among other things, attention is paid to the possible adverse effect on freshwater organisms. The standards used by the CTGB are prescribed at the European level, although the standards related to water quality are different from those indicated in the WFD.

Additional restrictions

Besides the regulations discussed above, environmental laws, such as the Water Act, can enforce additional restrictions to the actual use of pesticides. Relevant instruments to this end are the water permit granting system (in Dutch, *Watervergunningen*) and the enforcement of general binding rules (in Dutch, *Algemene Regels*) (Helpdeskwater, 2013). For the agricultural sector, the Discharge Open Cultivation and Livestock Farming Decree have been replaced by the Activities Decree (in Dutch *Activiteitenbesluit*). This decree contains general environmental rules for business, based on the Environmental Management Act and the Water Act.

Box 5.14. OECD guidelines to move toward sustainable management of water quality in agriculture

Recent OECD (2012) work on the sustainable management of water quality in agriculture developed guidelines for policy makers to tackle this difficult issue and improve the effectiveness and cost efficiency of responses. These are general guidelines, which need to be tailored to specific country circumstances.

- Use a mix of policy instruments to address water pollution rather than a single policy instrument, like a pollution tax. There is increasing use of innovative policy tools, such as water quality trading arrangements.
- Remove perverse support in agriculture to lower pressure on water systems. Policies that raise producer prices or subsidise inputs (fertilisers, pesticides, etc.) encourage farmers to increase production and use more inputs than would be the case in the absence of this support.
- Take into account the polluter pays principle to reduce agricultural water pollution. Encouraging farmers to internalise their environmental costs through the implementation of the polluter pays principle can generate both economic and environmental benefits.
- Set realistic water quality targets and standards for agriculture. Targets can help track progress towards water quality goals in agriculture, but need to be realistic, easily measurable and have a clear time frame.
- Enforce compliance with existing water quality regulations and standards. Stricter enforcement of regulations can assist in putting into practice the polluter pays principle.
- Improve the spatial targeting of policies to areas where water pollution is most acute. Spatial targeting within a water system can have a positive impact on water quality, such as differentiation by livestock density or by farms generating the most pollution in a catchment.
- Assess the cost effectiveness of different policy options to address water quality in agriculture. It is necessary to consider producer abatement costs and programme monitoring and enforcement costs, compared to the benefits generated by a given policy in terms of improving water quality.
- Take a holistic approach to agricultural pollution policies. This can help to avoid adverse environmental effects and encourage co-benefits. For example, the development of riparian buffers, which can limit pollutant farm runoff, can also provide other benefits in terms of wildlife habitats and carbon sequestration by establishing green cover.
- Establish information systems to support farmers, water managers and policy makers. Policy makers need considerable technical and socio-economic information about the likely impact (science), costs (financial) and farmer reactions (social) to a given policy change to address water quality. Improving information systems is also critical in supporting farm advisory services to raise awareness of water quality management in agriculture.

Source: OECD (2012), *Water Quality and Agriculture: Meeting the Policy Challenge*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264168060-en.

Managing risks of inadequate quality more cost-effectively: Ways forward

1. Fundamentally, a **high level of political commitment and common vision** among stakeholders (mainly farmers) is required to tackle this issue. In this regard, the role of politicians is critical, as they are key players in promoting agriculture and water policy reforms, and can explain the impacts of reforms to society at large (OECD, 2012).
2. The current emphasis on curative (e.g. remediation of water quality), rather than preventative, efforts is costly. Greater **policy coherence** between water, agriculture and nature is required, as is a clear strategy on how to reduce negative impacts on water quality due to agricultural pressures. Given the considerable heterogeneity of the sector, **targeted and tailored approaches** to reducing emissions from agriculture (which may vary per region and type of production) are needed.
3. Current efforts to manage the negative impacts on water quality of agricultural practice could benefit from **increased stringency** and **wider application**. While voluntary agreements can be used to encourage co-operation from agricultural producers, they are insufficient on their own to achieve water quality objectives effectively. The OECD guidelines for good practice set forth a number of options that could be considered to support efforts to move toward the sustainable management of water quality in agriculture.
4. The greater use of **economic instruments** (e.g. **water quality trading, pollution taxes**) to address non-point source pollution can improve the cost effectiveness[10] of measures. While water quality trading has the potential to lower the cost of achieving improved water quality, in practice, experience with such programmes remains fairly limited to date.[11] Design features (e.g. scale, compliance requirements, transaction costs) have an important bearing on their overall performance in reaching environmental and efficiency objectives.
5. Current efforts to advance sustainable agricultural practices (including, for example, "precision agriculture") could be considerably scaled-up and provide opportunities for **green growth**. Initiatives to **capture and re-use nutrients** as a source of fertilizers or bio-energy provide **economic opportunities**.

Managing the risks to freshwater ecosystems

Despite recent efforts to give more consideration to the natural functioning of freshwater systems (e.g. re-naturalising river flows, restoring wetlands), the environment will continue to remain a reflection of Dutch engineering.

Managing water risks often entails balancing "risk-risk trade-offs" as efforts to manage a given water risk may (inadvertently or not) increase other risks. For example, reducing flood risk or the risk of shortage can increase the risk of undermining the resilience of freshwater systems. In a heavily modified environment that is also spatially constrained, such as the Netherlands, risk-risk trade-offs are a part of the daily activities of water management. Overtime, attention given to various water risks has fluctuated depending on current policy priorities.[12] In the current agenda of the Delta Programme, the focus is primarily on managing the risks of floods and shortage. Risks of water quality and to freshwater ecosystems are receiving less attention.

Ongoing debates about the management of the Volkerak-Zoommeer provide a useful illustration of weighing trade-offs in managing water risks. The Volkerak-Zoommeer is an internal lake formed as a consequence of the engineered response to the catastrophic episode in 1953, which caused 1 836 casualties. Unexpected eutrophication threatened the freshwater ecosystem. Possible response (re-salinisation of the lake) involves trade-off between ecological benefits and freshwater provision. The case of the Vokerak-Zoomeer is a potent illustration of how water risks and trade-offs are balanced in water management decisions. The case also demonstrates how economic analysis informs these decisions and how the valuation of ecosystems services is often overlooked. The analysis in this case study helps to shed light on opportunities to improve the consideration of the value of ecosystems in decisions about managing water risks.

Balancing ecosystems in trade-offs in managing water risks: The case of the Volkerak-Zoommeer

The delta area in the south-western part of the Netherlands underwent a major change after a disastrous storm surge in February 1953 during which the dykes were breached in more than 100 places and 1 836 people lost their lives.[13] To prevent such a disaster from ever occurring again, a solution was found in the closing of the main river estuaries, a project widely known as the "Delta Works". This large-scale engineering project consisted of a series of dams, sluices and dyke reinforcement. It started in 1958 and was finished in 1997 with the completion of the movable Maeslant storm surge barrier in the mouth of the New Waterway (van Steen and Pellenbarg, 2004; De Jonge, 2009).

The Delta Works, unmistakably, were a conscious choice for safety, and to a lesser degree, the improvement of the freshwater provision for agriculture and industry.[14] As a result of the dam structure of the Delta Works, various freshwater basins were formed, including the Volkerak-Zoommeer.[15] The Delta Works not only realised safety by reducing the risk of flooding, but also created opportunities for the growth and development of agriculture, shipping, transport and industry. The dams in the delta were functional in controlling the water levels in the Rhine-Scheldt connection, the direct route between the major international ports of Rotterdam and Antwerp. In addition, the practically unlimited freshwater availability created opportunities for the development of agriculture and drinking water supply, thereby boosting economic development in an area that historically had been rather unfit for cropping.

Unexpected problems

During the 1960s, the Delta Works were widely celebrated as a manifestation of Dutch national vitality and civil engineering expertise, and up to this very day, this project is an international icon for Dutch water management. However, this achievement, in terms of managing the risk of flood, has undermined the resilience of ecosystems and increased the risk of inadequate water quality. In nearly all parts of the delta region, including the Volkerak-Zoommeer, a continual decline in ecological integrity and water quality has been observed. Even if, at first, the ecological development of this new freshwater basin seemed to develop favourably, from the beginning of the 1990s, this water body was confronted with unexpected water quality problems.

Due to a combination of high nutrient discharge through the rivers of Brabant and the Hollands Diep, and a marginal outflow (e.g. a high retention time) the basin is highly eutrophicated. Especially during summer, these circumstances culminate in extensive blooms of toxic cyanobacteria, which severely destabilises the ecosystem and poses a danger to human and environmental health. The excessive growth of these blue-green algae, among others, inflicts ecological damage and leads to mortality of fish and bird species. It can also pose a health risk to inhabitants, and makes the water unsuitable for swimming and drinking water for cattle. In addition, the blue-green algae can pose a threat to agricultural production. This is due to the fact that high-quality water is needed for the irrigation of high-quality crops, such as horticulture, fruits and bulbs. Also, in an effort to prevent the spread of blue-algae in the regional water and ecosystem, the inlet of water is stopped when the concentrations of algae are too high. The algae bloom causes odour nuisance for people living in the neighbourhood, tourists and water sports enthusiasts (Warringa, 2009).

Towards a solution

A number of studies have been conducted on possible solutions for the Volkerak-Zoommeer and the larger delta area, including an (intermediate) environmental impact assessment and a societal cost-benefit analysis (Warringa, 2009; MER, 2012). Subsequent research established that the necessary improvement in water quality cannot be obtained if the Volkerak-Zoommeer remains a freshwater lake. Indeed, the research results led to the conclusion that a re-salinisation of the basin, in combination with a reintroduction of some of the original tidal flow, is the only viable option to solve the algae bloom problem.[16]

Box 5.15. **Assessing the costs of retaining a freshwater lake**

A study by the Regional Water Authority Brabantse Delta examined the extent of emission reduction necessary to solve the blue algae problem while retaining a freshwater Volkerak-Zoommeer. This study concluded this would require major investments (between EUR 155 and EUR 295 million), annual operating costs between EUR 8 and EUR 16 million, a substantial change in the landscape, as well as significant interventions in agriculture. Despite the significant cost, the chance of success would still not be assured. The study estimates that even after 30 years of implementing the measures, the chance of success would only be around 50%-75%. In other words, even with a structural decrease of the intake from nutrients, the problem caused by blue algae in a freshwater Volkerak-Zoommeer would not be solved for a long period, if at all.

Source: van den Berg (2007), “Algenoverlast: de Delta uit! Een KRW analyse over blauwalgenoverlast in het Volkerak Zoommeer, Mark en Vliet”, Waterschap Brabantse Delta, Breda, Netherlands.

The re-salinisation of the Volkerak-Zoommeer is a very drastic proposal, and a solution that could pose a threat to the agricultural sector in the region, as this sector is highly dependent on the availability of freshwater. At the same time, it is a proposal that fits well with the changing paradigm in Dutch water management based on the idea that less human control and more space for water can provide more safety as well as growth in ecological and landscape quality (van Buuren et al., 2010).

Cost-benefit analysis

In 2009, an intermediate societal cost-benefit analysis on the water quality of the Volkerak-Zoommeer was conducted. Overall, the cost-benefit analysis of the preferred option for re-salinisation (as compared to the status quo) was negative. This outcome is mainly the result of the negative effects on agriculture, which are considerably higher than the positive effects of a saltwater Volkerak-Zoommeer. When mitigation measures (to provide an alternative freshwater supply) are included in the analysis, the costs outweigh the benefits to an even greater extent. This is due to the fact that the costs of the mitigation measures are higher than the damage to agriculture (Warringa, 2009). However, it is important to note that in this analysis, the effects on nature were not quantified and consequently, not included in the cost-benefit analysis.

From an ecological perspective, the proposed re-salinisation of the basin, in combination with a reintroduction of some of the original tidal flows, creates various opportunities and a more resilient freshwater system. The current water quality of Volkerak-Zoommeer is starkly inadequate, thus creating ecological damage. It does not meet the legal standards deriving from the EU Water Framework Directive (Plan van Aanpak, 2012). Accordingly, an improvement in water quality created benefits for the ecosystem. Moreover, environmental NGOs have also emphasised that given the unique location of the Volkerak-Zoommeer in the delta region, a saltwater Volkerak-Zoommeer is perceived as more valuable than an artificial fresh lake. However, it is also important to note that a re-salinisation of the lake and a reintroduction of some of the original tidal flows would also cause losses for some important existing freshwater dependent nature values (van den Boom, personal communication, 5 June 2013). On the balance, however, (local) environmental NGOs support the plans for the re-salinisation of the Volkerak-Zoommeer.

Freshwater first

Given the gravity of the enduring water quality problem and despite the negative cost-benefit analysis, the Dutch Cabinet decided in 2009 that the Volkerak-Zoommeer may be turned into a salt lake on the condition that first the alternative freshwater provision is provided (Programmabureau Zuidwestelijke Delta, 2013). However, this decision was made without any accompanying financial commitments. In the region, the support for this decision was vast.[17] Since 2009, however, decision making at the national level has been repeatedly postponed. To date, no final decision has been taken.

Box 5.16. **Storage capacity for the Volkerak-Zoommeer**

Parallel to the current discussion about the possible salinisation of the Volkerak-Zoommeer, it was recently decided that the lake will undergo an additional transformation. While the decision process related to the water quality is still pending, it has been decided that the Volkerak-Zoommeer will be prepared as a water storage area (part of the PKB measure “Room for the River”).

This decision relates to the fact that in the Rhine-Meuse delta, flood risks can arise in the unique situation when, due to a heavy storm at sea, the Maesland storm surge barrier in the New Waterway, the Hartel storm surge barrier, and the Haringvliet sluices will all be closed, making it is impossible to discharge river water to the sea. When this situation coincides with high river levels, river dykes may overflow. To prevent this from happening, four alternatives have been considered, including river widening, dyke reinforcement and a different operation of storm surge barriers (Ministry of Infrastructure and the Environment 2012). Eventually, the government decided to prepare the Volkerak-Zoommeer as a water storage area (Kamerstuk 33531, 2013).

The cost of preparing the Volkerak-Zoommeer for extra water storage capacity is estimated at EUR 40 million. This investment would eliminate the need to reinforce dykes over a much larger area (a savings of about EUR 175 million). Projections indicate that the extra water storage capacity of the Volkerak-Zoommeer would only be used once every 1 430 years.

New insights, less willingness

The period since 2009 can be characterised as a period of new insights and less national willingness to address the water quality problems of the Volkerak-Zoommeer. One of the most important new insights relates to the threat of a saltwater Volkerak-Zoommeer to the adjacent estuary Hollands Diep, a large freshwater basin important for the provision of drinking water, freshwater supply for agriculture, horticulture and the industry in the Port of Rotterdam. Initially, it was assumed that as a result of the frequent opening of the locks in the Rhine-Scheldt corridor, the re-salinisation of the Volkerak-Zoommeer could pose a threat to the Hollands Diep, translating into enormous costs for an alternative freshwater supply. Since 2009, new studies have been conducted on technical solutions as to prevent/minimise the influx of salt water into the Hollands Diep, including an experimental design for regulating water flows and dynamics.

As a result of these studies, it is now assumed that additional technical measures can minimise this influx to such a degree that an alternative freshwater supply to compensate for this influx in the Hollands Diep is no longer necessary (Boeters, personal communication, 10 June 2013). Table 5.4 shows that this new insight has a significant impact on the net present value of the costs and benefits of the 2012 social cost-benefit analysis.[18]

In this 2012 social cost-benefit analysis, three project alternatives are compared to the reference alternative. Alternative A depicts a scenario with a saltwater Volkerak-Zoommeer, without mitigation and compensation measures. Alternatives B and C both include measures against salt intrusion and an alternative freshwater provision. The main difference between Alternatives B and C relates to different technical designs and a larger supply of freshwater to Tholen-St. Philipsland (in Alternative C).

Table 5.4. **Overview of costs and benefits of alternatives for the Volkerak-Zoommeer**

	Alternative A (saltwater Vokerak-Zoommeer, without measures to mitigate or compensate for the impact on freshwater supply)	Alternative B (including measures against salt intrusion and an alternative freshwater supply)	Alternative C (including measures against salt intrusion and an alternative freshwater supply)
Direct economic impacts			
Agriculture	-189	59.1	95.6
Housing value	1.1	1.1	1.1
Shipping	10.8	10.8	10.8
Fishery	66.8	66.8	66.8
Recreation	4	4	4
Indirect economic impacts			
Agriculture	-171.9	65.3	105.9
Employment	30.3	30.3	30.3
Cost of measures			
Investment	50.2	137.7	165.1
Operational	-3.5	17.7	34
Total	-294.5	82.2	115.4

Source: Based on MER – Milieueffectrapport – Ontwerp (2012), *Milieueffectrapportage Waterkwaliteit Volkerak-Zoommeer*, Initiatiefnemer Bestuurlijk Overleg Krammer -Volkerak.

This analysis shows a positive result for both Alternatives B and C. As indicated above, this difference between this positive result and the negative result of the 2009 intermediate cost-benefit analysis can largely be explained by the reduction of measures needed to provide for an alternative supply of freshwater.

This positive result, however, does not necessarily mean that a saltwater Volkerak-Zoommeer is more likely than it was in 2009 (Boeters, personal communication, 10 June 2013). One explanation is that, at present, the water quality problem seems less urgent. In fact, since 2006, the quality of the Volkerak-Zoommeer has unexpectedly improved due to the introduction of the quagga mussel that filters the water and removes algae. Whether the improvement of water quality is structural or just temporary is highly uncertain (MER, 2012). In addition, a lack of consensus regarding who should pay for the measures for the Volkerak-Zoommeer has also contributed to the persistent delays in the decision making.

Looking to the future

Until recently, the decision making of the Volkerak-Zoommeer took place separately from the decision making around the adjacent Lake Grevelingen.[19] However, it was recently decided to consider the future of the Volkerak-Zoommeer in the context of a National Structure Vision (in Dutch, *Rijksstructuurvisie*), which also considers options for the Grevelingen as well as the water safety discussion of the Rijnmond-Drechtsteden. By considering these decisions together, it is expected that synergies can be realised via additional savings and extra benefits (among others, in the shipping, recreation and tourism sectors). In the planning of this National Structure Vision, a strategic, environmental impact assessment and social cost-benefit analysis is expected in the summer of 2014 (this time covering not only the Volkerak-Zoommeer, but the entire National Structure Vision).

Lessons learnt from the Volkerak-Zoommeer

The case of the Volkerak-Zoomeer provides insight into how water risks and trade-offs are balanced in water management decisions. It provides an illustration of how economic analysis informed decisions about alternative options, how costs and benefits were identified and assessed, and how ecosystems were (not) factored in. The ecosystem changes and shifts in technological options over time demonstrate that assessments are strongly influenced by prevailing conditions (even if they are transient). The case also highlights a number of challenges, including balancing competing interests related to varying uses of natural resources.

In general, when natural capital (natural resource stocks, land and ecosystems) remains undervalued, it is often mismanaged, or at least not fully taken into account in policy decisions. Uncertainty about ecological impacts of alternatives can often make it difficult to quantify benefits of improved ecological functioning. In the case of the Volkerak-Zoomeer, some of the benefits related to the improvement in water quality were captured through benefits in increased housing values. However, additional positive effects, such as those related to recreation, energy production and water storage, were not quantified or considered too uncertain. This often means that benefits related to improvements in ecological functioning are overlooked in economic analysis.

The case also illustrates how economic policy decisions can create significant path dependency and technological and institutional lock-in. The provision of freshwater encouraged agricultural development over the years. When re-salination was explored, foregone benefits to agriculture and the costs of an alternative freshwater supply weighed heavily in the economic assessment. These dynamics create strong links between decisions made today and opportunities in the future.

Finally, the question of allocation of costs is paramount. Limited information about the willingness to pay of various actors and a lack of consensus about who should pay contributed to delays in decision making.

Ways forward to manage risks to freshwater ecosystems

1. In the context of water management in the Netherlands, the **value of well-functioning ecosystem services** – the benefits that humans derive from nature – **remains relatively hidden**. Recent efforts to re-naturalise waterways, make room for the river and consider the multi-functionality of water management infrastructures that can improve environmental benefits are a positive step in the right direction. However, there remains significant potential to **link water management more systematically to green growth pathways** (see discussion on innovation in Chapter 3).
2. The development of the new **Environmental Planning Act**, integrating all spatial, environmental and water legislations at the national level, could provide an **opportunity to put renewed emphasis on minimising risks** to freshwater systems and ensuring a better balance among various water policy objectives. However, the way the act is currently formulated allows for significant flexibility to decide how objectives will be balanced. Hence, in the development of specific plans, there will remain significant discretion to prioritise economic development and short-term cost reductions, at times at the expense of long-term benefits to the environment. As a result, there is a need **to ensure that securing ecosystem services** should have a formal and strong consideration in planning decisions.
3. Risks to freshwater systems are often exacerbated in the course of managing other water risks and the resulting risk-risk trade-offs are rarely made explicit. **Analysis of trade-offs** that may result from a policy intervention (or lack thereof) can make them more explicit and weigh the comparative importance of managing inter-related risks when difficult choices are required. Efforts to account for the **value of ecosystem services** can help to inform such analyses and should be included in the **assessment of policy options**.

Notes

1. Since January 2012, the Inspectorate for Transport, Public Works and Water Management is part of the Human Environment and Transport Inspectorate (in Dutch, *Inspectie Leefomgeving en Transport*, ILT) of the Ministry of Infrastructure and the Environment.
2. The National Co-ordination Committee for Water Distribution was established in 1982 in order to be able to act fast in the event of national water shortages.

3. According to the report from the European Commission, "around 86% of water bodies in the Netherlands are subject to an exemption under Article 4(4)" (European Commission, 2012).

4. Although Westergouwe is situated in the Zuidplaspolder, it is no longer part of the planning process for the large-scale transformation of this polder (van den Brink et al., 2010).

5. At that time the Zuidplaspolder was part of the Green Heart.

6. Besides the national government's concern about water management, the government initially refused to approve the Westergouwe urban extension plans as it believed that this project would worsen Gouda's financial problems. In addition, it did not want to be held responsible for the compensation for damage in case of a flood disaster, which it feared Gouda would not be able to compensate for (van den Brink et al., 2010).

7. This is not to say that the Water Assessment is considered less effective overall. For instance, where it concerns the reconstruction of existing areas and the operational design of new areas, the evaluation is more positive (van Dijk et al., 2011).

8. Entered into force 1 September 2013 (see: http://ec.europa.eu/environment/chemicals/biocides/regulation/regulation_en.htm).

9. Active substances are evaluated at the EU level and the pesticides are authorised at the national level. However, since Regulation 1107/2009 has taken effect, the evaluation process of pesticides is now regulated at the zonal level (e.g. three geographical zones within the EU).

10. A United States Environmental Protection Agency (USEPA) study estimated, for instance, annual savings of nearly USD 1 billion could be achieved from pursuing water quality goals using such water quality trading systems that encourage efficient emissions allocations among and between different types of pollution sources (OECD, 2012).

11. See Fisher-Vanden and Olmstead (2013) for a recent review and assessment of experience with water pollution trading programmes.

12. After 1985 (*Omgaan met Water*) and 1998 (3rd National Waterplan) ecology was one of the top priorities. Flood protection hardly got any attention (the Delta Works were almost finished) and the problems of shortage (1976) were almost forgotten. The river floods in 1993 and 1995 and the excess rain in 1998 resulted in a new focus on flooding and excess rain problems and the 2003 dry summer caused a new interest in the problem of shortage.

13. The 1953 disaster took place after many decades of plan development and research. In fact, more than ten years earlier (in 1940), a commission already concluded that the quality of the dykes in large parts of the province of Zeeland was alarming (van Steen and Pellenbarg, 2004; Olsthoorn et al., 2008).

14. All but one of the estuaries were sealed off by storm barriers, sluices and dams. An open delta structure was replaced by a highly controllable estuarine area. As a result, the physical and ecological character of the area changed dramatically. The islands were connected, the relation with the sea and harbours in the villages was cut off, and the characteristic ecology of the delta deteriorated. The shortening of the shoreline and the compartmentalisation of the original open area resulted in hard

divisions between land and water, between fresh and salt water, and an almost complete loss of the natural dynamic.

15. Created in 1987, the Volkerak-Zoommeer consists of two large freshwater basins connected by the Rhine-Scheldt corridor and is situated in the provinces of North Brabant, South Holland and Zeeland. With a surface area of 6 450 hectares, the Volkerak is the third largest freshwater body in the Netherlands. Lake Zoommeer has a surface area of about 2 000 hectares.

16. Studies established that a substantial improvement of the water quality can be reached at an exchange of 270 m^3/s (the so-called P300 variant). The P300 variant encompasses the inlet of salt water via the Philipsdam (270 m^3/s), and a tidal difference of about 30 centimetres. In addition, to decrease seepage to surrounding polders, the average water level of the lake will be lowered to NAP -0.10 m (NAP stands for the "Normal Amsterdam Water Level" and is the reference plane for height in the Netherlands). The P300 variant encompasses various measures, including the adjustment of the Philipsdam (to enable the inlet of salt water); measures to prevent salt intrusion; the dismantlement of current fresh and salt water barriers within the Krammer sluices and the Bergsediep lock, and the adjustment of the outlet sluice near Bath. Other alternatives that were examined include the p700 alternative and the Zout30 alternative, with a salt inlet of respectively 700 m^3/s and 100 m^3/s.

17. In 2007, for instance, several (regional) NGOs, including environmental organisations, the local farmers' union and recreational interests groups jointly published a manifest "Investing in a vital and sustainable delta" (in Dutch, "Investeren in een vitale en duurzame Delta") in support of re-salinisation of the Volkerak-Zoommeer in combination with an alternative freshwater supply.

18. The calculations of the societal cost-benefit analysis are based on a 100-year period of analysis, and a discount rate of 5.5%.

19. Since the early 1970s, when the tidal effect disappeared from the Grevelingen estuary, nature, recreation and fisheries have been adversely affected by the deteriorating water quality, shortage of oxygen and lack of dynamics. One of the key decisions in the national structure vision is about a proposal to restore the tides in the lake (with a tidal range of 50 centimetres).

Annex 5.A1
The "snowball effect" in Westergouwe

Further details related to the case study on Westergouwe provide insight about the decision-making process and the recommendations of the 3W Working Group.

Turning tides

The Minister of Housing, Spatial Planning and the Environment showed concern about the project's (financial) sustainability and its robustness in light of flooding risks. As a result, the ministry ordered the province and the municipality to develop an integral vision for the development of the Zuidplaspolder and to pay more attention to water issues, and in particular, to explain the soundness of the proposed residential development in the light of water management (Pols et al., 2007; Smits et al., 2006 Neuvel and van den Brink, 2009).[1] At the same time, several key developments helped to push Westergouwe into the political spotlight. These included the increasing impact of the advice of the Advisory Committee on Water Management in the 21st century (Commissie WB21, 2000), the position of the Dutch Cabinet "dealing differently with water", as well as growing public debate about the potential impacts of climate change (van den Brink et al., 2010; Oostdam, personal communication, 5 June 2013). In view of this, the Ministry of Transport, Public Works and Water Management (in Dutch, *Ministerie van Verkeer en Waterstaat*), also became involved.

When at the end of 2003 the (new) minister showed a positive inclination towards the project, the Gouda Municipal Executive, under pressure of the central government, initiated the establishment of the working group Water Task Westergouwe (in Dutch, *Werkgroep Wateropgave Westergouwe*, 3W) to study how the planned residential extension project could be designed in a responsible and "water-proof" manner (van den Brink et al., 2010). This 3W Working Group consisted of representatives from the ministry, the province, the water board and the municipality. To develop its recommendations, the 3W Working Group created different groups to address water quantity, water quality and safety, and invited various stakeholders to participate in the process (regional parties, national government authorities, research institutes, private companies and external experts in the field of sustainable water management and urban development) (van den Brink et al., 2010). The focus of the 3W Working Group was on the development of measures, such as the introduction of varying water levels and the adjustment of houses, parking spaces and infrastructure as to reduce the potential impacts of flooding.

Given that at the time, the main thrust of flood risk management was on reducing the probability of an event through structural measures, this focus on reducing vulnerability was considered to be rather innovative.[2]

An innovative new plan: Praise and criticism

In September 2004, the 3W Working Group presented its recommendations. It concluded that "given the choice for the location, from a water management perspective, it is both possible and safe to develop a residential area on the location as laid down in the regional plan". The most important and innovative element of the advice of the 3W Working Group was their recommendation to use spatial planning to reduce potential flood consequences (Neuvel and van den Brink, 2009).

One of the most key recommendations of the 3W Working Group was that the seepage pressure could be compensated by the creation of different water level sections (in Dutch, *peilvakken*) and the development of "water stairs". Furthermore, as to reduce potential exposure of people and properties in case of a dyke breach, they advised that a part of the area had to serve as water storage area (with at least 15% open water), and that both the street and floor levels had to be adapted to the potential inundation level (van den Brink et al., 2010). Accordingly, it was decided that the proposed houses would be raised between 1 and 1.5 metres, since it is expected that water levels would most likely reach this height in case of a dyke failure (Pols et al., 2007; Neuvel and van den Brink, 2009).

In reaction to the 3W Working Group recommendations, the Minister of Housing, Spatial Planning and the Environment approved, under strict conditions, the development and construction of Westergouwe (Pols et al., 2007; van den Brink et al., 2009). At the same time, the minister indicated that the national government would not feel responsible if,, despite all precautions, the Westergouwe would be flooded. In an interview published in the *Government Gazette* (in Dutch, *Staatscourant*) the minister said that those who have taken the initiative have to bear all of responsibility, and that the national government will not compensate for the damage in case of a flood disaster (Pols et al., 2007).[3]

This ministerial decision was received with applause by some and outrage by others. For instance, prominent commentators, like the former chairman of the Association of the Regional Water Authorities, Sybe Schaap, argued that the municipality of Gouda was recklessly courting danger (Smits et al., 2008). In an interview with *NRC Handelsblad* (17 February 2005) he called the approval "a disastrous plan" and the "the wrong signal to the rest of the Netherlands". His reaction stemmed less from the doubt that it was possible to make such a deep polder suitable for living, but because this decision went against all the new principles of "Water Management in the 21st century" (Schreuder, 2005). Despite these protests, the ministerial approval of the plans, and herewith the proceeding of Westergouwe, had been decided. In June 2009, the integrated plan for Westergouwe was formally approved. The Westergouwe project organisation, a consortium of Gouda Municipal Executive and two private construction companies, Heijmans and Volker Wessels, became responsible for its further elaboration and implementation (van den Brink et al., 2010).

Notes

1. Besides the national government's concern about water management, the government initially refused to approve of the Westergouwe urban extension plans as it believed that this project would worsen Gouda's financial problems. In addition, it did not want to be held responsible for the compensation for damage in case of a flood disaster, which it feared Gouda would not be able to compensate for (van den Brink et al., 2010).
2. Despite its innovative character, it is important to note that the location choice was not explicitly part of the discussion. Accordingly, measures to reduce the flood probability as well as solutions to solve the housing shortage of Gouda differently were not considered in the W3 planning process (van den Brink et al., 2010).
3. However, the juridical and political meaning of the minister's statement on compensation in Westergouwe in the case of disaster is not clear.

Annex 5.A2
Developing an effective water-sharing regime

In order to develop an effective water-sharing regime there are number of key elements that must be put into place, including:

- water-sharing plans: to define the net and total amount of water that could be abstracted from a water resource
- permits for every significant water user in the pool (referred to in the plan): used to limit the amount of water that may be abstracted from any water resource.

Building blocks of a water-sharing regime

Water-sharing regimes create strong incentives for users to improve the way they use water and make investments that depend upon access to water. The value of water is revealed.

The following elements provide building blocks of a water-sharing regime.

- Use statutory water-sharing plans to define the relationships among interconnected water bodies and to set a maximum limit on the amount of water that may be abstracted from each water body and then to partition this limit into a suite of priority resource pools.
- Convert the existing abstraction regime into one that grants each user an entitlement to a share of the water that may be taken.
- Record share ownership in a share register that allows the recording of mortgages and other financial interests in a share portfolio.
- As soon as water becomes available for use, allocate this water to a defined water resource pool and then distribute volumetric allocations to water users in proportion to the number of shares they hold.
- Establish a set of water accounts that enable use of and trade in these allocations to be tracked.
- Separate these sharing and allocation management arrangements from any permitting arrangements used to authorise the abstraction of water, manage water quality issues, local environmental impacts, etc.

Generally, the approach taken in the design of a water-sharing regime is built upon a limiting factor approach to water management. Rather than trying to integrate every feature of an administrative regime into a single location specific permit, different instruments are used to pursue different objectives. Each instrument can then be used to optimise the aggregate consequences of use at any point in time. Trade in shares and in allocations is allowed and this provides a strong incentive for innovation and change in response to changing product prices, technology and water supplies.

One of the features of state-of-the-art water-sharing systems is the definition of each shareholder's entitlement as a "net" entitlement. That is, the amount of water that is transferrable from one place to another takes into account return flows. Return flows are normally defined as a proportion of the amount of water that is taken from a water body and returned back to a water body following use. In the case of a city, for example, almost all the water taken by households is returned back to the water body following sewage treatment. Consider what would happen if the entitlement was simply to take an amount of water and there was no requirement to return a percentage. Under such an arrangement, and as soon as water became scarce, users would have an incentive to reduce the amount they return back to the river. While profitable for these users, the result has the perverse effect of decreasing the amount of water than can be allocated to downstream users. A much lower percentage of the water applied to gardens and or crops is returned.

Amendment to the Water Act

Amendment of the Water Act could be used to signal government intent to manage and plan for water shortages with the same degree of sophistication used to manage floods and protect water resources in the Netherlands. The amendment would enable a competent authority to:

1. Prepare a water-sharing plan for any water body facing a significant risk of water shortage or saline intrusion that:
   - defines the maximum amount of water that may ever be abstracted from a water body on a net basis
   - partitions this maximum amount into four or more priority categories and defines the rules for determining the maximum size and reliability of each pool
   - determines the maximum shares to be issued in each pool and sets in place an equitable process that will result in the distribution of these shares among existing users and, if appropriate, retains a proportion of these shares in reserve
   - establishes the rules for determining when and how much water will be allocated to entitlement holders and under what rules they may hold, use or transfer this water
   - specifies how the interception of water that previously flowed into a water body and how the net amount of water taken by non-shareholders will be accounted for.
2. Issue entitlements to existing users of the water body in an equitable manner and periodically makes allocations to entitlement holders.
3. Make a set of water accounts available to each entitlement holder.
4. Replace and expand the existing permitting regime so that it can be used to regulate land use, monitor water use, control discharge, etc.

Consistent with the notion that, in the first instance, these arrangements would operate as a trial, entitlements would be issued in perpetuity but if the water-sharing plan is suspended or repealed, the shares would lose their value and eventually could be cancelled. Once issued, however, they would need to create a public expectation that the basic structure would operate forever. The greater the strength of this expectation, the greater the likelihood that the new regime will drive innovation and lessen the adverse impacts of water shortage on the Dutch economy.

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Chapter 6

Achieving financial sustainability for Dutch water management

This chapter provides an overview of the financing system for Dutch water management, bringing together data from a variety of sources into a consistent framework. The chapter provides insights into the overall cost of water resources management, across functions and institutions, examines the various sources of financing, and summarises key studies on projected future costs. Based on the OECD's framework for financing water resources management, it also identifies opportunities to improve financial sustainability. Particular attention is paid to the application of the "beneficiary pays" and "polluter pays" principles, as well as incentives for cost efficiency and the fair allocation of costs across water users.

Introduction

Water management in a delta like the Netherlands is a complex undertaking, due to its low-lying geographical position, the high density and variety of water ways, the high population density, and the intense use of land (van der Veeren and Keijser, 2011). An elaborate financing structure has been established to fund water management in this setting. Benefits of these water management functions accrue to a variety of users. For example, several user groups – such as households, farmers, industry, businesses – benefit from flood risk management, as more than 30% of the country is below sea level (van der Veeren and Keijser, 2011), and 65% of the Dutch GDP is earned in areas that need to be protected against flooding by rivers or the sea (Delta Committee, 2011).

This chapter provides insights into the overall costs of water resources management in the Netherlands, financing flows and projected future costs. It then provides an overview of OECD's framework for financing water resources management and uses this as a basis to analyse existing financing arrangements for water management in the Netherlands and identify opportunities to improve financial sustainability.

An overview of current expenditure and financial flows

This section provides an overview of current expenditure on water management tasks based on 2012 data. Assessing total water management costs is not a trivial task because of the many different parties involved in water management (see Chapter 1), which have specific functions, responsibilities, budgets and ways of financing their expenses. Key findings include:

- The aggregate cost of water resources management (costs incurred by public authorities as well as private organisations) is estimated at EUR 7.6 billion per year, or about 1.26% of the GDP of the Netherlands.
- Total expenditures for water management by public institutions and drinking water companies were EUR 6.67 billion in 2012, or about 1.1% of the GDP of the Netherlands.
- The distribution of total public expenses for water resources management is as follows: regional water authorities (42%), drinking water companies (21%), municipalities (20%), central government (15%) and provinces (2%).
- At least 80% of the annual costs of water management in the Netherlands are financed via local and regional levy structures (i.e. via levies of municipalities and regional water authorities, and regional drinking water companies).
- The costs related to water quality account for the largest share of total expenditures at a cost of EUR 4 470 million (about 67% of the total). This includes EUR 1 292 million of costs for wastewater treatment by the regional water authorities and EUR 1 360 of costs for collection and discharge of rainwater and wastewater by municipalities. It also includes EUR 1 370 of expenditure by drinking water companies (which in part consists of costs related to the purification of poor quality water). The total is almost entirely financed from regional levies and consumer payments (EUR 4 197 million, or about 94% of the total).

- Expenditure for flood risk management accounts for about EUR 940 million (14% of the total expenditure). These flood risk management costs include investments in, and maintenance of, (mostly primary) flood protection infrastructure. The larger part of these costs was incurred by the central government, financed via national tax revenues (EUR 650 million, about 69% of the total expenditure for flood risk management).
- About EUR 1 106 million was spent on water quantity management (17% of the total). This cost was almost entirely borne by regional water authorities (EUR 992 million, or about 90%). The remaining 2% of total expenditure for water management was spent on activities related to water management tasks.
- In addition to the main public agencies and drinking water companies that provide water services, other private organisations incurred expenses for water resources management of about EUR 821 million in 2012. These costs are mainly incurred by industry and agriculture (e.g. for water production, water treatment, drainage and water storage).

Estimates of current costs of water resources management

In this section, total water resource management costs are estimated based on the budgets of the main institutions involved in water management. An important assumption behind this method is that these budgets completely recover the costs of the provided water services. Table 6.1 shows the estimation of cost recovery percentages for different water services provided by provinces, regional water authorities, municipalities and drinking water companies. This information is based on an analysis of an independent research institute for applied environmental economics (TME) using annual reports and budget assessments as well as data from the Statistics Netherlands (*Centraal Bureau voor de Statistiek*, CBS) (Jantzen, 2008).

The figures in Table 6.1 show that full cost recovery is almost always obtained, which implies that the water-related expenses of these agencies provide a good indicator for the costs of these water services.

Table 6.1. **Cost recovery of water service budgets**

Water service	Cost recovery	Main agency involved
Collection and discharge of rainwater and wastewater	95%-100%	Municipalities
Wastewater treatment	100%	Regional water authorities
Regional water system management	100%	Regional water authorities
Production and distribution of water	100%	Drinking water companies
Groundwater management	100%	Provinces, regional water authorities

Source: Based on Jantzen (2008) (which is largely based on self-reported annual reports and budget assessments from the bodies involved in water management, and data from Statistics Netherlands [CBS]); and van der Veeren and Keijser (2011) (which are largely based on Jantzen, 2008 and on their own calculations).

Total expenditures for water management tasks by Dutch governmental bodies and drinking water companies were EUR 6.67 billion in 2012 (Ministry of Infrastructure and the Environment, 2013), or about 1.1% of the GDP.[1] The distribution of (total, aggregated) expenditures over the involved bodies is given in Table 6.2.

Table 6.2. **Distribution of total expenditures for water management in the Netherlands**

2012 (EUR millions)

Water management institution	Distribution of costs	
	Aggregated costs per institution	As % of total costs
National government (i.e. Ministry of Infrastructure and the Environment)	1 010	15%
Provinces	136	2%
Regional water authorities	2 790	42%
Municipalities	1 360	20%
Drinking water companies	1 370	21%
Total	6.670 billion	100%

Source: Ministry of Infrastructure and the Environment (2013), *Water in Beeld 2012*, progress report on water management in the Netherlands, Ministry of Infrastructure and the Environment, The Hague.

Regional water authorities incur the largest share of expenditure by far (42% of the total costs). The remaining water-related expenditures are shared by the national government (15%), municipalities (20%) and drinking water companies (21%). The provinces have a relatively small share (2%) of the expenditures for water management tasks.

These expenditures can be categorised into three main water management functions: water quality management, flood risk management and water quantity management. In practice, making a distinction between functions is not always straightforward, because water management tasks in the Netherlands often serve more than one function simultaneously. For instance, flood risk management and water quantity management are closely related and sometimes overlap. Flood risk management is focused on prevention and dealing with incidents of large amounts of excess water, and entails investments in, and maintenance of, flood defences. Water quantity management is focused on regular day-to-day management and distribution of water tables and includes dealing with water shortages.

The various institutions involved in water management use differing broad expenditure categories, so a clear-cut comparison of expenditure by each institution for each water management task is not readily available. For example, the Ministry of Infrastructure and the Environment currently categorises expenditures broadly into "water management" − which includes water quality and water quantity management − and "water barriers" − which includes flood risk management. Regional water authorities categorise expenditures into "wastewater treatment" and "water system management" − which include water quantity management, flood risk management and partly water quality management. However, an overall view of estimated expenditure per institution and water management function is valuable; Table 6.3 provides a consolidated view. Expert judgement from the ministry and the regional water authorities was used to estimate some of the breakdown of costs across categories.

Water quality tasks accounted for the largest share of water management costs, with a total of EUR 4 470 million (about 67% of total costs). The sum of EUR 1 467 million includes costs for wastewater treatment (EUR 1 292 million) and water quality measures (EUR 175) by the regional water authorities. It also includes EUR 1 360 of costs for collection and discharge of rainwater and wastewater by municipalities and EUR 1 370 of expenditure by drinking water companies. A smaller proportion was spent on flood risk and water quantity management: about EUR 940 million on flood risk management (about 14% of total costs), and about EUR 1 106 million on water quantity management (about 17% of total costs). The remaining 2% is understood to be spent in a distributed way over these water management tasks (Ministry of Infrastructure and the Environment, 2013).

Table 6.3. **Distribution of total expenditures for water management across institutions and functions**

2012 (EUR millions)

	Water quality	Flood risk management	Water quantity management/ water systems management	Water management-related tasks/ distributed across functions	Not specifically allocated/for other tasks	Total
Ministry of Infrastructure and the Environment	273[1]	650[3]	50[1]	x	37	1 010
Provinces	x	20[3]	64[3]	52	x	136
Regional water authorities[2]	1 467	270	992	x	62	2 790
Municipalities	1 360[3]	x	x	x	x	1 360
Drinking water companies	1 370[3]	x	x	x	x	1 370
Total	4 470	940	1 106	52	99	6 670

Notes: x: not applicable. For the Ministry of Infrastructure and the Environment and the provinces, costs associated with the management of water barriers is categorised here under flood risk management. For the regional water authorities, costs associated with wastewater treatment are included in the category water quality.

Sources: Based on: (1) Kokshoorn, personal communication, 27 May 2013. (2) The breakdown of regional water authorities' expenditure between the different tasks is based on a detailed estimation of the different cost components that form the total costs of these tasks (Dekking, Association of Regional Water Authorities, personal communication, 8 July 2013). (3) Ministry of Infrastructure and the Environment (2013).

For the regional water authorities, water quality (mainly related to wastewater treatment) and water system management each account for about 50% of the budget (UvW, 2013). The costs for flood risk management and water system management together were EUR 1 262 million in 2012. The breakdown of the regional water authorities' expenditure among different tasks is based on a detailed estimation of the different cost components that comprise the total cost of these tasks (Dekking, personal communication, 8 July 2013).

In addition to the main public agencies and drinking water companies that provide water services, other private organisations (mainly industry and agriculture) incur expenses for water resources management.[2] These entities incur an estimated EUR 357 million for the production of water. Expenses for water treatment by households, industry and agriculture total EUR 427 million.[3] Agriculture also incurs some costs for drainage (EUR 25 million) and water storage (EUR 12 million) (van der Veeren and Keijser, 2011). In total, these private water resource management costs amount to EUR 821 million. When added to public water resource management costs (EUR 6 770 million), total costs rise to an estimated EUR 7 591 million (or EUR 7.6 billion per year), which is about 1.26% of GDP.[4]

Sources of financing, beneficiaries and transfers

This section provides insight into the current sources of financing of various institutions that cover water resources management in the Netherlands and discusses existing transfers. The complex setting of Dutch water management makes it difficult to gain insight into "who pays how much for what". Key findings include:

- Several important principles guide the financing of water resources management in the Netherlands. These include the "user pays" and the "polluter pays" principle, and "interest, pay, say".
- There is significant variation in municipal sewerage levies (in some cases by a factor of ten). Levies for wastewater treatment and water system management differ greatly amongst the 24 regional water authorities. Prices for drinking water in 2012 varied between EUR 1.09 per m^3 and EUR 2.07 per m^3.
- Aside from the existing manure policy, there is currently no specific policy in place in the Netherlands to address the agricultural sector as a "polluter" of water quality, and hence as payer for losses in terms of decreased biodiversity, recreational values, scenic beauty and other water quality-related values.
- Overall, it can be concluded that regional transfers are limited. An estimated 80% of the total public budget for water resources is spent by regional and local scale water institutions in their own territory, which finance their budgets mostly from local charges.
- However, part of the costs of water-related services (in particular for flood protection via the primary defences) are funded by the central government and financed from general tax revenues. The EUR 1 billion of water management expenditures made by the central government is the main source of regional transfers and cross subsidisation.
- Several trends are influencing the financial sustainability of Dutch water management. These developments include climate change, a stagnation of economic growth, a possible integration of higher level government institutions, a further decentralisation of water management tasks, and growing regional disparities.

Financing of budgets

The agencies involved in water resources management in the Netherlands finance their budgets in different ways. Guidance is provided by "the user pays" or the "polluter pays" principles. An objective of most water-related levies is ensuring full cost recovery. Nevertheless, it is not always feasible to allocate all costs and benefits to individual users and polluters. This means that, in practice, levies often rely on a proxy and do not always fully reflect the amounts of water resource services used (e.g. the application of the sewage levy on households, which is based instead on a flat rate per household).[5] Moreover, water resource management tasks with a public good nature, such as the maintenance of primary flood defences, have mostly been paid out of central public budgets.

As discussed in Chapter 5, there are regulations on the management of manure and soil protection, which contribute to reducing negative impacts on water quality. Aside from these regulations, however, there is currently no specific policy in the Netherlands to address the agricultural sector as "polluter" of water quality (Willems et al., 2012; van Puijenbroek and Willems, personal communication, 14 May 2013). That would allow the agricultural sector to "pay" for losses in terms of decreased biodiversity, recreational values, scenic beauty and other water quality-related values.

Table 6.4 provides an overview of sources of finances for the water management tasks, which will be discussed in more detail in this section. On an aggregate level, the management of water quality is almost entirely financed from regional levies and consumer payments (EUR 3 934 million, or about 94% of EUR 4 470 million). Almost all of the costs that were spent in 2012 on flood risk management were financed via national tax revenues (EUR 650 million, or about 69% of EUR 940 million). The costs in 2012 for water quantity management (e.g. regular day-to-day management and distribution of water tables, include dealing with water shortages) were also almost entirely financed by regional water authorities levies (EUR 992 million, or about 90% of EUR 1 106 million; the remaining 10% was roughly split between the national government and the provinces).

Table 6.4. **Overview of sources of financing for water management tasks in the Netherlands**

	Ministry of Infrastructure and the Environment[1]	Provinces	Regional water authorities (RWAs)	Municipalities	Drinking water companies
Water quality management	National tax revenues	x	– RWA wastewater treatment levy – RWA water systems levy	Municipal sewerage levy	Payments, partly per used unit of water
Flood risk management	National tax revenues	– Contributions from national government – Other provincial levies	– RWA water systems levy – Specific subsidies from the Ministry of Infrastructure and the Environment	x	x
Water quantity management	National tax revenues	– Provincial groundwater levy – Contributions from national government – Other provincial levies	– RWA water systems levy	x	x

Note: x: not applicable. 1. Sources of financing in 2012 also included some subsidies from the European Union.

Central government

The national budget for water resources management is financed out of the central government budget (van der Veeren and Keijser, 2011). The central government budget is mainly financed by tax revenues from citizens and companies. The Netherlands has a progressive income tax system. This implies that high-income households contribute relatively more than low-income households to the financing of the central government budget and related water management expenses incurred by the central government. This is not the case for local governments, for which the law prohibits implementing an income policy since local taxes must not interfere with the macroeconomic policy or the income policy of central government and because a local income policy can trigger migration (FRC, 2011). Some projects in 2012 were also financed by specific subsidies from the European Union (Ministry of Finances, 2013). In 2012, the executive agency of the Ministry of Infrastructure and the Environment (*Rijkswaterstaat*) received in total about EUR 3.5 million of EU subsidies. Of these subsidies about EUR 3 million was granted for flood risk management, EUR 0.25 million for water quality management and EUR 0.25 million for water quantity management (Kokshoorn, personal communication, 3 June 2013).

The Delta Fund was established by the Delta Act to provide financial resources for measures of national importance for flood risk management and freshwater supplies (as well as the water quality measures directly related to these tasks). For the 2014-28 period, approximately EUR 16.6 billion is available, which means that the annual budget averages approximately EUR 1 billion.

Recently, the central government's environmental tax on groundwater abstractions was abolished on 1 January 2012. The total amount raised from this tax was about EUR 180 million per year and its cancellation has not been widely announced. The implications of the cancellation of this tax for the extraction of groundwater and for the financing of the costs of groundwater management have not been widely discussed.

Provinces

The provincial water management budgets are mostly used for the application of the national water policy programmes in provincial policy programmes concerning water, and for the supervision and guidance of activities of the regional water authorities and municipalities. The provincial budgets are financed by the central government and by motor tax surcharges.[6] Provinces finance groundwater management by charging a groundwater levy for large groundwater abstractions. These groundwater extractions are mostly done by industry and drinking water companies, so the agricultural sector is typically not charged for groundwater abstractions. In 2012, the provinces received EUR 15.2 million via groundwater levies. The national government provides EUR 121 million (including contributions via the "Provincial Fund"), but it is difficult to determine the exact contribution from the other provincial tax revenues or levies (Hoeben, personal communication, 21 May 2013). Table 6.5 provides an overview of the sources of financing for the provincial water management tasks in 2012.

Table 6.5. **Sources of financing for provincial water management tasks**

Task	Source of financing
Flood risk management	National tax revenues and other provincial levies[1]
Water quantity management (groundwater bodies and surface waters)	EUR 15.2 million via provincial groundwater levy[2] Remaining 89% (of EUR 136 million) from contributions of the national government (including contributions via the "Provincial Fund") and/or other provincial levies[3]

Sources: 1. Based on Hoeben, personal communication, 21 May 2013; and Ministry of Infrastructure and the Environment (2013), *Water in Beeld 2012*, progress report on water management in the Netherlands, Ministry of Infrastructure and the Environment, The Hague. 2. Based on CBS (Statistics Netherlands, *Centraal Bureau voor de Statistiek*) (2012), *Provinciebegrotingen; heffingen*. CBS Statline, Central Bureau of Statistics, The Hague and Heerlen, http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=7486mfo&D1=a&D2=0&D3=a&VW=T (accessed 30 May 2013) (i.e. about 11% of EUR 136 million). 3. Based on Hoeben, personal communication, 21 May 2013.

Regional water authorities

Regional water authorities have their own taxation area, and can set the level of their taxes to such a level that they cover their costs for water management. They do not receive financial resources from the national government like the provinces and do not raise general (or other than specific) taxes. They can finance their water resources management tasks using their own levies.[7] Levies by regional water authorities differ by region because of different levels of region-specific risks, which require different levels of expenditure. Specific reasons for regional differences include geographical characteristics (below or above sea level; flat or hilly terrain; soil type), population density, type of flood defences (primary or regional defences), varying objectives and policies for flood protection, water quantity and quality management.

In 2009, the regional water authorities put in a place a new tax system that removed separate levies for the maintenance of water barriers, water quantity management, waterways, road management and water quality. The system kept in place the following three categories of levies:

- Wastewater treatment levy for the costs of wastewater treatment (in Dutch *Zuiveringsheffing*). It depends on the amount of pollution that households or businesses discharge into the sewage system. The levy is based on a "pollution equivalent" equal to the average amount of waste substances discharged per year per entity.[8] In 2012, the average levy was EUR 53.51 per pollution equivalent and the ratio of tax revenues of businesses to households was 26% to 74% (Dekking, personal communication, 16 October 2013).
- Water systems levy to cover the costs of "dry feet" and provide sufficient and clean surface water (in Dutch *Watersysteemheffing*). It is charged to building and home owners ("built" or "property owners" pay about 49%), households ("residents" or "households" covers about 39%), and owners of "not-built" land for agriculture (the category "not built" or "owners of cultivated land") and nature conservation (together cover about 11%) (Ministry of Infrastructure and the Environment, 2013).
- Pollution levy for direct discharges into surface water (in Dutch *Verontreigingingsheffing*) (van der Veeren and Keijser, 2011) is charged depending on the amount of pollution that households or businesses discharge into surface waters.

In addition to these three levies, five regional water authorities also charge for road management through a separate road charge (Hofstra, 2013). These levies should be set to cover the regional water authorities' (RWAs) expenses since there are very limited other funds. Therefore, the levies ensure nearly full cost recovery. The RWAs have to pay any differences in the tax revenues and expenditures from their savings (Hoeben, personal communication, 21 May 2013).

The RWAs also benefit from a dedicated financial institution, the NWB Bank (Box 6.1). This unique model could be of interest to other countries looking to secure stable, predicable low-cost finance required for water-related investment. There are a number of advantages of such an institution, including keeping financing costs low and pooling financial expertise. However, low-cost access to finance could, in some cases, lead to over investment, for instance when checks and balances fail to systematically assess opportunity costs of investments (see further discussion around the checks and balances, benchmarking and their relationship to financial performance, in Chapter 7).

The RWAs do receive some specific subsidies for flood risk management from the national government (Ministry of Infrastructure and the Environment, 2012; 2013). As discussed above, the 2011 Water Governance Agreement introduced a new cost-sharing arrangement for the investments in primary flood defences. The RWAs contributed EUR 81 million per year in 2011-13, EUR 131 million in 2014 and EUR 181 million per year starting in 2015. Table 6.6 provides an overview of the sources of financing for the water management tasks conducted by the regional water authorities for the year 2012.

Box 6.1. **The NWB Bank (Nederlandse Waterschapsbank N.V.)**

The NWB Bank (Nederlandse Waterschapsbank N.V.) provides a dedicated financial institution for the Dutch regional water authorities (RWAs). Havekes et al. (2011) provides an accessible synthesis of the bank's establishment, institutional arrangements and mission. It also draws out useful lessons for other countries considering this unique model of a specialised financing institution.

The NWB Bank is a public limited liability company that provides low-cost capital and financial services to the RWAs. The bank may only grant loans to the public sector, meaning that credit risk is minimal (credit risk weighting of 0% and an AAA rating). Indeed, due to the legal framework and solid financial basis arising from their own taxation powers, the RWAs are regarded as risk-free in terms of credit risk (as are other local authorities and the state of the Netherlands). Therefore, the bank does not devote resources to assess the credit risks of local authorities and focuses on providing financial services to the RWAs.

The bank serves several key functions, including providing essential financial services (long-term, low-interest loans, a central treasury function, financial expertise); cost savings via economies of scales, thereby lowering overall financial costs; and knowledge sharing, in the form of financial advisory services that are pooled across the RWAs.

Key NWB Bank figures (as of 31 December 2012)

Balance sheet total	EUR 76.1 billion
Equity capital	EUR 1.2 billion
BIS (Bank of International Settlements) solvency ratio	111.2%
Capital ratio	1.6%
Net profit	EUR 40.0 million
Operating expenses/interest ratio	13.1% (excluding bank tax)

Source: Based on NWB Bank (2012), "Headline figures 2012", https://www.nwbbank.com/home-en.html (accessed 27 January 2014).

Source: Havekes, H., et al. (2011), *Water Governance*, Association of Regional Water Authorities, The Hague .

Table 6.6. **Overview of sources of financing for water management tasks by the regional water authorities**

Task	Source of financing
Water quality (wastewater treatment)	Wastewater treatment levy (in Dutch *Zuiveringsheffing*) Some small subsidies
Water system management (including flood risk management and water quantity management)	Water system levy (in Dutch *Watersysteemheffing*) Some small subsidies Specific subsidies for investments in flood risk management from the Ministry of Infrastructure and the Environment
Dealing with direct pollution of surface waters	Pollution levy (in Dutch *Verontreinigingsheffing*)

Sources: Based on Ministry of Infrastructure and the Environment (2013), *Water in Beeld 2012*, progress report on water management in the Netherlands. Ministry of Infrastructure and the Environment, The Hague; COELO (2012), *Atlas van de lokale lasten 2012*, Centre for Research on Local Government Economics, University of Groningen, Groningen, Netherlands, www.coelo.nl/rapporten/atlas2012.pdf (accessed 30 May 2013).

Box 6.2 provides an international perspective to financing mechanisms for river basin management with the example of Portugal.

Box 6.2. **Financial flows and earmarked funds in a river basin: The "muscle" of the water reform in Portugal**

The role of financial flows and earmarked funds at the river basin level

An effective, proactive and respected river basin administration requires financial strength to promote initiatives, trigger synergies and overcome problems successfully. It is important that a significant part of the funds available are generated by the water users at the river basin level, and seen as some sort of "condominium" contribution that is paid for the improvement of the river basin and its relevant water bodies. This source of funding at the basin level does not exclude other contributions from central government, supported by the taxpayers in general, given that an effective water management at the basin level is also positive at the national level and generates many positive externalities that contribute to the national wealth and well-being. However, the payment of water levies by the users at the basin level corresponds to a contribution of the direct beneficiaries of the improvements that can be promoted with the financial resources generated at that level. This is certainly important as a source of funding, but it is also important as a way to promote awareness and to induce participation, notably in the discussion and approval of the appropriate use of those funds. In that sense, it promotes citizenship and involvement in the decision-making processes. Furthermore, if properly established, those water and/or pollution levies may induce an appropriate behaviour with respect to the use of the resource and therefore it may lead to the improvement of the water environment.

From the point of view of the river basin administration, it is the "muscle" of its action, providing means of investment and intensifying a constructive dialogue with water users. It allows going beyond "good will" and bringing into practice what is needed for a better management of water at the basin level. There is a big difference between river basin councils in which good ideas (to be implemented by others) are simply discussed, and river basin councils in which priorities are set and there are means to be allocated for implementing those priorities. From the point of view of the users, this is a way of somehow getting back the water levies that were paid. This is obviously an incentive to participate in the discussion for setting the priorities, be it pollution abatement, improvement of flood defences, improving river landscape or any other activity.

The reform of the water financial regime in Portugal

This is the approach adopted by the Portuguese Water Law (Law no. 58/2005, of 29 December) and complementary legislation, namely on the "economic and financial regime of water use" (Decree-Law no. 97/2008, of 11 June). This legislation is significant because it made possible the implementation of what was determined in general terms by the 1987 Framework Law for the Environment. It is also important because European funds, namely the European Regional Development Fund (ERDF) and the Cohesion Fund, are entering a phasing out period in Portugal. Therefore, the collection of water levies is essential for the sustainability of the water sector.

The water levy in Portugal includes five additive parcels, covering a wide range of uses of water and adjacent areas under public jurisdiction. The basic formula is:

$$WRT = A + E + I + O + U$$

In which (A) is the parcel related to the volume of water **A**bstracted from the water body, (E) is related to the discharged **E**ffluents (BOD, total nitrogen and total phosphorous), (I) is related to the "**I**nert" materials (sand and gravel mining), (O) is related to the area **O**ccupied by kind of device or construction, and (U) is a supplement related to the **U**se of water subject to public management and flow regulation. Of course, these five parcels express a wide range of possible situations but in general are not applied simultaneously.

Box 6.2. **Financial flows and earmarked funds in a river basin: The "muscle" of the water reform in Portugal** (*cont.*)

Funds raised by the five river basin administrations are used directly by those administrations in close interaction with the users (50%), incorporated in a reallocation fund that redistributes these financial resources among the five river basin administrations according specific needs (rich pay for the poor, more infrastructure pay for the needy, etc.) (40%), and transferred to the National Water Institute for supporting some costs at the central level (10%).

Each river basin administration works closely with a river basin council that plays a crucial role in defining the use of the funds collected in its area of jurisdiction. Typically, river contracts may be signed with municipalities or relevant water users to work together on the improvement of the water systems or in the implementation of flood defences. Of particular interest is the possibility of transferring funds to water users associations, created by the 2005 Water Law, to finance the implementation of programmes jointly agreed and contracted by the river basin administration and the users.

This is a way of involving civil society, citizens, enterprises, farmers, municipalities, etc. in water management and giving back to those relevant actors a significant part of the amount they paid as water levies, although this is done in a "collective" manner, with specific and agreed purposes, and under a contract signed with the administration.

This proved to be a powerful instrument of the water reform in Portugal, increasing awareness on water problems and promoting participation in the decision-making processes.

Lessons learnt

There is no more appropriate scale for water management than the one that is "given" by the natural processes that are relevant for that management. River basins and dyke-protected areas, considered alone or grouped at a convenient scale, seem to be a good geographic basis for building institutions that provide a governance of proximity.

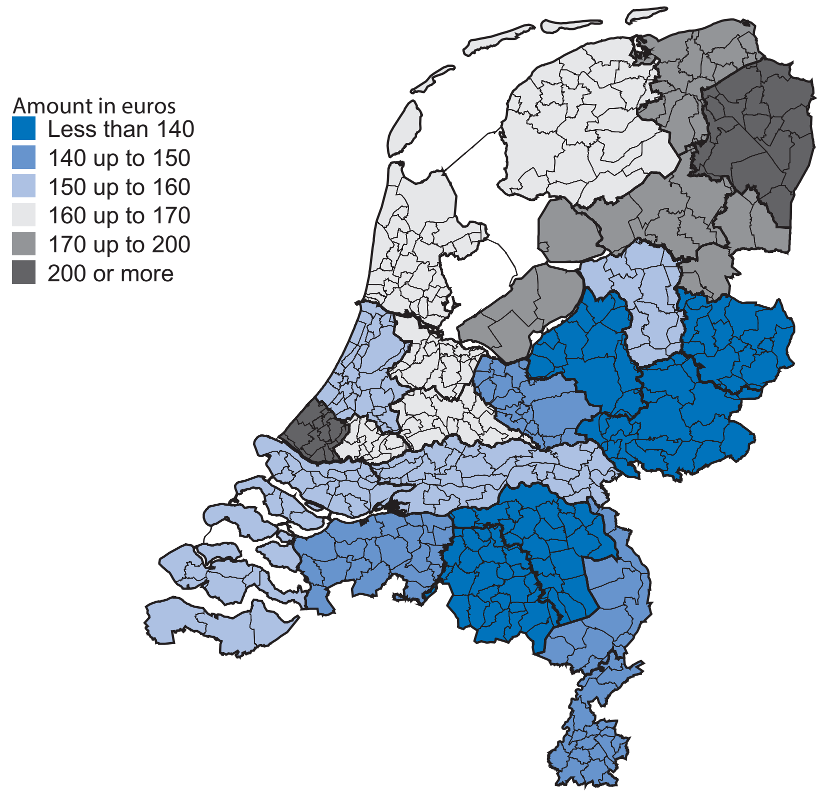
The availability of funds at that level of administration is essential for providing "muscle" and for being able to mobilise water users, and the society in general, around specific projects leading to the improvement of natural or modified water systems.

Those funds should be largely managed at the local level and the participation of the various water users is essential to achieve effective and sound practical results and to increase water awareness in society.

Source: Contribution from Francisco Nunes Correia, Professor at IST, former Minister of Environment, Portugal.

The variety of the amounts of the levies for wastewater treatment and water system management among the 24 regional water authorities is large. As an illustration, Figure 6.1 shows the variety of levies for wastewater treatment in the regional water authorities' districts for the year 2012 (COELO, 2012). These variations may be influenced by many factors (e.g. excess or shortage of water, relatively low or high elevation, soil type, rural or urban area) and different policy priorities among the regional water authorities (Ministry of Infrastructure and the Environment, 2013). Moreover, part of the regional differences in levies could also reflect differences in efficiencies, due to a lack of economies of scale, an insufficient focus on cost efficiency in some areas or a general lack of financial incentives for efficiency.

Figure 6.1. **Variation in levies for wastewater treatment for households with two or more people among regional water authority districts**



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

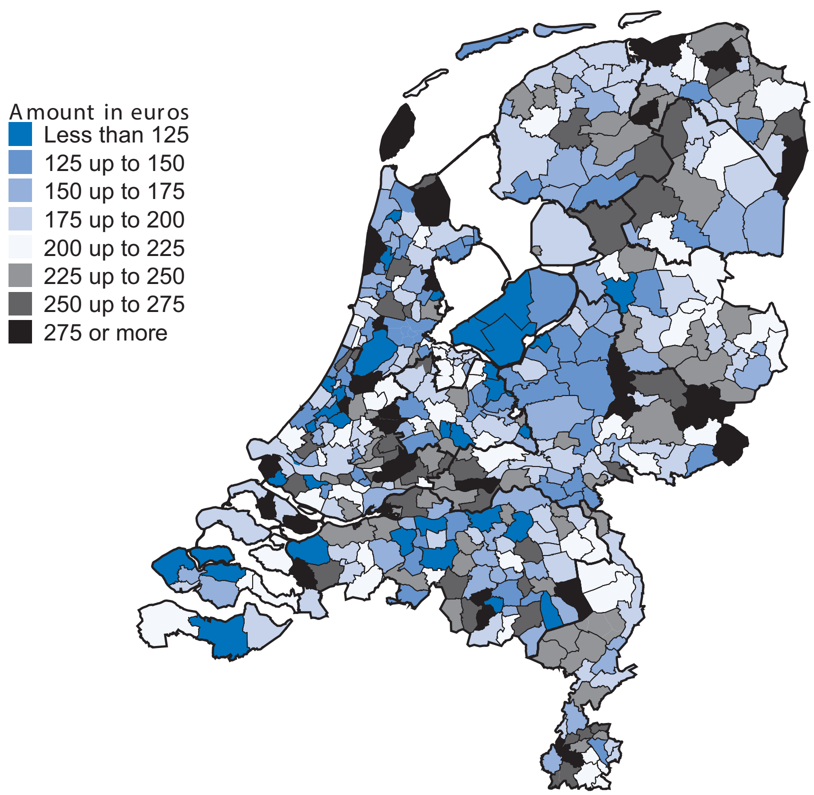
Source: COELO (2012), *Atlas van de lokale lasten 2012*, Centre for Research on Local Government Economics, University of Groningen, Groningen, Netherlands, www.coelo.nl/rapporten/atlas2012.pdf (accessed 30 May 2013), based on 2012 data.

Municipalities

Sewage costs by municipalities can be paid from sewage levies (more than 95% of costs) or from the general municipal budget (less than 5% of costs) (see Jantzen, 2008). Sewage levies can be charged to owners of a property that is connected to the sewage system and consist of a fixed charge per owner and/or a flexible charge depending on the value of the property. Alternatively, sewage levies can be charged to users and can depend on the amount of drinking water consumed, and/or the number of household members (COELO, 2012; Ministry of Infrastructure and the Environment, 2012). Sewage levies are earmarked and municipalities set the levels so as to achieve full cost recovery.

As with the regional water authorities levies, municipal levies for sewage management differ greatly across the country. Figure 6.2 shows municipal levies for sewage management for multiple person households (COELO, 2012). Tariffs in 2012 varied between EUR 45 to EUR 370 for such households, and between EUR 29 and EUR 362 for single person households (COELO, 2012). These variations depend on factors like the charging structure (e.g. the charging of users and/or owners of the connection to the sewage system), applying a fixed charge per owner and/or a flexible charge depending on the value of the property, applying a dependency on the consumption of drinking water and/or number of household members (COELO, 2012; Ministry of Infrastructure and the Environment, 2012). As in the case of wastewater treatment, significant differences in levies could also reflect differences in efficiencies (e.g. due to a lack of economies of scale, an insufficient focus on cost efficiency in some areas) or a general lack of financial incentives for efficiency.

Figure 6.2. **Municipal levies for sewage management for multiple person households**



Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: COELO (2012), *Atlas van de lokale lasten 2012*, Centre for Research on Local Government Economics, University of Groningen, Groningen, Netherlands, www.coelo.nl/rapporten/atlas2012.pdf (accessed 30 May 2013), based on 2012 data.

The unique organisation of the water chain in the Netherlands makes international comparison difficult, in particular as regards wastewater collection and treatment. The OECD Survey on Water Prices (see OECD, 2010) indicated that increasingly, separate wastewater charges are being introduced to recover wastewater management costs. Most of the countries that responded to the OECD survey used the same tariff structures for wastewater as for water supply services, often combining a fixed and a variable element. Their levels, however, generally differ from those of drinking water tariffs, and so can the number of blocks used when increasing or decreasing block tariffs are used. In most cases, the variable wastewater charge is applied to the volume of water used, or a percentage of the variable water charge. Most countries levy separate charges for sewerage *vs.* wastewater treatment, although in most cases the basis for charging remains water consumption; only the size of the volumetric rate differs.

Drinking water companies

Drinking water companies finance the costs for the production and distribution of drinking water by means of a user fee. The user fee consists partly of a fixed price per user unit for the costs of infrastructure and a variable component, which depends on the amount of water used. Prices in 2012 varied between EUR 1.09/m^3 and EUR 2.07/m^3 for access to, and use of, drinking water (Vewin, 2012). These variations between the drinking water companies are due to factors such as differences in operational efficiency, geological and biophysical circumstances of the water supply used to prepare drinking water − preparing drinking water from surface water is more expensive than from groundwater − and practical aspects, including transport distance and transport circumstances (Vewin, n.d.). The recent cancellation of the tax for groundwater extraction could imply that costs for drinking water, and subsequently the tariffs for users, will decrease.

International comparisons on water tariffs are complex and fraught with methodological difficulties. However, the current tariffs for water supply reported by Vewin are in the upper end of tariffs monitored in OECD countries: according to the OECD survey published in 2010 and based on 2008 data, unit prices of water supply services to households (including taxes) in 2008 ranged from 0.5 USD/m^3 (in Canada) to USD 2.6/m^3 (in Scotland). In this survey, the average unit price for water sanitation in the Netherlands was USD 2.3/m^3 (including taxes) (OECD, 2010). This comparison accounts neither for the quality of the service deliver nor for the share of costs recovered from the water bills.

Average household water bill

What do all these different financial flows for water management mean for the average household bill? Table 6.7 provides an overview of the average costs for water management for a household in the Netherlands for the year 2012. The largest cost components of the bill are the sewage and wastewater levies.

Table 6.7. **Average household water bill in 2012**

Payment for	Payment to	Average amount	Source
Drinking water	Drinking water companies	EUR 126	(Vewin, 2012)
Sewage – Sewage levy	Municipalities	EUR 177	(Coelo, 2012)
Wastewater – Wastewater levy	Regional water authorities	EUR 161	(Coelo, 2012)
Water management – Water system levy[1]	Regional water authorities	EUR 69	(Coelo, 2012)
Total		EUR 533	

Note: 1. This includes a water pollution levy and is the approximate average for the category “residents” or “households”.

Based on these figures, the average water bill for households amounts to EUR 533, or EUR 464, if the costs of water management are not factored in. The OECD survey referred to above suggests that the Netherlands compares well with countries that recover costs from revenues through water bills (e.g. Belgium-Wallonia and Flanders, England and Wales, France, Sweden, Switzerland).

Per capita tap water use by Dutch households was 129 litres in 2011. This figure initially increased from 109 litres in 1970 to a peak of 149 litres in 1990, but subsequently declined (CBS, 2013).

That water bills in the Netherlands are split in three is a fairly unique practice. The OECD survey indicated that in some cases (e.g. Belgium, Denmark, Italy and Sweden), customers receive a combined bill for drinking water, sewerage and sewage treatment services. Separate invoices, or separate information on one single bill, are adopted in Australia, Canada, Finland, France, Germany, Hungary, Korea, the Netherlands, the United Kingdom and the United States. The Dutch model may increase willingness to pay, but blurs information about the costs of water services.

Beneficiaries of water resources management

This section identifies the main beneficiaries of the water management services provided by the government institutions. These beneficiaries mainly include the users of the water services, but can also be people who value the service while they are not directly using it (e.g. improved environmental values). Box 6.3 provides an illustration of how the benefits of water resources management are estimated in France.

Box 6.3. **Estimating the multiple benefits of water management: France**

A partial picture offered by current estimates of the benefits of water resource management in France illustrates that they take various forms, and can amount to several billion euros per year.

A first order of magnitude is given by the annual turnover of commercial activities directly dependant on water resources, which are estimated to be EUR 9.6 billion – including EUR 3.5 billion related to natural mineral waters, EUR 2.8 billion to hydropower, EUR 2.2 billion related to fish and EUR 1 billion related to spas. Examples of more direct benefits are those of avoided flood damages in Paris through construction of lake reservoirs (estimated to be EUR 300-700 million), and those of preserving bathing water quality in tourism resorts (estimated to be EUR 1 billion).

Estimates of future benefits from implementation of the EU Water Framework Directive in France include those of reduced drinking water supply costs from avoided agricultural pollution (EUR 1.8 billion), with non-commercial impacts of achieving good quality status being estimated via contingent valuation surveys at EUR 1 billion. Another example of (non-monetised) benefits is the increase in water quality in the River Seine generated by several decades of investments in wastewater treatment in the Paris agglomeration area, prompting significant reductions in concentrations of biochemical oxygen demand (BOD), ammonium and phosphorus, and resulting in improved biodiversity (currently 32 fish species are listed, from 3 fish species in the 1960s). A final example is the potential of river navigation in the Nogent-Le Havre corridor to reduce CO_2 emissions from freight transport – the current configuration allows a reduction of 28% and an improved configuration would allow a further reduction of 55% of CO_2 emissions.

Source: Bommelaer, O. and J. Devaux (2012), “Financing water resources management in France”, *Études & Documents* No. 62, January, MEDDTL, Paris, in: OECD (2012), *A Framework for Financing Water Resources Management*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264179820-en.

Beneficiaries of management of risks of excess, including floods

Beneficiaries of Dutch flood risk management are those located in vulnerable areas that can potentially be flooded by rivers or the sea and benefit from reduced risk of flooding due to investments in flood protection. As discussed in previous chapters, the benefits of investments in primary defences are not evenly distributed across the

Netherlands as safety standards vary considerable among dyke-ring areas. Some areas, mainly in the east or south of the country, are not part of the main dyke-ring system, and therefore do not have direct benefits from investments in primary flood defences. Nevertheless, it could be argued that these areas benefit indirectly from the protection of the flood-prone part of the Netherlands, where the main economic activities of the country are located and which are the main sources of the national GDP.

Benefits of freshwater supply management

The main beneficiaries of preventing water shortages are the agriculture, shipping and energy sectors as well as the industrial sector. These sectors benefit from preventing freshwater shortages, as water shortages result in crop damage, low river discharges imply that ships cannot be fully loaded, reduced water availability implies less cooling water for energy companies and water for industry. Moreover, ecosystems and biodiversity can suffer from a reduced freshwater supply, and drinking water companies may encounter problems in their water production. Not all of these sectors benefit equally from ensuring adequate freshwater supply to meet demand, as their exposure to the risk of shortage varies according to the "sequence of priorities" (see further discussion in Chapter 5).

Benefits of water quality management

In the Netherlands, water quality is maintained, with further targets for improvement, in order to generate several benefits. More specifically, recreational users of surface waters (such as for water sports, fishing and swimming) also benefit from clean surface water (van der Veeren and Keijser, 2011; van Gaalen et al., 2012). Increases in saltwater quality and related improvements of the marine ecology may result in economic benefits for the recreation and fisheries sectors (van der Veeren and Keijser, 2011). Farmers benefit from surface water and/or groundwater with a water quality sufficient for agricultural practices, like irrigation (van Bommel et al., 2007; van Gaalen et al., 2012). Industrial companies benefit from sufficient water quality for industrial practices, such as for washing products, preparing water for use in products, cooling processing installations and machines (van der Mierde et al., 2007).

A monetisation of the benefits of improved water quality shows that important advantages of improved water quality are values attached to living in a beautiful natural environment. Drinking water users could benefit from supply of surface water with improved water quality, as this would lower the costs of drinking water preparation in areas where surface water is used (Schotsman et al., 2007; Vewin, n.d).

Improved environmental values could, in principle, benefit both users of the improved water environment and non-users who place an existence value on the increased biodiversity and environmental benefits that depend on water quality (Penning and van der Vat, 2007). Note, however, that water quality standards set in the Water Framework Directive for nature conservation are generally not achieved in the Netherlands (van Gaalen et al., 2012).

Financial transfers between regions and income groups

The budgets of the main institutions involved in water management and the descriptions of finances and main beneficiaries described in the previous sections provide a basis for an analysis of the financial flows of water resources between areas. Overall, it can be concluded that regional transfers are limited. This is apparent from the distribution of total public expenses for water resources management. An estimated 80% of the total public budget for water resources is spent by regional scale water institutions that finance their budgets mostly from local charges. The remaining 20% is spent by either provinces or the central government, which is mainly financed from the general budget.

In particular, the benefits of the water management services provided by the 24 regional water authorities accrue to the businesses and households in their jurisdiction and are primarily financed from local levies, which are paid by the beneficiaries of these services. The same applies to the benefits of the water management services by the 408 municipalities, which mainly entail installation and maintenance of local sewage systems, the benefits of which accrue to, and are paid by, local beneficiaries in the community. The beneficiaries of sewerage and wastewater treatment services extend beyond the direct users to downstream water users and the environment. The ten drinking water companies provide drinking water in the region where they are located, and users pay for their costs.

Overall, transfers within the regions between beneficiaries and non-beneficiaries are limited because the local financing system is based on the user and polluter pays principles (van der Veeren and Keijser, 2011). This implies, in principle, that those who benefit from the provision of a water service should pay for this service. For example, the water systems levy charged by the regional water authorities is based on the property and business values or the surface area of agricultural land, which functions as a proxy. The wastewater treatment levy and the pollution levy depend on the amount of pollution by households and businesses. It is, of course, complicated and practically impossible for regional water authorities to fully charge every user exactly according to the benefits received from a provided water service. However, the distributive effects of the proxy used for households require a detailed assessment, as they may mask implicit transfers between groups that differ in terms of revenues, size of the family, consumption patterns (more or less hedonist water users), etc.

Municipalities pay their costs for sewage by charging sewage levies to households and businesses with connections to the sewage system. Drinking water companies charge a user fee for the services provided, which partly depend on the amount of water used. Within these regions, there is no explicit cross-subsidisation between urban and rural areas, because payments are mainly based on the use of water services. Although, since part of the levies (of regional water authorities) are related to property values, urban areas (with typically higher property values) and higher income groups might contribute relatively more.

The main cross-subsidisation arises from the financing of the water resources services provided by the central government (15% of the total public expenses or about EUR 1 billion) and provinces (2% of the total public expenses or about EUR 136 million). This implies that the funding of this amount is associated with a degree of cross-subsidisation of beneficiaries of provincial water services by non-users of these services, but this amount is small compared with total water resource management expenses in the Netherlands. Therefore, it can be concluded that the main regional transfers and cross-subsidisation arises from the EUR 1 billion of water management expenditures made by the central government. About 64% of these expenses accrue to flood risk management and the remainder to water quality and quantity management. These benefits provided by the central government are partly subsidised by non-users of these water services. Nevertheless, it should be noted that non-use benefits of these services exist, such as improved environmental values that may result from clean water and adequate water management.

The analysis above suggests that the main regional transfers and cross-subsidisation comes from expenditures of the central government on flood risk management (related to the primary defences) of about EUR 650 million. About 28% of these costs are funded by taxes on businesses, with the remainder paid by households (Wienhoven et al., 2012), leaving an estimated EUR 468 million paid by households.[9] Of this amount, about EUR 300 million is estimated to be contributed by households outside of areas protected by the primary defences.[10] Since the main urbanised areas in the Netherlands are located near the coast and are flood prone, this transfer, or cross-subsidisation, comes in large part from rural areas.

The public nature of these flood protection defences – non-rivalry and non-excludability in their use – provides the rationale for financing out of general taxes. Given that a significant portion of the country would be underwater in the event of breach of primary defences and two-thirds of GDP could be affected, even citizens not directly exposed to the flooding would suffer significantly. In a number of ways, primary flood defences represent a "national security" issue.

Nevertheless, this implies an implicit subsidisation of flood protection by citizens in areas that are not exposed to flooding. The 2011 Water Governance Agreement provides a significant change in financing arrangements for the primary defences. Starting in 2014, costs will be shared 50-50 between the central government and regional water authorities. The existing financing structure of the regional water authorities may be problematic if the costs related to primary defences sharply increase in the future, while taxation capacity is limited or may even decline if the population in the jurisdiction of a regional water authority decreases. Recent legislative changes have allowed for cost-sharing among regional water authorities to mutualise the costs related to investments in primary defences. It creates an additional incentive to open an informed public debate about acceptable levels of water risks and their costs to society (see Chapter 5).

Future cost projections

This section examines estimates of future costs of water resources management in the Netherlands. Key findings include:

- Climate change impacts, such as sea level rise, higher peak discharges of rivers, more intensive rainfall events and increased risks of water shortage in the summer period may increase future water resource management costs.
- Future costs of water resources management are very uncertain because they depend, amongst other factors, on uncertain effects of climate change, future societal preferences for flood safety, uncertain unit costs of water management measures (dyke protection) and assumptions about how costs of dyke strengthening relate to increased water levels.
- Future costs for flood defences could substantially increase future water management costs more than increased costs of managing water shortage or managing local excess water. For example, the costs of the implementation of the Delta Programme to accommodate increasing flood risks is between about EUR 1 billion and EUR 1.5 billion per year, and is projected to stay this high for the next 100 or more years.

- The costs for adapting local water management to prevent water nuisance and accommodate projected climate change impacts (such as intense rainfall) until the year 2050 are estimated at about EUR 2.5 billion. More significant costs are expected related to the improvement of sewage systems in order to reduce the impact of flooding and wastewater flowing directly into surface waters in case of heavy rainfall. Additional total expenses by all municipalities in the Netherlands are estimated to be about EUR 0.8 billion per year (if investments are spread over time and combined with other activities) until the year 2027.
- Estimates of the possible costs for improving water quality − including achieving the standards under the Water Framework Directive − were about EUR 7.1 billion for the period 2007-27.
- Only modest increases are projected for costs related to drinking water (an average increase of 0.4% per year) and wastewater treatment[11] (an increase of roughly 2% per year for estimates available up to 2016).
- An indicative projection of total public water resources management costs for the year 2025 shows that these costs may increase to EUR 9 093 million, or to EUR 8 343 million, if planned savings from increased efficiency can be achieved.

Insights into potential future water management costs are important for ensuring that government budgets are financially sustainable and compatible with projections of fiscal deficit and public debt (OECD, 2012a). A major concern is climate change, which may increase flood risks in the Netherlands because of sea level rise, higher peak discharges of rivers and more intense rainfall events (KNMI, 2006; Aerts et al., 2008). There are, moreover, concerns that climate change may increase risks of summer droughts, which cause shortfalls in freshwater supply and insufficient water for transport in inland waterways (RIZA, 2005a; 2005b).

As discussed in Chapter 3, these expected future changes are likely to impact the demand for, and costs of, water resources management. Several socio-economic developments are also expected to influence Dutch water management. These developments include a possible stagnation of economic growth, a drive towards administrative simplification and territorial reform, and a decentralisation of water management tasks and their financing. Moreover, growing regional disparities may influence local demand for water resources management and local abilities to cover water resource management costs (see Chapter 3).

There are also political and societal concerns regarding increasing taxes (despite the moderate levels of current water levies) to meet growing financing needs. As a result, the regional water authorities are in a difficult position to raise more funding for a number of reasons, including reduced available budgets from the national policy programmes ("*Bestuursakkoord Water*" and "*Onderhandelingsakkoord Natuur*") used for financing water measures for quality improvement, the burden of rising costs for flood risk management and wastewater treatment, and reluctance to raise levies (van Gaalen et al., 2012).[12] A complicating factor for accommodating expected increases in water management costs is that household willingness to pay for water services may decrease in the future, in particular if economic growth remains sluggish. If fiscal constraints persist, innovative financing mechanisms could be explored. Box 6.4 provides an example of an innovative mechanism from the United States.

Box 6.4. **Clean Water State Revolving Fund: An innovation financing mechanism in the United States**

The Clean Water State Revolving Fund (CWSRF) Programme, solely administered by the United States Environmental Protection Agency (EPA), operates much like environmental infrastructure banks that are capitalised with federal and state contributions. The programme provides matching funds (equal to 20% of federal government grants) for projects that improve water quality that meet the environmental review requirements of the United States' clean water laws, including all types of non-point source, watershed protection or restoration, and estuary management projects, as well as more traditional municipal wastewater treatment projects. The Clean Water State Revolving Fund monies are loaned to communities, and loan repayments are recycled back into the programme to fund additional water quality protection projects. The revolving nature of these programmes provides for an ongoing funding source that will last far into the future. To date, the CWSRFs have assumed varying degrees of involvement in smart growth strategies and have funded over USD 89 billion, providing over 30 012 low-interest loans to date. The CWSRFs offer:

- low interest rates, flexible terms
- significant funding for non-point source pollution control and estuary protection
- assistance to a variety of borrowers
- partnerships with other funding sources.

Supporting "Smart Growth" policies

Clean Water State Revolving Funds are required to establish and use priority ranking systems which prioritise eligible treatment works projects based on public health and environmental considerations. States may wish to consider assigning a portion of the points in the ranking system to projects that embody smart growth principles or which support the state's smart growth goals. State CWSRFs can consider requiring applicants to develop a long-term comprehensive growth plan before it can receive funding from the programme. For example, this can be used to control effective growth management/urban sprawl available to municipalities or to encourage municipalities to adopt some form of "access management" for sewer lines to serve new development areas.

The state of Maryland was the first to have a state-wide smart growth policy that directs development to community-designated growth areas. Since 1997, the Neighbourhood Conservation and Smart Growth Initiative directs the expenditure of specific types of state funding to geographic areas of Maryland that have been locally designated as growth areas. State law requires local governments to identify "priority funding areas" that are essentially designated growth areas for future development. These designated growth areas are incorporated into 20-year county land-use plans.

The Maryland CWSRF funds sewer projects only within these designated priority funding areas. If the project is not within a designated growth area, the project will not receive funding. Any project outside the growth area will need to qualify as an exception. Exceptions are granted where a project is necessary to protect public health/safety or where a denial of a project funded with federal funds would be inconsistent with federal law. At the time of pre-application, the CWSRF Programme staff review all projects for consistency with priority funding area requirements. This involves correlating projects with designated growth area maps in the county land-use plans. To date, the CWSRF has funded both expansion and upgrade projects and has not had to deny any high-ranking project on the basis of smart growth deficiency.

Source: United States Environmental Protection Agency (n.d.), "Water grants and funding", http://water.epa.gov/grants_funding (accessed 13 October 2013).

Estimates of expected future developments of costs

Costs of water resources management have already increased significantly in the past and are expected to increase further in the future. As an illustration of the past evolution of costs, the total costs of water management (not including costs associated with drinking water) in 1998 were EUR 3.216 billion (as reported in van der Veeren and Keijser, 2011), which increased by about 65% to EUR 5.296 billion in 2012 (not including costs associated with drinking water) (Ministry of Infrastructure and the Environment, 2013). Table 6.8 shows how costs of the different institutions involved in water management have evolved over time (1998-2012). As the financing system has evolved over the years,[13] this comparison is only indicative.

Table 6.8. **Indicative comparison of assessment of water resource management costs between 1998 and 2012**

EUR million/year

Water management institution	1998	2012
Central government	900	1 010
Provinces	96	136
Regional water authorities	1 551[1]	2 790
Municipalities	560	1 360
Drinking water companies	..	1 370
Total	3 107 (excluding drinking water companies)	6 666

Note: ..: not available. 1. Figure provided by Wihnard Dekking (personal communication, 2013).

Source: Based on van der Veeren, R.J.H. and X. Keijser (2011), *Financing Water Resources Management in the Netherlands*, RWS Waterdienst; and Ministry of Infrastructure and the Environment (2013), *Water in Beeld 2012*, progress report on water management in the Netherlands. Ministry of Infrastructure and the Environment, The Hague.

To give an indication of the evolution of costs per water management function, the expenditures for the regional water authorities for 1998 and 2012 are given in Table 6.9.

Table 6.9. **Comparison of costs incurred by regional water authorities between 1998 and 2012 across water management functions**

% of total expenditures

Water management task	1998	2012
Water quality management	64% (EUR 962 million)	54% (EUR 1 467 million)
Flood risk management	7% (EUR 113 million)	10% (EUR 270 million)
Water quantity management	29% (EUR 436 million)	37% (EUR 998 million)
Total	100% (EUR 1 511 million[b])	100% (EUR 2 728 million)

Notes: The costs for flood risk management and water quantity management for 1998 and 2012 are based on estimations by expert judgement (Dekking, personal communications, 8 July and 30 September 2013).

Source: Based on Dekking (personal communications, 8 July and 30 September 2013), UvW (Unie van Waterschappen, Association of Regional Water Authorities) (2013), *De belastingen van de Waterschappen in 2013*, Association of Regional Water Authorities, The Hague, available at: www.uvw.nl/zoekpagina-zoekresultaat-nieuws.html?newsdetail=20130315-1410_de-waterschapsbelastingen-in-2013&highlight=waterschapsbelastingen%202013.

Future costs of primary flood defences

As can be expected in a low-lying delta as the Netherlands, the main expected medium- and long-term cost increase arises from adapting primary flood defences to the expected rise in sea and river water levels as a result of climate change. Climate change impacts, such as sea level rise, imply that considerable efforts of dyke heightening and widening are needed to keep flood safety standards at current levels, while an increase in safety standards would require even more investments. To better understand how water resources management (in particular flood risk) should be adapted to accommodate the effects of climate change and the associated risks, a major study was conducted by the Second Delta Committee. The committee's report provides a long-term perspective (the year 2100 and beyond) on the measures that should be taken to prevent flooding from the sea or the main rivers and to guarantee sufficient freshwater supplies, in particular, in Lake IJsel (Delta Committee, 2008). The combination of these measures has been called "The Delta Programme".

The Delta Committee advised that flood protection standards must be raised in the future (by 2050) by a factor of ten compared to their current levels, which implies that flood protection infrastructure has to be strengthened to reduce the flood probability by this factor. This objective is very ambitious since current flood protection standards are already high by international standards. Moreover, a recent evaluation of the flood protection infrastructure showed that about one-third of the flood defences does not, in fact, meet current flood protection standards (Inspectie Verkeer en Waterstaat, 2011). Cost-benefit analysis has shown that increasing flood safety standards by a factor of ten is not economically efficient (Kind, 2013). Therefore, this advice is unlikely to be implemented, at least not in the near future. As a next step, the Delta Commissioner will provide a new set of plans and proposals for long-term flood risk management by the year 2014 (Delta Commissioner, 2011).

The Delta Committee based its proposed flood risk management strategies and its costs on a sea-level rise scenario of 0.65 up to 1.3 metres in 2100 and 2 up to 4 metres in 2200, including soil subsidence.[14] Climate change impacts on higher peak discharges of the main rivers were also accounted for (Delta Committee, 2008).

Indications of costs reported by the Delta Committee of achieving the improved flood safety standards and accommodating climate change are shown in Table 6.10 (Delta Committee, 2008). The costs of the Delta Programme are estimated at between EUR 1.2 billion and EUR 1.6 billion per year until 2050 and between EUR 0.9 billion and EUR 1.5 billion per year until 2100. Increasing sand nourishment in order to create additional space at the coast (i.e. stretching of the beach zone in a seawards direction) for flood protection, recreation and nature conservation entails additional costs of EUR 0.1 billion or EUR 0.3 billion per year. These costs do not include the costs of maintenance and operation of water safety and water management incurred by the central government, regional water authorities and provinces, which are currently about EUR 1.2 billion per year according to the Delta Committee (2008). The estimates also do not include the costs of adjusting regional flood defences, which are expected to be relatively small. They do, however, include measures for ensuring sufficient freshwater supply (Lake Ijssel).

Table 6.10. **Estimated future costs of implementing the Delta Programme**

EUR billion per year

	Period		Average
	2010-50	2050-2100	2010-2100
Delta Programme	1.2-1.6	0.9-1.5	1-1.5
Delta Programme including sand supply for additional space at the coast (for flood protection, recreation and nature conservation)	1.3-1.9	1.2-1.8	1.2-1.8

Notes: Costs are in 2007 price levels and include value added tax (VAT).

Source: Based on Delta Committee (Deltacommissie) (2008), *Working Together with Water: A Living Land Builds for its Future*, Hollandia Printing, www.deltacommissie.com/doc/deltareport_full.pdf (accessed 30 May 2013).

Input for the cost estimates reported by the Delta Committee (2008) was provided by Kok et al. (2008), who estimated the costs of strengthening primary flood defences as a function of sea level rise. Their overall methodology involves a division of the Netherlands in four main water systems (upstream rivers, coast, Lake Ijssel and delta) and assessing for each area what changes in flood defences and related measures are needed to cope with higher water levels and waves, which are all translated into costs. An important assumption made is that the costs of adjusting flood defences are a linear function of the (higher) water level. A motivation for this assumption is that important cost parameters (use of land and height of a flood defence) increase linearly with the design water level. The total cost for adaptation and maintenance were expressed as annual costs, which were estimated at about EUR 900 million up to EUR 1.2 billion per year (Kok et al., 2008). This study also identified a broad variety of factors of uncertainty about these cost estimates.[15]

A more recent publication of the expected future flood risk management cost by the same group of authors is Stijnen et al. (2013). This study estimates how future flood risk management costs in the Netherlands may increase as a result of climate change. It focuses on increased costs of preventing breaches in the primary flood defences that arise from future sea level rise and tectonic subsidence. The reason for this focus is that the authors assume that increasing costs from flood defences are the dominant factor behind increased costs of flood risk management that are expected to be caused by climate change. Moreover, it is assumed that rising sea and river levels are the main cost components, as only these adaptation costs are calculated.

Stijnen et al. (2013) estimate future flood risk management costs for two policy strategies. Strategy 1 keeps flood defences in compliance with current safety standards. Strategy 2 applies a risk-compensation approach in which new safety standards are introduced, which compensate for increases in potential flood damage due to economic growth and demographic change by stronger flood defences that lower the flood probability.[16] The study estimates the development of yearly flood defence costs (excluding operation and maintenance costs) for the KNMI (2006) climate change scenario, which projects the largest increase in wintertime precipitation (W+). Under Strategy 1, costs increase to EUR 0.86 billion in 2025 to EUR 0.91 billion in 2100 and EUR 0.92 billion in 2200. Cost estimates for the alternative sea level rise scenario are EUR 1.1 billion per year in 2025, which increases to EUR 1.2 billion in 2200.

It is perhaps remarkable that the cost differences between the years 2200 and 2100 is small, while the assumed sea level rise in 2200 is with +200 cm considerably higher than the year 2100 (+85 cm) (Stijnen et al., 2013). Stijnen et al. (2013) argue that additional cost increases for additional sea level rise are relatively cheaper because "initial costs [will] have already been made", and because the authors assume that the relation between flood defence costs and sea level rise is almost linear. This assumption of linearity may be correct, but as Jonkman et al. (2013) point out, several factors could contribute to a non-linear increase of costs, for example, if widening of dyke footprints requires removal of a relatively higher number of objects and buildings, or if more costly defence measures need to be implemented to prevent this. Moreover, if higher dykes are built because of sea level rise, pumping capacity needs to be increased to keep low-lying areas dry (Jonkman et al., 2013). Such increases of water management costs are not included in the flood defence costs estimates by Stijnen et al. (2013).

Annual flood defence costs in Strategy 2 are EUR 1.07 billion in 2025 and increase to EUR 1.19 billion in 2200. These estimates increase to EUR 1.3 billion in 2025 and EUR 1.5 billion in 2200 in the alternative sea level rise scenario. According to Stijnen et al. (2013), increased flood defence costs over time are mainly caused by strengthening coastal flood defences. The second highest cost category is adapting to higher water levels in the tidal areas, and the third highest cost category is adapting flood defences in the upstream river area. Stijnen et al. (2013) project a substantial decline in flood defence costs as a percent of GDP because they assume that GDP growth (1.5% per year) is larger than growth in flood defence costs (about 0.04% per year on average).

The estimates of flood risk management costs depend on uncertain projections of climate change, cost estimates of improving flood defences and economic growth (which determine the calculation of potential flood damage which is to be offset by stronger flood defences in Strategy 2). An underlying assumption of these cost estimates is that there are no rapid changes in sea or river water level rise, meaning that abrupt and large effects of climate change are not considered, which could in fact occur if so-called "tipping points" exist in the climate system (Lenton et al., 2008). Other potentially expensive excluded factors of influence on costs are situations in which public acceptance or environment and spatial planning delay flood protection improvement projects. Moreover, addressing ecological concerns in flood protection projects may entail considerably higher expenses (Stijnen et al., 2013).

Future costs of local water management systems

The main increase in future costs of water management will come from the need for additional investments in primary flood defences, but other cost increases can arise from the need to adapt local water management systems and sewage systems. These systems may need to be adapted in order to anticipate potential increases in intense precipitation as well as potential demographic changes, such as increased urbanisation in some areas (including upstream countries), impacts on water quality and associated costs. Estimates of these latter cost categories are provided by the Netherlands Environment Assessment Agency (MNP, 2007), which conducted an audit of the study "Waterpolicy 21st century" (*Waterbeleid 21e eeuw*). The study assumes an increase in precipitation intensity of 10% by the year 2050 (consistent with the middle point of the range of climate change scenarios for the Netherlands) (MNP, 2007). The costs for adapting local water management to prevent water nuisance and accommodate projected climate change impacts until the year 2050 are about EUR 2.5 billion,[17] which are to be spent until the year 2015. These costs are borne by local water management authorities and ultimately paid out of the levies that they charge. A large part of these investments should have been made by now, which means that according to the results of MNP (2007), additional costs for managing local surface waters are probably modest, at least until 2050.

A more substantial cost category is the required investments in urban water management, including the replacement of sewage systems. Sewage systems are expected to need improvement in order to reduce the impact of flooding and wastewater flowing directly into surface waters in case of heavy rainfall (MNP, 2007). Municipalities can reduce the costs of replacing sewage systems by combining these works with other activities, such as the design of new, or renovation of old, neighbourhoods and road infrastructure works. If investments in urban water management and sewage are spread over time and combined with other activities, then this results in additional total expenses by all municipalities in the Netherlands of about EUR 0.8 billion per year, until the year 2027 (MNP, 2007).[18] MNP (2007) stresses that the estimates of future urban water management costs are uncertain and based on extrapolations of information that was available from only a few municipalities.

Projected future costs of water shortage management

Managing water shortage is currently part of the Dutch integral water management and the related measures are estimated to amount to EUR 120-400 million per year. Shortage is projected to increase after 2015 due to climate change and socio-economic developments, which implies that water managers should carefully consider these shortages in their planning. Current large-scale freshwater storages such as the IJsselmeerlake and Haringvliet/Hollandsch Diep will remain important in the future, and scenarios on how their use can be optimised are currently being considered in the context of the Delta Programme. Cost-benefit analysis of various options are also currently underway as part of the Delta Programme and the results will be taken into account to develop an adaptive strategy. On the basis of these recommendations, it may be concluded that no substantial increase in future costs of managing water shortages may be expected. However, the financial consequences of the adaptive strategy will become clearer once the Delta decision has been further elaborated.

The way in which the risk of shortage will be managed in the future (and who bears the risk of shortage) will affect future costs. For example, accepting reduced agricultural revenues from periodic water shortages could be cheaper in some cases than investing in structural measures to prevent water shortages on a large scale. Water shortages can also be dealt with by small local-scale water management planning, allowing damage from drought should be accepted at times (RIZA, 2005b).

Projected future costs of drinking water

Drinking water companies have examined how their costs are expected to develop up to the year 2020 (Hoeben and Allers, 2012). This projection is based on an assessment of the 2010 budgets of drinking water companies and estimates of how these companies expect that their costs will develop over that time period. The purpose of the projection was to obtain an estimation of exogenous development of costs, which could serve as a benchmark for measuring possible future efficiency savings by drinking water companies. Therefore, this projection does not include potential cost savings, which may result from efficiency gains. The study finds that a modest increase in costs from EUR 1 322 billion in 2010 to EUR 1 388 billion in 2020 is expected (2010 price level). This equates to an average increase of 0.4% per year (Hoeben and Allers, 2012). This cost increase is mainly attributed to an expected increase in costs of deprecation and external financing. Costs may be higher if unexpectedly large parts of the infrastructure for water distribution need replacement (Hoeben and Allers, 2012). Costs could possibly be lower because of the recently cancelled groundwater extraction tax for drinking water companies (Rijksoverheid, n.d.).

Possible future costs for water quality improvement

Costs for maintaining and improving water quality until 2027 are under discussion, which includes achieving the standards as agreed upon in the Water Framework Directive. Estimates of the possible costs for improving water quality − including achieving the standards of the Water Framework Directive − were about EUR 7.1 billion for the period 2007-27 (Ligtvoet et al., 2008b). Regional water authorities would finance about EUR 5.5 billion of these costs and the central government would finance about EUR 1.7 billion (based on Ligtvoet et al., 2008b).

Although the national government had cancelled the budget for the Water Framework Directive from the year 2015 (van Gaalen et al., 2012), in the most recent budget of the central government (presented on 17 September 2013), this cancellation was rolled back.

Possible penalties for the Dutch government, sanctioned on behalf of the European Commission for not implementing or not achieving the Water Framework Directive, are estimated to vary from EUR 25 000 to EUR 300 000 per day, and possible fines are estimated to vary from EUR 10 million to EUR 30 million (Wienhoven et al., 2012).

Potential cost savings

Part of the aforementioned potential future increases in water resource management costs may not result in a higher tax or water bill if these can be partly offset by efficiency gains. It is expected that a more efficient operation of water resource management could result in substantial savings. For example, the 2011 Water Governance Agreement (*Bestuursakkoord Water*) envisaged that by the year 2020, savings in the order of EUR 450 million could result from a more efficient operation of the water chain (the pipe network of sewage, wastewater treatment and drinking water) and EUR 300 million could be saved on surface water and flood defences (Hoeben et al., 2012). Innovative strategies, such as recycling water and waste or energy capture from waste, can also be a potential source of cost savings and provide opportunities for green growth (see discussion on innovation in Chapter 3).

Summary of future cost estimates

An indication of the future costs of water management is provided by a review of future cost estimates across water management functions. Table 6.11 summarises the main results of these studies. An important concern is whether long-term trends, such as climate change, will substantially increase the costs of water resources management in the Netherlands.

It should be noted that the cost estimates of adapting flood defences in the last two rows are total cost estimates, while the cost estimates for implementation of the Delta Programme are costs which are additional to current costs, and are thus considerably higher. An important difference between these studies is that the Delta Programme envisages a more ambitious adaptation programme with a substantial increase in flood safety standards compared with current levels. This suggests that the desired safety standards of flood protection infrastructure have a large influence on future flood defence costs.

Table 6.11. **Summary of estimates of increases in future water resources management costs**

Future costs of:	Reported estimates	Source
Drinking water	Increase in EUR 66 million (from 2010-20)	Hoeben and Allers (2012)
Freshwater supply	No major cost increase related to the costs of operating and maintaining hydraulic infrastructure expected after 2015	RIZA (2005a, 2005b)
	Note: Costs of the Delta Programme include management of national freshwaters (below)	Delta Committee (2008)
Water quality	About EUR 7.1 billion (from 2007-27)	Ligtvoet et al. (2008b); van Gaalen et al. (2012)
Local management excess water	EUR 2.5 billion is spent until 2015 for climate proofing up to 2050	MNP (2007)
	Urban water management (sewage) costs an additional EUR 0.8 billion per year until 2027	MNP (2007)
Primary flood defences	The Delta Programme costs an additional EUR 1.2-1.6 billion per year until 2050 and EUR 0.9-1.5 billion until 2100	Delta Committee (2008)
	More space at the coast for nature and recreation costs additionally EUR 0.1-0.3 billion per year	Delta Committee (2008)
	Adapting to sea level rise results in total flood defence cost of EUR 0.9-1.2 billion per year until 2200, compared with EUR 0.77 billion in 2009	Kok et al. (2008); Stijnen et al. (2013)
	Total flood defence costs of keeping flood risk constant are 1.1-1.3 billion per year until 2025 increasing to 1.2-1.5 billion per year in 2200	Stijnen et al. (2013)
Replacement and renovation of hydraulic infrastructures	Estimates of costs of replacing and renovating hydraulic structures are currently in preparation and are expected to be significant	Rijkswaterstaat (forthcoming)

Evidently, the cost projections in Table 6.11 are inherently uncertain, especially the long-term projected costs of adapting primary flood defences. Several important assumptions can be identified. The costs depend on the sea and river water level rise that will materialise in the future, as well as the pace at which these changes occur. Obviously both are very uncertain, but the projections in Table 6.11 are consistent with the current state-of-the-art climate change projections for the Netherlands. However, if sea and river water levels rise more and faster than these projections, then the adaptation costs increase. Another important assumption is that the costs of widening and heightening of flood defences increase linearly with water level. Further research is needed to examine whether this also holds for the high rises of water levels that could occur in the future. Moreover, the applied unit costs of flood protection infrastructure introduce uncertainty in the cost estimates, and recent insights show that the applied unit costs may be underestimations.

The future cost estimates reviewed in this volume may be used to make a projection of future water resource management costs in the Netherlands. Here, a rough indicative estimate of these costs for the year 2025 is provided. This time horizon was selected because there are cost projections available for adapting primary flood defences and it allows for the incorporation of the medium-term cost projections for drinking water and local management of excess water. The cost projection includes the following components:

- Costs of drinking water are assumed to increase by 0.4% per year from 2012 onwards, which results in a cost increase of EUR 73 million in 2025.
- Additional investments in local management of excess water (including sewage replacement) increase costs with EUR 0.8 billion in 2025 compared with 2012.
- Additional costs of implementing the Delta Programme and creating additional space at the coast are EUR 1.45 billion (average of Table 6.11).

Adding these costs increases (EUR 2 323 million) to the 2012 total expenses of water resources management (EUR 6 770 million) results in an estimate for 2025 of EUR 9 093 million. If the cost savings from increased efficiency as has been laid down in the Governance Agreement on Water can be reached, then EUR 750 million may be deducted from this amount, which results in total costs of water resources management of EUR 8 343 million in 2025. These estimates are merely indications, which are surrounded by large aforementioned uncertainties, and should, therefore, be treated with great care.

An important question is how the expected increase in water resource management costs will be financed. Part of the increases of local water resources management will translate into a higher water bill for households. In order to secure funding of the Delta Programme, the 2010 Delta Act set up the Delta Fund. An additional policy agreement by the Balkenende IV Cabinet stated that from the year 2020 the Delta Fund would be filled with at least EUR 1 billion per year, which should cover the aforementioned adjustments of flood defences envisaged by the Delta Committee. Although this amount could be sufficient to accommodate the expected cost increases discussed in this report, funding for the Delta Fund was recently cut, reducing the amount by EUR 600 million until 2028.

Analysis based on the OECD Framework for Financing Water Resources Management

Policy frameworks underpinning the financing of water resources management have, in most countries, evolved organically over time. They determine how the various functions of water management are financed, or in other words, who pays how much for what. To provide a basis to inform policy discussions about financing water resources management, the OECD developed a framework for analysis based on four key principles drawing on the experience of a number of member and non-member countries (OECD, 2012b). The framework and principles can provide a basis for an assessment of the Dutch financing system for water management and be used to identify opportunities for improving the financial sustainability.

Four principles to finance water resources management

In general, four key principles can be relied on to improve the effectiveness, efficiency and equity of water resources management:

- The polluter pays principle creates conditions to make pollution a costly activity and to either influence behaviour (and reduce pollution) and/or generate revenues to alleviate pollution and compensate for welfare loss. This principle is efficient to the extent that it internalises the external costs of pollution.

- The beneficiary pays principle allows sharing the financial burden of water resources management. It takes account of the high opportunity cost related to using public funds for the provision of private goods that users can afford. A requisite is that private benefits attached to water resources management are inventoried and valued, beneficiaries are identified and mechanisms are put into place to harness them.
- Equity is often used to guide discussions about affordability or competitiveness issues, in particular when water bills, driven by the first two principles, may be disproportionate with users' capacity to pay.
- Coherence between policies that affect water resources is also important to emphasise the need to reduce the overall financial burden on water resources and find opportunities to take preventative action (often less costly), rather than relying on curative approaches. Agriculture, land use or energy policies can severely increase the cost of water management. Factoring water in and reforming allocation of public moneys in these policies can be more cost effective than mobilising additional financial resources for the water sector.

In practice, these principles tend to be unevenly applied by countries. The interaction of principles can also be problematic (highlighted in Box 6.5). For example, when the equity principle is invoked to reduce the cost paid by polluters, second- or even third-best solutions can result, crowding out more effective and efficient policy options (such as the use of pollution charges) (OECD, 2012b).

Assessing the current financing system in light of the OECD principles

The Dutch financing system, in general, provides a robust basis for water resources management. However, there are still opportunities to improve the efficiency and soundness of the system, improve equity in allocation of costs and limit the growth of long-term financial liabilities.

While the Dutch financing system for water management is currently guided by the principles of "user/beneficiary pays", "polluter pays" and "interest, pay, say" principles, these principles could be more fully applied in practice. While equity considerations are taken into account to address affordability issues, they are sometimes invoked to limit the broader application of the "beneficiary pays" and "polluter pays" principles. The equity principle could also be used to examine the fairness of allocation of costs across groups in society (e.g. to what extent does society bear the cost burden of negative impacts on water quality resulting from economic sectors, such as agriculture). There is also significant scope to consider how greater coherence between policies could reduce the overall financial burden for water resources. This section examines further the current financing system according to four OECD principles.

Box 6.5. **Potential tensions between the polluter pays and beneficiary pays principles**

The "polluter pays" principle and the "beneficiary pays" principles require careful attention in their implementation. Lax definition can lead to apparent contradictions. This can be illustrated by flawed Payment for Ecosystem Services (PES) schemes, which can be a way to share the cost of pollution, in disguise. Hanley et al. (1998) discuss situations which could be portrayed as "Pay the Polluter Principle". For instance, farmers who have acted in an ecologically responsible way can be penalised *via-à-vis* others, if the less virtuous ones received a larger incentive to change their behaviour. Similarly, Salzman (2005) highlights the perils of payment for ecosystem services, which, despite their high potential, can create moral hazard, rent-seeking behaviour, free-riding or perverse incentives.

Payment of ecosystem services is only legitimate when the services are clearly defined and properly enhanced. Observers note that this is not always the case, and a number of PES schemes are in fact, inadequate.

Source: OECD (2012), *A Framework for Financing Water Resources Management*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264179820-en; Hanley, N., et al. (1998), "Principles for the provision of public goods from agriculture: Modeling moorland conservation in Scotland", *Land Economics*, Vol. 74, pp. 102-113; Salzman, J. (2005), "The promise and perils of payment for ecosystem services", *International Journal on Innovation and Sustainable Development*, Vol. 1, pp. 5-20.

"Beneficiary pays"

Currently, the beneficiary pays principle applies to a number of water management tasks, including drinking water, sewage collection and flood protection. As discussed, for flood protection for the primary defences, given the significant externalities associated with their function in the national interest, a solidarity principle also applies.

However, the beneficiary pays principle could be more broadly applied to users benefitting from activities relating to ensuring freshwater supply and distribution as well as managing the water level. The main beneficiaries of these activities are the agriculture, shipping and energy sectors, and the industrial sector. Abstraction charges for bulk water supply are almost completely absent (there are only limited exceptions). The recent abolition of the central government's groundwater tax also undermines the fuller application of the beneficiary pays principle (even if the provincial groundwater tax remains in place). Similarly, the "snowball effect" documented in Chapter 5 illustrates a loose application of the beneficiary pays principle regarding protection of urban and property developments from flood risks.

"Polluter pays"

The polluter pays principle applies to some extent to guide current financing arrangements, as seen with the regional water authority's wastewater treatment levy and pollution levy for direct discharges into surface water. However, in the case of the pollution levy for direct discharges, it is not clear to what extent this is stringently monitored and enforced, and what are the sanctions for non-compliance (the issue of enforcement is further discussed in Chapter 7).

However, the principle is not applied to diffuse sources of pollution, a main driver of inadequate water quality. As discussed above, there is currently no specific policy in the Netherlands to address the agricultural sector as "polluter" of water quality. Such a policy would allow for the agricultural sector to "pay" for losses in terms of decreased biodiversity, recreational values, scenic beauty and other water quality-related values and provide financing for measures to improve water quality.

"Equity"

Although not an explicit principle of the Dutch water resources financing system, affordability issues appear to be adequately addressed. Overall, the perception is that the overall cost for households and businesses of water management is relatively low, considering the services provided. However, recourses to competitiveness issues have been used to argue against the establishment of abstraction charges.

A more pressing issue relates to the current allocation of costs of water resources management. Society at large bears a significant portion of the costs and unrealised benefits of low water quality, in particular. To date, there is a lack of transparency around the allocation of costs. For example, to what extent do the water companies (and hence their customers) bear additional treatment costs because of high pesticides and nitrates? Do the water authorities have to strip more phosphate out of sewage effluent to offset the large proportion derived from agriculture? A better understanding of the allocation of costs requires detailed study and evaluation of who pays how much for what and would provide a robust basis for more fully applying the principles for financing water resources management.

"Coherence"

The principle of coherence could be more broadly applied to the Dutch water management context to lower costs and improve the efficiency of responses. This principle applies across all water management functions: flood risk management, freshwater supply and water quality management. Policies in agriculture, energy, urban development, among others, are often responsible for growing pressures on water resources and subsequently, increasing the costs associated with water management. Moreover, from the perspective of long-term financial sustainability, coherence is even more important in light of significant path dependency. Policy measures to improve coherence between spatial development (e.g. the beneficiaries of spatial development typically do not pay the full cost associated with mitigation measures for water management), agriculture, nature and water management are discussed in further detail in Chapter 4.

Ways forward to improve financial sustainability

Based on the review of the current and projected costs of water resources management, an examination of the sources of financing (institutions and various instruments), beneficiaries of water management, and transfers, as well as an analysis based on the OECD framework for water resources management, a number of opportunities for improving financial sustainability have been identified.

- To ensure the financial sustainability of the Dutch water management systems, there is a need to **avoid increasing current and long-term financial liabilities** to the extent possible. Climate change is a potentially significant cost driver of water management in the future and one that policy decisions in the Netherlands can only impact to a very limited extent. However, the financial sustainability of water management today and in the future can be improved through various means, including avoiding taking on additional financial liabilities. Promising avenues include:

- limiting the negative impact on water management of spatial development
- shifting from a focus on structural measures towards a risk-based approach for freshwater supply; this could improve incentives for water users to manage risks and stimulate more efficient approaches as well as applying innovative approaches over time
- pursuing preventative rather than costly curative approaches for managing water quality
- better accounting for risks to freshwater ecosystems in water management decisions, rather than facing costly negative impacts and remediation measures.

- The **polluter pays principle** could be more fully applied to cover non-point sources of pollution, in particular from agriculture. The **cost burden imposed on society** as a whole by the so-called "van der Vlies Resolution"[19] could be made more transparent and used to inform policy decisions.
- In accordance with the **beneficiary pays principle**, the financial burden of water resources management should be shared among all beneficiaries. Economic instruments, such as abstraction charges or taxes, could be used to put this into practice. The recent **cancellation of the central government's groundwater tax**[20] (EUR 180 million/year), is a step in the opposite direction. Aside from the provincial groundwater tax, there is currently no abstraction charge for bulk water supply.
- Although the current financing system has a number of strengths, the issue of **equity** in the allocation of costs across various categories of society has not been sufficiently assessed to date (for example, to what extent do the water companies, and hence their customers, bear additional treatment costs because of high pesticides and nitrates? Or, more broadly, to what extent does society bears costs imposed by economic actors?). **Improved transparency** around the allocation of costs across users is required, and an in-depth study of this issue would be beneficial.
- The absence of independent information and accountability mechanisms (despite existing checks and balances), as discussed in Chapter 7, undermines the incentives for **financial performance** and **cost efficiency**. While benchmarking systems exist, they are generally self-regulating, and reporting to external authorities occurs at an aggregated level. Improved transparency could improve the current system by generating pressure to resolve potential issues in a timely way.
- Given the importance of safety, **long-term financial flows for flood risk management for the primary defences need to be assured**. These flows should also be **insulated from political interference**, to the greatest extent possible, even if such interference cannot be completely avoided in practice. This was the intention behind the establishment of the Delta Fund. Financing for the primary flood defences at national level based on solidarity is a sound approach. However, the recent budget cuts have eroded the financing available for the fund and have also demonstrated that it is not immune from broader fiscal pressures.
- Ensuring the **stability of financial flows for flood protection** is one argument for shifting part of the financing responsibility for new investments in primary flood

defences to the regional water authorities, which insulates these decisions from national level fiscal trade-offs and enables local decisions to be made about priorities for protection works. The OECD argues that earmarking (such as in the case of the regional water authority levies) can be appropriate, against clearly defined objectives and recurrent assessments (OECD, 2012b). However, while it has been suggested that this **new cost-sharing arrangement** for primary flood defences will improve the incentives for cost efficiency, this outcome is far from clear. This new arrangement is the result of a political agreement, and the pros and cons of cost sharing have not been fully examined and **deserve further attention** to ensure that new arrangements do not distort investment. At the same time, the **existing financing structure** of the regional water authorities **may be problematic** if the costs related to primary defences sharply increase in the future, while taxation capacity is limited or may even decline in some regions. Finally, the way regional water authorities will share the burden among themselves may be affected by growing regional disparities, which will be reflected in contrasted ability to pay. These trends could force the postponement of the necessary investment, or create tensions related to financial transfers among regional water authorities.

- **Sewage collection** (municipalities) **and wastewater treatment** (regional water authorities), which account for a significant portion of total water management expenditure, require proper attention as to the performance of current institutional arrangements. **Pursuing economies of scale and efficiencies** by examining potential consolidation between regions and/or reallocation of tasks and responsibilities across the water chain is advised. The system currently is in a state of flux. Again, the potential benefit of independent information, performance and monitoring mechanisms (discussed in Chapter 7) to improve cost efficiency could be considered. **Innovative strategies**, such as recycling water and waste or energy capture from waste, can also be a potential source of cost savings and provide opportunities for **green growth**.
- To **improve transparency in tracking water management expenditures** and cost recovery, public institutions and drinking water companies could provide a harmonised accounting of expenditure for water management across water management functions.

Notes

1. Based on the 2012 GDP level reported by Statistics Netherlands.
2. Estimates of such expenditures are provided by Jantzen (2008). Estimates for 2012 are provided here, which are based on expected cost developments as estimated by Jantzen (2008).

3. Jantzen (2008), moreover, reports costs of the recreational and fishing sector of using water resources for their activities. These are, however, not included here as expenses of water resources management.

4. Based on the 2011 GDP level reported by Statistics Netherlands.

5. Relying on a proxy entails determining a relevant basis that can be used to assess levies.

6. The motor vehicles tax is linked to the holding and registration of a passenger car, van, motorcycle or lorry.

7. A levy (or fee) is a payment for a public service for which an individual act is compensated. They are designation levies with earmarked revenue. A levy differs from a tax with no directly individualised compensation (FRC, 2011).

8. The "pollution equivalent" is based on the oxygen consumption that is required to treat wastewater. Small businesses with a pollution value of less than five equivalents are taxed for one or three pollution equivalents (based on their size). Medium-sized businesses with an annual discharge of up to 1 000 pollution equivalents are assessed on the basis of their water consumption and average concentrations of pollutants. Large industries of more than 1 000 pollution equivalents are assessed on the basis of measurements, samples and analyses of their wastewater. A household of two or more people pays the fixed charge for residential accommodation of three pollution equivalents. While a single person household pays for one pollution equivalent (Dekking, personal communication, 16 October 2013).

9. This is calculated by multiplying the proportion of the governments' budget that is paid by taxes on households (72%) with the amount that the central government spends on flood risk management (EUR 650 million).

10. This is calculated by multiplying the proportion of households in the Netherlands outside areas protected by the primary defences (64%) with the amount that households pay for the central government's flood risk management expenditures (EUR 468 million).

11. The projected future costs of wastewater treatment cited here are based on estimated future net annual costs of all activities that are charged by the regional water authorities' wastewater treatment levy (Dekking, personal communication, 16 October 2013).

12. Note that the Delta Fund has reserved money for flood risk management and freshwater supply, but not for water quality (van Gaalen et al., 2012).

13. For example, the sewage levy in its actual form dates only from 2008. Prior to that, municipalities had only partial cost recovery from their sewage levy.

14. The upper bound of sea level rise used by the Delta Committee is consistent with a global temperature increase between +2°C and +6°C by the year 2100 (Delta Committee, 2008).

15. Kok et al. (2008) list the following main factors contributing to the uncertainty of future flood risk management costs and their order of effect (shown in between parentheses): climate change scenario (30%); new demand for compensation, such as for nature (20%-30%); application of other flood risk management strategies than strengthening flood defences, such as room for rivers (3 to 5 times higher costs); changes in prices (10%-20%); new techniques (probably minor); changes in safety

norms (not provided); changes in building codes (30%-40%); multi-functional use of flood defences (5%-10%).

16. In their paper, Stijnen et al. (2013) define what we call Strategy 1 and 2 as Strategy B and C, respectively.

17. This amount includes EUR 1.7 billion of costs for solving water nuisance problems, EUR 0.4 billion of costs for solving water nuisance in combination with achieving other goals, and a surcharge of EUR 0.4 billion for the uncertainty about costs.

18. MNP (2007) reports that these costs are EUR 16.2 billion for the period 2006-27, which is about EUR 0.8 billion per year.

19. Discussed in Chapter 5, the resolution implies that Dutch agricultural sector shall not be burdened with an increase in costs when measures have to be taken for the implementation of the Water Framework Directive.

20. As detailed in the chapter, the provincial groundwater tax is still in place.

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Chapter 7

Water governance in the Netherlands as a driver for better accountability

This chapter discusses the effectiveness of stakeholder engagement and economic regulation in fostering accountability in Dutch water governance. It provides insights on strengths and needed improvements of existing benchmarking systems for regional water authorities, municipalities and drinking water companies, as well as a menu of options for further transparency of information and performance monitoring. The chapter also discusses the origins, key actors and on-the-ground results of the Dutch "Polder Model", its evolution in the context of the European Union incentives for public participation. It suggests ways forward for better inclusiveness of civil society at large and reflection of unheard voices (the environment) in the decision-making process.

Introduction

Coping with pressing and emerging water challenges at the least cost for society requires effective public governance that sets the right incentives for overall performance and cost efficiency of water institutions, and effectively engages society at large in the decision-making process. This implies independent accountability mechanisms and inclusive stakeholder engagement.

This chapter provides insights on the policy framework for benchmarking and monitoring enforcement and compliance in water services, and analyses the strengths and weaknesses of current stakeholder engagement processes. The objective is to assess the contribution of existing governance instruments in discharging key regulatory functions and involving society in decision-making processes. This is being done by building on international comparisons.

An important awareness gap to bridge

A striking fact in Dutch water governance is the awareness gap among citizens about key water management functions, how they are performed and by whom (see Chapter 1), as well as their low perception in terms of flood protection, water risks and costs. In practice, many people are not aware of the basics about evacuation policy, the origin of the water they drink, whether their property is built on a flood plain, the regional water authorities they correspond to, the real cost of water management, or the threats to ecosystem services.

In a country where several dimensions of water management are considered as a "national security issue", the increasing distance between citizens and water institutions can be explained by several factors.

The absence of a major catastrophic flood event since 1953 provides a feeling of "safety" and generates a "not in my term of office" syndrome at different political levels.

Water is considered a public responsibility, which is primarily dealt with by the government, with limited room for mobilising the private sector and spreading risks across stakeholders (Chapter 5). This generates a sort of "no news is good news" attitude backed-up by a false perception of safety, excellence in technology and consensual decision making.

The relationship between citizens and water institutions has gradually evolved towards a more technical and managerial dimension to the detriment of social and political aspects. This has generated more distance between water managers, who are perceived as bureaucratic and technical, and the general public.

The awareness gap is largely a result of a high level of trust in government and the successful avoidance of major flood disasters since 1953. But it raises challenging questions for policy makers: how to increase the awareness of the risks, to influence decisions of property owners, businesses and municipalities about exposure and vulnerability to risk, and thereby reduce the expected cost of damages in a flood event? How to make the public more aware of what is needed to keep the country dry and habitable, and to secure willingness to pay for flood safety? Key enabling elements of a society resilient to future shocks include the density of social interconnections between authorities, social players and the population in general; confidence, trust and a sense of community; and technical capabilities and political vision and leadership.

Effective public governance is also critical to ensure accountability of institutions in delivering water policy outcomes. This means independent oversight for performance and compliance (which does not necessarily have to be carried out at national level), as well as balanced and action-oriented stakeholder engagement that does not override the interests of the "unheard voices". Adaptive governance implies flexible institutions that can evolve to become more efficient and better articulate their functions and roles. At the same time, this flexibility should build on the comparative advantage of century-old institutions that have proven to be less vulnerable to, and able to recover from, disaster.

Economic regulation[1]

Dutch water services (drinking water, sewage collection and wastewater treatment) are managed by a diverse set of decentralised authorities which are responsible for the different phases of the water cycle (see Chapter 1), and governed by a number of rules and standards (see Table 7.1). Drinking water companies are responsible for abstraction, treatment and distribution of potable water; municipalities deal with sewage collection; and regional water authorities manage wastewater treatment.

This unique framework relies exclusively on a limited number of public institutions, which can be prone to monopolistic attitudes. This organisational set up suggests the need to strengthen service provider oversight mechanisms, especially following a long trend of upscaling of municipalities, mergers of regional water authorities and aggregation of drinking water companies.

The OECD identified a number of regulatory functions for water services that can be discharged by different authorities at different levels (see OECD, forthcoming). These include tariff setting, enforcement of quality standards (drinking water, wastewater treatment discharge), public service obligations and performance requirements for operators, data collection from water managers, monitoring and benchmarking performance and taking remedial action in case of non-compliance, overseeing contracts with the private sector, engaging customers on regulatory issues and handling consumer complaints, and managing dispute resolution mechanisms. When analysing these functions, a distinction must be made between the institutional setting, i.e. who should carry out the functions, the modalities to discharge the functions (mandate, internal organisation, independence), and the instruments of regulation, which range from control on entry/licensing, benchmarking, pricing, incentives and sanctions.

At present, the Dutch policy framework for economic regulation relies on three sets of voluntary or obligatory benchmarking monitoring performance, enforcement and compliance. These benchmarks apply to municipalities (urban drainage), drinking water companies (drinking water supply) and regional water authorities (water management system).

Three sets of benchmarking

Monitoring performance, enforcement and compliance can take different forms, and are instrumental to provide baselines for measuring improvements and making comparisons across water managers. It can inform policy makers, those providing investment funds and customers regarding cost effectiveness and efficiency of water management. Consolidating the information base and monitoring framework involves putting in place the appropriate mechanisms to collect information and consolidating key performance indicators agreed on by all.

Table 7.1. **Regulatory instruments for water management in the Netherlands**

Water-related functions	Main Dutch legislation	Examples of implementation tools	Mechanisms for monitoring, supervision and compliance
Flood defence	Water Act (Chapter 2) Water Decree Water Regulation Provincial and regional water authority by-laws	– Infrastructure development and maintenance (dams, dykes, dunes, storage basins, embankments, etc.) – Flood hazard and flood risk assessments	– EU Floods Directive monitoring system (e.g. scoreboard, EU Court of Justice ruling for non-compliance) – Water tests (municipal assessment of risks and costs of flood events in land-use planning) – Supervision of flood safety standards by the Ministry of Infrastructure and the Environment (national waters) and the provinces (regional waters)
Water quantity management and drainage	Water Act Water Decree Water Regulation Provincial and regional water authority by-laws	– Flood standards – Water agreement – Water-level decision – Registration and discharge permit system – Withdrawal, supply and drainage measures – Displacement in shortage periods	EU Water Framework Directive monitoring system (e.g. river basin management plans, progress report, EU Court of Justice ruling for non-compliance, etc.)
Water quality management	Water Act (Chapters 6 and 7) Water Boards Act	– Standard for chemical and ecological status of surface water – Permit and levy system – General rules for specific type of wastewater discharge	– EU Water Framework Directive monitoring system (e.g. river basin management plans, progress report, EU Court of Justice ruling for non-compliance, etc.) – Supervision of standard compliance by the Ministry of Infrastructure and the Environment (national waters) and the provinces (regional waters) – Monitoring of shallow groundwater (application of manure) by the National Institute for Public Health and the Environment – Monitoring of manure policy by the nationwide network *Landelijk Meetnet Effecten Mestbeleid* – Monitoring of deeper groundwater by nationwide network *Landelijk Meetnet Grondwater*
Sewerage and wastewater management	Environmental Protection Act	– General rules for specific type of wastewater discharge – Registration and discharge permit system	– EU Urban Wastewater Treatment Directive monitoring system (e.g. EU Court of Justice ruling for non-compliance) – Benchmark of municipalities (compliance with performance indicators) – Benchmark of regional water authorities (compliance with performance indicators) – Supervisory role of regional water authorities over municipal sewerage and zoning plans
Drinking water supply	Water Supply Act	Drinking water supply plans	Benchmark of drinking water companies (Environmental Impact Index)[1]

Note: 1. Among the performance indicators there is the Environmental Impact Index, developed to quantify the environmental impact of the drinking water industry, in terms of energy consumption, produced residues and their recycling, and land dehydration and its prevention.

The late 1990s saw the development of benchmarking worldwide as a key tool to promote and achieve better performance and service levels in the water sector. Many efforts have been taken internationally to harmonise such initiatives and groups like the European Benchmarking Co-operation and the International Standard Organisation contributed to enhance learning from international best practices and standards.

Following a call for greater transparency and accountability in the water sector, Dutch benchmarking has developed in the last decade. Existing benchmarks differ significantly in terms of number of associated organisations (10 drinking water companies, 24 regional water authorities and 408 municipalities). They also differ with respect to ranking (name and shame), learning and exchange of best practices, and development of key performance indicators. In addition to these benchmarks, the Consumer Association (*Consumentenbond*) also plays an important role in terms of customer interest protection with regard to all aspects related to water and sanitation, especially the quality of services.

Regional water authorities

Every two years a benchmarking of regional water authorities is carried out by the Dutch Association of Regional Water Authorities (UvW, *Unie van Waterschappen*) and presented in two reports: *Waterschapspeil*,[2] covering the overall sector, and *Waterschapsspiegel*,[3] comparing the performance of individual regional water authorities. This information is published online and shared with a wide range of stakeholders. The areas benchmarked relate to key water management functions (see Chapter 1). Selected, and rather limited, information on financing and efficiency gains and on customer satisfaction can also be found. The benchmarking exercise is also an opportunity for regional water authorities to share their experiences, for example in maintaining dykes.

Information provided from the 2012 benchmark on water safety reveals the following:

- 63% of the primary flood defences meet the standards against which they were assessed
- the benchmark documents ledgers laying down the requirements in terms of direction, shape, size and construction, liabilities to maintain and management plans for both primary and regional dykes
- information on muskrat and coypus management (muskrats per kilometre) as well as on disaster/calamity management (budget and fund availability) is available
- data on the costs of the construction and maintenance of dykes per kilometre reveal substantial differences between regional water authorities and are not easily comparable.

Evaluation related to water quantity provides almost no information about the cost efficiency of regional water authorities, but rather focuses on technical dimensions revealing that:

- Seventy-one percent of the relevant area is covered with “up-to-date” water level decisions (less than 10 years old) *vs.* 60% in 2007 and 58% in 2009.
- A large portion of the territory meets the standards for flooding and green-blue services.
- Net costs of the design and maintenance of water systems average EUR 191 per hectare and EUR 9.788 per kilometre of watercourse; these absolute values do not help assess the financial performance. But it is interesting to see that such costs have decreased by 5.4% on average in 7 regional water authorities, while they increased by 9.4% on average in 18 regional water authorities.

For water quality, the evaluation:

- Provides indication on the percentage of water bodies for each regional water authority that meet the standards related to the priority substances, nitrate, phosphate, biology and swimming water quality standards. For the priority substance requirements, it ranges from 100% compliance in the Vallei and Eems to less than 5% in Hollands Noorderkwartier in 2009.
- Shows that regional water authorities in the higher parts of the Netherlands are more dependent on projects of third parties compared to regional water authorities in the lower part of the country,[4] which can sometimes generate delays in regional water authorities' programme of measures.

For wastewater treatment, the benchmark provides technical information related to:

- Processing/taking up obligation performance and purification performance, i.e. the extent to which the main nutrients and waste products are removed – the latter percentage having improved from 84% in 2007 to 87% in 2011.
- Data presented on the costs of wastewater treatment, which is the main expenditure item of regional water authorities, amounting to EUR 1 292 million in 2011 (see Chapter 6).

The benchmark also reports on progress in achieving the efficiency gains requested in the 2011 Administrative Agreement on Water Affairs.

- Regional water authorities reported 61 efficiency trajectories (17 internal, 44 related to external co-operation), mostly in the wastewater chain, followed by tax collection and purchasing.
- The new cost-sharing arrangement induced by the High Water Protection Programme is also a contributing factor (collective realisation).
- Another important area is the 2011 merger of the regional water authorities Zeeuwse Eilanden and the Zeeuws-Vlaanderen resulting in a structural efficiency gain of annually EUR 6.7 million.

The benchmarking of regional water authorities provides information on gross investments per regional water authority, and the percentage to which these investments are covered by subsidies or third parties. In addition, data are presented on the net costs for each policy field; and how regional water authorities finance their assets (own/debt capital), resistance/resilience capacity; tax remissions; and cost of collection (taxes) with details provided per unit and comparable costs. Chapter 6 provides an overview of current expenditures and financial flows in the Dutch water sector, including the aggregate cost of water resources management, total expenditures by public institutions (including regional water authorities) and drinking companies, the distribution of total public expenses, local and regional levy structure, flood risk management costs (mainly incurred by the central government) and water quantity management costs, almost entirely borne by regional water authorities (EUR 992 million, about 90%).

Data produced on customer satisfaction suggests that:

- 72% of the general complaints are dealt with in time versus 93% in 2009
- each regional water authority received on average 7 787 notices of objections related to tax assessments (ranging from 691 to 76 006)
- 92% of all notices of objections were handled within six weeks in 2011.

Environmentally friendly indicators related to corporate responsibility suggest that 87% of regional water authorities' energy consumption was green in 2011; 25% of which was produced by the regional water authorities themselves. Data is also gathered on innovation and the use of environmental criteria when purchasing products and services, integrity and international co-operation.

Drinking water companies

In accordance with the 2009 Drinking Water Act, the Ministry of Infrastructure and the Environment is responsible for benchmarking. It can also delegate this responsibility to another party, e.g. Vewin, the Association of Drinking Water Companies. The Drinking Water Act does not, however, specify how the mandatory benchmarking is to be executed or what the frequency or the indicators should be.

The benchmarking of the drinking water industry is compulsory and carried out every three years. It aims to provide greater transparency on the performance of drinking water companies to all interested parties – including supervisory directors and shareholders (municipalities, provinces) – and to provide insight as to how the industry can further improve performance and processes.[5]

The information provided in this section is based on the fifth benchmark available "Reflections on Performance 2009".[6]

The benchmark compares the performance of drinking water companies in terms of water quality, service, environment, as well as finance and efficiency.

In terms of drinking water quality, companies complied with legal drinking water quality standards; and this, despite existing water quality problems in rivers.

Ninety-one percent of the customers surveyed are satisfied with the price-quality ratio of drinking water, and 96% have no particular complaint on the taste of the drinking water.

Service continuity is well ensured, although disruptions (7:35 minutes per year in 2009) increased by 32% compared to the previous benchmarking period; and interruptions for scheduled maintenance (9:24 minutes per year per connection) increased by 19%.

Regarding environmental performance, the total energy use per cubic metre of drinking water produced has increased by 11% since 1997, partly due to the softening process and new treatment measures.

Evaluation of the finance and efficiency of drinking water companies has shown that since 1997, the total costs of drinking water have decreased by 2.4% per administrative connection and increased by 14.8% per cubic metre supplied. Water companies are faced with various cost-increasing taxes up to EUR 22 per connection on average. Of these taxes, the groundwater tax has the greatest effect on total tax costs. Other cost-increasing taxes include provincial groundwater levies and distribution refunds. A substantial spread exists between water companies with regard to the amount paid in taxes. The average costs of capital have decreased since 1997 by 45% from EUR 44 to EUR 24 per connection. Average operational costs have increased by EUR 11 since 1997.

Several studies suggest that the benchmarking system in the Dutch drinking water sector has led to improvements in the cost performance and reduced output prices. A study by De Witte and Marques (2010) that compared efficiency improvements in the drinking water sector in five countries showed a positive impact on sector performance of clear and institutionalised incentive systems such as yardstick competition and benchmarking. The Dutch water companies showed the highest efficiency levels (with an improvement of 21% between 1997 and 2005) and thereby outperformed their sister companies in Australia and England that have institutionalised incentive systems. These good results were partly attributed to the institutional framework supporting the functioning of public limited companies: autonomy of the managing director, financial responsibility for losses caused, transparency and accountability in the conduction of operations, and representation of consumers' interests through locally elected bodies (Blokland and Schwartz, 1999).

Municipalities

The municipal benchmark covers urban drainage and sewer system management and is carried out every three years. It also provides a basis to exchange experience between municipalities to enhance their service levels through "bench-learning" as all municipalities have been given full access to the complete benchmark database containing source data, indicators and a user-friendly web-based application for self-assessment.[7]

The 2010 Urban Drainage Benchmark included, for the first time, all municipalities (430 at the time versus 408 today).[8] It was composed of an overall sector report (Riolering in beeld, 2010); 430 municipal reports – each comparing their individual performance with the national average and selected reference groups with similar population, degree of urbanisation, soil type or average age of sewer systems; and a digital database.[9]

The municipal benchmark starts by evaluating the state of the sewer system, i.e. the connection rate (99.8%), the length of sewer mains per type (combined or separated), the year of construction, the number of sewer overflows, the number of pumping stations, the length of high pressure tubes and mechanical sewage, and drainage.

For management, data is provided on the number of full-time equivalents in the sector, planning, co-operation, reparation and the management of surface waters in urban areas.

The evaluation also takes into consideration the effect and impact of the activities related to the sewage system on the general public and society at large, including the protection of public health (for instance, only three municipalities received complaints related to public health).

On municipal finances for sewer management, the latest data available show a total cost of EUR 1.07 billion. Together, municipalities saved EUR 1 350 million for the purpose of the sewer system, less than 2% of the total replacement value.

Limitations of Dutch benchmarking

This section sheds light on challenges to Dutch water benchmarking and proposes ways forward that improve on the existing system. The suggestions build on international experience to go beyond current self-policing and self-assessing frameworks with the aim to consider independent mechanisms that strengthen existing checks and balance and can challenge the overall performance and cost efficiency of the sector.

Table 7.2. **Benchmarking water services in the Netherlands: Key indicators, functions and institutions**

Water function	Benchmarked institutions	Benchmarking institutions	Latest benchmarking available	Key priority themes	Examples of performance indicators
Drinking water supply	10 water companies	Vewin (Association of Dutch Water Companies)	2009	Quality of drinking water	– Water quality indices per parameter group – Compliance with legal standards
				Quality of service	– Customer score – Telephone accessibility
				Environmental impact	– Energy consumption per cubic metre – Percentage of recycling residues by the water companies – Effort of company to combat dehydration in the context of Natura 2000
				Financial costs and efficiency	– Costs of connection – Costs per cubic metre – Share of the water rate generated by taxation in comparison to previous benchmarking
Wastewater treatment	25 regional water authorities	UvW (Association of Regional Water Authorities)	2010	Quality of treatment	– Nitrogen levels – Phosphate levels – Compliance rate
				Financial efficiency	– Net costs per unit of pollutant
				Treatment plant efficiency	– Volume of water treated
Urban drainage	430 municipalities	RIONED	2009	Physical performance	– Length of sewer main per type – Number of connections – Number of pumping stations
				Economic and financial performance	– Total cost – Operations cost – Investment – Revenues (such as sewer taxes)
				Level of service	– Number of complaints – Number of blockage – Number of pump failures – Average downtime
				Environmental impact	– Status of Combined Sewer Overflow abatement measures
				Personnel	– Number of staff – Contract form
				Operational performance	– Amount of sewer cleaning – Amount of sewer inspection – Amount of renovation – Amount of replacement – Number of repairs

Sources: Oosterom, G.E. and J.G. Langeveld (2011), *Dutch Urban Drainage Benchmarking: From a Reflection of Today's Status to a Driving Force for Future Development of the Sector*, RIONED Foundation Publishing, Ede, Netherlands; Vewin (2010), *Reflections on Performance 2009: Benchmarking in the Dutch Drinking Water Industry*, Association of Dutch Water Companies, Rijswijk, Netherlands; RIONED Foundation (2010), *Benchmark Urban Drainage Management* ("Riolering in beeld" - Benchmark rioleringszorg 2010), RIONED Foundation Publishing, The Hague; UvW (Unie van Waterschappen, Association of Regional Water Authorities) (2010), "Reflecting on regional water authorities" ("Waterschapsspiegel, 2010"), Association of Regional Water Authorities, The Hague.

It should be noted that benchmarking does not document opportunity costs, i.e. the benefits that could have derived from taking an alternative action. For example, benchmarking can help assess if an investment was managed in an effective way. It does not help to assess whether that investment was required; other checks and balance are needed for that purpose. Similarly, while water supply companies and regional water authorities are committed to gain efficiency, it is not clear how the efficiency gains reflect the actual potential or contribute to a specific policy objective. This can raise challenges in a system where earmarked revenues generate a risk of over-investment, which may happen despite the oversight of decentralised assemblies and shareholders pushing for the minimisation of costs and taxes. Scrutiny is particularly needed because of trends in consolidation of service providers in the last 50 years and the reduced number of players, which both increase risks of information asymmetry and monopolistic behaviour.

Regional water authorities

From the information available online[10] regarding the performance of regional water authorities, it would appear that:

- benchmarks pay more attention to technical performance rather than efficiency of operations; in particular the cost of achieving goals that are set
- little information can be accessed on the balance between overhead and administrative costs, and the costs of technical operations
- few metrics were presented that would enable a reader to determine whether, for instance, unit wastewater treatment costs varied significantly between regional water authorities or how such costs compared with other jurisdictions.

In the absence of such information, assessing the overall cost efficiency (therefore performance) of regional water authorities is a difficult task. Incentives for greater transparency and disclosure of all relevant costs should therefore be set up.

Drinking water companies

The trends towards consolidation of drinking water companies in recent years (from more than 200 to 10 today)[11] has exacerbated, if not generated, a number of challenges, raising the question of "independent oversight" to minimise risks of monopolistic behaviour:

- The decreased number of reference observations in the benchmark likely reduces the potential effectiveness of benchmarking in identifying under performance.
- The lack of a third-party involvement in service quality performance assessment or monitoring is all the more challenging when there is a reduced number of players with higher risks of monopolistic behaviour.
- The information and capacity asymmetry between companies and their shareholders to understand common assessments related to the annual approved investment packages and criteria for decision making can be a challenge.
- Investments considered as "technically essential" by companies may not be understood (or further investigated) by their public shareholders. In such cases, an independent authority that would carry out the benchmark exercise and use results to set tariffs may help to avoid the vicious circles of under-investment or expensive technological or infrastructure options, and achieve better water demand management and more environmentally friendly innovations.

In this context, drinking water companies' shareholders (provinces and municipalities) should reflect more on service providers' actual effectiveness to better safeguard public interests, and need independent information and monitoring mechanisms to do so.

Municipalities

The role of municipalities in the delivery of urban drainage and sewer system management can be a source of intersectoral complementarities if well-co-ordinated with urban planning on the one hand, and wastewater treatment on the other hand. Assessing these synergies requires taking account of the following observations:

- At present, the benchmark does not provide sufficient operational information to help sewer managers improve cost effectiveness, but primarily on options for cost reduction and to a minor extent efficiency.
- Current indicators therefore need to be taken to the next level in order to challenge the sector to focus on the service level provided rather than the efforts taken.
- With the improvement of the overall cost effectiveness of the Dutch urban drainage sector as one of the main future objectives of the benchmark, it is clear that the set of indicators needs to be updated to also provide more information on output and outcome.
- The main difficulty is that the required output and outcome are not regularly defined nationally like in the drinking water and wastewater sectors.

The main challenge to overcoming this aspect has, until recently, been the lack of continuous data with a sufficient temporal and spatial coverage and large differences between individual municipalities.

Given these challenges, the development of new key performance indicators for urban drainage (a project is ongoing between STOWA and RIONED and a joint report will be published in 2014) will require time and capacity to collect relevant data, which may be difficult given asymmetries across municipalities. In such a situation, performance measurement by an independent third party can be considered, drawing lessons from international best practice in benchmarking (Box 7.1).

Drawing lessons from the existing experience of established regulatory bodies in the water sector and other infrastructure sectors can help the Netherlands to bridge gaps in the current self-assessing policy in terms of producing and disclosing to the public independent information on financial performance and costs. This could be addressed by a third-party mechanism, with roles and functions that could be adjusted according to the expected objectives (e.g. a national observatory, a committee, a regulator). The development of a specific regulator has been debated in the past in the Netherlands, motivated especially by the positive impact of the regulatory agency for the energy sector ("DTe"), which has improved economic efficiency in the sector.

OECD countries regulate the dimensions of water services (the network, quality, service delivery, pricing, etc.) in different ways and at different levels (Figure 7.1). One recent trend, the development of dedicated regulatory bodies for water services, seems to stand out across countries as a consistent response to some of the pitfalls of regulatory frameworks for water services (including the severe fragmentation of roles and responsibilities in the sector). On the whole, dedicated water regulators remain at earlier stages of development (Chile, Italy, Portugal, United Kingdom, etc.) than in other sectors, and a number of countries are still considering the modalities of their establishment.

Box 7.1. **Benchmarking water services: Experience in the United Kingdom and Portugal**

In the United Kingdom, governance reforms instituted in the water sector, in particular the creation of three sets of independent regulators (OFWAT, Drinking Water Inspectorate, and the Environment Agency) has contributed towards the progress achieved in the water sector.

Concerning the quality of service, OFWAT (the Office of Water Services – Regulation Authority) was established to oversee the economic regulation of the water companies and to ensure efficient delivery and good customer service. OFWAT monitors and evaluates the services provided by the companies to customers. Each company is required to publish a range of information about their performance, including aspects related to inadequate pressure, interruptions, restriction on use, flooding, contacts concerning billing, written complaints, measured billing and the ease of telephone contact. Information is published in an annual report comprising the levels of service practiced and made public to show customers and other stakeholders how their companies are performing, and to assist OFWAT in determining whether there are any risks to customers. OFWAT has progressively refined its approach to regulating and reporting: currently, it uses four key performance indicators (KPIs) and a range of sub-indicators to assess and make public water companies' performance:

- customer service
- environmental impact
- reliability and availability (which includes an assessment of the company's asset condition)
- financial performance.

Since privatisation, the water companies have developed business plans at five-year intervals, which set out their proposals for maintaining the asset base, delivering capital investment to support growth and environmental obligations, and to secure water supplies in a sustainable way. OFWAT scrutinises these plans in order to challenge companies' assumptions on costs and to assess the level of customer support, and then sets price limits for each company. This scrutiny has resulted in water bills being 30% lower than they would otherwise have been, and has created an industry which is viewed as a secure investment. Over time, companies have become increasingly financed by debt, and the regulatory framework has helped to ensure that they can borrow at relatively low rates. In the absence of any real competition, the companies have effectively acted as monopolies. In order to compensate for this, OFWAT has used comparative assessments in order to challenge companies on their costs and levels of service.

In Portugal, ERSAR (the regulatory authority for water and waste services), the national independent authority, was created to perform economic and quality regulation of the service of more than 500 companies, including from solid waste management. ERSAR's benchmarking of water utilities' performance follows a set of indicators related to drinking water supply and urban wastewater management divided into three groups:

- protection of users' interests: mainly the degree of access and the quality of the service provided
- operator's technical and economic sustainability: to assess their legitimate interests, concerning economic and financial, infrastructural, operational and human resources
- environmental sustainability to assess the protection level of environmental issues related with operators' activities.

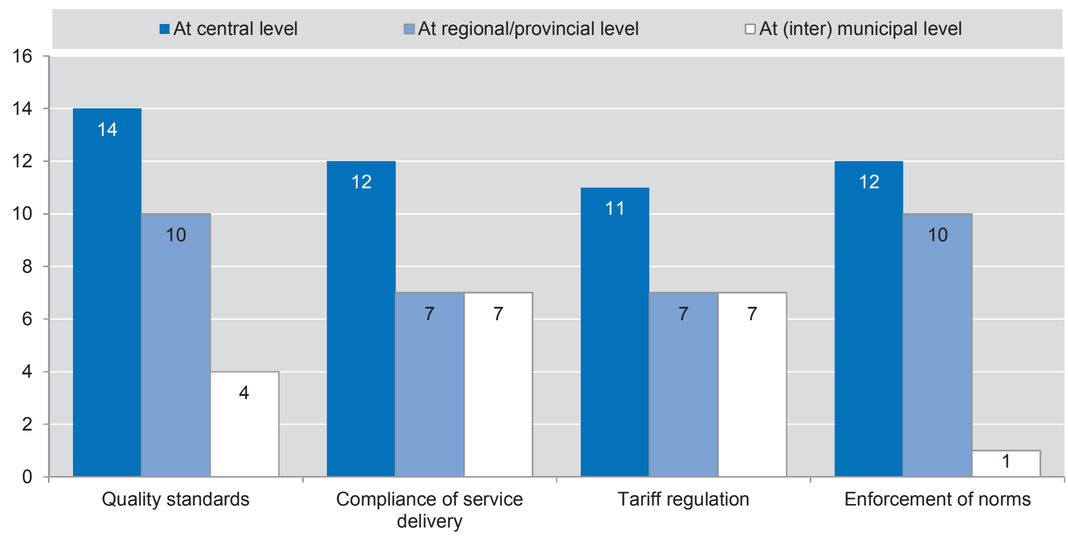
This assessment is carried out annually and results are published in the *Annual Report on Water and Waste Services in Portugal* (RASARP). Since 2007, and in partnership with the newspaper *Água&Ambiente*, ERSAR annually rewards the most distinguishable Portuguese operators with the Water and Waste Service Quality Awards. The main goal of this initiative is to identify, reward and publicly disclose the operators which distinguish from others.

Sources: Contribution from Ian Barker, Head of Water, Land and Biodiversity at UK Environment Agency; and Marques, R.C. (2010), *Regulation of Water and Wastewater Services: An International Comparison*, IWA Publishing, London; ERSAR official website: www.ersar.pt (accessed in December 2013).

Where they exist in OECD countries, water regulators play an important role in achieving good regulatory and policy outcomes. However, they are only one entity in the complex regulatory and policy framework for urban water services. Other public and non-governmental agencies play important roles that bear on the regulator's activities, including various ministries (e.g. Health, Local Housing, Environment, etc.); the legislature; sub-national authorities (state governments, municipalities, etc.) and interest groups (e.g. consumer advocacy groups). The effectiveness of the regulator is therefore contingent on its ability to define its position in the institutional landscape and to co-ordinate its efforts with other relevant entities.

Figure 7.1. **Allocation of regulatory functions for water services across levels of government**

17 OECD countries surveyed



Source: OECD (2011), *Water Governance in OECD Countries: A Multi-Level Approach*, OECD Studies on Water, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264119284-en.

However, a centralised approach to economic regulation of water services does not always work well, and a good regulatory process should incorporate country-specific considerations. For instance, OFWAT is viewed internationally as a model of independent regulation, but the framework conditions are important. In England and Wales, the political, economic and social context allows for the government, administrators, regulators and civil society to share values on sector policy model and therefore for a regulatory authority like OFWAT to regulate without direct political intervention. Therefore, as relevant as the OFWAT model can be to some countries, it is not automatically replicable. Debates about OFWAT's capacity to provide the right incentives and means for adequate investment in water supply and sanitation indicate how complex economic regulation of the sector can be.

OFWAT contributions to economic regulation in the United Kingdom need to be considered in the light of other independent regulators' roles in the sector, which also have an influence on water companies. In particular, the UK Environment Agency provides guidance and oversees water companies' plans for ensuring security of supply over a 25-year horizon, and also their approach to drought contingency planning. This long-term structured approach to water planning has driven increasing efficiency of use and greater connection between the separate companies in order to make more efficient use of resources. The Environment Agency also oversees the environmental performance of the water companies; in particular, their compliance with discharge permits standards and their approach to serious pollution from sewerage infrastructure. This independent regulation has driven a reduction in the number of serious pollution incidents from 522 in 1995 to 67 in 2012. The Environment Agency takes enforcement action where necessary, as it does with any polluter. Through a process of annual performance reviews and challenge, the Environment Agency also provides each company with information about its performance relative to other companies against a range of criteria including pollution incidents, compliance with permits standards, self-reporting of incidents (it is a good indication of whether a company understands its assets if it can report a pollution incident to the Environment Agency before a member of the public does) and delivery of its programme for environmental improvement.

Another example of "oversight" mechanism used for regulating water services can take the form of a national observatory. In France for example, the Observatory for Water Supply and Sanitation set up in 2008 has become a valuable tool for monitoring and benchmark in the context of a highly fragmented sector with more than 35 000 water supply and sanitation service providers across the country. This public online platform provides users and civil society access to water tariffs and service quality indicators produced under a common methodology (SISPEA). They address both the characteristics and the performance of services, and were developed and standardised by a task force of public and private experts and representatives from the water sector. This national database updated by local authorities and validated by state services under the umbrella of ONEMA, aims to inform the public, feed discussions, enhance knowledge sharing and promote progress among services. The observatory also provides access to all relevant legislation related to the water sector, as well as to annual national overviews of the overall performance of service providers with detailed maps and tables updated in real time.[12]

The right combination of instruments and institutions for economic regulation varies from country to country. There is no "one-size-fits-all" regulatory model to water services, but rather context-dependent policies building on the existing wide range of options and modalities for discharging key functions, and ensuring sufficient oversight to be able to challenge the performance of the system.

Conclusions and ways forward

Benchmarking of Dutch water services, which initially originated from a voluntary approach, is a **valuable instrument to collect and disclose performance data**, and should continue providing insights into how regional water authorities, drinking water companies and municipalities perform in carrying out their tasks. Their frequency depends on: *i)* the effort required to carry them out; and *ii)* the time needed to implement improvement measures. One could argue that more regular updates (e.g. every year) could significantly contribute to improved transparency and accountability.

However, **important information gaps** exist and hinder the actual assessment of the cost efficiency and overall performance of the Dutch water system. Amongst others, it is worth noticing that:

- Regional water authorities' benchmarking pays **more attention to technical performance rather than efficiency of operations**; in particular the cost of achieving goals that are set. It provides little information on the **balance between overhead and administrative costs** and the costs of technical operations, and it presents only few metrics that would enable a reader to determine whether, for instance, unit **wastewater treatment costs** varied significantly between regional water authorities, and even fewer data on how such costs compared with other jurisdictions.

- Drinking water companies' benchmarking has gone through a decreased number of reference observations (in parallel to the aggregation of companies), which likely reduces the potential **effectiveness in identifying under performance**, and provides little insight for shareholders to understand and **assess the relevance of investment** choices.
- Municipalities' benchmarking does not provide sufficient **operational information** and information on **costs and financial implications** of day-to-day management, to help sewer managers to improve cost effectiveness and focuses on the efforts taken rather than **assessing output and outcome**; and suffers from the lack of continuous monitoring data with a **sufficient temporal and spatial coverage** as well as large differences between individual municipalities.

Another striking fact of the Dutch regulatory model is the **absolute lack of a third-party institution or independent mechanism** for monitoring overall performance and compliance.

- Dutch **water governance relies on a system of many checks and balances**, which include decentralised assemblies of regional water authorities, oversight of provinces, shareholders and drinking water companies (municipalities and provinces), the Inspector General, the Authority of Consumers and Markets, the minister, and both Houses of Representatives. Extensive reporting on quality, performance and financial obligations of water, sewage collection, wastewater treatment services is ensured through voluntary (municipalities, regional water authorities) and mandatory (drinking water companies) benchmarking. These checks and balances are instrumental to contribute to safeguarding the public interest, but **insufficient to ensure an independent performance measurement**, at an arm's length from service providers.
- There is an **important gap in terms of transparency on water-related expenditures** across authorities, which undermines the incentives for financial performance and cost efficiency. While benchmarking systems exist, they are generally self-regulating and reporting to external authorities occurs at an aggregated level. Improved transparency could improve the current system by generating pressure to resolve potential issues in a timely way.

Strengthening independent accountability mechanisms for more transparent information and performance monitoring can contribute to bridge multi-level governance gaps in terms of cost efficiency and financial performance, accountability and stakeholders' awareness. A range of options can be considered, some of which can preserve the distinctive benefits of the Dutch "polder approach". All do not necessarily have to be adopted at once. Sequencing and customisation is required, depending on the "regulatory functions" at stake. The following suggestions can help address issues related to tariff regulation, incentives for efficient investment, customer engagement, financial accounts and supervision of utilities.

- Ensure that decisions with significant infrastructural and economic consequences are shielded from short-term political considerations and not captured by specific interests. Such **independent oversight**, at an arm's length from water institutions, can address the current absence of a third-party mechanism. It can be organised in different ways (e.g. national observatory or committee, a regulator, etc.). It could focus on opportunity costs, assess financial performance and make sure data produced is guiding policy and operational decisions.

- Facilitate **stakeholders' access to independent information on water costs, risks and performance**. Shedding light and greater transparency on dispersed, embedded and accepted costs can help bridge the awareness gap, improve accountability and bring higher visibility (to end-users) on performance. This can take different forms, including strengthened prerogatives for the legislator, independent monitoring and evaluation (at an arm's length from water institutions) beyond existing self-assessment. Non-governmental organisations (NGOs) and academia could contribute, be it only to reflect the interests of the "unheard voices" (such as the environment).
- Provide and oversee a **harmonised accounting** of expenditure for water management across water management functions in order to improve transparency in **tracking water management expenditures and cost recovery**. An independent review, commissioned by and reporting to ministers, could help shed better light on relative and absolute efficiency, accountability and oversight for the full breadth of water services.

When thinking of solutions ahead, some principles need to be taken into account:

- Data produced (e.g. through benchmarking) needs to be consistent with those required by **legal frameworks**, and actually used to guide decision making regularly assessed.
- Basic **regulatory functions** need to be clearly spelled out and allocated to avoid overlaps, grey areas, gaps and incoherence. For example, at present, there is no clarity as to how benchmarking information helps regulate tariffs and set incentives for efficient use and investment.
- All regulatory functions do not necessarily have to be in the hands of one single institution but can be discharged by different authorities, within and outside the government, and at different territorial scales. When **regulators** are created, they are one entity in the complex regulatory and policy framework for urban water services. Their effectiveness is therefore contingent on their ability to define their position in the institutional landscape and to co-ordinate their efforts with other relevant entities.

International experience shows a wide **variety of context-dependent arrangements** and legal instruments that can provide interesting lessons; whatever the combination of instruments and type of institutions for economic regulation, a key question is whether it is working properly and efficiently.

Framework conditions for effective (economic and environmental) regulation are also needed:

- Transparency provides opportunities during all phases of the policy cycle to "measure" each other's performance, draw lessons and adjust implementation accordingly. Public disclosure of data underlying benchmarks should thus be encouraged.

- Trust between institutions is also important, as well as opportunities for sharing interests, working methods and plans and expectations (even informally), are important in order for regional water authorities, municipalities, provinces and drinking water companies to "speak the same language".

Building on the "Polder Model" for effective stakeholder engagement

The Dutch civic culture relies on a process of reaching consensus that is the very essence of how to get big, bold, ambitious things done through a particular way of decision making. The so-called "Dutch polder approach" is centuries old and has proven crucial to build dykes, drain swamps and create land out of water in a country mostly located below sea level.

However, the policy dialogue revealed some concerns about the appropriateness of the "Polder Model" in leading to effective decisions in sensitive fields such as water quality, compliance with (flood and other) standards, as well as land use. Indeed, this culture of voluntary agreements and consensus building, which is very much in line with the call for water policies to go beyond "command and control", can, in some cases, slow down and paralyse decision making because of lengthy processes, and requires relentless practical co-operation to override conflicting interests, overcome differences and take action when all have been heard. In addition, the risk of "capture" can also be a challenge, due to the very vocal nature of some interest groups while other, equally legitimate, are unheard.

The discussion on the effectiveness of stakeholder engagement in the Netherlands implies a closer look at how the basic elements and modalities of participation across water management functions – from information, to consultation, consensus building, co-production of policies and co-implementation – have been carried out thus far, but also lost in some cases. This goes with the changing and expansion of some functions (across the water chain, over time) and the very same evolution of institutional arrangements and the main actors fostering stakeholder engagement including, but not only, regional water authorities as the traditional platforms for public participation. The key underlying issue is the connection between good governance and governability, meaning the importance of looking at the system to be governed, its governing system and their governance interactions.

Stakeholders are herein defined as persons or groups who are directly or indirectly affected by water policy, as well as those who may have interests in it and/or have the ability to influence its outcome – either positively or negatively – and want to engage. They may include civil society organisations and groups with special interests, including locally affected communities (e.g. indigenous peoples, women's groups, youth) or individuals and their formal and informal representatives, national or local government authorities, elected representatives, regulators, agencies, civil society organisations , end users, the academic community, utilities and other businesses and non-state actors/non-governmental organisations.

The following sections provide insights on the (historical, economic and social) origins of Dutch polder approach, its evolution following the Water Framework Directive and the institutionalisation of major stakeholder groups in water institutions' governance (regional water authorities, the National Water Authority, drinking water companies, municipalities, end users, NGOs, etc.). Examples are also provided from international experience on how to explore the forces-counter forces to deliver water management functions effectively.

Origins of the Dutch "Polder Model"

In practice, the origins of the "Polder Model" [13] go back to farmers' way of building consensus to protect their interests back in the medieval period. But it really gained international reputation in the late 1980s as an example of successful and consensus-based economic and social policy making that allowed to create jobs, minimise unemployment and reduce public debt through "tripartite co-operation" between employers' associations, national labour unions and the central government.

The Treaty of Wassenaar, signed in 1982 at the height of a severe economic crisis, between business, trade unions and central government is generally considered as the start of this unique socio-economic consensus system (Schreuder, 2001; van Steen and Pellenbarg, 2012). The treaty encompassed a wide range of measures to address the critical economic problems of the times, including the willingness of the labour unions to lower wage demands as long as large-scale unemployment prevailed, together with the promise of the business community not to lay off more employees than absolutely necessary. In turn, the central government agreed to maintain the effective safety net and to conduct a policy of strict fiscal austerity. This mode of co-operation was later embodied in the Social Economic Council, a public body with seats for employers, labour unions and independent members, serving as an advisory platform for consensus building on socio-economic issues.[14]

In the 1990s, the Polder Model was criticised and even declared bankrupt (Hendriks, 2010) because of frequent tensions between central government's corporatist strategy and social partners' competitive self-interested behaviour, all exacerbated by macroeconomic circumstances and exogenous factors structuring the behaviour of actors involved as well as the related performance.

The Social Agreement concluded between business, trade unions and the government on 11 April 2013 (in the midst of an economic crisis) somewhat revived the Polder Model to agree on less stringent reforms to social security and labour markets than those intended by the coalition agreement, as well as short-term measures to stimulate economic recovery. In addition, the agreement postpones, or depending on short-term economic growth even withdraws, planned additional austerity measures needed to lower the country's budget deficit.

Key actors of the Polder Model in Dutch water management

Dutch water management relies on multi-stakeholder co-ordination and co-operation, including a variety of interest groups, organisations and policy areas in decision-making processes. Consultation and co-operation with different levels of governmental bodies, private sector and not-for-profit organisations is key to set converging targets in a highly fragmented sector. Traditional vehicles of stakeholder engagement (developed below) have been: regional water authorities, the National Water Authority (technical arm of the Ministry of Infrastructure and the Environment) as well as the Water Framework Directive provisions on public participation. The recent contribution of "policy entrepreneurs" to foster individual change also deserves particular attention as a form of stakeholder engagement.

Regional water authorities: A long-standing facilitator of stakeholder engagement

The tradition of consensus building and co-operation towards common goals, especially during crises, is also often associated to the country's history of water management. The word "polder" originally refers to these low-lying areas of (reconquered) land protected from flooding through dykes and dams. The first "polders" were realised by placing windmills on the dykes of the polder that would pump water from the polder into a canal. At low tide, excess water would find its way out to the sea, and at high tide, a system of sluices and locks prevented water from re-entering (Schreuder, 2001). Over time, the Dutch reclaimed as much as 520 000 hectares of land, resulting in about 4 000 polders nowadays (most of them situated below sea level).

Back in the 12th century, "water boards" (known today as regional water authorities) were small organisations with relatively few tasks, whose constituencies were mainly farmers. Since then, they have turned into relatively big and highly professional organisations with various tasks representing diverse interests. They have also moved from predominantly focusing on drainage to develop agricultural land towards a more integral water management approach, whereby groundwater, surface water, and quantity and quality issues are viewed in their mutual inter-relationships, and whereby ecological considerations are more and more appreciated.

Nowadays, the governing bodies of regional water authorities consist of a general assembly, an executive assembly and a chairperson (at the same hierarchical level as a mayor), who is appointed by the Monarch, hence a relatively independent position *vis-à-vis* the governing board. Through a rather complicated and fast-evolving combined system of direct and indirect elections, and in accordance with the interest-pay-say triplet, the regional water authority assembly consists of representatives of the so-called general task interests (the residents) as well as of representatives of the so-called specific task interests (farmers, companies, and managers of forests and nature reserves) who bear a substantial part of the costs (Havekes et al., 2004; Lazaroms and Poos, 2004). In addition to this formal representation of stakeholders within the general assembly, regional water authorities involve stakeholders in local project implementation.

Originally, (functional) "water boards" and general government worked closely together. Local water management was the responsibility of the local land-owners, supervised by the government of the local community. The construction and maintenance of regional infrastructure was the joint responsibility of the concerned local communities, supervised by the regional water board, in which the local communities had a big say. After 1798, functional water management and general government were increasingly separated. Municipalities were introduced and often began to take on new water management functions, such as supply of clean water and drainage of wastewater from towns. Provincial supervision over the water boards became, in parallel, more intense.

Regional water authorities have gone through an extensive consolidation in recent years, achieved mostly on a voluntary basis. In 1953, there were 2 544 water boards, many of which were tinier than (the then approximately 1 000) municipalities. That same year, a combination of high tide and a strong storm raised the water level in the southwest of the Netherlands to a level 0.57 metres higher than the highest level previously recorded. An area of 200 000 hectares was flooded, and 1 836 people drowned. The (poor) maintenance of the dykes in the affected area had been the responsibility of mostly very small water boards without much technical expertise and little financial possibilities. A direct consequence was the merger of several water boards in the southwest and other parts of the country (van de Ven, 1993; Greive, 1982).

Concentration was also necessary because the scale and complexity of water management increased. Firstly, dykes of some water boards were also in the interest of inhabitants outside of their area: infrastructure sometimes had the effect of integrating areas that were previously managed separately into one water management unit. More importantly, inter-relations with other policy sectors with ever bigger scales increased. Thirdly, water quality management also required expertise that could not be developed by small water boards, and debates started about the interest of running quantity and quality problems together. The solution chosen was to give the responsibility for water quality management to the provinces, which could delegate the task to existing (bigger) water boards or to newly formed water quality water boards (Greive, 1982; Ijff, 1995). With the "integrated water management" approach calling for a holistic management of water systems (surface and groundwater quality and quantity, banks, waterbed and technical infrastructure) and more attention to nature, further mergers across water institutions took place, resulting in 67 water boards in May 1997 to 24 regional water authorities in 2013.

The role of regional water authorities has long been debated in the Netherlands. Despite the globally laudative assessment of the capacity of the Dutch to sustain their existence close to or below sea level through these historic community-based institutions, recent administrative reforms may jeopardise the future of regional water authorities. The questioning of these functional democracies with specific taxation powers, in a highly centralised fiscal system, led to a proposal in parliament to merge them with the (12) provinces into 5 "national areas" by 2025. Some argue that "general government" (municipalities, provinces, national government) could better balance the different interests involved in water management (e.g. spatial planning, land use, nature conservation, etc.).[15] General government is also seen as functioning more democratically, as municipal, provincial and national governments are elected by all inhabitants within their area. Although regional water authorities' representatives are also elected by all inhabitants (despite the low voter turnout), this form of stakeholder engagement, which follows the interest-pay-say principle and can appoint (a minority) representatives, is sometimes perceived as "less democratic".

But many arguments have also been raised in favour of regional water authorities, building on the principle that water should be managed at the lowest possible level and that those concerned should have a say in it and should pay for it. Furthermore, contrary to municipalities and provinces, the areas of regional water authorities follow the boundaries of water systems. The limited possibilities to balance interests were seen as positive, as the interests served by water management are a precondition for all other interests and are therefore non-negotiable. The vital water management interests should then be served best by specialised water management bodies isolated from politics and its short-term preoccupations.

This acknowledgement of regional water authorities' longstanding contribution to Dutch governance does not mean that the status quo should prevail. As in all sectors, governance needs to adapt to the changing demands of the society. In this perspective, eventual resetting of water-related tasks could be further pursued, where need be with a bottom-up approach allowing for regional differentiation and based on the principles of integrated water resources management and hydrologic boundaries. The fact that regional water authorities are functional democracies (democratic representation in governing bodies) with taxation powers and earmarked revenues derives from their initial focus on flood defence and related water resources management; such a governance system and financing scheme is less adequate to invest in and operate wastewater treatment services. Regional water authorities can retain the wastewater treatment function, if it is managed and financed in a distinctive way, more in line with the needs for such services.

Box 7.2. **Lessons from stakeholder engagement in water resource management in South Africa**

South Africa made legal and policy provisions for extensive stakeholder involvement in water resource management. This was to be achieved principally through the establishment of catchment management agencies that would actively engage stakeholders to undertake a range of water resource management functions delegated to them and overseen by the national government.

Concern over the ability to structure institutions to balance social, economic and environmental interests in a highly unequal society, with the (technical and financial) capability to engage in the complex issues and processes inherent in water resource management has resulted in a reluctance to establish the catchment management agencies.

The South African experience suggests that participation is mobilised where there are specific interests at stake and that a range of potential mechanisms will be used to exercise those interests. Thus, in South Africa, there has been significant participation in discussions about the government's medium-term water resource strategy, which is perceived to have impacts on a wide range of interest groups. Similarly, there is extensive participation in operational management of water resource systems where system failure poses serious risks to key users.

Source: Contribution from Mike Muller, peer reviewer of the policy dialogue, based on Muller, Mike (2013), "New strategy highlights value of planning and partnerships", *Business Day*, 12 July, South Africa Department of Water Affairs, National Water Resources Strategy 2nd edition.

Rijkswaterstaat, a vehicle of public participation

Established in 1798, the *Rijkswaterstaat*, a technical arm of the Ministry of Infrastructure and the Environment, frequently considered as a "state within the state" – has unmistakably left its mark on the Netherlands. It has grown into the leading agency for the large-scale construction of flood protection infrastructure and the management of the main highway network, with over the last centuries, hundreds of thousands of hectares of land reclaimed from the water, deep-sea inlets cut off from the sea, reshaped river landscape, and many infrastructural works, including motorways, railways, bridges, tunnels, weirs, locks and storm surge barriers (Lintsen, 2002; van Leussen and Lulofs, 2009).

In recent decades, both the *Rijkswaterstaat's* strong position and working methods, in particular its highly technocratic character, have been challenged in various social and political debates (Enserink et al., 2007; van den Brink, 2009). At the same time, important shifts have taken place within the *Rijkswaterstaat*, with the rise of the environmental movement, together with general processes of democratisation in Dutch society questioning the agency's traditional, predominant civil engineering approach to water management, whereby water issues were usually framed as technical problems (Huitema and Meijerink, 2009). Exemplary for this new consideration of potential ecological impacts of coastal defence has been the decision not to close off the Eastern Scheldt Estuary, part of the Delta Works deemed necessary after the 1953 flood disaster. Contrary to the previous Delta Works projects whereby the protection of the environment was simply disregarded, the closure of the Eastern Scheldt had been controversial from the very beginning (Disco, 2002; Meijerink, 2005; Olsthoorn et al., 2008; Huitema and Meijerink, 2009). The drastic change in the original construction plan of the Eastern Scheldt storm surge barrier, and accordingly the *Rijkswaterstaat* itself, did not occur without striking a blow. Only when local protests transformed into a national debate and a political drama, the construction plan changed in 1974 to a storm surge barrier with moveable panels instead of a closed dam so as to preserve the natural tidal variation (Disco, 2002; van der Brugge et al., 2005).[16] The environmental and economic opposition, and ultimately the ecological turnaround on this storm surge barrier, made that the hydraulic engineers – who had been in control until then – had no choice but to share power. In retrospect, one can conclude that this episode paved the way for biologists, chemists and ecologists to enter first into the *Rijkswaterstaat* (during the construction of the dam the relevant environment department grew quickly to over 100 biologists), and ultimately within the overall field of Dutch water management (Disco, 2002; van der Brugge et al., 2005).

Box 7.3. **Independent Consultative Body for Infrastructure and Environment**

The Dutch Ministry of Infrastructure and the Environment, which defines stakeholder participation and dialogue with society as one of its core values, has recently created (by law) the Dutch Independent Consultative Body for Infrastructure and Environment (OIM),[1] a permanent platform involving stakeholders in policy processes related to a wide range of infrastructural, transport, environmental, space and water themes. It gathers representatives from about 50 organisations, including interest groups, industry associations, business and representatives of the minister.

These OIM meetings (which gathered 55 times in 2011) are led by an independent chairman, who creates a neutral setting in which all participating organisations have an equal position. All views and opinions of the relevant stakeholders are expected to contribute to better and more effective policies, with an increased likelihood of successful implementation (OIM, 2011; 2012).

Note: 1. Before the year 2011, the Dutch Independent Consultative Body for Infrastructure and Environment (OIM) was known as the Water and North Sea Counsel (OIM, 2011).

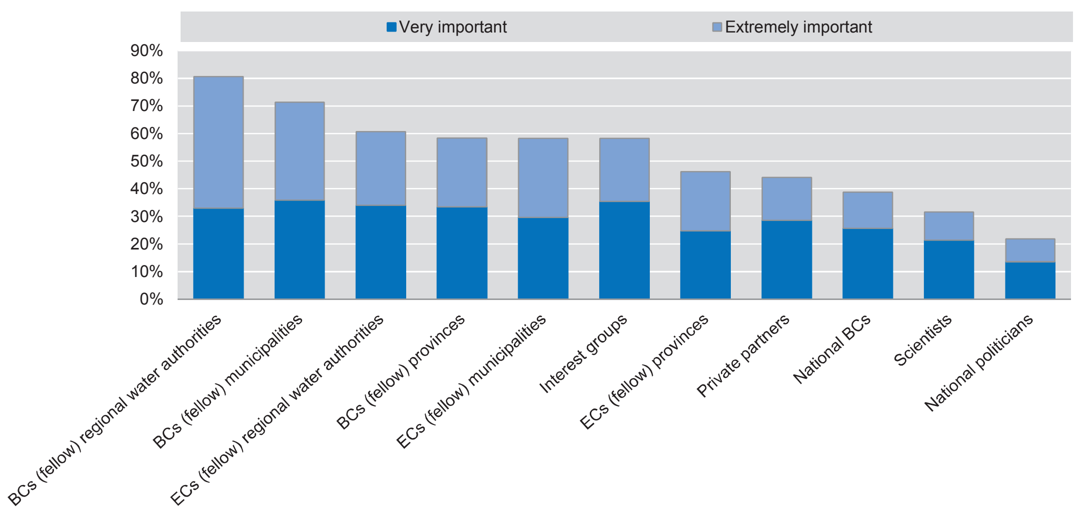
Policy entrepreneurs' contribution to behavioural change

Another angle to assess the effectiveness of Dutch stakeholder engagement is to shift the focus from the "institutional setting" to the "practical everyday" world of "policy entrepreneurs". Policy entrepreneurs are successful managers or risk-taking bureaucrats working within water institutions, who seek to have an influence on policy change. This section assesses the networking activities of these highly talented individual change agents in local Dutch water management and their contribution to better governance.

A recent census study among policy entrepreneurs working within Dutch municipalities, provinces, regional water authorities and the regional services of the *Rijkswaterstaat*, identifies ten different strategies they use for successful implementation of local water projects, including networking (Brouwer, 2013).[17] This strategy, in practice, largely consists of spending time talking with and listening to a broad set of influential and well-positioned actors across the water chain and public authorities. It confirms the idea that water management in the Netherlands is no longer a matter of working in a closed realm of engineering within the relatively autonomous policy domain of water management, but relies more and more on consulting and co-operating intensively with representatives of local, regional and national governmental bodies and, albeit to a lesser degree, other stakeholders (Figure 7.2).

The data presented above show that policy entrepreneurs generally consider it very important to network with a relatively broad set of actors, especially regional water authorities, which they consider as very important (33%) or extremely important (47.6%) interlocutors, followed by municipalities, which 71.3% of policy entrepreneurs surveyed consider very or extremely important. Provincial bureaucrats rank third, with 58.3% of respondents considering them very or extremely important, against 38.8% for national bureaucrats. These figures suggest that governmental actors are still highly important in the way water is managed in the Netherlands, especially given the low importance that policy entrepreneurs attach to networking with private partners and scientists (respectively 44.1% and 31.6% consider this very or extremely important). Networking with interest groups, however, is considered relatively important (58.2% of Dutch water management policy entrepreneurs consider it very or extremely important).

Figure 7.2. **Importance of networking with external partners**



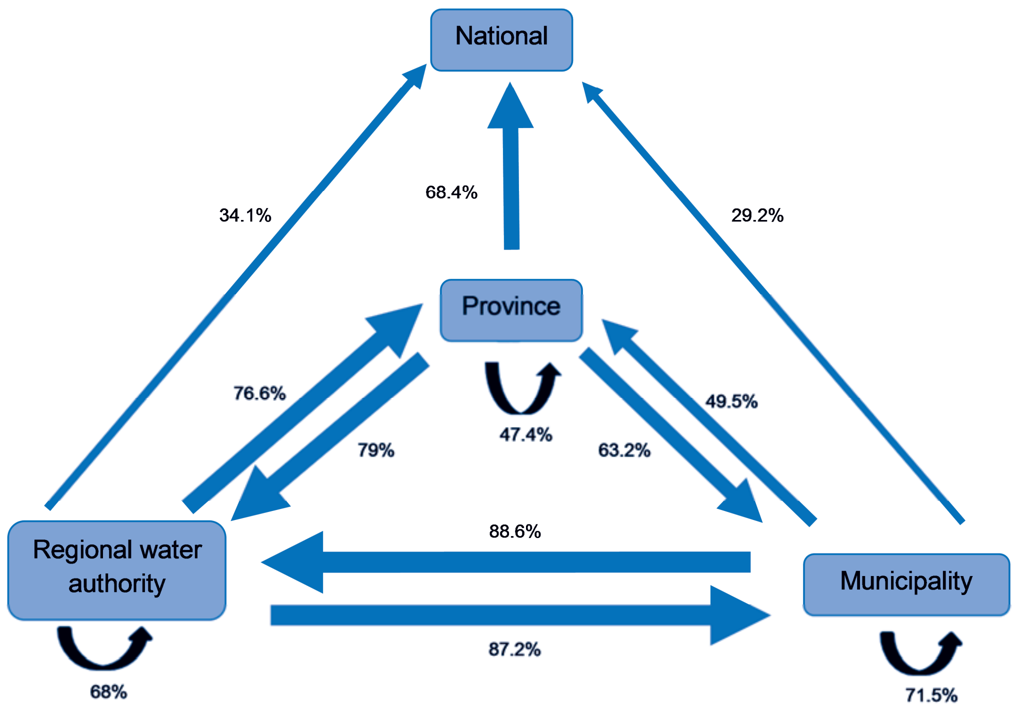
Notes: This figure displays the percentage of policy entrepreneurs that for the realisation of a desired policy change consider networking with bureaucrats (BCs), executives (ECs) and external parties to be very or extremely important.

Source: Brouwer, S. (2013), "Policy entrepreneurs and strategies for change: The case of water management in the Netherlands", PhD dissertation, VU University Amsterdam, Amsterdam.

Despite strong mutual dependencies and multi-level interactions across water institutions (see Chapter 4) networking relationships and priorities between regional water authorities, municipalities, provinces, and the National Water Authority vary. The highest intensive networking relationship is to be found between: *i)* regional water authorities and municipalities; and *ii)* between regional water authorities and provinces. In other words, this means municipal and provincial policy entrepreneurs consider regional water authorities' bureaucrats the most important partners to network with for policy change. Furthermore, over two-thirds (68.4%) of all provincial policy entrepreneurs hold that networking with bureaucrats at the national level is very or extremely important, considerably more than the importance regional water authorities (34.1%) and municipal policy entrepreneurs (29.2%) attach to it.

Policy change is also enhanced through networking with bureaucrats of fellow organisations, essentially between municipalities (71.5%), and between regional water authorities (68%). Only provincial policy entrepreneurs give relatively little weight to networking with their equals in other provinces. Presumably, this variation can be explained by responsibilities and dependencies of these three types of governmental organisations. Whereas regional water authorities and municipalities (despite processes of merging) are relatively small and (also due to their tasks) often have to collaborate with each other, provincial policy entrepreneurs collaborate relatively more with national and local partners than with their fellow provinces.

Figure 7.3. **Networking with bureaucrats**



Notes: The size of the arrows in the future corresponds with the percentage of the policy entrepreneurs who answered "very or extremely important" on the survey to the question "how important do you consider frequently talking with bureaucrats from, respectively, regional water authorities, provinces, municipalities and the national level?".

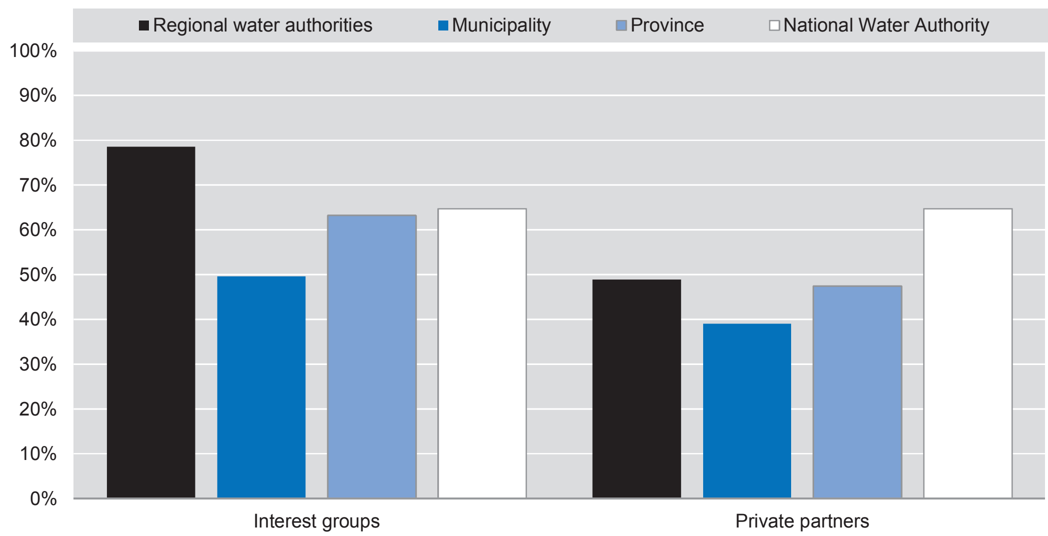
Source: Brouwer, S. (2013), "Policy entrepreneurs and strategies for change: The case of water management in the Netherlands", PhD dissertation, VU University Amsterdam, Amsterdam.

Networking with non-governmental actors and interest groups is considered relatively less important by half of municipal policy entrepreneurs (Figure 7.4). Regional water authorities' policy entrepreneurs (76.6%) are, instead, most in favour of networking with interest groups, which is rather unsurprising given their traditional focus on farmers and, growingly, openness towards environmental organisations (Disco, 2002; Kuks, 2009). Except for *Rijkswaterstaat* policy entrepreneurs, networking with private partners, such as constructors and property developers, is still considered even less important, especially by municipalities.

Stakeholder engagement in local water management projects

This section discusses two individual case studies on local project implementation to assess the impact of stakeholder engagement on decision making. The cases have been selected to illustrate the varying levels of stakeholder participation in local project implementation and differentiated results.[18] The case of the Overdiepse Polder was successful in taking into account stakeholders' views and contains important lessons for participatory plan development. This also holds for the case of Arnemuiden, even if (or especially because) the final result is considered more mitigated.

Figure 7.4. **Perceived importance of networking with non-governmental actors and interest groups**



Source: Brouwer, S. (2013), "Policy entrepreneurs and strategies for change: The case of water management in the Netherlands", PhD dissertation, VU University Amsterdam, Amsterdam

Case 1: Overdiepse Polder

The Overdiepse Polder[19] is a polder in the west of the province of North Brabant, and is enclosed by the south bank of the Bergsche Maas and the Oude Maasje, which both form part of the Meuse River basin. It covers 550 hectares and a floodplain of 180 hectares, and has been suitable for permanent living and agriculture only since the 1970s. In 2003, the polder housed 94 inhabitants and 19 enterprises, mostly dairy farms. In view of the expectation that due to climate change and subsidence the water discharged via the Bergsche Maas (as in many other rivers) will increase during the coming decades, the polder had been designated a potential water storage within the context of the "Room for the Rivers" project, which aimed at enlarging the discharge capacity of the main Dutch rivers by increasing the amount of space for them.

When the residents of the polder – through an article in a regional newspaper – learned that the government considered their polder as one of the options for a flood retention basin, they initially reacted in a defensive way before exploring with the province if they could play an active role in making their own plan for the polder. This would both offer an alternative solution to the problem and protect the residents' interests. It was believed that this proactive and co-operative approach would also more rapidly help to reduce the uncertainty concerning their future living circumstances.

In 2000, the residents worked together with the farmers union, the provinces and water experts to develop their own plan. Despite uncertainty and conflicts about the new roles and the distribution of responsibility between the *Rijkswaterstaat* and the province (it was the first Space for the River project that was delegated to a province), and conflicts between the *Rijkswaterstaat*, the province and the residents (mainly about compensation structures), advanced on the development of an alternative and innovative plan for water storage and living areas on mounds: the so-called "Terp Plan". One important factor to the project's success was the support it received early on from the province of North Brabant.

The core of this plan includes a combination of technical solutions and spatial measures, whereby houses and farms in the polder are relocated to elevated locations. This ensures the agricultural function of the polder, allows the excess water from the Meuse River to flow through the polder, and prepares the polder for temporary water storage in the event of flooding. In addition, the plan could realise the principal project goal to reduce floodwater levels in the Meuse River by 30 centimetres.

The Overdiepse Polder project was not an ordinary Room for the River project from the onset. It was designated as both a demonstration and leading project and was therefore eligible for financial support. The innovative plan was developed with active support from the residents in a way that was compatible with the authorities' policy and gained support from both the administrative and governmental authorities. The participative nature of plan during the development phase helped to speed up project implementation; reconstruction of the polder based on the "Terp Plan" will probably be finalised around 2014 or 2015.

Two factors are considered of key importance when explaining the success of the Overdiepse Polder project. First, was the residents' proactive role in the project's organisation and overall vision for the project. Second, the role and active commitment of the province was instrumental during the course of the project. Especially the provincial firmness, conflict management approach and intermediate role between the national and the local level, proved to be crucial in the planning process. On a more general level, active networking and trust were also successful contributing factors to this local water management project, as well as the fact that it was in line with the government's desire for innovative water projects.

Case 2: Arnemuiden

Arnemuiden is a small town near the city of Middelburg, located in the Zeeland delta in the southwest of the Netherlands, where inhabitants and local stakeholders played an important role in the redevelopment planning process of an adjacent rural area. Whereas governmental parties aimed to initiate a revival of water recreational functions and focused on ambitious housing plans, the local stakeholders and inhabitants of Arnemuiden, who were not involved in developing the plan, preferred to preserve the existing rural character of the area. From the 1990s onwards, all plans proposed by the government faced severe resistance and were successively obstructed leading eventually to a deadlock due to the municipality and the inhabitants positional bargaining (van Schie, 2010; Edelenbos et al., 2011).

The municipality and province persevered with redevelopment of the area needed, and an interactive process (Around Arnemuiden) was set up at the beginning of 2006. The objective of the process was to develop a joint vision for the reorganisation of the area and to create a body of co-produced knowledge through a participatory process involving all relevant governmental and non-governmental parties, including local actors. To this end, the stakeholders were gathered in an advisory group with the task to develop scenarios for reorganising the area. Next to the advisory group, an expert group was established, which included bureaucrats and experts from a variety of disciplines. In the

Around Arnemuiden project, the expert group played a merely reactive role and was only involved in the process after the stakeholders had formulated their first ideas. Aiming to create more room for the stakeholders in developing their views and knowledge, as well as to prevent further domination by expert views, the communication between the stakeholders and bureaucrats/experts was mediated through a process team. This process team included members of both the scientific and bureaucratic organisations that initiated the Around Arnemuiden project (Edelenbos et al., 2011).

Apart from existing policy documents and prior (local) agreements, and despite the fact that the project's aims and limitations were set by the bureaucrats, the project was kept as open as possible. Indeed, contrary to the deadlock situation prior to the start of the process, the stakeholders were actively involved from the start. An important first milestone of the process was the formulation of four "dream" scenarios for the redevelopment of the area by the advisory group, expressing the ideal future, irrespective of formal and technical constraints. After a process of (re)adjustment between the expert and the advisory group, the advisory group presented two scenarios to develop the area in an integral fashion – which the participants found to reflect their values (van Schie, 2010; Edelenbos et al., 2011).

The bureaucrats and experts, however, were less satisfied with both the process and outcome. They considered (their) expert knowledge superior and more legitimate to the input from stakeholders, which "lacked scientific grounds and expertise". In addition, decision makers and politicians were rather sceptical and distanced, which ultimately broke down discussions and resulted in difficult communication between the municipalities and stakeholders. In addition, the advice, at least to a large degree, has been ignored (van Schie, 2010; Edelenbos et al., 2011).

The Arnemuiden case is interesting in relation to the discussion on participation in Dutch water management for a variety of reasons. First, because it shows that when the views (and knowledge) of stakeholders are ignored in the decision-making process that there is a risk that decisions are not considered to be legitimate. This, as demonstrated in this case study, includes the risk that stakeholders use all kind of strategies to postpone or stop decision making. Second, this case shows how difficult it can be for both experts and bureaucrats to appreciate the value and potential of stakeholder knowledge. At the same time, it shows how difficult it can be for stakeholders to trust and recognise the value of expert knowledge and the input of bureaucrats.

This case provides broader lessons, as it shows the importance of:

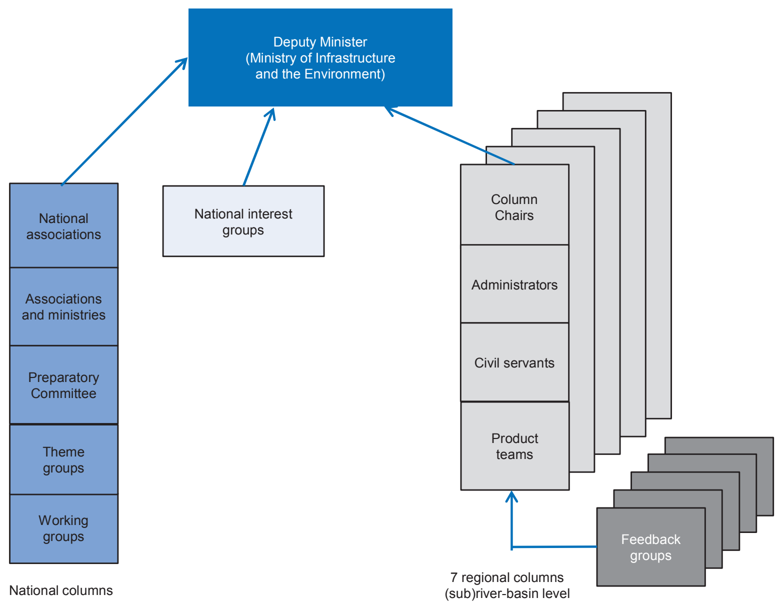
- involving stakeholders in an early stage
- combining the input of stakeholders, experts and bureaucrats to enable co-production
- considering synchronisation of the knowledge of stakeholders, experts and bureaucrats to impact decision making
- allowing stakeholders to recognise their own insights and, accordingly, be in agreement with the result
- anchoring the methods for co-production to the actual decision-making procedures to ensure the legitimacy of the process (the way in which methods are used) and intentions of involved actors.

EU incentives for public participation in Dutch water management

Provisions of the Water Framework Directive

The Water Framework Directive (WFD) was the first piece of legislation in which the European Commission explicitly required its member countries to ensure "mandated public participation" in water management. Its implementation in the Netherlands was assessed positively in the 2012 European Commission evaluation of the WFD stating "Public participation has been carried out very extensively, and stakeholder involvement seems to be of great importance through the entire RBM [river basin management] development process" (European Commission, 2012b).

Figure 7.5. **Simplified overview of the Netherlands' WFD implementation structure**



Source: van der Heijden, J. and E. Ten Heuvelhof (2013), "Coping with mandated public participation: The case of implementing the EU Water Framework Directive in the Netherlands", *Perspectives on European Politics and Society*, Vol. 14, Issue 4, Taylor & Francis – Routledge, http://dx.doi.org/10.1080/15705854.2013.772722

Compliance with the WFD provisions on public participation triggered the preparation of communication supports and awareness campaigns (e.g. Netherlands Live with Water Campaign on flood risk), and enhanced co-operation across municipalities, provinces and interest groups in formulating water quality goals and measures, as well as proactive participation of civil society in regional water authorities. Important efforts are also underway for research institutions, businesses, universities and governments to work together on water-related issues. A set of risk maps on the Internet also contribute to raise awareness, as do social media and the Youth Water Board actions.

The WFD implementation structure in the Netherlands was designed in 2004 in consultation with the relevant stakeholders. It consists of a national and seven regional columns – one for each (sub-)river basin (Figure 7.5).

The national column is the arena where the debates between the minister, the representatives of national associations and ministerial departments take place and where the overall framework for the implementation of the WFD on the (sub-)river basin level is established. The Dutch Independent Consultative Body for Infrastructure and Environment (OWN) was the main participatory institute at the national level, which was organised in parallel with the top of the national column to advise the deputy minister.

Seven regional columns on the (sub-)river basin level were established and governed by administrators in the provinces, regional water authorities and municipalities. These authorities, responsible for organising public participation, established seven "feedback groups" comprised of representatives of both interest groups and landowners, in order to reflect and comment on the river basin management plans.

Individual water boards were also set up to discuss, at a lower scale, regional goals and measures under an advisory status

Benefits and pitfalls of public participation in the EU context

Recent studies have pointed out some limitations of public participation in the EU context (Behagel and van der Arend, 2013; van der Heijden and Ten Heuvelhof, 2013) revealing the overall negative assessment of the public participation exercise related to the implementation of the WFD by all stakeholder groups, except farmers and business. Indeed, major groups involved, including national, regional and local policy makers and government representatives (from ministries, provinces, municipalities and water boards), specific interest group representatives (farmers and environmentalists), and industry stakeholder representatives (drinking water suppliers and land developers) – considered their voice unheard, and perceived the process as a one-way flow of information, rather than true co-operation and shared decision making.

At the beginning, the implementation of the WFD in the Netherlands received little public attention, and was mainly considered to be administrative and government-centred and following a pre-established timeframe. These assumptions of limited effects and impacts changed dramatically at the end of 2003, when a scenario study on the implications of the WFD on agriculture, nature, fishery and recreation, named "Aquarein", was published (van der Bolt et al., 2003). It was commissioned by the Ministry of Agriculture, Nature and Food Quality and provided an expert-based "quick scan" and four scenarios for each sector, one of which was the level of "ambition" ranging from the achievement of "good ecological status" for all waters in 2015 as the lowest and "very good ecological status" as the highest. The scenarios all painted a pessimistic picture for the agricultural sector (the scenario based on the lowest level of ambition predicted that 70% of agricultural land in the Netherlands would have to be taken out of production in order to meet the WFD goals).

This report was followed by animated discussions among actors from the government, civil society, interest groups from agriculture, fishery, recreation, commerce and industry, and environmental NGOs. Environmental groups, such as Natuurmonumenten and SNM became increasingly discontent with how the implementation of the WFD took shape in the Netherlands. They considered that their voice was marginalised by a more hegemonic discourse of agriculture. Their discontent concerned not only the low ambitions that the government set for the implementation of the WFD in terms of allocated resources and goal commitment, but also the expectations that government had of civil society in terms of the role it could play and the deliberative input it could deliver beyond interest representation.

Frustration emanating from nature NGOs has grown in the Netherlands as regards their involvement and influence in water policy making. The Dutch polder approach to decision making foresees that all water policy proposals should be discussed and validated by the regional water authority parliaments, the provincial parliaments and the national parliament. The Dutch legislation provides that two-thirds of the regional water authority's parliamentary seats be attributed through elections, while the remaining third be allocated by provinces to the three main water-related sectors: nature, agriculture and industry.

These nominations are based on the level of interest of each sector, which often results in the over-representation of the agricultural sector. Combined with limited public financial support, this has prevented nature NGOs from effectively taking part in the decision-making process.

The WFD requirements regarding public participation were therefore first seen as a positive sign for NGOs to share their views and concerns. However, this active participation of NGOs has remained limited to information and consultation instead of co-production of decision making. Nature NGOs therefore criticised that the Netherlands missed the opportunity to use the WFD to go beyond the consensus-building effort of the polder approach and thereby weakened the WFD ambitions in the field of stakeholder engagement (Santbergen, 2013).

In addition, apart from the fact that it took stakeholders a great deal of time to get used to the new institutional setting and to build new relationships, it was argued that public participation provisions of the Water Framework Directive simply did not match well with the participants' capacities and resources. As most groups were invited at all three levels, there was a common frustration, shared by the majority, that it was too much, i.e. that there were too many participatory processes. The approach chosen (series of information supply and consultation meetings, feedback groups and area processes) was considered time-consuming since it added a new institutional setting (seven districts) to a more or less unchanged traditional (nation) structure of water policy. This, in combination with the complexity of the WFD, and the fact that many events had to take place in a relatively short period of time, meant that various participants felt overloaded, frustrated and disappointed, to the point of dropping out of the formal participation processes. Instead, they relied on their existing networks and access points in the relevant organisations, such as the regional water authorities and provinces (Behagel and van der Arend, 2013; van der Heijden and Ten Heuvelhof, 2013).

Implementing the WFD requirements on public participation thus raises the question: who is "the public"? The European Commission's requirement for public participation relates to "all interested parties", meaning stakeholders and the public. In practice, however, the involvement of the general public in the implementation of the WFD in the Netherlands was rather missing, mainly because of the Dutch culture of corporatism, a system of interest representation to which the involvement of the public is somewhat foreign (Behagel and van der Arend, 2013; van der Heijden and Ten Heuvelhof, 2013).

In such situations, one may wonder whether mandated public participation strengthens or weakens democracy. To a certain extent, it is considered that the Dutch approach of layering a new institutional setting into an existing traditional one may lead to the danger of over-representation of certain groups. The more these groups or individuals who are actively involved use their voice, the weaker is the unheard voice of those not attending the meetings, whether they fail to attend because they lack interest or because they lack the means to do so (van der Heiden, 2013).

Similar conclusions on public participation in the EU framework can be drawn for France, and most likely, across EU countries. In any case, difficulties with Dutch implementation of Article 14 of the WFD should not be taken as an argument to question existing vehicles for stakeholder engagement, be they regional water authorities, the National Water Authority or other democratic settings. A way forward could consist in modernising the present system of representation in regional water authorities' boards, in the same manner as is (hotly) debated in France, to avoid over-representation of certain categories of stakeholders and to ensure the balance between represented and unheard voices (see section below).

Recent evolutions in Dutch NGOs' involvement in water policy

In the Netherlands, the contribution of NGOs to water-related strategic and decision-making processes has occurred essentially on decentralised assemblies of regional water authorities.[20] Indeed, most civil society organisations and NGOs channel their input through existing umbrella organisations as well as local political parties. Elections to the governing board of the regional water authority (only organised for the category residents) also give some access to NGOs. For example, the green party "Water Natuurlijk" won the elections of 2008 and joined the governing board before the (national) political parties which joined the elections. Therefore, "nature" is represented in two ways within the decentralised assembly: by Water Natuurlijk and by nature reserve authorities. The General Water Board Party (*Algemene Waterschapspartij*) was founded with the specific purpose to form a national party, independent of politics and with expert administrators that can be voted for during regional water authorities' governing boards elections. The party advocates for settlements safe from floods and drinking water in sufficient quantity and adequate quality. It calls upon regional water authorities to make these priorities "inexpensive" in an effort to reduce taxes.[21] Similarly, the "green" Water Natuurlijk is an umbrella organisation gathering mainly environmental and nature NGOs and recreation organisations; it was founded to take part in the regional water authorities' elections.[22] The NGO "3VO" is an association of three women's organisations, mainly from rural areas, which has been very active in supporting women representativity in regional water authorities, especially the 2010 Water seeks Women campaign, which encouraged the participation of women as leaders regarding water management.[23]

The participation of NGOs has been somewhat constrained by significant budget cuts from the central government in support of their activities; even if many are still playing a role (for example in the OIM). This trend has been observed across Europe in the past five years, especially in Italy and Spain. In the Netherlands, in 2012, the government unveiled new development priorities amid a EUR 958 million cut to its development co-operation budget, representing a 17.8% decrease from the 2011 budget. Due to the reduction of the total development co-operation budget, budgets for emergency aid, good governance, and environmental and climate programmes have declined.

United States' experience in public participation

Governmental institutions can create an enabling framework through engagement of local communities and stakeholders in planning and decision making. The United States' Environmental Protection Agency (EPA) has learned that communities must be the driver for local solutions and has implemented numerous programmes that support community empowerment and provide community benefits at all levels, from basic educational and leadership development to comprehensive approaches to achieving healthy, sustainable and green communities. These place-based programmes include financial assistance programmes such as Environmental Justice (seeking the equitable distribution of environmental benefits and burdens), the EPA's Local Climate and Energy, Sustainable Communities and Smart Growth, Urban Waters, River Rallys, Brownfields programmes, and others. The EPA undertakes these programmes in collaboration with other federal agencies, state, tribal and local governments, water utilities, private industries, environmental groups, the media and the general public, and uses innovative policies to raise awareness about priority water-related issues. Multi-stakeholder meetings, conferences and social media postings on Twitter (@epawater), Facebook (EPA-Water Is Worth It) and YouTube are important new ways to communicate with the general public.

Box 7.4. **A spotlight on public participation in action: The Anacostia River, Washington, DC/Maryland**

The Anacostia River's challenges encompass an entire watershed – 176 acres of land in Washington, DC, and Montgomery and Prince George's counties in Maryland that drains surface water into the river. The river's tributaries struggle with large quantities of polluted runoff that blight the landscape and lead to flooding, erosion and infrastructure damage; compromise the health of the entire ecosystem; and threaten public health. These tributaries also deposit tons of trash and sediment into the river annually.

Overview of ongoing community work that will continue to improve the water quality of the river

Anacostia Watershed Restoration Plan

A comprehensive watershed restoration plan for the Anacostia (ARP) was completed in 2010. The EPA, through its participation as a member of the Anacostia Watershed Restoration Partnership, helped to co-ordinate the development of the Anacostia and will help with its future implementation.

Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCP)

Under a federal consent decree, the EPA will continue to monitor and enforce the obligations of the District of Columbia Water and Sewer Authority (D.C. Water) in controlling overflows pursuant to the authorised Long-Term Control Plan; a 96% reduction or capture of Combined Sewer Overflows (CSO) in an average year will result from this 20-year agreement. These provisions will have a dramatic effect on the quality of the tidal river.

CSO controls and funding

A USD 1 746 000 earmark grant was awarded to D.C. Water to perform sewer separation work that would address a CSO problem at a key outfall along the Anacostia River.

Total maximum daily load (TMDL) approvals and support (District of Colombia and Maryland)

The D.C. Department of Environment and Maryland Department of Environment along with members of several non-governmental organisations worked collaboratively with the EPA to develop a trash TMDL for the Anacostia River. To restore water quality, the TMDL requires capturing or removing more than 600 tonnes (1.2 million pounds) of trash from the watershed annually.

MS4 – Municipal Separate Storm Sewer Systems permits

The EPA will oversee green infrastructure and TMDL permit conformance with the DC MS4 permit through required monitoring, modelling and evaluation and will work with the District of Colombia to update the permit as necessary. The TMDL implementation plans will be updated pursuant to this permit and will be reviewed by the EPA for adequacy. The EPA is discussing a similar approach with Maryland, with the aim of working with both jurisdictions to support an integrated storm water management approach to address interstate urban storm water issues.

Box 7.4. A spotlight on public participation in action: The Anacostia River, Washington, DC/Maryland (*cont.*)

Blue Plains Wastewater Plant permit

The Blue Plains permit was recently reissued to update conditions pertaining to nutrients.

Washington Sanitary Sewer Commission (WSSC)

In a settlement agreement in an enforcement case, the WSSC will perform several supplemental environmental projects (SEPs) totalling USD 4.4 million.

Recent accomplishments and activities

The Anacostia River and watershed hold enormous potential to provide abundant natural beauty, wildlife habitat and a variety of recreational amenities. The recently released Anacostia Watershed Restoration Plan (AWRP) is the product of unprecedented regional, multijurisdictional co-operation to identify specific projects that can, when collectively implemented, provide greatly enhanced environmental, economic and social benefits for the river and the watershed and enhance the vitality of the surrounding communities.

Anacostia Watershed Restoration Partnership members:

- Akridge
- Audubon Naturalist Society
- Cohen Companies
- District of Columbia Department of Environment
- District of Columbia Water and Sewer Authority
- Maryland Department of Natural Resources
- Maryland Department of Environment
- Mayor of College Park, Maryland
- Mayor of Edmondson, Maryland
- Metropolitan Washington Council of Governments
- Montgomery county, Maryland
- Prince George's county, Maryland
- United States National Oceanic and Atmospheric Administration
- United States Department of the Interior
- Summit Fund of Washington
- United States Army Corps of Engineers

Source: Anacostia Watershed Citizens' Advisory Committee.

As an example, in the recent years, the Mystic River (once a popular swimming place with abundant fishing) faced significant problems from years of industrial use, pollution and neglect, although efforts have partially restored a watershed that had suffered from bacteria, nutrient over-enrichment and heavy metal pollution. A Mystic River Watershed Summit was convened that focused on flooding, industrial contaminants, bacteria and stormwater, and reconnecting people to the river. It was attended by over 150 people and resulted in the creation of a steering committee with environmental advocates, state and federal regulators, and business and municipal leaders working collaboratively to promote actions that will improve environmental conditions throughout the watershed addressing equity concerns. Currently, with 21 communities engaged in the watershed, pooled restoration efforts have increased water quality monitoring, stepped-up enforcement which has put an end to the dumping of more than 10 000 gallons of sewage a day into the river, and expanded local community partnerships jointly addressing the long-neglected river and its tributaries.

Similarly, what began 19 years ago on the banks of the Rogue River in southern Oregon as a small gathering of state-wide river leaders has since grown into an annual River Rally that attracts thousands of attendees and 750 advocate organisations for healthy rivers and watersheds. The River Rally, with educational workshops, inspiring speakers, a celebratory River Heroes banquet, field tours and unsurpassed networking, has proven to be a very effective way to build and maintain an engaged citizenry through a national movement of educated, effective river advocates and sustainable watershed protection organisations. The event brings together river leaders, volunteers, staff, board members, stewards and funders for an intensive sharing and collaborative learning experience which has led to a renewed spirit of commitment to their cause.

Conclusions and ways forward

Local public engagement can have significant dividends if:

- potentially affected community members have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health
- the public's contribution can influence agencies' decision
- the concerns of all participants involved will be considered in the decision-making process
- the decision makers seek out and facilitate the involvement of those potentially affected.

The Dutch Polder Model, rooted in history and based on centuries-old civic culture, can be characterised as a **consensus-based system**, wherein stakeholders are consulted and involved in important decisions through different ways:

- institutionalised mechanisms of participation: interest-pay-say representation in regional water authorities' boards; provinces/municipalities as shareholders of drinking water companies
- local water management projects (Overdiepse Polder, Arnemuiden)
- institutional vehicles, be they national (*Rijskwaterstaat*) or supranational (EU WFD)
- innovative approaches such as networking activities of "policy entrepreneurs" with public authorities, interest groups and the private sector

- incentives (be they financial or not) such as the 2011 Administrative Agreement on Water Affairs, searching for efficiency gains through improved collaboration across the water chain.

However, in recent years public participation has been challenged in the Netherlands because of the **complexity of performing water management functions** in a multi-level context. More sensitive bottlenecks seem to concern land use and its impact on flood risk and land drainage, two different interests competing and blocking each other, consisting more in a clash of interests with managed discourses.

For example, fundamental conflicts of interest in terms of flood risks and their costs arise between:

- municipalities, which need to allocate land for development to generate revenue
- regional water authorities that have to manage the consequence of this planning, and particularly its costs
- environmental actors who want concessions (e.g. of land) to nature.

A separate set of conflicts is equally prominent between:

- environmental interests (including now the European Commission as custodian of the Water Framework Directive)
- agricultural interests, which are the main source of pollutants, impacting on water quality
- water companies and regional water authorities, which are the collectors of much of the polluted water through their drainage works and may end up having to manage it.

In all these dimensions, the interest of the broad public is in the **costs and benefits of the different initiatives**. Still, they are hardly involved in what remains a highly specialised and obfuscatory set of discourses, carried out in a **culture of corporatism** whereby a relatively small number of organisations have a say. The evidence for that is the failure, in the wide range of public participation mechanisms and experiences in the country, to engage clinically in related costs to the main stakeholders concerned, which would perhaps be the surest way to bring challenges to their attention and gain their participation.

In addition, some areas of interest to stakeholders, such as flood protection standards, remain largely absent from discussions or void in leading to effective decision making. For example, in defining flood standards, public perceptions and value judgements are taken into account, but the influence of information produced and at hand has been minimal to date (though this may change with forthcoming decisions of the Delta Programme).

Agricultural and business groups have had a rather dominant impact on the relatively low level of ambition of the Netherlands in the WFD, but at the same time other actors consider the formal public participation exercise related to the implementation of the WFD (whereby all participatory bodies only had an advisory status) a failure. It is noteworthy that while they have experienced a fair access to information and consultation processes, environmental NGOs signal they had only limited influence on decision making related to EU policy in the country. This has generated some frustration and resulted in a notable disengagement of environmental NGOs from national policy debates on water management in the Netherlands.

Challenges to the effectiveness of stakeholder engagement also stemmed from the consolidation of regional water authorities in the last decades, and the expansion of certain of their functions into an "all-in model" to provide integrated water management (e.g. increasing wastewater treatment).

Urban dwellers who know little about the boundaries and roles of regional water authorities may be tempted to consider them as purely a **financial vehicle** of a system dominated by industry and farmers. It is therefore necessary to understand why regional water authorities may seem at odds with the democratic set up and related rules in contemporary EU water governance.

Regional water authorities' tasks have expanded into an **"all-in model"** and are no longer easily identifiable and are certainly not restricted to the inhabitants of their different areas. This is not necessarily the case of drinking water companies, whose tasks inhabitants tend to better identify as they are solely focused on the supply of drinking water.

The **corporatist system** of interest representation, combined with the WFD provisions for public participation, has led to an over-representation of certain groups, and the risk that the unheard voice of those not attending the meetings may only become weaker.

At present, the real issue of participation is willingness, or most of the time a lack of, to share decision-making power (e.g. changing the exclusively advisory status of participatory bodies). Most Dutch citizens think that their own and direct interests are being well taken into consideration and competently dealt with. In such cases, "business as usual" and status quo is not a major issue. However, when changes or threats are perceived, like building a new canal in one's backyard or using one's polder for flood storage, participation can be activated to protect one's interest while finding alternative solutions through multi-stakeholder dialogue. In such cases more particularly, the intention of, and mutual trust between, the actors involved are key to successful stakeholder participation.

Notes

1. The choice was made to focus the analysis on water services, as several aspects of environmental regulation (for water resources) were addressed in Chapter 1 (mapping key actors), Chapter 2 (defining water risks against existing standards) and Chapter 5 (providing insights on the licensing system).
2. *Waterschapsspiegel* is the third nationwide benchmark report for regional water authorities and can be accessed via: www.uvw.nl/publicatie-details.html?newsdetail=20121204-23_waterschapsspiegel-2012.
3. Regional water authorities can also access all data via: www.wsp.waves.databank.nl.

4. ILG stands for the Investment Budget for Rural Areas.

5. The study was carried out for Vewin by Accenture Nederland. Contributions to the individual themes were made by TNS NIPO, Synovate and the KWR Watercycle Research Institute.

6. The study was previously carried out in 1997, 2000, 2003 and 2006 (Blokland, 2009).

   The only company that did not take part was N.V. Bronwaterleiding Doorn (this company was taken over by Vitens on 1 July 2010 and at the time of the Benchmark 2009 was not yet fully integrated into Vitens' operational management). In terms of connections, participation percentages in 1997, 2000, 2003 and 2006 were 85%, 90%, 81% and 100% respectively.

   Since the completion of the drafting of this report, the 6th benchmark was published. It covers all ten drinking companies representing 7.6 million connections.

7. See www.benchmarkrioleringszorg.nl.

8. In the year 2000, municipalities asked the RIONED Foundation (the national centre of expertise in sewer management and urban drainage in the Netherlands) for the first time to carry out a benchmarking of their sewerage operations to enable them to further improve the quality. In 2001, this resulted in a feasibility study into benchmarking amongst six municipalities. The latest benchmarking report was published in 2013.

9. All municipalities have full access to the complete benchmark database containing all source data, KPIs and additional analysis results via www.benchmarkrioleringszorg.nl.

10. And from the information presented to the OECD delegation during the missions.

11. Mergers took place for diverse reasons. It was believed that operating at the larger scale would: *i)* increase efficiency (scale economies); *ii)* enable specialised and improved supervision (corporate governance); *iii)* help better comply with environmental regulation; and *iv)* foster policy coherence with an objective of more than one drinking water company per province. Several of the ten remaining drinking water companies are discussing new mergers, possibly resulting in still less utilities in the next few years (De Witte and Dijkgraaf, 2010).

12. *Source:* Observatoire national des services d'eau et d'assainissement, www.services.eaufrance.fr.

13. This section of the report refers to the "Polder Model" and not the "polder approach" as the latter term is also used to refer to the drainage and flood protection of low-lying areas by means of pumps, canals and flood defences (see Stijnen et al., 2013).

14. One-third of the seats in the Social Economic Council are occupied by members representing employers, one-third by members representing unions and one-third by so-called independent or "Crown" members appointed by the government, usually professors of economics, finance, law or sociology. Also the directors of the Dutch Central Bank and the Netherlands Bureau for Economic Policy Analysis are Crown members (SER, 2010).

15. One could also say that general government has more possibilities for bargaining and solving conflicts by issue linkage, e.g. by linking a water management issue with an issue from another policy sector for which the distribution of costs and benefits is the reverse, thus creating a win-win solution. Functional water management can only link water management issues with other water management issues, and this may be too limited.

16. Another notable milestone in this respect is the 1974 decision not to close off and reclaim (parts) of the Wadden Sea, whereby environmental arguments – the value of the sea as a natural area – were decisive (De Jonge, 2009).

17. The empirical research is based on a study entailing more than 60 in-depth interviews and an extensive mail survey among all 339 identified policy entrepreneurs within the 491 Dutch local governmental bodies concerned with water governance (Brouwer, 2013).

18. Apart from the general observation that public participation may be more difficult to organise in urban areas, there is no particular reason to assume that the Polder Model functions differently in urban and in rural areas.

19. This case study builds on findings from Cox et al. (2005); Roth and Winnubst (2010); and Edelenbos et al. (2013).

20. The present composition of the governing boards of regional water authorities includes residents, open land owners, businesses and nature reserve authorities. Of these different categories, residents always have the majority in the board.

21. *Algemene Waterschapspartij* official website: www.algemenewaterschapspartij.nl (accessed in December 2013).

22. *Water Natuurlijk* official website: http://waternatuurlijk.nl (accessed in December 2013).

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Annex A
List of Dutch stakeholders consulted during the policy dialogue

Name	Institutions
Adema, Ina	Municipality of Veghel – Mayor/VNG Commission on Water – Chair
Alwayn, Elaine	Ministry of Infrastructure and the Environment
Bannink, Floris	Berenschot
Behagel, Jelle	Utrecht University
Berkel, William van	Ministry of Infrastructure and the Environment
Blanken, Martien den	Vewin
Bleker, Roelof	Rivierenland River Basin Authority – Chairman
Boeters, René	Ministry of Infrastructure and the Environment – Rijkswaterstaat
Bolsius, Emmy	Ministry of Infrastructure and the Environment
Boom, Bjorn van der	Natuurmonumenten
Boonstra, Carla	Delegation of the Netherlands to the OECD
Bosch, Ans van de	Ministry of Infrastructure and the Environment
Bosch, Rik van den	Alterra
Botterweg, Joke	Programmabureau NHWBP
Botzen, Wouter	VU University Amsterdam
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