Delta Programme 2015

Working on the delta

The decisions to keep the Netherlands safe and liveable

Safety

Freshwater

New Urban Development and Restructuring

Rhine Estuary-Drechtsteden

Southwest Delta

IJsselmeer Region

Rivers

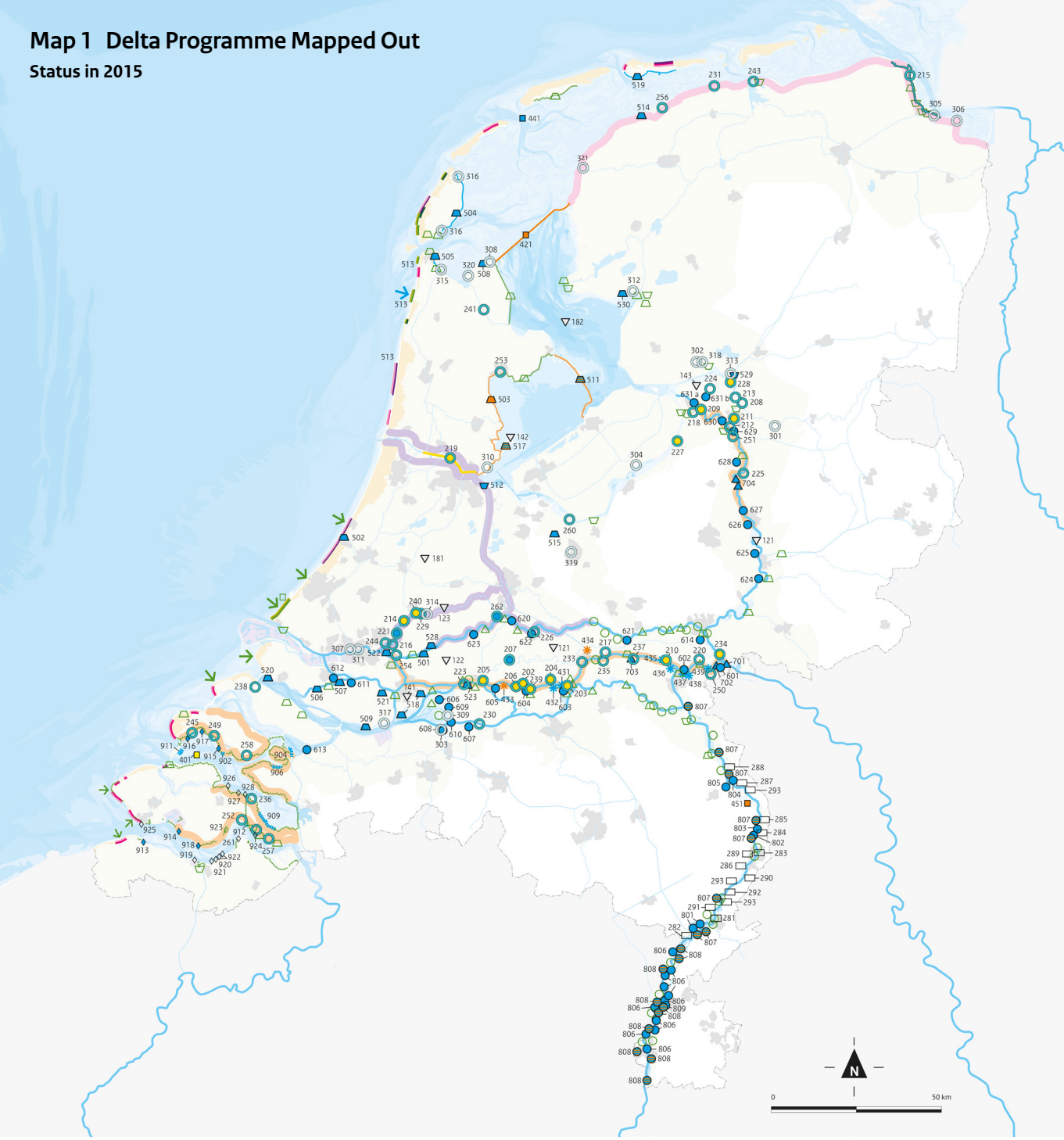
Coast

Wadden Region

The Delta Programme is a national programme, in which the central government, provinces, municipal councils and water boards work together, involving social organisations and the business community. The objective is to protect the Netherlands from flooding and to secure a sufficient supply of freshwater for the generations ahead.

Map 1 Delta Programme Mapped Out

Status in 2015



Projects and implementation programmes Project numbering refers to programmed measures in the Delta Programme (↗ tables 2 to 12 in section 4). Any inner colour in the symbol indicates the plan phase.

Delta Programme (MIRT) studies
- 100 project number
- project location

2015-2020 Flood Protection Programme
- 200/300 project number
- programmed dyke improvement project
- prefinanced dyke improvement project
- dyke section
- General explorations: Piping (271), Wadden Sea dykes (272), Central Holland (273), Macrostability (274, linked to project 202)
- Meuse agreement project

Second Flood Protection Programme (HWBP-2)
- 500 project number
- improvements to dyke, dune or dam
- improvements to engineering structures
- dyke section
- Weak Links project along the coast

Room for the River
- 600 project number
- project location

Further elaboration of area around the major rivers (NURG)
- 700 project number
- project location

Meuse Projects: Grensmaas en Zandmaas
- 800 project number
- project location

Other projects
- 400 project number
- project location
- WaalWeelde

Repairs of stone-cladding in Oosterschelde and Westerschelde
- 900 project number
- stone-cladding
- deposit location

Sand replenishment location
- beach replenishment
- beach replenishment finished
- shore face replenishment
- shore face replenishment finished

Current status per project: plan phase as of 2015
- not yet at plan phase
- study
- exploration
- plan elaboration
- between elaboration and realisation
- realisation
- finished

Basic map
- freshwater
- saltwater / brackish water
- flood area
- area outside the dykes
- urban area
- docks
- border

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Photo cover:
IJsselmeer Closure Dam, May 2014 *At 12 km from the Frisian coast lies Breezanddijk, the former IJsselmeer Closure Dam construction island Zuiderhaven. In the top left of the centre of the picture is the Blue Energy Plant.*

Photo page 2-3:
Lent, June 2014 *By moving the dyke approximately 350 m inland, the Waal is given more room at Nijmegen-Lent. In the new area outside the dykes, an island is formed in the Waal because a large secondary channel is being excavated. The island will provide room for new urban development.*

Contents

A high-resolution version of the maps in this publication is available online.

1 Introductory summary

This year the Delta Programme Commissioner is proposing five Delta Decisions to improve flood risk management policy and to ensure a sufficient supply of freshwater for the Netherlands in the long term. As such, the Delta Programme is designed to make the Netherlands a robust country that is resilient enough to handle climatic extremes; a liveable, inhabitable and economically strong country.

After the Delta Plan, which followed the 1953 flood disaster and the advice from the 2008 Veerman Commission, the decisions on flood risk management and freshwater that will be presented to politicians this year will mark a new historical moment for our low-lying delta. This time, we are not developing measures to recover from a disaster; we are developing measures to prevent a disaster. The Cabinet is very pleased with the achievements the collaboration on the Delta Programme has enjoyed over the last four years. The flood risk management and freshwater tasking, in both the short and the long term, and the framework of the approach are clear.

Working on flood risk management is an urgent tasking for the Netherlands. Although we are safe, our delta is still vulnerable. We have to make good time if we are to properly protect our people and our economy from flooding in the future. Moreover, freshwater can become a scarce commodity in dry periods. As such, the Delta Programme includes proposals for national Delta Decisions, as a normative framework for working on our delta, and concrete preferential strategies for each area as a guide to implementing measures until 2050.

The objective is to ensure sustainable and robust flood risk management and freshwater supplies in 2050, which will allow our country to withstand the (greater) climatic extremes in a resilient manner. In this way, the considerably increased economic values and the higher number of people are well protected. We will ensure that the Netherlands is prepared for various scenarios. We will choose strategies and measures that can give us flexibility in the way we respond to new measurements and insights, by stepping up our efforts if necessary or changing strategy. Everything is at hand.

New flood risk management, predictable freshwater supply, water-robust design

The twentieth century was the century of the Delta Works, which were built in response to the 1953 flood disaster. The twenty-first century will be the century of the resilient further development of this foundation and focusing more on the opposite of floods, namely drought. We will take a new approach to working on the delta in three key areas: flood risk management, the availability of freshwater and water-robust spatial organisation.

The flood risk management policy is formulated along new, different lines. Over the past few decades, efforts were made to improve protection against flooding in accordance with the current statutory standard (probability of overtopping). With new insights we can now incorporate the approach to flood risks into the flood risk management policy, by taking account of the probability of a flood and the consequences.[1] This is a much better approach. This new approach and the norm to be selected ensure that the probability of dying as a result of a flood behind the dykes is not higher than 1:100,000 per annum for any location. In areas with a relatively high potential of large numbers of victims, serious economic damage or failure of vital infrastructure of national importance, we will step up the level of protection. This protection level has been translated into a new standard specification for each dyke stretch. This approach is based on the latest insights into flood risks, the considerably increased population and economic values, and the plausible forecasts for climate change. Bringing the flood defence systems in line with the proposed new approach is no easy task, but there are major benefits to it in terms of safety and efficiency. For the first time ever, everyone living behind dykes and dunes will enjoy an equal level of protection as standard. Once the new approach has been implemented in the coming decades, the economic risks associated with floods will decrease by a factor of about 20 and the group risk (probability of 1,000 flood victims) will decrease by a factor of around 45. The new approach allows targeted investments in locations where the

1 The research that forms the basis for the new safety approach will be rewarded with a prestigious international award for operational research: the Franz Edelman Award.

risks are the highest, making it a cost-efficient approach. The main tasking is in the area around the major rivers. In the coming 35 years, the necessary investments in flood risk management associated with this new approach will be significantly lower compared to our current approach.

Approximately 16% of our economy depends on the easy availability of freshwater in our country. The Delta Programme has developed and shared a great deal of new expertise in freshwater supplies in the Netherlands as a result of joint fact-finding initiatives with all stakeholders. These have shown that freshwater can become a scarce commodity in our country if demand increases and the climate changes. Periods of low water and drought may become more frequent, and salinisation may increase in certain parts of the country. The joint efforts of government authorities and water users can keep freshwater supplies at a satisfactory level. To this end, a number of targeted investments are being made in the water systems and in economical water consumption. At the same time, by agreeing supply levels, the availability of freshwater becomes transparent to users. This new approach will be introduced over the next few years.

The spatial organisation will become more climate-proof and water-robust in the coming decades. The government authorities will work together and work systematically to ensure that any built-up areas being (re)developed are able to better withstand heat, drought, pluvial flooding and floods. Special attention will be paid to vulnerable and vital uses such as drinking water supplies, health care, energy, telecommunications and IT.

We are using this new approach to work on the delta on various fronts, with 2050 as the target year: in that year, all primary flood defence systems will meet the standards associated with the desired protection levels, freshwater supplies will be robust, freshwater consumption will be economical and the Netherlands' spatial organisation will be as climate-proof as possible.

This ambition requires an ongoing effort over the next 35 years. Putting innovations into practice and linking the delta tasking to other social tasking are essential in order to arrive at (cost-)effective solutions and investment decisions for society.

Adaptive delta management

The new approach centres around 'adaptive delta management': looking at tasking ahead of us, using that insight to put in place (cost-)effective measures in good time and remaining flexible to be able to act on new opportunities, insights and circumstances. Alternative measures are available should they be necessary in the future. That is also part of the adaptive approach to work: being practical, alert and prepared. Adaptive delta management has been embraced by all of the government authorities, social parties, knowledge institutes and companies as a practical solution for dealing with developments, the direction of which is clear to us, but the rate of which is not.

Proposals for Delta Decisions

To be able to put our new approach into practice, we need national frameworks. The Delta Programme has been gradually working towards this since 2010, using all available and new knowledge and working with government authorities, social organisations and the business community. This year, this has resulted in proposals for structuring widely supported 'Delta Decisions', namely:

- **Delta Decision on Flood Risk Management:** new approach to protecting people and the economy against floods;
- **Delta Decision on Freshwater:** new approach to limiting freshwater shortages and making optimal use of freshwater supplies for the economy and utility purposes;
- **Delta Decision on Spatial Adaptation:** new and targeted approach to water-robust and climate-proof (re)development in built-up areas;
- **Delta Decision on the Rhine-Meuse Delta:** structuring choices for flood risk management in the Rhine-Meuse delta;
- **Delta Decision on the IJsselmeer Region:** structuring choices for flood risk management and freshwater supplies in the IJsselmeer region.

In addition to the above, the Delta Programme Commissioner is proposing choices for sand replenishments along the coast: the Strategic Decision on Sand. Once the decisions have been embedded in

national policy, legislation and administrative agreements, they can be elaborated and put into practice from 2015 onwards. The Delta Decisions are the beginning of a well-thought-out follow-up to working on the delta. The Delta Programme Commissioner will report on this every year in accordance with the Delta Act.

Preferential strategies and Delta Plans

The central government, provinces, municipal councils and water boards have translated the proposed Delta Decisions into a preferential strategy for each sub-region. For the sub-region in question, the preferential strategy forms the strategic guide to choosing measures and provisions resulting from Delta Decisions. In many cases, the measures consist of an innovative approach to dyke improvements and sand replenishments or of a combination of dyke improvements and spatial measures such as river widening. A robustness test has shown that the strategies are heading in the right direction, also if the climate changes even more drastically. As stipulated in the Delta Act, every year the Delta Programme Commissioner issues a proposal for a programme of measures in the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater, in detail for the first six years and in broad outline for the next twelve years, plus a view up to 2050.
The scientific substantiation of the proposed Delta Decisions and preferential strategies has been given special attention. Under the auspices of the Knowledge for Climate Programme, a panel of forty independent experts has reviewed the substantiation. This panel has concluded that the Delta Decisions and preferential strategies have, broadly speaking, been presented and substantiated in a clear manner.

Administrative Agreement on the Delta Programme

In the Delta Programme, all the administrative partners have worked together on the proposals for Delta Decisions and preferential strategies. This has resulted in a unique national approach for a water-robust country until 2050. The commitment of all parties in the follow-up process is also important. Every government authority is responsible for the implementation of the proposed Delta Decisions and preferential strategies within its own area of competence. The Ministry of Infrastructure and the Environment and the umbrella organisations of provinces, water boards and municipal councils have underlined this commitment by signing the 'Administrative Agreement on the Delta Programme', with the intention of continuing the working method and all government authorities embedding the Delta Decisions and preferential strategies into their own plans. The administrative agreement is supplementary to the Administrative Agreement on Water (2011). In this way, the central government policy arising from proposals for Delta Decisions and preferential strategies will be embedded in policy in the form of an interim revision of the National Water Plan.

Knowledge and innovation

Knowledge development and innovation require continuous commitment. As such, the Delta Programme, the ministries involved, STOWA[2], NWO[3], knowledge institutes and the TOP Sector Water have drawn up the new Water and Climate Knowledge Innovation Programme. By continuing to be the world leader in terms of water management, we can make our own country optimally water-robust and climate-proof, and the Dutch domestic private parties can distinguish itself internationally. The Delta Programme approach has already become an export product itself: the 'Dutch Delta Approach' is drawing considerable attention around the globe. Various countries have called in the assistance of the Dutch government and business community to apply the Delta Programme approach to their own tasking.

Delta Fund and co-funding

The Delta Fund forms the necessary financial foundation for investments in the implementation of the Delta Programme. It provides a solid foundation, with an average annual budget of over €1 billion until the end of 2028. Given the major tasking in the coming decades, the Delta Programme Commissioner assumes that the Cabinet will make a timely decision on the further investments in the Delta Fund. Co-funding from other stakeholders will also be required for a number of measures. In this way, we will still have a prospect of sufficient financial

2 STOWA: Dutch Foundation for Applied Water Research.
3 NWO: Netherlands Organisation for Scientific Research.

resources to allow ongoing concerted efforts towards a safe delta and achieving the objectives and to be able to programme measures in good time.

Delta Programme and delta community
In recent years, the working method employed by the Delta Programme has led to great involvement in the tasking for flood risk management and freshwater. All tiers of government, a large number of government organisations and the business community have all contributed. Once the proposed Delta Decisions and preferential strategies are adopted, the Delta Programme will enter a new phase. The accent will then shift towards the elaboration and implementation of measures. This will entail new forms of organisation, while retaining the existing involvement and alliance.

The close relationship between the national programme and the regional elaboration will continue. According to many, it is precisely this relationship and the associated working method that account for the added value of the Delta Programme. The Delta Programme Commissioner remains the director, the driver and the linking pin. The Delta Act is leading in this regard. The national Delta Programme Steering Group connects the stakeholders at a national level and advises the Delta Programme Commissioner. Each sub-region chooses its own form of intergovernmental consultation, in line with the tasking in the area and aimed at combining the Delta Programme tasking with other ambitions in the region. The staff of the Delta Programme Commissioner organise the connections at national level.

The programming and implementation of measures are based on a comprehensive approach. Effective solutions can only be reached if the tasking and ambitions in the area of water and space are linked and opportunities to form links are seized. This counts for combined spatial measures, 'regular' dyke improvements and freshwater measures. The Flood Protection Programme plays a central role in dyke improvements. For combined spatial measures, the parties select an appropriate form of organisation on a project-by-project basis. The knowledge and experience gained in the Room for the River programme is of considerable value in this respect; this knowledge and experience is made available by the Flood Protection Programme Management. Freshwater measures are programmed mainly in the region, with a small degree of national coordination.

As a result, governance for the next phase is no stricter than necessary, the successful approach is continued and maximum use is made of the strength and collaboration of national and regional networks, including non-governmental ones.

Continuing to work on a resilient delta
Last year, the OECD underlined the fact that water management in the Netherlands is a matter of national importance and essential for the sustainable, future-oriented development of our country. The Delta Programme ensures that the Netherlands is well prepared for the future. We are updating the policy for flood risk management, freshwater and spatial organisation. We are continuing to work on the implementation of measures and keeping a close eye on how society and climate are changing. Our response to these changes is an adaptive one. We have potential measures at hand if things change faster than expected and we ensure that we will have sufficient room for them. Being practical, alert and prepared. The Delta Programme represents our ongoing work on a safe and robust delta that is resilient enough to withstand the extremes of nature. The programme ensures that the Netherlands remains an attractive place to work and to live in, now and in the future.

2 Delta Decisions

Petten, March 2014 *Sand replenishments on the Hondsbossche sea wall between Petten and Camperduin. Rainbowing is the process by which, at high tide, sand claimed from the North Sea is propelled in front of the dyke. This is part of the project to turn the hard sea wall into a natural dune, with nature, dunes and lagoons to swim in.*

2.1
Looking ahead in the delta

The Netherlands has its unique location at the mouth of the major rivers to thank for its prosperity. That said, the sea, the many watercourses and the major lakes also cause trouble every now and then and can even be threatening. Our country has a long history of flood disasters. And yet, at other times, there have been water shortages that have caused economic damage. We have many more people and economic values to protect than we did about fifty years ago. Our measurements also show that the sea level is rising, the soil is subsiding and precipitation patterns are changing. As a consequence, the Netherlands is faced with new tasking to remain safe and vital. A coordinated set of Delta Decisions offers thorough preparation for the future, with new frameworks and standards for measures. We continue to use these to work on the delta and respond to developments in good time. This will keep the Netherlands safe, ensure a sufficient supply of freshwater, and allow our economy and living environment to benefit from the favourable location in the delta.

Delta Decisions: new frameworks and structuring choices

As required by his statutory task under the Delta Act the Delta Programme Commissioner proposes a new approach in order to continue to protect Dutch citizens and the Dutch economy effectively against too much and too little water. This approach is in line with the Delta Programmes since 2010. The proposed Delta Decisions offer a set of coherent frameworks, standards and structuring choices to improve flood risk management, minimise water shortages and make the Netherlands more robust and less vulnerable to extreme weather conditions. These are tasks that we need to work hard on for the next 35 years.

Central elements of the Delta Decisions are the introduction of a risk-based approach in the flood risk management policy, the introduction of supply levels to improve the availability of freshwater and make it more transparent, and administrative agreements on spatial organisation to make the Netherlands more robust and less vulnerable. In addition, the proposed Delta Decisions offer structuring choices for two key areas where a range of tasking converges: the IJsselmeer Region and the Rhine-Meuse delta. As such, the proposals for the Delta Decisions offer coherent frameworks and choices to improve flood risk management and the availability of freshwater in the period from 2050 and will also show the way forward for the period after 2050.

Adaptive and comprehensive

Each Delta Decision begins with an practical approach based on adaptive delta management (↗ section 6): responding to developments in the climate and society step by step, making sure that plans for new (and larger) interventions are ready and keeping enough options open for future interventions. Taking currently needed decisions now, bearing in mind the steps that may be necessary in the long term. The Delta Decisions are best put into practice using a comprehensive approach, by connecting the tasking for flood risk management and freshwater with the ambitions of other parties and government authorities (‘link’ or ‘linkage’). Comprehensive means searching for solutions that serve multiple interests and coordinating the planning of various spatial developments as closely as possible. This is important in order to arrive at practicable and efficient solutions.

Adaptive delta management requires not only a practical approach but also a constant alertness. It is imperative that we have a clear view of the possibilities for the future at all times. Monitoring and evaluation are essential to know in good time when the strategy has to change and when other measures that have already been prepared should be put into effect.

Delta Decisions, preferential strategies, Delta Plans, knowledge agenda

The Delta Programme Commissioner proposes five Delta Decisions:

- **Delta Decision on Flood Risk Management:** new approach to protecting people and the economy against floods;
- **Delta Decision on Freshwater:** new approach to limiting freshwater shortages and making optimal use of freshwater for the economy and utility purposes;
- **Delta Decision on Spatial Adaptation:** new and targeted approach to water-robust and climate-proof (re)development in built-up areas;
- **Delta Decision on the Rhine-Meuse Delta:** structuring choices for flood risk management in the Rhine-Meuse delta;
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In addition to the above, the Delta Programme Commissioner proposes choices for sand replenishments along the coast: the Strategic Decision on Sand.

Together, the proposals for the Delta Decisions form the answer to the new tasking and the start of new measures for the future. The proposals for the Delta Decisions on Flood Risk Management and Freshwater constitute the basis for national policy frameworks to keep flood risk management and freshwater supplies at the required level in a contemporary fashion, both for our generation and the generations to come. In the transitional areas between the rivers and the sea, tasking overlaps a lot and the choices made in these areas impact a large part of the country. The proposals for the Delta Decision on the IJsselmeer Region and the Delta Decision on the Rhine-Meuse Delta offer structuring choices for these key areas. In addition to this, the proposed Delta Decision on Spatial Adaptation forms the basis for a process of change to ensure a water-robust and climate-proof organisation of the built-up part of the Netherlands in the long term.

The Delta Decisions and other decisions have been elaborated into concrete preferential strategies for each sub-region (↗ section 3). Based on these preferential strategies, which have been drawn up by the regional government authorities and central government together, the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater include measures programmed for the short term and measures placed on the agenda for the short and medium term (↗ section 4).

The adaptive elaboration of the Delta Decisions calls for continuation of the new forms of administrative collaboration that have been set up since 2010. Joint knowledge development is also essential. These forms of collaboration result from intergovernmental programmes and by coordinating the implementation programmes relating to space and water more closely and, where necessary, by conducting joint exploratory area studies (↗ sub-section 6.4). When making choices for measures – where, when, what magnitude – an adaptive approach also requires anticipating future circumstances and adjusting strategies periodically based on new insights into the course of climate change and the effect of water systems ('practical and alert'). The studies and monitoring required for this are on the Knowledge Agenda of the Delta Programme (↗ background document A (in Dutch)) and, to the extent that they are funded from the Delta Fund, have been included in the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater (↗ section 4).

The Dutch delta is part of international catchment areas. As such, the amount of water flowing our way also depends on the way the foreign parts of these catchment areas are managed and organised, during high water as well as low water. International collaboration continues to be important (↗ sub-section 6.3).

Multi-layer flood risk management

The risk of floods can be limited by various types of measures. These measures can be classified into the three layers of multi-layer flood risk management:

- Layer 1: preventive measures to limit the probability of a flood;
- Layer 2: spatial organisation of an area to limit the consequences of any flood;
- Layer 3: disaster and crisis management to respond effectively to any flood.

The Delta Decision on Flood Risk Management and the Delta Decision on Spatial Adaptation combined give these three layers substance. In the proposal for the Delta Decision on Flood Risk Management, layer 1 is paramount; it contains proposals for new standard specifications for the (preventive) primary flood defence systems. These specifications were determined allowing for the possibilities for preventive evacuation via disaster and crisis management, based on a conservative estimate. The proposal for the Delta Decision on Flood Risk Management also provides for the possibility, in specific cases, to replace the measures that the flood defence system requires with measures in layers 2 and 3 ('smart combinations'). The proposal for the Delta Decision on Spatial Adaptation centres around layer 2, with a set of administrative agreements to also consider flood risks and climate-proofness in spatial (re)development, for the purpose of limiting any flood-related damage and any additional damage ensuing from spatial developments. The water-robustness of vital and vulnerable functions is given special attention in this respect. For the purposes of layer 3, security regions, water boards and road authorities will be stepping up their collaboration in the preparation and response phases, devoting special attention to helping improve the coping capacity of citizens and companies.

Tasking for flood risk management, freshwater and spatial adaptation

Flood risk management

- 34.7% of the flood defence system along the major rivers, the major lakes and the sea does not meet the current statutory standards.*
- The current standards for flood risk management are outdated: there are more people and greater economic values to protect and we know more about the strength of the flood defence system than we did fifty years ago, when the current standards were established.
- The tasking for flood risk management may increase as a result of climate change, which includes such things as increased river discharges, rise in sea levels and soil subsidence.
- The protection level differs greatly in the Netherlands, and in certain parts of the area around the major rivers it is below the desired level.

Freshwater

- Sectors such as agriculture, nature and shipping, drinking water and power companies and various forms of industry have already been adversely affected by (extremely) dry years due to water shortages (falling groundwater levels and lower river water levels) and salinisation. The consequences are even more acutely felt in areas that receive no freshwater from the main water system.
- Freshwater tasking is expected to increase as a result of rising sea levels (salinisation) and climate change (higher temperatures and possibly more frequent very dry periods).

Spatial adaptation

- The built-up area may be more seriously disrupted by pluvial flooding, drought and heat-related stress, as climate change is expected to take the form of more severe rain showers and high temperatures, and the potential damage will increase as a result of economic developments. When decisions on location, spatial organisation and type of construction are made, the potential consequences of pluvial flooding and floods are often not taken into account.

* Improvement projects are already being carried out for half of these flood defence systems.

Map 3

Flood risk management and freshwater tasking

Tasking

Flood risk management

- repair flood defence system, major tasking
- repair flood defence system
- flood defence system management
- preserve sandy coastal system
- storm surge barrier maintenance tasking
- maintain water discharge into Wadden Sea
- limit the consequences of flooding: ensure climate-proof or water-robust design

Freshwater

freshwater issues

- no freshwater supply and falling groundwater levels
- limited freshwater supply and falling groundwater levels
- salinisation of intake points
- excessive demand on IJsselmeer lake water buffer
- river water levels too low (summer)
- salinisation and no freshwater supply

Climate-proof city

- limit the consequences of drought, heat and heavy precipitation

Causes

- 0.35-0.85 m rise in sea level
- soil subsidence
- salt wedge
- coastal sedimentation and erosion
- river sedimentation and erosion
- HT = increased peak river discharge
  Rhine: 16,000 → 18,000 m³/s
  Meuse: 3,800 → 4,600 m³/s
- LT = decreased low river discharge
  Rhine: 1,000 → 600 m³/s
  Meuse: 20 → 10 m³/s

longer periods of heat/drought, increased and more extreme precipitation

Basic map

- freshwater
- saltwater / brackish water
- area outside the dykes
- dunes
- border

2.2
Delta Decision on Flood Risk Management

Social importance

Approximately 60% of the Netherlands is so low that it is vulnerable to flooding. Nine million people live in areas that could be flooded by the sea, the major rivers or the major lakes. The majority of our gross national product is earned in these areas. As such, working on protection against floods is an ongoing necessity in the Netherlands. New knowledge and insights that we lacked just after the 1953 disaster have enabled the transition to a risk-based approach in the flood risk management policy: an approach that links the protection level to both the probability of a flood and the consequences of a flood. The introduction of the risk-based approach is a fundamental change that impacts the requirements we set for the flood defence systems and our way of testing and designing. This means that flood risk management can be taken on more efficiently and effectively. The aim is for all flood defence systems to meet the new requirements by 2050, something that will require a concerted effort.

Proposal for Delta Decision on Flood Risk Management

With regard to flood risk management, the Delta Programme Commissioner proposes to decide that:

- the central government, in due course, embeds the risk-based approach to flood risk management previously chosen (↗ DP2014) in the government policy;
- that everyone living behind dykes and dunes in the Netherlands can count on a protection level of 10^{-5} by 2050 (meaning that the probability of dying as a result of a flood is no higher than 1:100,000 a year) and that more protection is provided in places where there is a risk of:
  - large groups of victims and/or
  - serious economic damage and/or
  - serious damage as a result of failure of vital and vulnerable infrastructure of national importance;
- the desired protection level is translated into new standard specifications for primary flood defence systems, expressed in a flood probability per dyke stretch according to six categories from 1:300 tot 1:100,000 (↗ appendix 1);
- these new standard specifications for each dyke stretch form the basis for new flood risk standards in the current Water Act, instead of the current overtopping risk standards per dyke ring;
- the central government aims to have this ready to be embedded in legislation by 2017;
- even before it is embedded in legislation, the standard specifications can already serve as the basis for the design of flood risk management measures, after the interim revision of the National Water Plan (expected as from 2015) comes into effect;
- the central government adjusts the assessment and design tools to the new flood risk management policy;
- the next nation-wide assessment of primary flood defence systems (from 2017) will be done on the basis of the new flood risk management policy, the new standards and the associated, updated assessment tools;
- in accordance with the Water Act, the effectiveness and the effects of the new flood risk management policy are reported to the Dutch parliament every twelve years;
- linked to this, an assessment is made every twelve years as to whether the standards need to be adjusted if the underlying assumptions have changed materially;
- the protection level is, in principle, achieved by preventing floods as a result of sand replenishments in the coastal foundation zone, dunes, dyke improvements, river widening and operation of storm surge barriers;
- in specific cases – where preventive measures are overly costly or have too much of an impact on the community – a 'smart combination' of preventive measures, spatial organisation and supplementary disaster management can be selected in order to reach the protection level;
- such a 'smart combination' also requires the minister's approval, because the protection level is achieved through a combination of measures instead of prevention only;
- when using a 'smart combination', a tailored agreement is reached about tasks, responsibilities and funding on a case-by-case basis;
- the basic principle for the aforementioned tailored agreement is that resources are made available for using a 'smart combination' that are comparable to the savings generated in the budget for the Flood Protection Programme because fewer measures that qualify for a subsidy under that budget are taken;
- management and maintenance of flood defence systems by water managers are continued for the purpose of preserving the current physical condition;
- the aim is for all primary flood defence systems to meet the new standards by 2050;
- measures in the Delta Plan on flood risk management are programmed in consultation with the government authorities involved, with the flood risk forming the basis for prioritisation;
- where possible, the measures for flood risk management are implemented in an integral fashion, taking account

of area development and swift steps to address the flood risk.

Explanation

Risk-based approach and protection level
With this Delta Decision, the Netherlands is switching to a risk-based approach in the flood risk management policy: the requirements set for flood defence systems will have a direct relationship with the potential consequences of floods. That represents a fundamental change. The risk-based approach in the flood risk management policy is now possible because new calculation techniques and better insights into the course of a flood and the consequences of floods have become available.

The new flood risk management policy means that a basic protection level of 10^{-5} will apply to every individual living behind dykes or dunes. Consequently, the risk of an individual dying as a result of a flood must not exceed 1 in 100,000 a year. In places where the consequences could be extremely serious, the protection level is increased. This is the case when a flood could cause a large number of victims, serious economic damage or serious damage due to failure of vital or vulnerable functions of national importance. Initial calculations have shown that this new approach results in substantial gains in terms of safety. Once the new approach has been implemented in the coming decades, the economic risks associated with floods will be decreased by a factor of approximately 20 and group risk (risk of 1,000 victims) by a factor of about 45. What is new is that all people living behind dykes and dunes in the Netherlands will have a protection level of at least 10^{-5}. This is currently not the case. This is illustrated in ↗ maps 4 and 5. The maps show that once the new flood risk management policy has been implemented, the differences in safety in the Netherlands will be significantly smaller.

New standard specifications
In the current flood risk management policy, the standards (probability of overtopping) have been determined for each dyke ring: the entire flood defence system (and elevated soils) enclosing an area. It is now known that the consequences of a flood depend greatly on where the dyke ring is breached. For the new flood risk management policy, which builds on the risk-based approach, the proposal now is to abandon the classification in the scale of dyke rings and switch to a classification in dyke stretches and to translate the protection level (the objective) into a standard for each dyke stretch (the means). This will allow more targeted investments in safety. The proposed standard specifications are expressed in flood probability per annum, divided into six categories: 1:300, 1:1000, 1:3000, 1:10,000, 1:30,000 and 1:100,000. These new standard specifications constitute the basis for embedding the new standards (flood risk standards) in the Water Act.

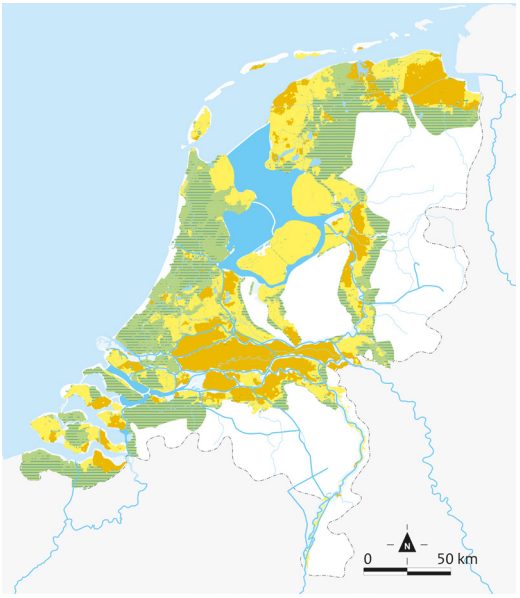
The national targets of the flood risk management policy and insights gained in the area-based sub-programmes combined have yielded a nation-wide consistent picture of standard specifications (↗ Appendix 1 on the standard specifications). The area-based sub-programmes have generated insights into such things as the group risks, transmission effects (the manner in which a flood continues into adjacent dyke rings), details about evacuations on, for example, the Wadden islands, and the contribution to flood risk management of forelands for flood defence systems, regional flood defence systems[4] and so-called 'C-dykes' (↗ Implementation).

↗ Appendix 1 provides the standard specifications for dyke stretches. Those flood defence systems that already meet the new standard specifications will be properly maintained for the purpose of preserving their current physical condition. Where the defence systems do not meet the new requirements, measures will be taken in the period until 2050. In most cases, this will be done by investing in the flood defence systems themselves or by creating more room for the river. Where necessary to ensure the desired protection level, the so-called Delta dykes can offer a solution.[5]

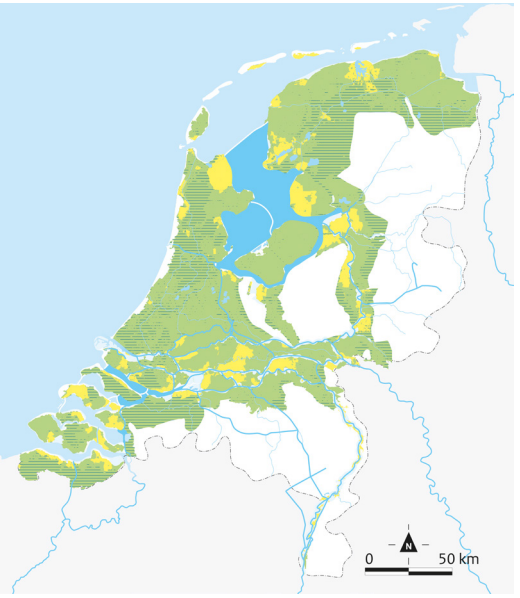
4 In a number of locations, the regional flood defence system plays a role in achieving the protection level. Where the stability of the regional flood defence system cannot be guaranteed, this has been taken into account in the standard specification for the primary flood defence system, eliminating the need for additional requirements for the flood defence system behind it.
5 Delta dykes are dykes with a very low failure probability.

Map 4a and 4b **Yield of new approach to flood risk management: individual risk**

Map 4a Situation in 2020 after current programmes have been implemented (reference)



Map 4b Situation in 2050 after implementation of new approach.

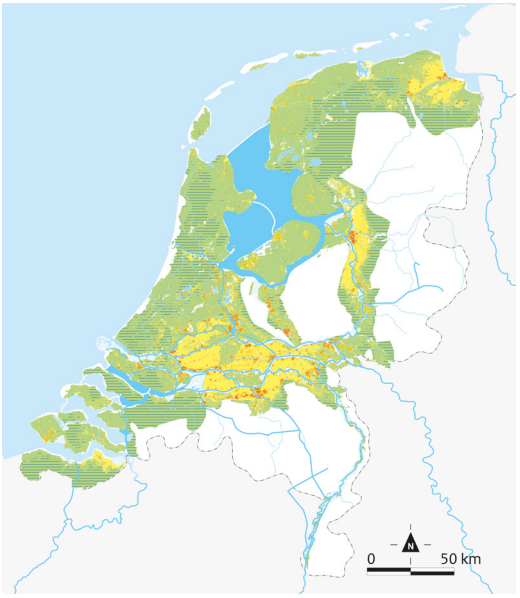


Annual probability of an individual dying as a result of a flood

- lower than 10^{-6}
- between 10^{-6} and 10^{-5}
- higher than 10^{-5}
- potential flood area
- freshwater
- saltwater / brackish water

Map 5a and 5b **Yield of new approach to flood risk management: risk of economic damage**

Map 5a Situation in 2020 after current programmes have been implemented (reference).



Map 5b Situation in 2050 after implementation of new approach

Annual risk of damage per hectare (euro)

- less than €100
- between €100 and €1,000
- between €1,000 and €10,000
- more than €10,000
- potential flood area
- freshwater
- saltwater / brackish water

Source: based on the "Technical elaboration of requirements for the primary defence systems (DPV 2.2, DPV work report) and proposed standard specifications per dyke stretch (↗ Appendix 1).

It is a major tasking to adjust the protection level in the Netherlands to the increased population and economic values behind the dykes, and to the soil subsidence and climate change. This is particularly relevant in the area around the major rivers, but other parts of the Netherlands need to be improved too.

The independent Flood Risk Management Expertise Network (Expertise Netwerk Waterveiligheid or ENW) has validated the data and methods on which the new standard specifications are based and has concluded that these are properly substantiated. One point that the ENW believes merits attention is that it should be clear how the standard specification is applied to the design and assessment of flood defence systems. The central government will take this recommendation into account when developing the new assessment and design tools.

Prevention first, 'smart combination' by way of exception

Prevention remains paramount: the required protection level is achieved by reducing the probability of floods, with solid dykes, dams, dunes and storm surge barriers, as well as creating sufficient room for the river.[6] At various locations, achieving the required level solely with such preventive measures is relatively costly or the measures have too much of a social impact, compared with other options. In those specific cases, it is possible to opt for a 'smart combination' of preventive measures and interventions in the spatial organisation or disaster management that, when combined, afford the required level of protection. To safeguard the protection level in such situations, tailored agreements are made on tasks, responsibilities and funding on a case-by-case basis. This has already been outlined in ↗ DP2014. The initiative lies with the defence system manager, who will consult with the province, the municipal council(s) the central government and/or the security regions. In their role in the spatial domain, provinces and municipal councils can also propose options for a multi-layer approach. The area-based structure of the Delta Programme, which involves all government authorities, facilitates this process. The minister's approval is also part of the tailored agreements. This is necessary because the protection level pursued through a 'smart combination' is achieved by a combination of various types of measures rather than measures from layer 1 only.

The use of a 'smart combination' means savings are made on the investments in dyke improvements. The basic principle, therefore, is that the budget made available is more or less equal to the amount of savings made in the Flood Protection Programme budget, as fewer measures are taken that qualify for subsidy from that budget. 'Smart combinations' are being studied for Dordrecht, the IJssel-Vecht delta and Marken.

Overview of measures

The measures and provisions for flood risk management to be implemented are outlined in the Delta Plan on Flood Risk Management (↗ sub-section 4.2). The preferential strategies for the various regions form the indicative framework (the guide) for programming measures (↗ section 3). For the implementation of flood risk management measures, it makes sense to distinguish between stretches where complex, wide-ranging solutions are envisaged, such as river widening and 'smart combinations', and stretches where there will be 'regular' dyke improvements and linkage opportunities. Stretches with complex, wide-ranging solutions will be selected on the basis of preferential strategies ('demarcation'). Both types of measures are part of the Delta Plan on Flood Risk Management. Dyke improvements are prioritised and programmed within the Flood Protection Programme, which is part of the Delta Plan on Flood Risk Management (↗ starting with DP2014). In the area around the major rivers, river widening is an important measure in tandem with dyke improvements. Its implementation should be coordinated in good time with the necessary dyke improvements. The Delta Plan on Flood Risk Management now includes an initial outline of the measures for river widening; DP2016 will contain a more detailed programme of river-widening measures.

Innovations are important in order to arrive at effective and efficient solutions with these measures. The Flood Protection Programme addresses this aspect. For this purpose, a link has been established with the Top Sector Water. By way of the Delta Technology Task Force, the business community collaborates on innovative solutions at an early stage (↗ sub-section 6.2).

6 The estimated effects of preventive evacuation have been taken into account.

Implementation

The new flood risk management policy is implemented in three phases. As requested by the Dutch House of Representatives, the risk-based approach has already become the starting point for prioritising flood risk management measures (Flood Protection Programme). The central government will embed the government policy arising from the proposed Delta Decision on Flood Risk Management in an interim revision of the National Water Plan (late 2014). Subsequently, studies under the Flood Protection Programme can take the new standard specifications into account. The aim is for the new flood risk management policy and the new standardisation to be embedded in law by 2017, because the next national assessment of primary flood defence systems will start in that year and the Cabinet will have to report on that to the Dutch House of Representatives in 2023. As laid down in the Administrative Agreement on Water, the water managers have been asked to advise on the standard specifications (implementation assessment). Both Rijkswaterstaat and the water boards have issued positive recommendations and suggestions for implementation. Once the time comes for it to be embedded in legislation, the water managers will once again be asked for advice. It will take up until around 2050 to bring all flood defence systems to the level as specified in the new flood risk management policy (↗ section 5). This is in keeping with the applicable National Water Plan.

The introduction of the risk-based approach and the new standards calls for new tools to be able to evaluate (assess) the safety of the flood defence systems and design measures for improvement for flood defence systems that do not meet the new standards. The new assessment tools will be made available in two phases. On 1 January 2017, the set of tools for the first phase will be ready. This will make it possible to identify flood defence systems that clearly do not meet the new standards for the Flood Protection Programme. The second phase will be made available on 1 January 2019, which will make it possible to subject the flood defence systems to closer scrutiny.

In certain places, there are high forelands in front of the flood defence systems, such as elevated (dock) sites or overgrown flood plains. Forelands and other elements lying on the water side of the flood defence systems can have a positive effect on flood risk management: wave reduction can ease the hydraulic loads on the flood defence system and inhibit failure mechanisms such as piping. The calculation models that are part of the new assessment tools are based on the current soil position, including the forelands and elements there that influence waves and water levels. The flood defence manager also has to take these forelands and elements into account in the assessment and associated schematics. The flood defence managers have instruments at their disposal (e.g. dyke boundary and test) to preserve forelands situated within the core zone or protection zone using active and passive management. If forelands or

‘Smart combinations’ at Dordrecht, IJssel-Vecht delta and Marken

There are three areas for which MIRT Studies are conducted into ‘smart combinations’. On the one hand, the objective is to explore the options of a ‘smart combination’ for flood risk management in the area in question, and, on the other, to gain more (general) insight into dealing with ‘smart combinations’.

The Eiland van Dordrecht research focuses on a mix of all layers of multi-layer flood risk management, by reinforcing a part of the dyke ring, using existing regional flood defence systems for compartmentalisation and preparing sound evacuation strategies. Special attention is paid to the division of roles between the government authorities, the decision-making structure, and embedding these in the local, the regional and the national policy. The IJssel-Vecht delta research focuses on a cost-effective, water-robust organisation in combination with spatial developments, such as the construction of a noise barrier along a road near Zwolle serving as a compartmentalisation dyke. This research also elaborates on the possibilities of exchanging measures between the three layers of multi-layer flood risk management. For Marken, the research focuses on alternatives to the previously planned dyke improvement, which had significant spatial consequences. The so-called ‘hydrobiography’ of Marken is a useful aid in that respect. The inhabitants play an important role in the search process. A second objective is to gain knowledge and experience using the practicality of multi-layer flood risk management.

elements are situated outside these zones, the flood defence manager must ascertain whether any changes there will impact the flood defence system in question. The water defence manager can reach agreements with the landowners or managers about preserving these forelands and elements. If necessary, the flood defence manager can even perform a new safety assessment. In this way, the mitigating effect that forelands have on flood risks is realistically and explicitly included in the assessment tools. In the short term, research will be conducted into the legal and spatial assurance of the contribution of forelands, showing the ways in which forelands can continue to contribute to the flood defence function. Resources will be available for this in 2015.

The Limburg Maasvallei is still subject to the regulation that all dyke rings must be floodable in the event of a normative discharge. This regulation will be cancelled, on condition that compensatory measures are implemented (↗ sub-section 3.3). The new assessment and design tools will be adjusted accordingly.

In all cases, it is essential that disaster management, part of which is preventive evacuation, is in good order. As such, the Ministry of Infrastructure and the Environment, the Ministry of Security and Justice, the security regions and the water and network managers will intensify their collaboration in the preparation and response phases. The security regions embed this intensified collaboration in the risk profiles, policy plans and crisis plans that they adopt every four years. On behalf of the Cabinet, the Minister for Security and Justice intends to reach further agreements with all security regions on embedding this in legislation in the form of 'common objectives'. On 16 May 2014, the Veiligheidsberaad (administrative platform of 25 security region chairs) agreed to elaborate on this in a road map. The Ministry of Security and Justice will update the Minister for Infrastructure and the Environment on the progress of the agreements. This progress information can be used in the periodical meetings on whether the standards need to be adjusted on account of material changes in the underlying assumptions. The Evacuation in case of Major Floods Module (Module Evacuatie bij Grootschalige Overstromingen or MEGO), which is being developed at the behest of the Minister for Infrastructure and the Environment, will help improve the effectiveness of evacuations. In the coming year, the ministries and security regions will work out an action strategy for citizens at postcode level and dedicate a public campaign to improve their coping capacity ('*awareness*').

No standard specifications have yet been adopted for a few dyke stretches, as further research is still ongoing (↗ Appendix 1). These must first be clarified before they can be embedded in legislation. This applies to stretches involving the following:

- 'Smart combinations': for a number of locations, research is being conducted into the possibility of using 'smart combinations'. Once there is clarity on whether the 'smart combination' will in fact be used, the definitive standard specifications will be established for these stretches.
- C-dykes: this risk-based approach has consequences for this special group of primary flood defence systems. C-dykes form a second line of defence, offering additional protection from the sea, the major lakes or the major rivers, but they are generally not immediately adjacent to these large bodies of water. Examples are flood defence systems along the Noordzeekanaal canal and the dammed up delta waterways. In the new approach, a number of these flood defence systems will retain their function as primary flood defence systems, but other C-dykes may not. After consulting with the provinces and water boards, the central government will announce the plans for each C-dyke by the end of 2014, in good time before the new policy is embedded in legislation.
- Central Holland: the Central Holland study and the Rivers sub-programme have shown that improving the northern Lek dyke is a cost-effective solution for the safety of Central Holland. As a consequence, the C-dykes along the canalised Hollandsche IJssel and possibly those along the Amsterdam-Rijnkanaal canal as well may ultimately lose their primary status. The status of the C-dykes along the Noordzeekanaal canal depends in part on the standard specification for the sluice complex at IJmuiden. As part of the Flood Protection Programme (general exploration of Central Holland), a start has been made on the elaboration of these changes, which in due course need to be embedded in legislation at a national level (i.e. amendment to the Water Act) and – depending on the results of the exploration – at a provincial level (i.e. provincial regulation).
- Volkerak-Zoommeer flood defence systems: as the Volkerak-Zoommeer is used for peak water storage, the flood defence system around this lake will hold back flood water as from 1 January 2016. The question of which standard specifications are appropriate for these defence systems is a complex one and is being studied.
- Further research is being conducted into a number of dyke stretches.

Besides A- and C-dykes, there are also B-dykes. These include storm surge barriers and closure dams. B-dykes, together with the A-dykes behind them, protect the hinterland. If B-dykes fail to function or to function properly, this will not immediately result in a flood. As such, B-dykes are not assessed in terms of flood risk but in terms of requirements for failure probability. These requirements are the result of considering the failure probability of the B-dyke in relation to the strength of the A-dykes behind it to ascertain whether these A-dykes comply with the set probability of a flood. The manner in which the failure probability requirement is determined depends on the water system behind the dyke. In the case of small water systems, such as the Noordzeekanaal canal, the failure probability requirement is linked to the number of victims. In the case of large water systems, such as the IJsselmeer lake, the consequences of failure for the water levels in the water system in the hinterland determine the failure probability requirement. In either case, a lower and an upper limit have been determined. These have been determined in such a way that, within these limits, the standard specifications for the regional A-dykes are no longer affected. A more refined elaboration is being worked out alongside the development of the new statutory assessment tools by Rijkswaterstaat.

The Cabinet is adopting the proposal for the Delta Decision on Flood Risk Management. The Cabinet shares the above line of reasoning and objectives for a fundamentally different flood risk management policy and is laying down this new approach in the interim revision of the National Water Plan. For the new standards arising from this, the Cabinet will employ standard specifications expressed in flood probability for each dyke stretch as the basis, as recommended by the Delta Programme Commissioner. The Cabinet will use the coming period to ascertain how these standard specifications are to be embedded in legislation and what requirements need to be applied in the new assessment and design tools to be developed for 2017, based on the new standards. The Cabinet aims to have the new standards included in the Water Act by 2017, so that in 2017 the Fourth Assessment can be carried out on the basis of the new standards. The Cabinet also aims to have all flood defence systems meet the new standards by 2050. Finally, the Cabinet will make the application of 'smart combinations' legally possible.

As such, the Cabinet deems it essential that disaster management remains effective and seeks to enhance the coping capacity of the Dutch population, because there is no such thing as 100% safety.

Flood risks and external safety risks

The risk-based approach that is currently proposed for the flood risk management policy is already applied within the policy for dealing with external safety risks. External safety risks are risks that stem from the storage or transport of hazardous substances or from human conduct. A 10^{-6} protection level applies to such risks, but only at the location affected by the risk. This is a big difference with the proposed protection level for flood risks that will apply to the whole of the Netherlands. The proposed protection level of 10^{-5} as the basis for the flood risk management policy does justice to the potential magnitude of the consequences and the investments required to achieve that protection level. With a higher basic protection level for all inhabitants, for example the 10^{-6} that applies to external risks, the costs would significantly exceed the level that would be justifiable based on a social cost-benefit analysis.*

* If 10^{-6} were applied in the flood risk management policy, the costs for flood defence systems would be approximately €5 billion higher than at the current protection level of 10^{-5}.

Current standards and new standard specifications

The new standard specifications cannot be compared to the current statutory standards. The current standards are based on a probability of overtopping: the risk that a certain water level or wave height is exceeded. However, this risk is not the only potential cause of a flood. The new standard specifications, which have been derived from the desired protection level, are expressed in probability of a flood: the probability that a flood defence system or part thereof fails, resulting in a flood. Moreover, the current standards relate to individual dyke rings, whereas the new standard specifications have been set for individual dyke stretches.

Recommendations by the Netherlands Environmental Assessment Agency

The Netherlands Environmental Assessment Agency (Planbureau voor de Leefomgeving or PBL) has published the research report 'Minor probabilities, major consequences'. The recommendations are largely in line with the proposals for the Delta Decision on Flood Risk Management and the Delta Decision on Spatial Adaptation. The PBL draws attention to the prevention of large numbers of victims (group risk). This is one of the objectives of the new policy on which protection levels are based. For this reason, a higher protection level and subsequent higher standard specification has been proposed for a number of stretches known as 'group risk hotspots' (↗ appendix 1). The objectives of the new flood risk management policy, however, include more than just preventing large groups of victims (group risk): other key objectives of the policy include offering a protection level that everyone living behind dykes throughout the Netherlands can at least count on and also preventing damage. The PBL research report also indicates that there are good opportunities to broaden the disaster management during a flood. This will be taken up in consultation with the security regions. The Ministry of Infrastructure and the Environment is developing a website with information for citizens and professionals. Moreover, the PBL points to the importance of preserving vital functions during a flood. The Delta Decision on Spatial Adaptation picks up on this with agreements on vital and vulnerable sectors (↗ sub-section 2.4).

2.3
Delta Decision on Freshwater

Social importance

Freshwater permeates our society in many ways. Sufficient freshwater is crucial to the stability of dykes, urban development, the drinking water and electricity supply, and more. Sectors that depend on water, such as agriculture, shipping and many forms of industry, rely on freshwater for their production activities. These sectors are worth over €193 billion (direct production) and account for approximately 16% of the national economy.[7] In addition, nature areas abounding in water, the urban living environment and public health depend on a sufficient supply of freshwater. However, the supply of freshwater does not always meet demand. The Delta Scenarios show that there will be more frequent water shortages in the future as a result of climate change, salinisation and socio-economic developments. Anticipating these potential developments will benefit the Dutch economy and society. The proposal for the Delta Decision on Freshwater will contribute to this by introducing the new 'supply levels' tool and an associated adaptive investment programme. This will allow the Netherlands to continue to use its favourable freshwater situation in the future for a strong economic position and attractive living environment.

Proposal for Delta Decision on Freshwater

With regard to freshwater, the Delta Programme Commissioner proposes to decide that:

- sufficient freshwater be a shared responsibility that requires cohesive efforts in the main water system, the regional water and among the users;
- the government authorities involved agree on freshwater supply levels in consultation with the users, by making the availability (bandwidth) and, where relevant, the quality of freshwater as transparent and predictable as possible for normal, dry circumstances, in addition to the National List of Priorities;
- the central government embeds the principle of supply levels and the associated national rules in central government policy;
- by 2021, supply levels will have been agreed and laid down for all areas and the main water system;
- in 2018, the Delta Programme will include an interim evaluation of the process, the rules, the available tools to safeguard agreements and the level of ambition;
- the central government and the water boards will make the freshwater supplies more robust with a number of targeted investments in the main water system and the regional water systems, in order to improve freshwater buffering and counter salinisation, as outlined in the Delta Plan on Freshwater;
- government authorities and users reach agreements to limit the demand for freshwater and reduce susceptibility to drought and salinisation by means of more economical and effective water consumption;
- government authorities and users take the necessary measures based on a mutual commitment according to interest and optimal (cost) effectiveness of the total package for each region;
- measures to ensure the availability of freshwater are programmed concordantly and are prioritised on the basis of urgency;
- where possible, freshwater measures are implemented in an integral fashion, taking area development into account.

Five national objectives of the freshwater policy form the starting point for this:

- to preserve and promote a healthy and balanced water system;
- to protect crucial designated uses: drinking water (public health), energy, vulnerable nature and flood defence systems (limiting subsidence and soil consolidation in both cases);
- to promote the competitive position of water-dependent sectors in the Netherlands;
- to use the available water effectively and economically;
- to develop hydraulic knowledge, expertise and innovations for the freshwater objectives.

Explanation

Joint responsibility

The prevention of water shortages will require efforts to be made by the government authorities responsible for the main water system and the regional water systems and by the freshwater users. These parties share responsibility for keeping the freshwater supplies at the required level. Only if all these parties make a concerted effort will the Netherlands have a sufficient, cost-effective supply of freshwater in the long term. The joint and reciprocal effort forms the starting point for funding measures in the Delta Plan on Freshwater.

7 The total direct production value amounted to approx. €1,186 billion in 2011 (CBS, 2013). An estimated €193 billion can be directly allocated to water-related sectors (VNO-NCW, 2013).

A coordinated set of measures in the main water system and the regional water systems and among the freshwater users will make the freshwater supplies robust. Rijkswaterstaat and the water boards improve the water systems to create better buffers and freshwater supply routes and to counter salinisation. Internationally, the central government will also endeavour to ensure a sufficient supply of freshwater. At the same time, measures in the regional water system and among users will be required to make water consumption more economical and effective and to minimise susceptibility to water shortages. These users include companies that use a lot of water, agricultural and horticultural businesses and nature organisations. Water managers can optimise water management by, for example, flushing watercourses more efficiently and managing polder levels in a flexible manner. The supply levels will afford the users insight into the probability of water shortages. They can prepare for this by introducing innovations in the business processes, for example.

Supply levels

The new 'supply levels' tool shows the availability of freshwater and the probability of water shortages in a certain area, under both normal and dry circumstances. The availability – expressed in a bandwidth – relates to surface water and groundwater and to the quantity and, where relevant, the quality of the water. The supply level is established by reaching agreements about the efforts to be made by the government authorities and the various users, bearing in mind the current supply level, any optimisations in the freshwater supply, buffering and use, and spatial developments. The 'supply levels' tool shows where the responsibility of government authorities for freshwater stops and what the residual risk is for the users. This creates transparency, predictability and an action strategy for freshwater users. One special form of use is the drinking-water supply. Just like taking care of safety, this is a public task: the Drinking Water Act obliges government authorities to safeguard the public drinking-water supply in the long term. Nature preservation also calls for a sufficient supply of freshwater. Pursuant to European and national policy (e.g. Natura 2000 and the Water Framework Directive), the government is obliged to achieve preservation objectives for protected areas.

There are three steps to the approach designed to achieve supply levels: 1) providing insight into the availability of water and the probability of water shortages, now and in the future, 2) beginning a dialogue about this information between government authorities and users 3) optimising efforts where relevant and laying down agreements.

Supply levels are established for the main water system and the regional water systems, by incorporating new or amended agreements into existing tools (such as (water) agreements). The National List of Priorities, which shows which functions are given priority in cases of water shortages, will be included in the agreements on supply levels. This will not change the list of priorities itself, which will remain effective in accordance with the established policy and as embedded in the Water Act.

Improve step by step

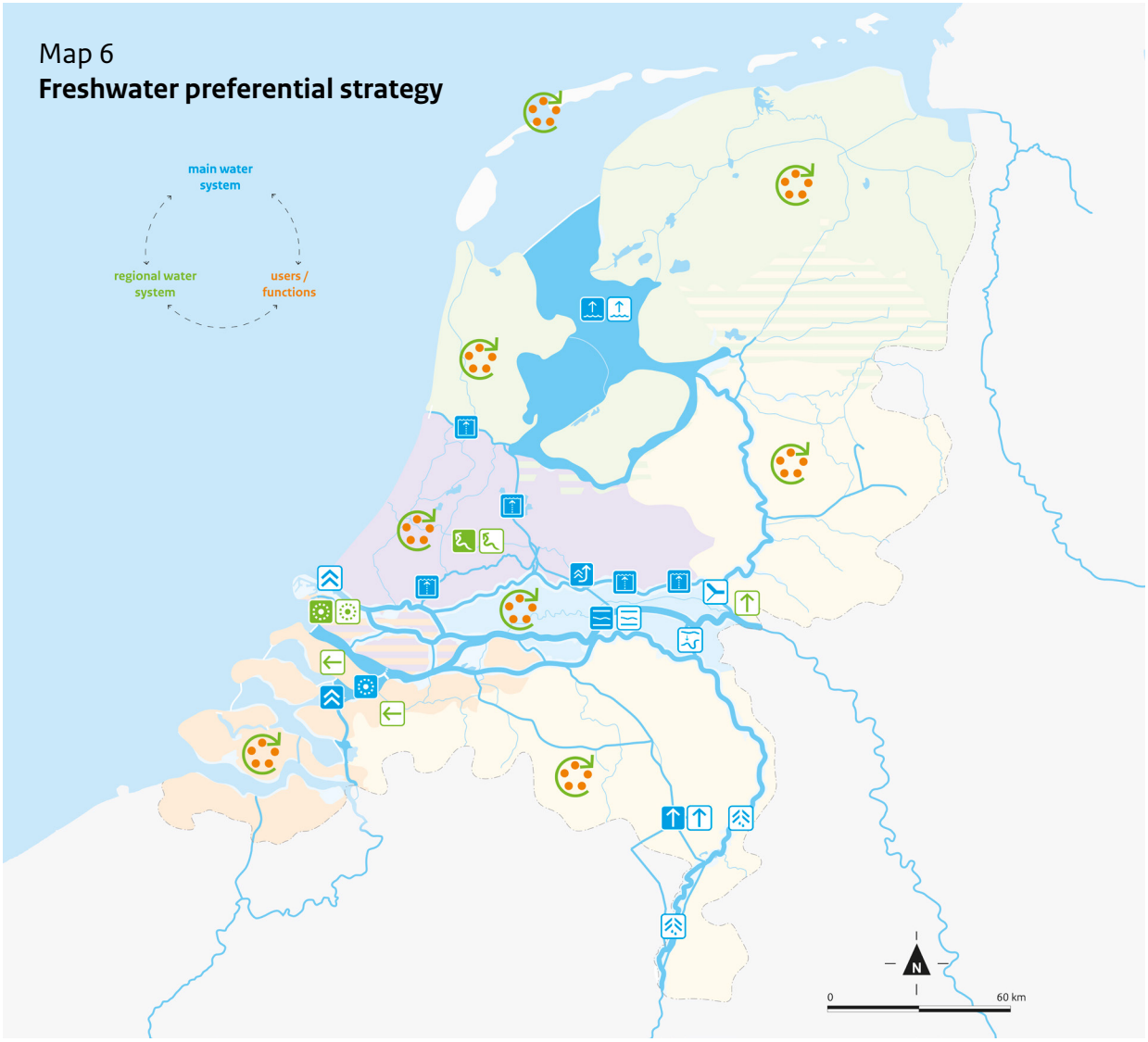
Over the last few centuries, the Netherlands has built a solid foundation for freshwater supplies, with strategic fresh-water buffers in Haringvliet/Hollandsch Diep/Biesbosch and in the IJsselmeer region, the weirs in the Nederrijn for the distribution of the Rhine water, the weirs in the Meuse and the system of regional watercourses for the further distribution of water in the country. This will continue to be the basis for freshwater supplies in the long term. In the short term, any bottlenecks in freshwater supplies can be addressed by investing in the main water system and the regional water system, and ensuring that water users use the water more efficiently and economically. In this way, freshwater supplies can remain at the current level or improve locally.

Apart from changes in use, climate change will determine the investments required in the medium and long terms. As the effects of climate change on freshwater are uncertain, an adaptive, step-by-step approach is advisable and innovations will become increasingly important in that regard. In the long term, spatial organisation may also help to maintain freshwater supplies and prevent water shortages.

The proposal is to prioritise and programme freshwater availability measures concordantly for the Delta Plan on Freshwater, also on the basis of the supply levels as soon as they are available. Innovations in the area of freshwater are addressed in the Water and Climate Knowledge Innovation Programme (↗ sub-section 6.2).

Map 6

Freshwater preferential strategy



Freshwater measures

short term	medium term (opportunities)	long term (opportunities)
effective and efficient water consumption[1]	effective and efficient water consumption[1]	effective and efficient water consumption[1], accept water shortages
permanent freshwater buffer IJsselmeer and Markermeer lakes 20 cm *(with robust design, including shore faces)*	further increase permanent freshwater buffer in IJsselmeer and Markermeer lakes (maximum 40-50 cm)	further increase permanent freshwater buffer in IJsselmeer lake
		adjust discharge distribution during low water
smart water management *(Hollandse IJssel, Amsterdam-Rijnkanaal, Noordzeekanaal and weirs at Driel, Amerongen and Hagestein)*	water-saving measures during lockage in Meuse	replace Maeslantkering storm surge barrier after 2070 *(may help prevent saltwater intrusion)*
	transport of water from Waal to Meuse	
trial with erosion control dams constructed parallel to the river current	scaling up erosion control dams constructed parallel to the river current	
expand alternative supply routes to15 m³/s	expand alternative supply routes to 24 m³/s, possibly with permanent supply from the east	expand alternative supply routes to>24 m³/s, possibly with permanent supply from the east
bypass Irene locks for small-scale water supply		
optimise management of Bernisse-Brielse Meer lake (including use of intake at Spijkenisse)	increase Bernisse-Brielse Meer lake buffer/small-scale alternative supply	(large-scale) alternative supply Bernisse-Brielse Meer lake
optimise management of Volkerak-Zoommeer lake	alternative robust freshwater supply in Volkerak-Zoommeer lake area[2]	
improve freshwater/saltwater separation at locks		
increase Noordervaart capacity from 4 to 5 m³/s	increase Noordervaart capacity from 5 to 6 m³/s	
	connect with Liemers area	

Basic map

- Western Netherlands region
- IJsselmeer region
- Elevated sandy soils region
- River region
- Southwest Delta region
- Wadden region
- freshwater
- saltwater / brackish water
- area outside the dykes
- border

1 for generic measures, see adaptation path for Freshwater Western Netherlands

2 Roode Vaart programming has been put on the agenda for this Cabinet's term of office (↗ sub-section 4.3, table 13)

Overview of measures

The Delta Decision on Freshwater has been elaborated into concrete preferential strategies for freshwater for each sub-region (↗ section 3 and ↗ map 6). The resulting investments and measures are outlined in the Delta Plan on Freshwater (↗ section 4.3). The programming now only contains the explorations of the most urgent measures for the coming years; the programming in DP2016 will be more detailed.

The proposal is to start explorations in due course for a number of targeted investments in a more robust freshwater supply in the main water system and in the regional water system, which can be increased step by step should this prove necessary: a larger freshwater buffer in the IJsselmeer Region for the area above the Amsterdam-Amersfoort-Zwolle line, expansion of small-scale freshwater emergency supply to the western Netherlands (the small-scale water supply or KWA), the step-by-step increase in robustness of the Brielse Meer lake for the Rhine Estuary-Drechtsteden and the Southwest Delta, and the increase in capacity of the Noordervaart canal for the supply of freshwater to the Elevated sandy soils in Brabant. The central government will not leave the Haringvliet sluices ajar until the fresh-water supplies are ready, and will then start monitoring salinisation in Haringvliet. In the government framework vision on the Grevelingen and Volkerak-Zoommeer lakes, the central government is preparing a decree on the possible introduction of limited tides in Grevelingen and salinising the Volkerak-Zoommeer. This decree may have consequences for the measures required for freshwater supplies in the Southwest Delta (↗ sub-section 3.5). The decision on this government framework vision is expected in late 2014. Rijkswaterstaat and the water boards are introducing 'smart water management' in order to improve the supply and buffering of water in the day-to-day operational management together. With new tools for monitoring, information exchange and decision-making support, they will be able to better control or retain water in case of any imminent shortages.

The regional water systems allow measures to be taken to increase freshwater buffers, flush more efficiently and counter salt intrusion. Especially areas that do not receive water from the main water system – over 60% of the Elevated sandy soils and parts of the Southwest Delta – stand to benefit from investments in good conservation and better utilisation of freshwater by regional water managers and users. This means new tasking for these areas. For the elevated sandy soils, where the current focus is on discharging water, a partnership between two regions – comprising government authorities and users – has drawn up a Strategy and Implementation Programme for the Elevated sandy soils. The Elevated sandy soils and the Southwest Delta may bring innovations that in the long term will be important for the rest of the Netherlands. Users are encouraged to limit the demand for freshwater and to reduce susceptibility to drought and salinisation by implementing water-saving measures in business operations, cultivation and intake points. These are also important themes within the Top Sector Water. In the short term, a number of pilot projects with more efficient water consumption can be organised.

↗ Figure 1 shows the general approach, in the form of an adaptation path for the Delta Decision on Freshwater. The preferential strategies are flexible and offer alternatives in case of any imminent major freshwater shortages in the future as a result of climate change or changes in demand (↗ section 3). The alternatives are far-reaching and any decision will require monitoring as well as further research and a thorough evaluation. These options can be kept open without having to take decisions in the short term.

Implementation

The central government embeds the central government policy arising from the proposed Delta Decision in an interim revision of the National Water Plan (scheduled for late 2014). Moreover, at international meetings, the central government seeks to secure a sufficient supply of freshwater to the Netherlands.

When elaborating the supply level, the following rules apply, allowing room for customisation:

- The central government takes the initiative to arrive at supply levels for the main water system, in consultation with other government authorities and users of the main water system.
- The provinces take the initiative to launch the process of establishing supply levels for regional water systems.
- Depending on the tasking and the local context, the province, the water board or, in some cases, the municipal council leads the process for the area-based supply levels for the regional water systems. It makes sense here to link the tasking for urban areas to tasking for climate-proof cities in terms of drought and heat stress (↗ sub-section 2.4, Delta Decision on Spatial Adaptation).
- The proposed Delta Decision on Freshwater and the preferential strategies for freshwater per sub-region, including the choices and measures mentioned therein, form the basis for elaborating the supply levels.
- The government authorities will make the supply levels transparent to users.
- The government authorities will lay down the efforts required for the agreed supply levels in existing tools, such as water (management) plans, water agreements, decisions on water levels or groundwater levels, disaster plans and agreements with major users.
- The national guidance group (Freshwater Steering Group) coordinates the elaboration and implementation of supply levels to safeguard interconnectivity.

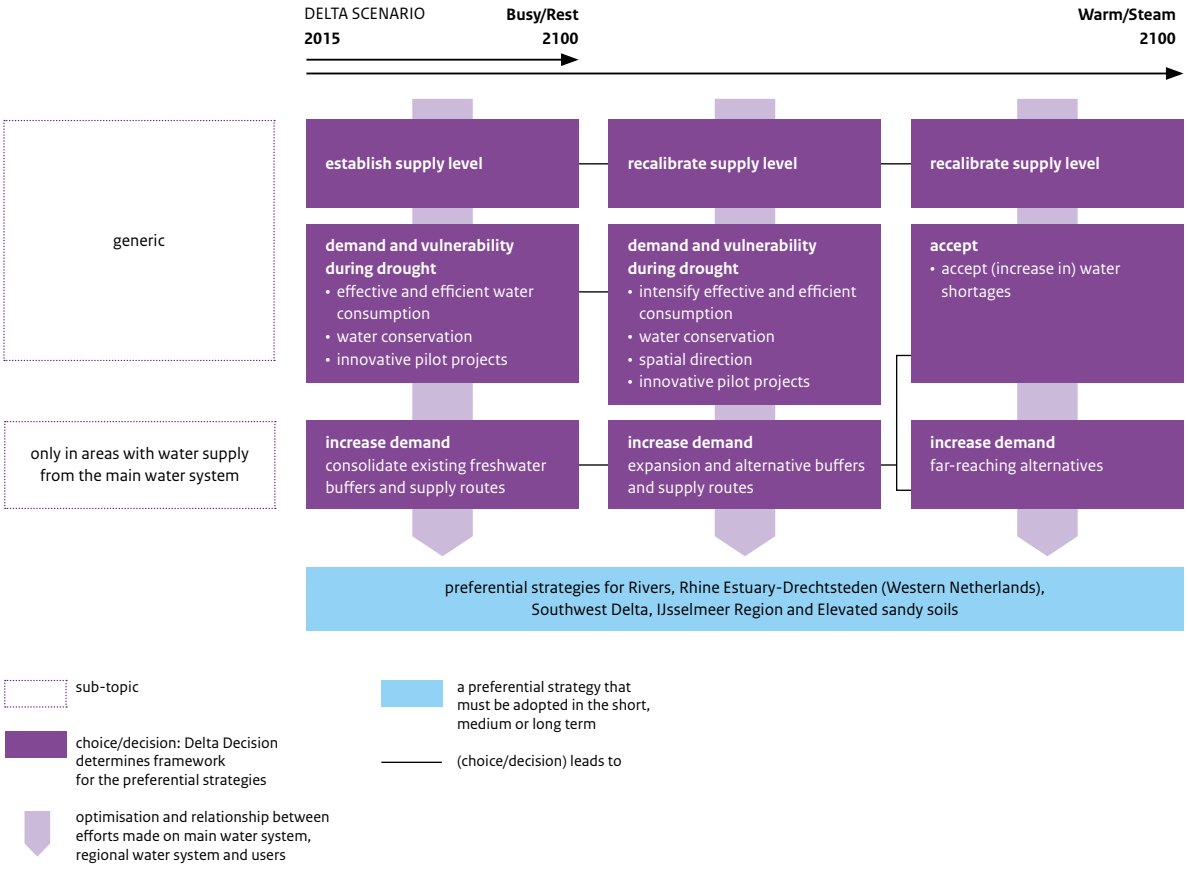
The supply levels may materialise differently for each region. The nature and scale of the information and the agreements may vary, depending on the characteristics of the area, urgency of the (drought) problems and the type of water consumption.

The 'supply levels' tool is new and will therefore be introduced in phases. In 2018, the supply levels will be ready for the first group of areas; they will be described in DP2019. Based on that, the 'supply levels' tool will be evaluated in 2018, as will the process, the rules, the available tools and the level of ambition. By 2021, supply levels will have been agreed and laid down for all areas. The supply level is subject to a performance obligation and applies for a period of 18 years, with the option to revise it after every 6 years. In the National Water Plan, the central government outlines the procedure for establishing supply levels, as outlined in this sub-section. The provinces lay down the principles underlining the supply level in the provincial policy. In collaboration with the other partners in the Delta Programme and in conjunction with the other aspects of water management and the 2014 EU directives, the central government will elaborate on the profit principle and the cause principle, for the purpose of agreements on the further improvement of supply levels based on mutual commitment according to the interests of the various government authorities and users. Optimal (cost-) effectiveness of the total package of freshwater measures will form the basis for this.

The proposal is to programme (and to prioritise) the freshwater availability measures and the required studies and pilot projects (↗ background document A (in Dutch), DP2015 Knowledge Agenda) concordantly for the Delta Plan on Freshwater, also on the basis of the supply levels as soon as they are available (↗ sub-section 4.3, Delta Plan on Freshwater). A small organisation should suffice for this (↗ sub-section 6.4). The basis for the investments is mutual commitment according to interest in the efforts being made by the central government, regional authorities and users.

The partners of the Delta Programme have jointly drawn up an investment programme to make the freshwater supplies more robust and water consumption more economical and efficient. The investment programme has been compiled on the basis of a national investment agenda (measures in the main water system), regional implementation programmes of the freshwater regions and (a number of) implementation programmes of designated uses. For the short term (2015-2021), a concrete investment programme has been put on the agenda, partly on the basis of regional proposals. This programme includes a financial arrangement under which the central government and the regions share the costs (↗ sub-section 4.3, table 13). The parties will endeavour to acquire these resources for the implementation.

Figure 1 Adaptation path for Delta Decision on Freshwater



The Cabinet agrees with the proposal for the Delta Decision on Freshwater and will embed the new freshwater policy with the new national objectives and rules for the 'supply levels' tool in the interim revision of the National Water Plan. The Cabinet is pleased with the wide support for the structuring choices and the adaptive implementation programme. The existing water system is increased as a water buffer and supply route for freshwater by means of targeted investments. Users will use freshwater more economically and effectively. Step by step, a coordinated set of measures is taken in the main water system and in the regional water system and among users. The Delta Plan on Freshwater allows the government authorities and users to roll out measures for sustainable freshwater supplies. In consultation with users, the government authorities will provide clarity on the availability of freshwater under normal and dry circumstances in the form of supply levels. This will lead to more transparency on the efforts being made and establish a clear division of responsibilities.

2.4
Delta Decision on Spatial Adaptation

Social importance

Three quarters of the housing in the area inside the dykes may be damaged if the primary flood defence systems are breached. There are buildings in the area outside the dykes as well, where there is often little flood protection. Vital and vulnerable functions, such as hospitals and power plants, are generally not flood-proof. As a result of climate change, built-up areas may also suffer damage caused by heat, extreme drought and pluvial flooding. This was often not taken into account when decisions on location, spatial organisation and construction method were being made. As such, it is important to make built-up areas less vulnerable to extreme weather conditions and potential flood-related damage. That requires a process of change: climate-proof and water-robust development should be part and parcel of spatial (re)developments in the Netherlands. This change can tie in with the ongoing (re)developments taking place in the area. All government authorities and private parties will share responsibility for this. Accordingly, a set of administrative agreements and tools that these parties can use to lay down the ambition and the working method form a central part of the proposal for the Delta Decision on Spatial Adaptation. Water and space are systematically connected in this way.

Proposal for Delta Decision on Spatial Adaptation

With regard to spatial adaptation, the Delta Programme Commissioner proposes to decide that:

- the central government, provinces, municipal councils and water boards lay down the joint ambition that in 2050 the spatial organisation of the Netherlands is as climate-proof and water-robust as possible, eliminating any incidental risks of damage and victims to the extent that this is reasonably feasible;
- by 2020 at the latest, a climate-proof and water-robust organisation is part and parcel of the policy and actions of these parties, which they can achieve by analysing the water-robustness and climate-proofness of their own planning area in their regional and local spatial considerations ('knowing'), translating the results of this analysis into a supported ambition and an adaptation strategy with concrete objectives ('wanting') and safeguarding the policy-based and legal effects of this ambition for implementation ('working');
- each of these parties contributes to the agreed joint ambition based on its own responsibilities and powers;
- the parties employ a number of generic principles for this, as outlined in the explanation below and in ↗ appendix 2;
- the Water Review remains embedded in legislation as a process tool and is applied at an early stage of the spatial process;
- the government authorities jointly make the guide to Spatial Adaptation along with an Stimulation Programme for Spatial Adaptation available as tools to help realise the ambition;
- The central government ensures that by 2050 national vital and vulnerable functions are more resistant to flooding (↗ interdepartmental agreements in appendix 3) and that it has adopted policy and laws for this in 2020 or earlier if necessary;
- in 2017 and from then on regularly, the Delta Programme will evaluate the progress of the climate-proof and water-robust organisation and the instruments available to realise the ambition.

Explanation

Ambition

In their policy, the government authorities have laid down the ambition to have a climate-proof and water-robust organisation for the Netherlands by 2050. New developments, redevelopment, management and maintenance will entail as little incidental risk of damage or victims caused by heat stress, pluvial flooding, drought and floods as is reasonably possible. This ensures that a future tightening of flood risk management standards can be prevented or at least delayed. Consequently, the proposed Delta Decision on Spatial Adaptation is closely linked to the proposed Delta Decision on Flood Risk Management: the organisation of the Netherlands becomes less vulnerable to floods. The government authorities will realise this ambition gradually. They are doing their utmost to ensure that the climate-proof and water-robust organisation is a permanent feature of their policy and actions by 2020.

Knowing, wanting, working

The central government, provinces and municipal councils will work with the water boards to realise the ambition. To this end, they will complete three steps, together with social organisations and private parties if necessary, based on the following generic principles:

1. 'knowing': analysing the water-robustness and climate-proofness of the area (covered by the plan) and the functions. To the extent that the required data is available, this analysis is carried out within the bandwidth of the Delta Scenarios, using the most recent

data sets on which they are based, with 2030 and 2050 as reference years. The government authorities will select an appropriate scale for this analysis.
2. 'wanting': translating the threats and opportunities found in the analysis into a supported ambition and adaptation strategy. The government authorities will draw up concrete objectives for this. They will link the adaptation strategies at a regional and a local level, and safeguard the link with the Delta Programme's preferential strategies for flood risk management and freshwater.
3. 'working': policy-related and legal impact of ambition. Each government authority indicates how the ambition impacts its own policy (for the entire physical domain), spatial plans and regulations, business cases, implementation, management and 'major' maintenance.

When completing these steps and assessments, the parties' existing division of responsibilities and room for assessment will remain unchanged. ↗ Appendix 2 contains an explanation of the generic principles and a number of fitting examples.

Supporting tools

Within the Delta Programme, the Guide to Spatial Adaptation has been drawn up together with the Knowledge for Climate Programme. Government authorities, private parties and social organisations can use this to complete the steps of knowing, wanting and working, also for areas outside the dykes. The guide is available on ↗ www.ruimtelijkeadaptatie.nl (in Dutch).

The government authorities encourage the assessment of water-robustness and climate-proofness using a joint Stimulation Programme for Spatial Adaptation. In this way, they put the ambition for spatial adaptation in the region on the agenda, at both an administrative and an official level. Moreover, the Stimulation Programme enables government authorities to share knowledge and experiences in the area of climate-proof and water-robust organisation. The central government will set up a digital knowledge portal for this, in collaboration with Knowledge for Climate.

The proposal is to retain the Water Review as a statutory process tool that is used early on in the spatial process. The Water Review process tool helps to ensure that climate-proof and water-robust organisation are considered in good time in spatial developments. The government authorities have agreed to conduct the Water Review with regard to all relevant plans, including framework visions, involving the water managers as early as possible. The Guide to Spatial Adaptation supports the Water Review process.

Vital and vulnerable functions

Various vital and vulnerable functions require that special attention be paid to the consequences of floods. These are functions that are crucial for disaster management in case of floods or functions that, in case of flood, can cause serious damage to humans, the environment or the economy. National vital and vulnerable functions that can result in supraregional damage in case of a flood are functions in the areas of power supply (electricity, gas, oil), telecommunications and ICT (public grid and emergency communication, wastewater chain, drinking water supply, health care (including hospitals), pumping stations and discharge-by-gravity facilities, haulage, chemical companies and laboratories using pathogenic substances.

By 2050 at the latest, these national vital and vulnerable functions will be more flood-proof. The central government will ensure this by completing three steps:
1. 'knowing': by 2015 at the latest, the responsible ministries, together with the sectors, will accurately map out the vulnerability and chain dependence (within a sector and between the various sectors). Based on this analysis, they lay down the ambitions for each sector, including concrete steps and a timeline for achieving the ambition (↗ appendix 3 on interdepartmental agreements). The ministries are responsible for the implementation of these agreements, with the Ministry of Infrastructure and the Environment playing a coordinating role.
2. 'wanting': by 2020, the responsible ministries will have prepared the policy and supervision to achieve the agreed ambitions, safeguarded in agreements with sectors or in laws where necessary.
3. 'working': by 2050 or earlier if possible, the sectors will take measures, by, for example, taking flood risks into account in their investment decisions. Every year, progress is reported on to the House of Representatives, as part of the annual Delta Programme.

The Stimulation Programme for Spatial Adaptation supports this process by sharing knowledge on floods and experiences with making vital and vulnerable functions water-robust. The central government also coordinates this

approach with the manner in which regional and local governments make their vital and vulnerable functions water-robust and with the interdepartmental Rethink Vital programme (coordinated by the Ministry of Security and Justice). The Netherlands will use the results of this programme for the National Adaptation Strategy that it draws up as an elaboration of the European Climate Adaptation Strategy.

Overview of measures

The proposed Delta Decision on Spatial Adaptation aims for a transition in policy. It is the responsibility of the regional and local governments to translate this transition in concrete measures. Good examples of measures for a climate-proof and water-robust organisation can be found on the Spatial Adaption Knowledge Portal (↗ www.ruimtelijkeadaptatie.nl (in Dutch)).

Implementation

In the Administrative Agreement on the Delta Programme, the central government, Association of Provincial Authorities, Assocation of Netherlands Municipalities and the Unie van Waterschappen agree to consider flood risk management and climate-proofness wholly in spatial developments, redevelopments and investments in management and maintenance in areas inside and outside the dykes. This will be incorporated into the Administrative Agreement on the Delta Programme (further to the Administrative Agreement on Water, 2011). The parties will implement those elements of the Delta Decision on Spatial Adaptation for which they themselves are responsible. The following applies to the approach, the vital and vulnerable sectors, and monitoring and evaluation:

Approach

The central government, provinces and municipal councils will take decisions on climate-proof and water-robust organisation by completing the steps 'knowing, wanting and working' together with the water boards on the basis of a number of generic principles (↗ appendix 2). They will in any event do so when the central government, the province or the municipal council adopts a framework vision for its entire territory[8], or earlier if the party in question deems this necessary. The central government will ensure that the Water Review is preserved as a statutory process tool. The central government, provinces and municipal councils will use the Water Review in close collaboration with the water boards in the preparation of all spatial plans, including framework visions. Together, the government authorities will make all supporting tools available, such as the Guide to Spatial Adaptation and the Stimulation Programme for Spatial Adaptation, which runs from 2015 until the end of 2017. Agreements on the programming of the stimulation programme in 2015 are outlined in ↗ section 4; DP2016 will include a proposal for the content of the programme in 2016 and 2017. The government authorities are jointly responsible for the management and maintenance of the stimulation programme; the central government is responsible for the management and maintenance of the Guide to Spatial Adaptation and contributes to the management and maintenance of the Knowledge Portal.

Agreements on vital and vulnerable sectors

The central government will ensure that the national functions will be more flood-proof by 2050 at the latest and will adopt policy and, if necessary, legislation by 2020 at the latest. Interdepartmental agreements on this approach to vital and vulnerable functions are listed in ↗ appendix 3. Before 2050, the sectors will take the measures required to make vital and vulnerable functions more flood-proof. The central government will coordinate the national approach with the way in which decentralised government authorities make their vital and vulnerable functions more water-robust, using information available from these government authorities. For each function, the central government and the decentralised government authorities will agree who is responsible for what. The central government will use the results from this programme for the National Adaptation Strategy that it draws up as an elaboration of the European Climate Adaptation Strategy. The central government will also ensure that activities tie in with the Rethink Vital Programme (coordinated by the Ministry of Security and Justice).

Monitoring and evaluation

Every year the Delta Programme charts the extent to which the climate-proof and water-robust spatial organisation of the built-up area and the vital and vulnerable sectors are part of stakeholder activities. In 2017, progress will be evaluated, also with regard to the question of whether additional tools are needed to realise the ambition. The central government and umbrella organisations jointly

8 This concerns a framework vision based on Section 2.1(1), Section 2.2(1) or Section 2.3(1) of the Spatial Planning Act.

design and implement the monitoring programme and evaluation, ensuring coordination with other measurement occasions, such as the benchmarks in the water chain.

The Cabinet agrees with the proposals for the Delta Decision on Spatial Adaptation and subscribes to the importance of the agreement between the central government, the provinces, municipal councils and water boards to fully consider flood risk management and climate-proofness in all spatial (re)developments and investment in the management and maintenance of the areas inside and outside the dykes. The Cabinet will embed this in the interim revision of the National Water Plan. With respect to the Water Review, the Cabinet has decided that it will be preserved as a statutory process tool, to be used at an early stage of the spatial process. The Water Review process tool helps to ensure that climate-proof and water-robust organisation are considered in good time in spatial developments. The Cabinet supports the new joint Stimulation Programme for Spatial Adaptation that is to be set up.

2.5 Delta Decision on the IJsselmeer Region

Social importance

The IJsselmeer Region – the largest area of lakes in northwest Europe – provides the Netherlands with a freshwater buffer of national importance.[9] Half of the Netherlands, from Amsterdam to Stadskanaal, depends on this buffer. However, the water buffer in the IJsselmeer Region may decrease as a result of climate change, while demand increases.
The introduction of a new, flexible method of water level management will lead to a permanent freshwater buffer in the summer, from which the entire supply area will benefit. Flood risk management in the area around the lakes also needs to be addressed: the rising sea level is making it increasingly difficult to discharge IJsselmeer water into the Wadden Sea by gravity, making the water level harder to manage in the winter. This will ultimately have consequences for flood risk management. Using pumps in the IJsselmeer Closure Dam, the water can be discharged into the Wadden Sea quickly enough. This will prevent the winter water level of the IJsselmeer lake from adapting to the sea level rise, which would require major adjustments to the flood defence systems and designated uses along the lake and would cost €5-10 billion if the rise in sea levels and climate change were to occur rapidly.

Proposal for Delta Decision on the IJsselmeer Region

With regard to the IJsselmeer Region, the Delta Programme Commissioner proposes to decide that:

- the central government embeds in its policy the previously made choice to discharge water through a combination of pumping and discharging by gravity at the IJsselmeer Closure Dam;
- the central government embeds in its policy the previously made choice to maintain the average winter water level of the IJsselmeer lake at the current level through this combination of pumping and discharging by gravity until 2050;
- the average winter water level of the IJsselmeer lake should only be allowed to adapt to the rise in sea level to a limited extent (10-30 cm) after 2050 if this is necessary and cost-effective;
- the central government replaces the policy-based reservation in the area outside the dykes for a 1-metre rise in the winter water level of the IJsselmeer lake with a reservation for a potential rise of 10-30 cm;
- the central government embeds in its policy the choice for flexible water level management in the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes, to make water supply more robust;
- the central government lays down, through a revision of the National Water Plan, that the bandwidth of the summer water level of the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes is increased, allowing the level to rise to 30 cm above the current target level (water buffer of 40-50 cm);
- the banks are organised flexibly where possible, in conjunction with ongoing dyke improvements, so that they are able to withstand larger water level fluctuations in the future;
- investments in freshwater supplies respond gradually to changes in the climate and demand, with a coordinated set of measures in the main water system, the regional systems and among users;
- the government authorities and users in the supply area of the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes limit the demand for freshwater and reduce the vulnerability to drought by using the water more economically and efficiently.

Explanation

Pumping and discharging by gravity

The winter water level of the IJsselmeer Region determines, among other things, the strength and height of the dykes. Without additional efforts, the winter water level should adapt to the rise in sea level. With a combination of discharging by gravity and pumping at the IJsselmeer Closure Dam, the average winter water level of the IJsselmeer lake will in any event remain at the current level until 2050. This solution is considerably more cost-effective and less far-reaching than adapting to the rise in sea level. Installing pumps appears to be the best and most efficient solution, and this was adopted in 2012 as a decision on a preferred solution. That is why the Cabinet decided in 2012, when the IJsselmeer Closure Dam was renovated, to install pumps in the Den Oever discharge sluice complex in phases. This will limit the hydraulic load on the dykes, such as the IJsselmeer Closure Dam and Houtribdijk, during the storm season.
As a result, the recommendation from the second Delta Committee to take a 1.5-metre rise in water level into account was taken off the table. For the water discharge, the water

9 The IJsselmeer Region consists of the IJsselmeer lake, the Markermeer lake, the Zuidelijke Randmeren lakes (Gooimeer, Eemmeer and Nijkerkernauw lakes that have an open connection with the Markermeer lake) and the Veluwerandmeren lakes (the Nuldernauw, Wolderwijd, Veluwemeer and Drontermeer lakes between Nijkerkersluis and Roggebotsluis).

manager will, where possible, use discharge by gravity under the motto 'discharge by gravity if possible, pump if necessary'.

At this stage, it is already clear that, even after 2050, it will not be cost-effective to allow the winter water level of the IJsselmeer lake to adapt completely to the rise in sea levels. Installing additional pumps would be less expensive. After 2050, however, a small rise in level may be cost-effective. Accordingly, this will remain an option in case this is in fact cost-effective and necessary for flood risk management. If a decision on this small rise in level is made in the future, other values in the area, such as nature, recreation and spatial-economic development will also be taken into account. For the other lakes in the IJsselmeer Region, there is no question of any concomitant rise in the water level of the lake.

Increasing the supply and saving on the demand step by step
The Delta Decision on the IJsselmeer Region is to balance freshwater supply and demand in the supply area of the IJsselmeer Region. This requires increasing the freshwater buffer step by step, while at the same time saving on demand. A coordinated set of measures in the main water system, the regional water systems and among users will lead to a robust freshwater supply (↗ Delta Decision on Freshwater).

Measures are implemented step by step, because climate development is surrounded by uncertainty (adaptive delta management). Implementing the most cost-effective measures step by step helps to defer very drastic measures among users and in the water systems for as long as possible. The speed and magnitude of climate changes and changes in freshwater demand determine when the next step needs to be taken. At that time, a closer study will show which set of measures offers the best solution, in terms of spatial and economic values and flood risk management.

Flexible water level management
Introducing flexible water level management in the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes in the short term creates a larger freshwater buffer, increasing the water supply in the IJsselmeer Region in the summer. Flexible water level management means that the water level may fluctuate around the target level within a certain margin. As the average winter water level does not change, flexible level management does not affect flood risk management. Flexible water level management allows the water manager to better anticipate forecasts of drought, heavy precipitation or storms and coordinate management with stakeholder preferences. Flexible water level management requires a flexible organisation of the banks.

The first step in flexible water level management means that freshwater supply increases up to 400 million m^3 (extra layer of water of 20 cm in the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes). If the demand for freshwater increases, the buffer can be further increased to an extra layer of water 40-50 cm. In the event of rapid climate change and large demand, even this supply may prove insufficient. In that event, other options may be looked into, such as: increasing the buffer even more, diverting more water along the IJssel in case of low water levels in the rivers or accepting more damage as a result of water shortages. These options have far-reaching consequences. In the short term, however, no decisions will have to be made to keep these options open.

Overview of measures

This Delta Decision has been elaborated into preferential strategies for the IJsselmeer Region for flood risk management and freshwater (↗ section 3). The preferential strategies form the basis for programming measures in the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater (↗ section 4).

The first pumps in the IJsselmeer Closure Dam will be finished in 2021 (↗ sub-section 4.2, Delta Plan on Flood Risk Management). The first step in flexible water level management means that measures will be implemented at a number of locations to prepare the banks for limited water level fluctuations and a limited number of mitigating measures for nature (↗ sub-section 4.3, Delta Plan on Freshwater). To be able to further increase the freshwater buffer in the long term, it is necessary to make the banks resistant to larger water level fluctuations. This can perhaps be combined with ongoing dyke improvement operations.

The managers of the regional water systems in the supply area of the IJsselmeer Region will make water consumption more efficient by means of flexible water level management and flexible bank organisation. Moreover, users will be encouraged to use freshwater more efficiently (↗ Delta Decision on Freshwater). The measures for this are listed in the Delta Plan on Freshwater and the preferential strategy for the IJsselmeer Region (see sections ↗ 3 and ↗ 4).

Implementation

An essential part of this Delta Decision is the link between measures for flood risk management, freshwater supplies and limiting the demand. On account of this link, managers from the entire supply area of the IJsselmeer Region are responsible for a balanced set for measures. These ties have called for new forms of administrative collaboration. The managers have gone about this by concluding the IJsselmeer Lake Pact. This pact expresses their ambition to learn together, evaluate together and programme measures together in the areas of water level management, freshwater supplies and flood risk management in the entire supply area.

As the manager of the IJsselmeer Region, the Minister for Infrastructure and the Environment is responsible for introducing flexible water level management in the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes and the required (mitigating) measures. Before the new water level management starts, a new water level ordinance is required. The regional water managers are responsible for the measures in the regional water systems. The government authorities explain the need for efficient water consumption to the users by showing supply levels and they promote efficient consumption by means of a number of pilot projects (↗ Delta Decision on Freshwater).

For the period after 2050, there will still be the option of a limited rise in the winter water level of the IJsselmeer lake by 10-30 cm, if that is cost-effective and necessary. The central government, provinces, municipal councils and water boards prepare their policy allowing for the option of this limited rise in the winter water level of the IJsselmeer lake in the longer term. The policy-based reservation in the National Water Plan for a 1-metre rise in winter water level can be dropped. Those taking initiatives for developments outside the dykes remain responsible for any damage. If any decision on a small rise in water level is made in the future, other values in the area, such as nature, recreation and spatial-economic development, will also be taken into account.

In the National Water Plan (2009), the Cabinet announced that a new water level ordinance for the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes was to come into effect, allowing the water level to fluctuate within a certain bandwidth. The upper limit of this bandwidth would be no more than 30 cm above the target level for the summer. This new water level ordinance has not yet been adopted. In the interim revision of the National Plan, the central government has laid down that a bandwidth around the summer water level up to 30 cm above the current target level must be taken into account for the longer term. The provinces, municipal councils and water boards will incorporate this bandwidth around the summer water level into their plans. An impact study conducted by the water boards around the IJsselmeer lake demonstrates that any rise in the summer water level within this bandwidth will have no effect on the flood risk management criteria for the flood defence systems. In this way, freshwater supplies can be further increased by means of flexible water level management if the demand for freshwater increases. Combined with sustainable spatial development, this will keep the option for a further increase in the freshwater buffer open.

The Cabinet agrees with the proposal for the Delta Decision on the IJsselmeer Region. The Cabinet endorses the decision to discharge excess water into the Wadden Sea through a combination of pumping and discharging by gravity at the IJsselmeer Closure Dam, and to maintain the average winter water level of all lakes in the IJsselmeer Region until 2050 . For the period after 2050, the Cabinet would like to retain the option of allowing the winter water level of the IJsselmeer lake to adapt to rises in sea level to a limited extent; the interim revision of the National Water Plan will state that a rise in the winter water level of the IJsselmeer lake of no more than 30 cm after 2050 must be taken into account. For the connected lakes, the average winter water level will be preserved after 2050 as well.
The Cabinet also endorses the decision to increase the freshwater supply in this area in the summer – if the demand for freshwater increases – by means of flexible water level management in all lakes, with the exception of the Veluwerandmeren lakes. The central government is preparing a water level ordinance for this. In the short term, an extra water buffer of up to 400 million m^3 is possible; in the longer term, more is possible; the Cabinet assumes an upper limit of 30 cm above the current -20 cm NAP (Amsterdam Ordnance Datum) target level in the summer.
The Cabinet acknowledges the importance of a flexible organisation of the banks in the IJsselmeer Region to be able to respond – where possible – already to larger water level fluctuations. It aims to achieve this wherever possible by means of a comprehensive approach to future measures in the water system. The Cabinet will lay down these decisions in the interim revision of the National Water Plan.

2.6 Delta Decision on the Rhine-Meuse Delta

Social importance

The Rhine-Meuse delta is a transitional area between the sea and the rivers, where different kinds of tasking for flood risk management and freshwater converge. This is the most vulnerable area in a delta. The area is densely populated and consists of polders that can be submerged very rapidly and deeply in the case of a flood. The Rhine-Meuse delta is home to wide-scale economic activities that are of national importance. Its core is the port of Rotterdam and all associated activities there. Given the extensive spatial dynamics, the future approach to flood risk management and freshwater should be clear. This approach should make use of the economic and social character of the area itself, but it should also determine the approach in the regions that meet here: the Southwest Delta, the area around the major rivers, the Rhine Estuary-Drechtsteden and the coast. The foundation of flood risk management in the Rhine-Meuse delta consists of the sandy coastal foundation zone, dykes, storm surge barriers and sufficient room for the river. This foundation also seems to be a sound basis in the long term. The tasking can be taken up satisfactorily and in good time using sophisticated customised spatial solutions and adaptive delta management.

Proposals for Delta Decision on the Rhine-Meuse Delta

With regard to the Rhine-Meuse delta, the Delta Programme Commissioner proposes to decide that:

- for the long term (until 2100), a maximum normative discharge of 18,000 m³/s for the Rhine and 4,600 m³/s for the Meuse remains the starting point for flood risk management;
- as decided earlier, the central government maintains the adopted discharge distribution across the Rhine distributaries until 2050 in its policy;
- in 2017 the central government will decide, in consultation with the provinces and water boards and based on additional research, whether or not changing the discharge distribution after 2050 remains an option;
- the central government embeds in its policy the previously made decision to protect the Rhine-Meuse delta with an open closable storm surge barrier in the Nieuwe Waterweg in the long term as well, and uses the associated water levels as the starting point for all spatial and economic developments around the Nieuwe Waterweg and built-up areas outside the dykes;
- research is carried out into the possibilities of improving the effectiveness of the existing Maeslantkering storm surge barrier;
- water storage in the Grevelingen lake is no longer an option to keep flood risk management around Hollandsch Diep, Haringvliet and the Merwedes up to scratch in the future.

Explanation

Discharge distribution across Rhine distributaries and maximum river discharges

The Rhine water that enters our country at Lobith is distributed across the Waal, Nederrijn-Lek and the IJssel rivers in fixed proportions. The National Water Plan stipulates that in the event of discharges over, 16,000 m³/s, no additional water be discharged across the Nederrijn-Lek. The Delta Programme has researched whether a further change in the discharge distribution is possible and worthwhile to address the flood risk management and freshwater tasking. Not enough is known at present to be able to make a decision on this: both the pros and the cons are too uncertain. As such, the current discharge distribution and policy-based decision on discharges over 16,000 m³/s are upheld. The proposed follow-up research is designed to lead to clear conclusions about the discharge distribution after 2050: a decision on whether or not to keep the options regarding an alternative discharge distribution after 2050 open will be taken by 2017 at the latest.[10]

The National Water Plan (as well as the Room for the River PKB) advises that in the long term (until 2100), maximum discharges of 18,000 m³/s in the Rhine (near Lobith) and 4,600 m³/s in the Meuse (near Eijsden) should be taken as a basic assumption. An analysis using Delta Scenarios shows that these maximum discharges are still realistic values for the long term.

Central Holland

The Central Holland study and the Rivers sub-programme have shown that improving the northern Lek dyke is a cost-effective solution for the safety of Central Holland (↗ Delta Decision on Flood Risk Management). As a consequence, the C-dykes along the canalised Hollandsche IJssel and also

10 For this, research will be conducted in the coming years, focused on sparing the Nederijn-Lek at discharges of 8,000 to 16,000 m³/s and a different discharge distribution across the Rhine distributaries at discharges in excess of 16,000 m³/s. This research has started with joint fact-finding, to gather all information available on discharge distribution. The use and necessity of leaving both options will then be assessed and shared administratively.

Sea lock alternative

Former Delta Works engineer Spaargaren and some former colleagues have proposed an alternative to closing the Nieuwe Waterweg with sea locks, as this alternative is thought to be less costly and significantly less disadvantageous for shipping. Consequently, this alternative is believed to be more attractive than continuing the current policy. In this alternative, the permanent closure is located further inland: in the Nieuwe Maas, east of the Petroleum Docks, and in the Oude Maas by the Botlek Bridge. Freshwater supplies would also benefit, because there would be no salt intrusion from the sea.

Rijkswaterstaat and the Delta Programme have subjected the 'Spaargaren alternative' to closer analysis. The alternative option scores better than the previously researched option of closing the Nieuwe Waterweg, but is not effective compared with the preferential strategy for Rhine Estuary-Drechtsteden. The lock complexes are indeed less expensive and less disadvantageous for shipping. In this alternative option, the necessary dyke improvements in the area are comparable to the option of a closure in the Nieuwe Waterweg and the preferential strategy. The costs of dyke improvements and the additional damage to areas outside the dykes seawards from the closure, as in the Botlek, have not yet been taken into account here. As in the case of the closure in the Nieuwe Waterweg, there are disadvantages for nature, because the freshwater tide to the east of the closure will disappear entirely. There will certainly be advantages for freshwater supplies, but the small-scale measures envisaged in the preferential strategy will achieve the same effect at a lower cost. Based on the climate scenarios currently considered, the preferential strategy selected is therefore the best, also in the long term. The future is uncertain, however, which is why it is good that these and other options are available in case measures of a greater magnitude should unexpectedly be required. Being prepared for the uncertain future: that is also a typical principle of adaptive delta management.

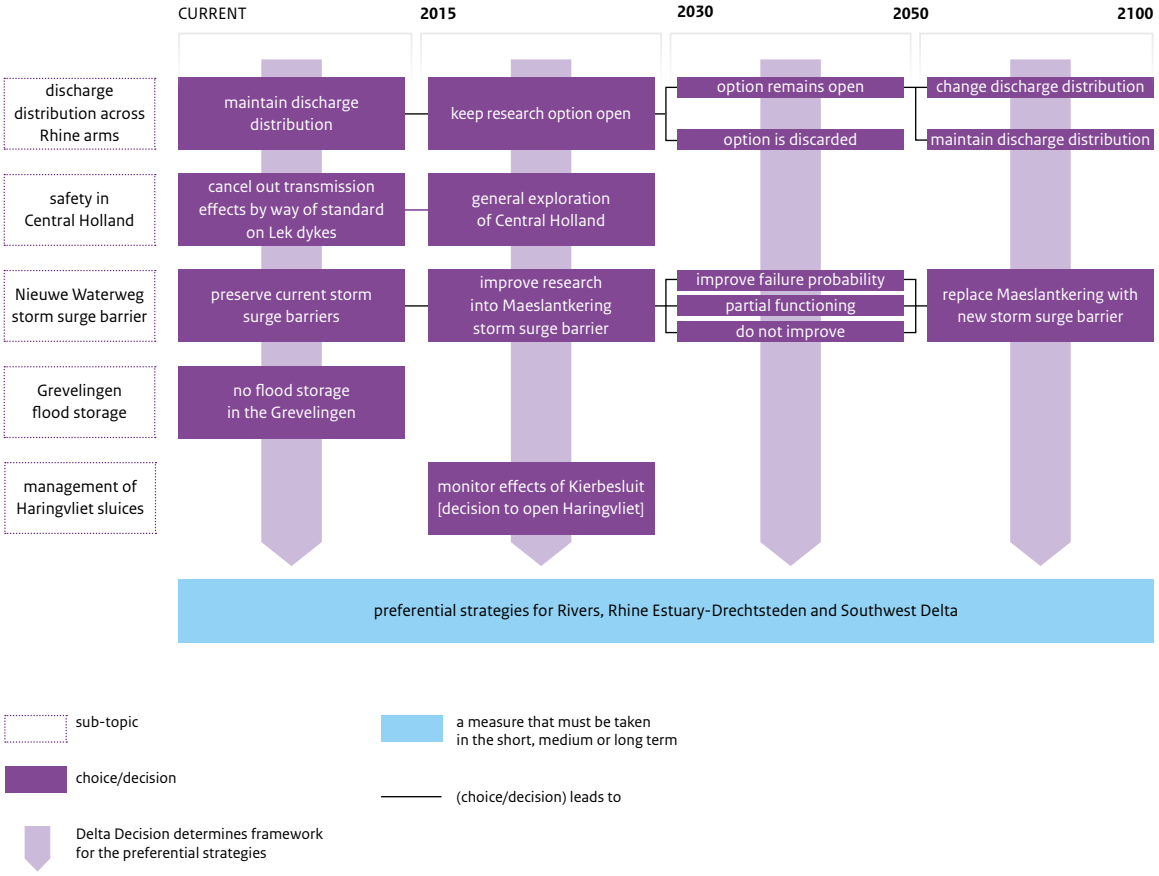
possibly those along the Amsterdam-Rijnkanaal canal will ultimately lose their primary status. The status of the C-dykes along the Noordzeekanaal canal depends in part on the standard specification for the sluice complex at IJmuiden. The elaboration of these changes has been started as part of the Flood Protection Programme (general exploration of Central Holland).

Nieuwe Waterweg storm surge barrier
By the time the Maeslantkering storm surge barrier needs to be replaced (after 2070), it is once again probably best, based on current knowledge, to keep the Nieuwe Waterweg open under normal circumstances and make it closable during a storm with a storm surge barrier. This is the basic principle for all spatial and economic developments around the Nieuwe Waterweg; for built-up areas outside the dykes, this decision will determine the water levels that may occur. The effectiveness of the flood defence system can be improved by introducing 'partial functioning' (in case of partial failure, the flood defence system still contributes to flood risk management) or by reducing the failure probability. This is under further study.

The Delta Programme has looked into the question of whether the Rhine-Meuse delta can be better protected with new system interventions, such as a dam with a sea lock in the Nieuwe Waterweg or a ring of flood gates in the river branches around the Rhine Estuary. Such system changes have proved to be ineffective, costly or to have negative effects. A dam with a sea lock is very costly and has significant negative effects for shipping and the estuarine nature. A ring of river defence systems is very costly and complex in terms of operation, and it requires upstream dyke improvements. In the past decades, a solid foundation for flood risk management has been constructed. Building on this with sophisticated customised spatial solutions is considerably more cost-effective than the large-scale technical operations that the second Delta Committee has proposed. However, system changes may be worth considering in the future. The options for this are left open as part of adaptive delta management: changing strategy in good time as necessary.

Grevelingen lake flood storage
As part of the framework vision on the Grevelingen and Volkerak-Zoommeer lakes, the central government and the region looked into whether water storage in the Grevelingen lake is a cost-effective option to keep flood risk management

Figure 2 Adaptation path for Delta Decision on the Rhine-Meuse delta



around Haringvliet, Hollandsch Diep and the Merwedes up to scratch in the long term.[11]
The conclusion is that there is no need to keep this option open. The parties do not have to allow for any water storage in the Grevelingen lake. In the future, system changes may once again be worth considering .

Freshwater

The proposal for the Delta Decision on Freshwater forms the framework for freshwater supplies in the Rhine-Meuse delta. This framework has been fleshed out for the Rhine-Meuse delta in the preferential strategies for Rivers, Rhine Estuary-Drechtsteden and the Southwest Delta (↗ section 3).

Management of Haringvliet sluices

The Haringvliet sluices are expected to be left ajar in 2018. The Cabinet has decided that the Kierbesluit is a separate decision that does not prelude a further recovery of the estuarine dynamics. [12] That is an important premise of this proposed Delta Decision. Monitoring the effects of the Kierbesluit on freshwater supplies will yield information in the medium to long term that can be used for any future decisions.

Overview of measures

↗ Figure 2 outlines the measures in an adaptation path with measures for the short term and possible decisions for the longer term. The proposal for the Delta Decision on the Rhine-Meuse Delta has been followed up on in measures and studies in the preferential strategies for the Southwest Delta, the Rhine Estuary-Drechtsteden and the Rivers (↗ section 3).

11 This study has focused on storm situations in conjunction with medium river discharges.

12 Letter from the Minister for Infrastructure and the Environment to the Dutch House of Representatives dated 20 June 2013, in which the 'tamed tide' ambition was abandoned.

Implementation

The central government will lay down the basic premises for flood risk management in the Rhine-Meuse delta in the interim revision of the National Water Plan: maintaining the current discharge distribution at least until 2050, maintaining the maximum river discharges as the basis and a new open closable storm surge barrier in the Nieuwe Waterweg as a basic premise for the long term. Provinces and water boards are basing their plans on these basic premises.

In 2017, the central government will decide whether or not to leave any long-term options open for an alternative discharge distribution across the Rhine distributaries, based on the results of research that is being conducted in the coming years. 2015 will see the start of a study into the options for improving the effectiveness of the Maeslantkering storm surge barrier. The Delta Plan on Flood Risk Management contains proposals for funding these studies into discharge distribution and the Maeslantkering storm surge barrier (↗ sub-section 4.2). Any changes in the primary status of C-dykes in Central Holland require embedding in legislation at a national level (amendment to the Water Act) and possibly also at a provincial level (provincial regulation), depending on the outcomes of the general exploration of Central Holland (↗ Delta Decision on Flood Risk Management).

The Cabinet agrees with the proposal for the Delta Decision on the Rhine-Meuse Delta, in which the current discharge distribution across Rhine distributaries until 2050 is maintained along with the basic premises for maximum discharge in the long term. For the long term, a new closable open storm surge barrier in the Nieuwe Waterweg will be the starting point. The central government will look into whether a different discharge distribution across the Rhine distributaries after 2050 may be worthwhile. The central government is also conducting a study into reducing the failure probability of the Maeslantkering storm surge barrier and the feasibility of having the flood defence system function partially in the exceptional situation that it is not fully usable. Furthermore, with respect to the water tasking around the Hollandsch Diep, Haringvliet and the Merwedes, the Cabinet opts for dyke improvement rather than water storage in the Grevelingen lake. The Cabinet will embed this choice in the interim revision of the National Water Plan.

2.7
Decision on Sand

The sand along the Dutch coast offers our country natural protection. The Netherlands keeps the amount of sand at the required level by means of sand replenishments. This is necessary to keep the coastline in its place and to prevent the systematic erosion of beaches and dunes. Without sand replenishments, one metre of coast would be lost every year. The sand volume of the outer delta is already decreasing and channels are moving towards the coast. This is not good for both flood risk management and all functions that use the coastal zone. As a consequence of rising sea levels, current sand replenishments may not be sufficient to preserve the coastline. With the Decision on Sand, the sandy system will be permanently kept in balance with the rise in sea levels, by gradually adapting the sand replenishments in the coastal foundation zone to the rise in sea levels.

Proposal for Decision on Sand

With regard to the sandy system, the Delta Programme Commissioner proposes to decide that:

- the principle of 'soft where possible, hard where necessary' remains the basic premise for maintaining coastal safety, by carrying out sand replenishments in the coastal foundation zone;
- extra monitoring, research and pilot projects are carried out to be better able to anticipate future developments that affect the sandy system and use replenishments more effectively and cost-efficiently ('learning as we go');
- the sand balance of the sandy system is maintained and the coastal foundation zone is permanently kept in balance with the rise in sea levels by increasing sand replenishments as necessary. Sand replenishments should not only contribute to preserving the coastline (primary objective) but also – and to the maximum extent possible – to local and regional objectives to ensure that the coast is economically strong and attractive, based on the funding principle from the National Framework for Coastal Development (Nationaal Kader Kust or NKK).

The Decision on Sand pertains to the sandy system and the coastal foundation zone. The sandy system comprises the sandy parts of the Southwest Delta, the coast along the provinces of Noord- and Zuid-Holland and the Wadden Region, including the Westerschelde, Oosterschelde, Wadden Sea and Eems estuary. The coastal foundation zone is the zone between the NAP -20m isobath in the sea and the inside edge of the dunes.

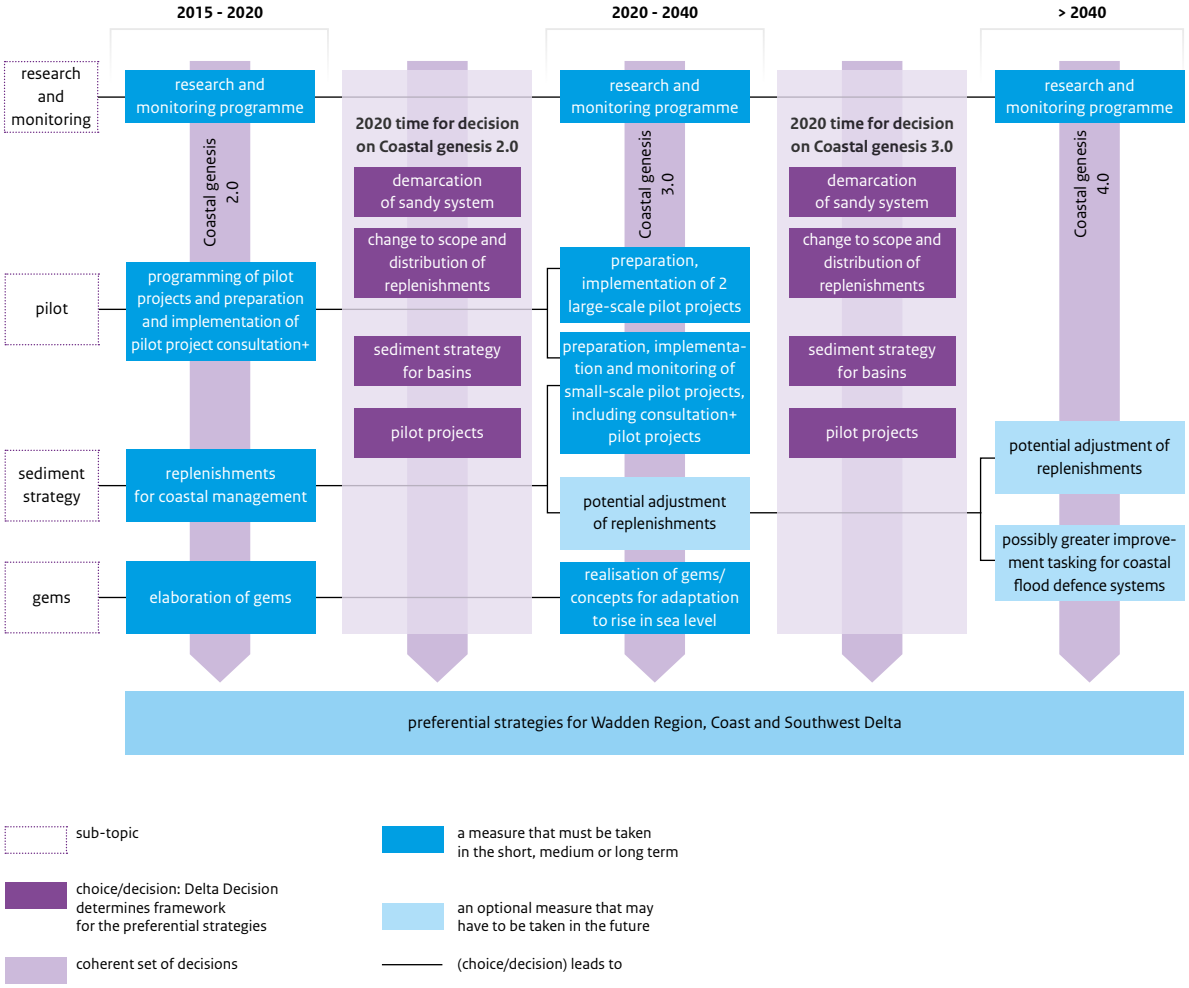
Explanation

Coastal foundation zone permanently kept in balance
By maintaining the sand balance, the basic condition for preserving the land area and long-term flood risk management along the coast continues to be met. This is achieved by continuing the current replenishment programme and intensifying it as necessary. Research shows how much sand is ultimately needed to keep the sandy system in balance with the rise in sea levels. It also shows where and when replenishments are needed.

Learning as we go
To be able to anticipate future developments, expertise is being developed concerning the operation of the sandy system as a whole and of the individual sub-regions, for now and in the future. The emphasis will be on the Wadden system and the Southwest Delta, and on the effect of the tidal inlet systems and outer deltas and channels that are getting increasingly closer to coast and threaten to undermine the flood defence systems ('channels that encroach on the coast'), and on the Voordelta and the outer deltas of the Wadden Region. The aim is to use replenishments in such a way that the sand flows to the areas where it is needed via natural processes. Learning as we go comprises monitoring and carrying out research and pilot projects. Knowledge issues are programmed in the Water and Climate Knowledge and Innovation Programme (↗ sub-section 6.2). The knowledge generated in the process forms the basis for decisions on future replenishments. It is expected that this will enable the Netherlands to use replenishments more effectively.

Social added value
It is possible to use sand replenishments in such a way that they contribute not only to flood risk management but also, and to the maximum extent possible, to local and regional objectives to ensure a coast that is economically robust and attractive. The National Coastal Vision (2013, ↗ www.nationalevisiekust.nl) proposes a joint process to arrive at smart solutions for the spatial challenges of coastal areas of tomorrow and for the necessary adjustments to flood risk management in the coming decades. If the use of sand replenishments for purposes other than flood risk management leads to additional costs, other parties will contribute to the financing, depending on the degree to which the sand replenishments benefit them and help them accomplish their social task. The principle of co-funding

Figure 3 Adaptation path for Decision on Sand



has been elaborated in the National Framework for Coastal Development (2011).

Overview of measures

↗ Figure 3 outlines the measures for the Decision on Sand in an adaptation path with measures for the short term and possibly decisions for the longer term.

Implementation

The current replenishment programme, involving a total of 12 million m³ of sand a year, will be continued. A study into the effect of the sand-sharing elements of the natural system will show how much sand is needed to keep the sandy system in balance with the rise in sea levels. This study will also clarify when and where the sand must deposited. A more detailed study and closer monitoring are important to gain a better understanding of the behaviour of the sandy system and the exchange of sand between the North Sea and the Wadden Sea. In addition to small-scale pilot projects, large-scale pilot projects will have to be carried out to determine how the tidal inlet systems and channels that encroach on the coast can be balanced.

2015 will see the start of Coastal Genesis 2.0, with further studies and monitoring. This programme will include a number of small-scale pilot projects with replenishments in the Southwest Delta, the Wadden Region and the coast along the provinces of Noord- and Zuid-Holland (↗ section 3). As part of the Coastal Genesis programme, the central government will have the sediment balances for Haringvliet and the Volkerak-Zoommeer and Grevelingen lakes analysed. The joint programming and intergovernmental

coordination will lead to greater ties between replenishments, new knowledge and pilot projects along the coast and a better understanding of the options for increasing the social added value of replenishments by linking them to other spatial developments. The Ministry of Infrastructure and the Environment will utilise the results of Coastal Genesis 2.0 to determine whether and to what extent the replenishment volumes need to be adjusted and which large-scale pilot projects will be rolled out after 2020. Coastal Genesis 3.0 is planned for the 2020-2040 period, Coastal Genesis 4.0 for the period after that.

There is enough sand in the North Sea to keep the coast safe, also in the very long term (the coming centuries). Good sand extraction sites that are located relatively close to the coast are essential to keep sand replenishments affordable. That is why sand extraction in the zone between the twelve-mile limit and continuous isobath at NAP (Amsterdam Ordnance Datum)-20 metres is a priority. It has been decided to extract a layer of sand of 10 metres where possible (instead of the previous layer of 2 metres). This will ensure that the area has enough sand to meet the demand for sand in the coming century, even if the demand for sand increases rapidly as a consequence of policy choices and an accelerated rise in sea levels. Effective management of the sand supply, taking other uses and nature into account, is essential, however.

The Delta Plan on Flood Risk Management contains proposals for funding monitoring, research and pilot projects. The central government will embed the continuation of the replenishments in the replenishment programmes.

The Cabinet agrees with the proposal for the Decision on Sand to keep the coastal foundation zone permanently in balance with the rise in sea levels. To this end, sand replenishments will be carried out in the coastal foundation zone and, based on research, monitoring and pilot projects, the best way of restoring the sand balance will be determined. The current replenishment programme will be continued and, where necessary, stepped up. Decision-making in 2020 will address the question of which measures should be taken where and when in order to retain the balance in the sandy system in an effective and cost-efficient manner; and, in particular, the question of whether, how and where large-scale pilot projects can be carried out to work towards that balance in a controlled manner. To this end, the Cabinet wishes to use natural processes wherever possible. The Cabinet will embed this in the interim revision of the National Water Plan.

3 Preferential strategies

Geulle aan de Maas, Limburg, May 2014 *Work on the Meuse as part of the Meuse Projects. Across a total length of 222 km, work is being carried out to make the Meuse a safer, more navigable and more natural river by reinforcing embankments, lowering and widening the river bed, constructing flood channels and lowering the flood plains.*

3.1
Customised work in practice

The tasking for flood risk management and freshwater differs throughout the Netherlands, because each area has its own characteristics. The options to link this tasking to other ambitions also differ from area to area. As such, the Delta Decisions have been translated into preferential strategies for each individual area. The preferential strategies act as a guide for implementing measures to keep the Netherlands safe and prosperous. The key points are: customised work, innovation, multifunctional solutions and building with nature.

Preferential strategies per area

Preferential strategies are concrete specifications of the Delta Decisions for each specific area (↗ section 2). The preferential strategies are a strategic guide to programming measures in the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater. Knowledge-related issues arising from the preferential strategy are included in the Knowledge Agenda and in the Water and Climate Knowledge and Innovation Programme (↗ section 4).

Preferential strategies have been drawn up for and by the following areas:

- the IJsselmeer Region
- the Rivers
- the Rhine Estuary-Drechtsteden
- the Southwest Delta
- the Coast
- the Wadden Region
- the Elevated sandy soils

The preferential strategies are the result of close collaboration between all levels of government, social organisations and companies in the sub-programmes of the Delta Programme, for which each area has organised its own process, under the auspices of the Delta Programme Commissioner, appropriate to the tasking and administrative context in the region. This joint process has also highlighted the opportunities available to link water tasking solutions with ecological, economic and spatial ambitions. It is essential to always consider a preferential strategy in its entirety; each part is relevant to the final result.

The proposals for the Delta Decisions and preferential strategies have been conceived in a symbiotic process. For example, work on the Delta Decisions has generated concrete solutions that have been incorporated into the preferential strategies. Conversely, the preferential strategies have highlighted policy-based conditions that have been included in the proposed Delta Decisions. This symbiosis has spawned a cohesive set of proposals for Delta Decisions and preferential strategies.

For most areas, preferential strategies have been drawn up for both flood risk management and freshwater. As for the Coast, only a preferential strategy for flood risk management has been drawn up. There is no tasking for freshwater in this area; the importance of dune water for the production of drinking water has already been

safeguarded. For Elevated sandy soils, only a preferential strategy for freshwater has been drawn up; there is no tasking for flood risk management here. The proposal for the Delta Decision on Spatial Adaptation helps government authorities to design the built-up environment from a water-robust and climate-proof area perspective. The working method based on 'knowing, wanting, working' is the same in all areas and is therefore disregarded in the preferential strategies (↗ sub-section 2.4).

This section outlines the preferential strategies. More information on the substantiation of the preferential strategies can be found in the ↗ synthesis documents (in Dutch) and administrative recommendations for each area (background documents ↗ B and ↗ D in Dutch).

The basic principles for the preferential strategies

All preferential strategies elaborate on the following common basic principles:

- **Delta Decisions as the framework**
  The proposals for Delta Decisions from ↗ section 2 form the framework for all preferential strategies. For each preferential strategy, the relevant Delta Decisions have been indicated.
- **Anticipate rather than respond**
  Unlike policymaking in the past, the Delta Programme was not formulated in response to a disaster. The aim of the Delta Programme is to anticipate likely developments in society and the climate, to be prepared in time for new circumstances and disasters, and to prevent water-related damage.
- **Short and long-term commitment**
  An adaptive delta management approach is key to the Delta Programme. This means looking ahead at the tasking we face, taking the most (cost-)effective step-by-step measures based on those insights, and leaving options open to be able to respond in a flexible manner to new insights and developments (while being both practical and alert) .
- **Linking in with other ambitions**
  There is time to link the water tasking, where possible, to other spatial ambitions, for nature and construction, for example. This is an important feature of adaptive delta management, as it brings new, efficient and sustainable solutions within reach.

Comprehensive and adaptive

The preferential strategies have been developed on the basis of a comprehensive approach, in an attempt to link the tasking associated with the Delta Programme to other ambitions in the area wherever possible. The method of 'research by design' was key to this process. Safeguarding or adding spatial quality is an important added value of a comprehensive approach, also in the next phase of the Delta Programme. For this reason, the Director-General for Space and Water at the Ministry of Infrastructure and the Environment asked the Board of Government Advisors (on Spatial Planning) for advice, also on behalf of the Delta Programme Commissioner, following the advice given by the Board in September 2012. This advice will be taken into consideration in the next phase of the Delta Programme.

The Nature Ambition for Large Waters will paint a picture of the future of the nature of the national waters, as a source of inspiration. Any measures designed to work towards this picture of the future may possibly be linked (in part) to measures for the Delta Programme, allowing water and nature to reinforce each other.

An adaptation path is part of the preferential strategy. The adaptation paths indicate roughly when certain measures are expected to be necessary. The adaptation paths also indicate what is required now to ensure that measures that are necessary in the long term can in fact be implemented by that time. Depending on the actual developments in society and the climate, such measures may be taken either sooner or later. Where relevant, the adaptation path of the preferential strategy in question is indicated.

Costs

The costs of preferential strategies have been estimated as accurately as possible with the help of the Delta Programme's Expertisecentrum Kosten en Baten [Cost and Benefit Expertise Centre], particularly with regard to the measures for the coming decades (up to and including 2050). These measures are covered in the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater (↗ section 4). ↗ Section 5 provides a complete overview of the cost estimates and available resources for the Delta Programme.

Delta Programme and cultural history

The Netherlands is permeated with visible and sometimes less visible symbols of our long history of living with water. Dykes dating from the Middle Ages, reclaimed land, such as the 17th-century Beemster-polder, numerous water mills, defences designed to inundate the land, such as the Nieuwe Hollandse Waterlinie, the Zuiderwaterlinie and the Grebbelinie, the Scheveningen promenade with the Kurhaus and 20th-century structures such as the Maeslantkering storm surge barrier and the Zeeland bridge. They shape the identity of the landscape and showcase the country's history with water.

The Delta Programme adds a new layer to our water history. The existing stories, the knowledge on how to deal with water acquired over the centuries and the visible objects and structures dating from previous generations form the starting point and source of inspiration for this new layer.

The measures for flood risk management and freshwater offer opportunities to shed new light on the existing heritage and reinforce spatial identity. For example, peak water storage can be combined with the former inundation areas of the water defence lines or the retention basins of the water mills. Restructuring the flood plains to give the rivers more room creates opportunities to highlight old landscapes and types of settlements. Rijkswaterstaat and the Cultural Heritage Agency of the Netherlands have collaborated closely to preserve the characteristic features of the IJsselmeer Closure Dam – the longest straight line in the Netherlands – and to make this dam overtopping-resistant. Along the coast, safety and cultural heritage work very well together. Here, the long lines, such as dykes and dams and the Atlantic Wall, plus the diversity of various towns shape the characteristic identity of this region. This is how the Delta Programme builds on the past.

Development-oriented reservation and depreciated value due to anticipated future plans

The preferential strategies include measures to address the current tasking for flood risk management and freshwater as well as measures that may be required in the long term. In this respect, two categories of long-term measures can be distinguished. The first category consists of measures which are already certain to be required in the long term, such as dyke improvements at locations where there are no feasible alternatives available, such as river widening or spatial planning solutions. The second category consists of measures the long-term need for which has not yet been established. This depends on the manner in which the climate develops.

At present, no final decisions are taken about measures for the longer term and the actual implementation of these measures. This is neither necessary nor efficient. Their implementation depends on the climatological and socio-economic developments in the decades to come. Final decisions are therefore taken at a later date. That is the essence of adaptive delta management: we do what is required now and know what measures can be taken if the situation changes.

An important requirement for adaptive delta management is that government authorities announce long-term measures in policy plans. This creates clarity, for example about the locations that will or may be required for these measures in the future. Options for ultimately taking a decision about the implementation of these measures must be left open. Accordingly, at locations where certain measures are envisaged, any developments that could render any of these measures infeasible must be ruled out. The government can use a variety of tools to ensure this, such as laying down area reservations in the Spatial Planning (General Rules) Decree (Barro) in Dutch.

The announcement of a long-term measure in a policy plan alone does not yet have any legal consequences, as it is not certain whether or not the measure will be taken. The announcement can, however, have detrimental effects on residents and businesses. Residents may become uncertain about their housing situation and land prices may fall. In principle, this depreciated value due to anticipated future plans is not compensable.

The Delta Programme Commissioner notes a dilemma in this respect. The transparent and adaptive approach of the Delta Programme, which is essential to be able to address future uncertainties effectively, may lead to problems for individual landowners. On the one hand, it would not be appropriate to compensate 'depreciated value due to anticipated future plans' if the damage in fact never occurs because the measure is not put into effect or implemented differently, as this would mean that the landowner is 'rewarded' at the expense of the tax payer. On the other hand, it would be problematic if residents had to wait until a final decision is taken about the measure and incur any damage that is not yet eligible for compensation.

This issue is being considered. As part of the Delta Programme, pilot projects are carried out to ascertain whether (lasting) uncertainty about development opportunities in an area can be kept to a minimum. A 'development-oriented reservation' pilot project has been started for Rijnstrangen retention area.

However, even with development-oriented reservation, extreme hardships cannot be ruled out. What is particularly important is that the government recognises such hardships and comes up with an appropriate, customised solution in such cases.

3.2
IJsselmeer Region

Area and tasking

The IJsselmeer Region plays an essential role in water management in the Netherlands. The IJsselmeer Closure Dam has brought more safety to the entire area, enabled land reclamation and created a freshwater supply that benefits agriculture, industry and nature in a large part of the country. The IJsselmeer Region features special ecological and cultural-historical values. The area has grown significantly, both economically and in terms of population, especially around Almere and in the IJssel-Vecht delta. The community uses the lakes and banks for a variety of purposes, for example recreation, drinking water production and shipping. The water is managed in such a way that all functions can be realised. However, it is difficult to respond in a flexible manner to new developments and insights.

Sea levels continue to rise, which makes it more difficult to discharge water from the IJsselmeer lake into the Wadden Sea by gravity. At the same time, climate change may cause the supply of water via the river IJssel to increase under extreme circumstances. Moreover, one of the consequences of the new safety approach (↗ section 2) is that a number of flood defence systems must offer more protection. In addition, climate change and social developments may lead to an increased demand for freshwater. The preferential strategy ensures that the organisation, management and users of the IJsselmeer Region gradually adapt to these changes.

Main features of the preferential strategy for flood risk management

The proposals for the Delta Decision on Flood Risk Management, the Delta Decision on the IJsselmeer Region and the Delta Decision on the Rhine-Meuse Delta form the framework for this preferential strategy (↗ section 2). The main features of the strategy are (↗ figure 4):

1. Discharge by gravity if possible, pump if necessary

The basic principle of the proposed Delta Decision on the IJsselmeer Region is that the average winter water level will remain the same until 2050 at least and will not adapt to the rise in sea level by more than 10-30 cm after 2050 and only if this is cost-effective (↗ Delta Decision on the IJsselmeer Region). Water is discharged through a combination of discharging by gravity and pumping. This additional discharge capacity will be created by using the pumps that will be installed in the discharge sluices at Den Oever in 2021. Cost will be saved under the motto 'discharge by gravity if possible, pump if necessary'. As the sea level continues to rise, the required pump capacity can be increased in stages. In 2050, the discharge sluices in the IJsselmeer Closure Dam will need to be renovated.

2. Targeted investment in flood risk management

The Delta Decision on Flood Risk Management will lead to new protection levels and to new tasking in the IJsselmeer Region. The protection level can be achieved almost everywhere in this area with a strong flood defence system. At two locations, the required protection may also be achieved with a 'smart combination' of a flood defence system, a water-robust organisation and ongoing disaster management efforts. These two locations are around Marken and in the IJssel-Vecht delta. A MIRT Study will be conducted for both locations to examine the possibilities of 'smart combinations' in more detail (↗ section 2, Delta Decision on Flood Risk Management).

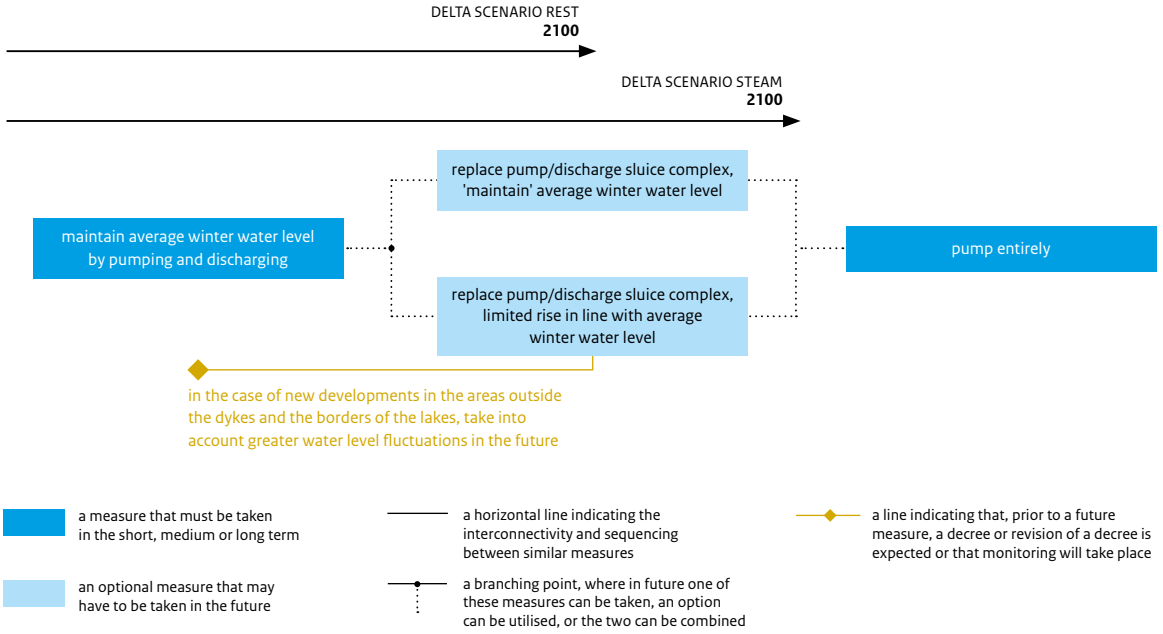
Main features of the preferential strategy for freshwater

The proposals for the Delta Decisions on Freshwater, the Delta Decision on the IJsselmeer Region and the Delta Decision on the Rhine-Meuse Delta form the framework for this preferential strategy (↗ section 2). The basic principle of these proposed Delta Decisions is that the efforts undertaken to limit water shortages gradually respond to developments in the climate and the demand for freshwater, and that the government makes the supply for freshwater transparent in the form of supply levels. The preferential strategy for freshwater for the supply area of the IJsselmeer region consists of a coordinated set of measures in the main water system, the regional water systems and among users (↗ figure 5).

1. Flexible water level management and flexible organisation of the banks

The Delta Decision on the IJsselmeer Region provides for flexible water level management in the main water system. The first step leads to a permanent supply of freshwater, consisting of a layer of water of 20 cm in the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes (between NAP-0.1 and NAP-0.3 m). If more freshwater is needed, this buffer can be increased with additional measures to an extra layer of water of 40 to 50 cm. If this buffer also proves insufficient, there are still various other options left: increasing the buffer even more, diverting more water across the IJssel in case of low water levels in the rivers or accepting more damage as a result of water shortages.

Figure 4 IJsselmeer region, adaptation path for preferential strategy for flood risk management



Flexible water level management requires measures to make the banks suitable for water level fluctuations, mitigate damage to nature and prevent nuisance flooding.

2. Measures in the regional water system
The managers of regional water systems start with no-regret measures to limit the demand for water, by flushing these water systems more efficiently, for example. They also increase the buffer capacity of the regional system by means of adjustable weirs or other spatial organisation measures.

3. Water saving by users
Key users of freshwater from the IJsselmeer region are farms in Noord-Holland, Flevoland and the north of the Netherlands, water boards (for water level management) and industries (for process water or cooling water).
These users are encouraged to save water with measures appropriate to their circumstances; for example, by using underground freshwater storage, modified drainage or drip irrigation in agriculture. The industry can save water by reusing process or cooling water.

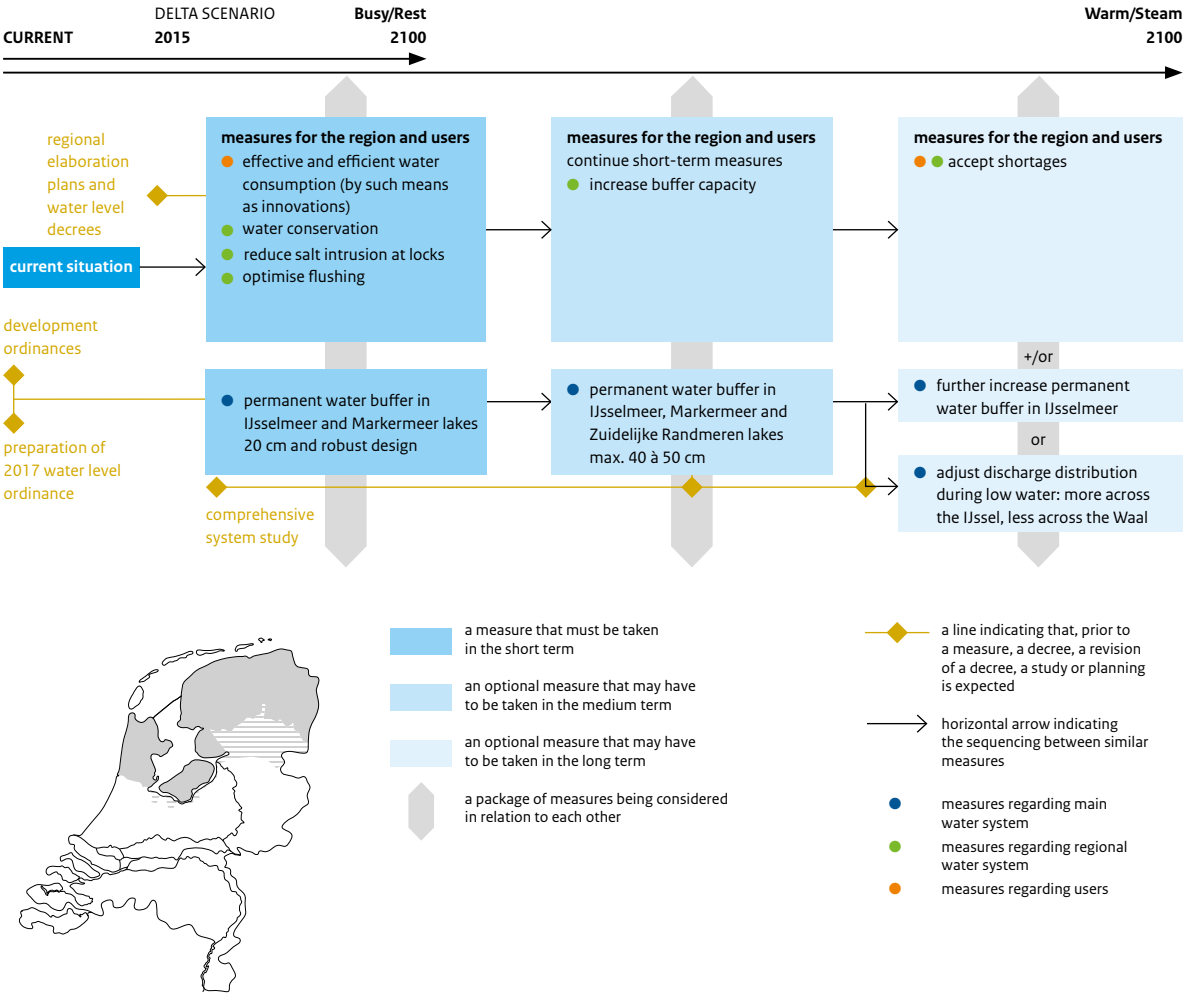
The proposal for the Delta Decision on Freshwater and this preferential strategy, with the choices and measures noted therein, form the basis for detailing the supply levels for the areas that receive freshwater from the IJsselmeer region.

The agreements on the new water level management already provide a great deal of clarity about the availability of freshwater through the main water system. A supply level agreement covering the entire supply area of the IJsselmeer region will be concluded after 2017.

Implementation

The Delta Plan on Flood Risk Management and the Delta Plan on Freshwater contain the measures from this preferential strategy that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. Given that the preferential strategies for flood risk management and freshwater in the IJsselmeer region are closely linked to each other, it is important to maintain this link when programming measures. Dyke improvements are prioritised and programmed in the Flood Protection Programme; it is proposed to programme and prioritise measures for the availability of freshwater concordantly too (↗ section 2, Delta Decision on Freshwater). The programming for freshwater now only comprises the most urgent measures for the coming period; the programming in DP2016 will be more detailed. The manner in which flexible water level management materialises is outlined in section 2 (↗ Delta Decision on the IJsselmeer Region). The preferential strategy for the IJsselmeer region offers sufficient

Figure 5 IJsselmeer region, adaptation path for preferential strategy for freshwater (including region name)



opportunities to address greater tasking for flood risk management and freshwater supplies in the future.

The central government, provinces, municipal councils and water boards will lay down the above-mentioned main features of this preferential strategy in their plans by 2016 at the latest. They will use their own tools in spatial organisation to respond to future developments to build a resilient and safe IJsselmeer region. Regional water managers are responsible for the measures in the regional water system, based on a regional elaboration plan that is yet to be drawn up. Government authorities encourage innovations among users, for example in the Spaarwater project.

The Minister for Infrastructure and the Environment is preparing a revision of the water level ordinance to allow the introduction of flexible water level management by 2021 at the latest. MIRT Studies are being conducted for Marken and the IJssel-Vecht delta to substantiate the possibility and necessity of 'smart combinations' for flood risk management. Taking part in these studies are the central government, province, water board and the municipal councils are involved (the Waterland municipal council for the Marken MIRT Study and the Zwolle, Kampen and Zwartwaterland municipal councils for the IJssel-Vecht delta MIRT Study). The flood defence managers take flexible water level management into account in their management and maintenance of the flood defence systems. The development of flexible banks in dyke improvement projects (forelands) will lead to more robust nature in the IJsselmeer region, which will in turn reduce the risk of negative effects on nature if a further increase in the

freshwater supply to 40-50 cm should ultimately prove necessary.

Knowledge

Together with the water managers, Rijkswaterstaat is conducting additional studies in the IJsselmeer region aimed at operationalising the water level ordinance. The water boards are exploring promising measures in the regional systems to further improve freshwater supplies and reduce their own water consumption. The water managers are monitoring and evaluating the effects of flexible water level management as well as the developments in the climate and the demand for water. In the period up to 2021, the Amsterdam region will be exploring the options for an increasingly water-robust organisation of the vital and vulnerable infrastructure in Westpoort Amsterdam. In 2015 and 2016, the province of Flevoland will carry out a pilot project to gain a better understanding of the consequences of flexible water level management for developments in the areas outside the dykes. To be able to make a good decision on the replacement of the discharge complexes in the IJsselmeer Closure Dam (in 2050), a better understanding is needed of the interconnectivity between flood risk management, the discharge capacity of the IJsselmeer Closure Dam, any pumps in the dyke between the Markermeer lake and the IJsselmeer lake, strategic storage in the Markermeer lake and regional water management. The Ministry of Infrastructure and the Environment is taking the initiative to conduct a comprehensive study of this topic. The results will be available in 2018. These studies are on the Knowledge Agenda of the Delta Programme (↗ background document A (in Dutch)). The Delta Plan on Flood Risk Management contains proposals for funding the necessary research from the Delta Fund (↗ sub-section 4.2). Area-specific knowledge issues about freshwater are included in the Delta Plan on Freshwater (↗ sub-section 4.3).

The Cabinet endorses the preferential strategy for the IJsselmeer region and will embed the government actions required to implement the preferential strategy in the interim revision of the National Water Plan. In this way, the central government is preparing the water level ordinance to allow the introduction of flexible water level management by 2021 at the latest and is also assessing to what extent flexible water level management impacts the design and assessment tools used for flood risk management.

Area and tasking

The Meuse and Rhine distributaries have their own characteristics: not only the rivers themselves, but the nature and use of space around it and the economy are all different. In recent decades, the economic development in the entire area around the major rivers has increased significantly. Space is becoming increasingly scarce. Many designated uses depend on sufficient water in the rivers, for production processes, drinking water production, shipping and use as cooling water, for example.

The area around the major rivers is currently the most prone to flooding. Over 300 kilometres of dykes do not meet the current standards. Many dykes in the area around the major rivers are susceptible to piping, a phenomenon that is capable of undermining dykes.[13] In addition, the protection level needs to be raised in virtually the entire area due to the risk of large numbers of victims or significant economic damage in the event of a flood. In the long term, the peak discharges are expected to rise as a result of climate change; the area downstream the major rivers is, moreover, affected by the rise in sea levels. If climate change also results in more frequent low river discharges, the tasking for shipping will increase.

As river discharges vary greatly by nature, it is still difficult to glean any signs of climate change from the discharges measured. Moreover, dyke improvements and dyke relocations call for long preparation times. When developing strategies for flood risk management in the area around the major rivers, these two factors combined have prompted the decision to assume the maximum expected normative discharges for the Rhine at Lobith (17,000 m^3/s in 2050 and 18,000 m^3/s in 2100) and the Meuse at Eijsden (4,200 m^3/s in 2050 and 4,600 m^3/s in 2100). Monitoring and scenario research will be continued to be better able to identify trends in river discharges in the future.

Main feature of the preferential strategy for flood risk management – area around the major rivers

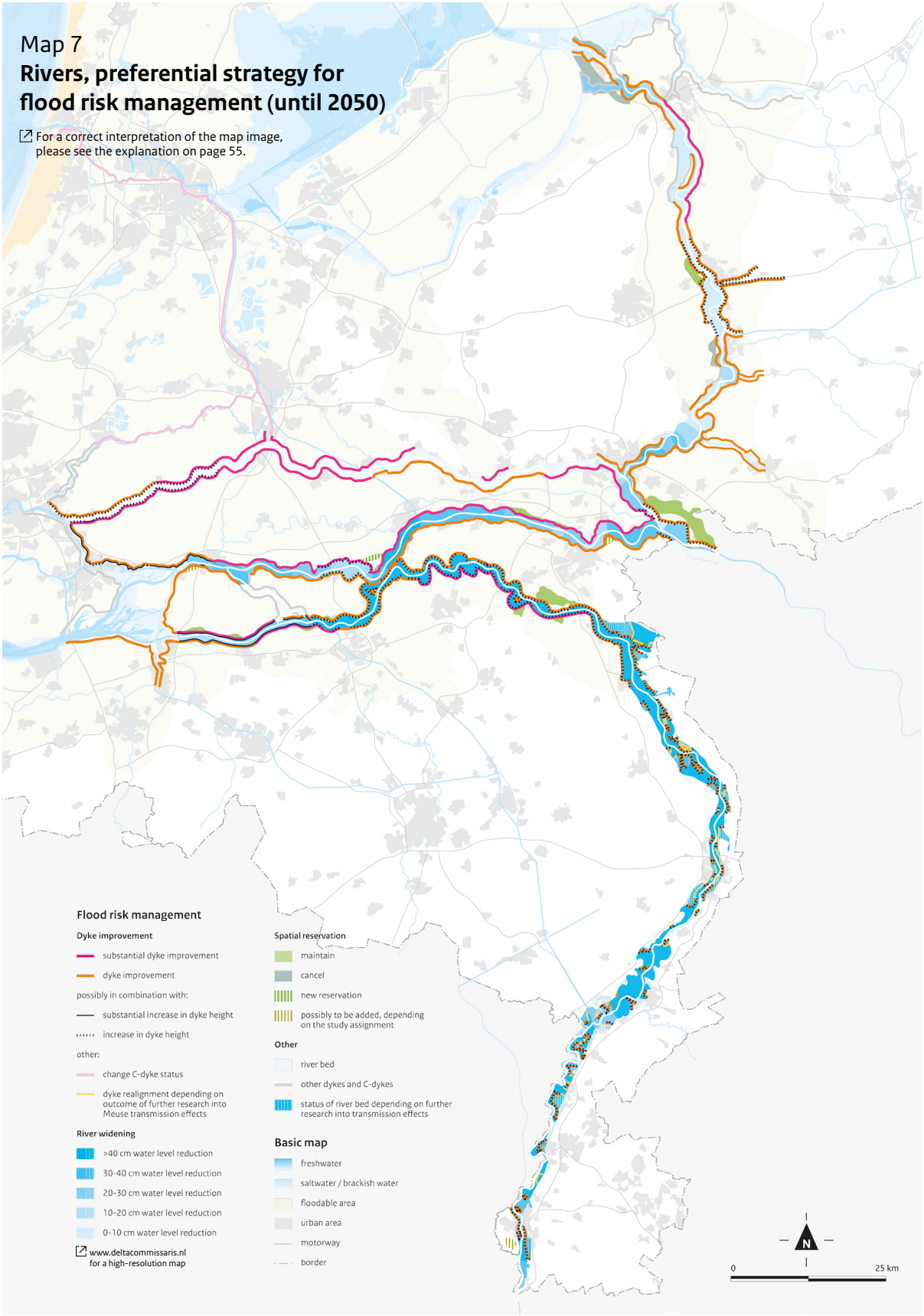
The proposals for the Delta Decision on Flood Risk Management, the Delta Decision on the Rhine-Meuse Delta and the Delta Decision on the IJsselmeer Region form the framework for the preferential strategies for flood risk

13 *Piping* sees water flowing underneath carrying sand. This may impact the strength of the dyke.

Map 7

Rivers, preferential strategy for flood risk management (until 2050)

For a correct interpretation of the map image, please see the explanation on page 55.



management in all parts of the area around the major rivers (↗ section 2). The main feature of the strategy for the area around the major rivers is:

A powerful combination of dyke improvement and river widening

To protect the area around the major rivers against flooding, two types of measures are possible: dyke improvement and river widening. Part of the safety tasking can be resolved with (innovative) dyke improvements alone. This is the case where dykes are not strong enough according to the new standards or the new standard specifications, for example because they are not stable enough or because there are problems relating to piping. Dyke improvements are also necessary in places where soil subsidence or a rise in sea levels is expected in the future. Another part of the safety tasking can be addressed with both dyke improvements and river widening: the tasking that ensues from higher peak discharges in the rivers as a consequence of climate change and, in part, the tasking stemming from the new standard specifications. In these cases, the characteristics of and development options for the area in question are considered first. River widening may involve measures taken in areas outside the dykes (such as lowering the flood plain, excavating secondary channels, removing obstacles and groyne lowering) and inside the dykes (such as dyke realignment, construction of a bypass or retention). River widening minimises the rise in water levels as a consequence of higher peak discharges brought about by climate change and thus contributes even more to minimising the risk of flooding. In many cases, river widening can also be effectively linked to area developments, as in the Waalweelde programme.

A combination of dyke improvements and river-widening measures is necessary to be able to create a robust river system. The combination will make it possible to respond to the characteristics of the river distributaries with customised work and to seize opportunities to link in with policy goals for nature and water quality, for example. The relationship between dyke improvement and river widening has been elaborated into a guiding framework for the period up to 2050 (↗ map 7). The proposals for river widening are based on the urgency of flood risk management, regional opportunities to link in and cost-effectiveness. The preferential strategies form the strategic guide for further elaboration, leaving some room for choice, however. In the final elaboration of the measures – and hence the choice between dyke improvement and river widening – there are a number of key factors to consider, namely contribution to the goal, costs, opportunities to link in and co-funding, other benefits and effects, and support. At the start of an exploration of river widening, there should be sufficient certainty about the financing from the government authorities involved.

Main features of the preferential strategy for flood risk management - Rhine distributaries

In addition to the preferential strategy for the entire area around the major rivers, the preferential strategy for the Rhine distributaries comprises the following main features (↗ map 7 and ↗ figure 6):

1. All Rhine distributaries

As a result of climate change, the Rhine discharge at Lobith is expected to increase to a maximum of 17,000 m³/s in 2050

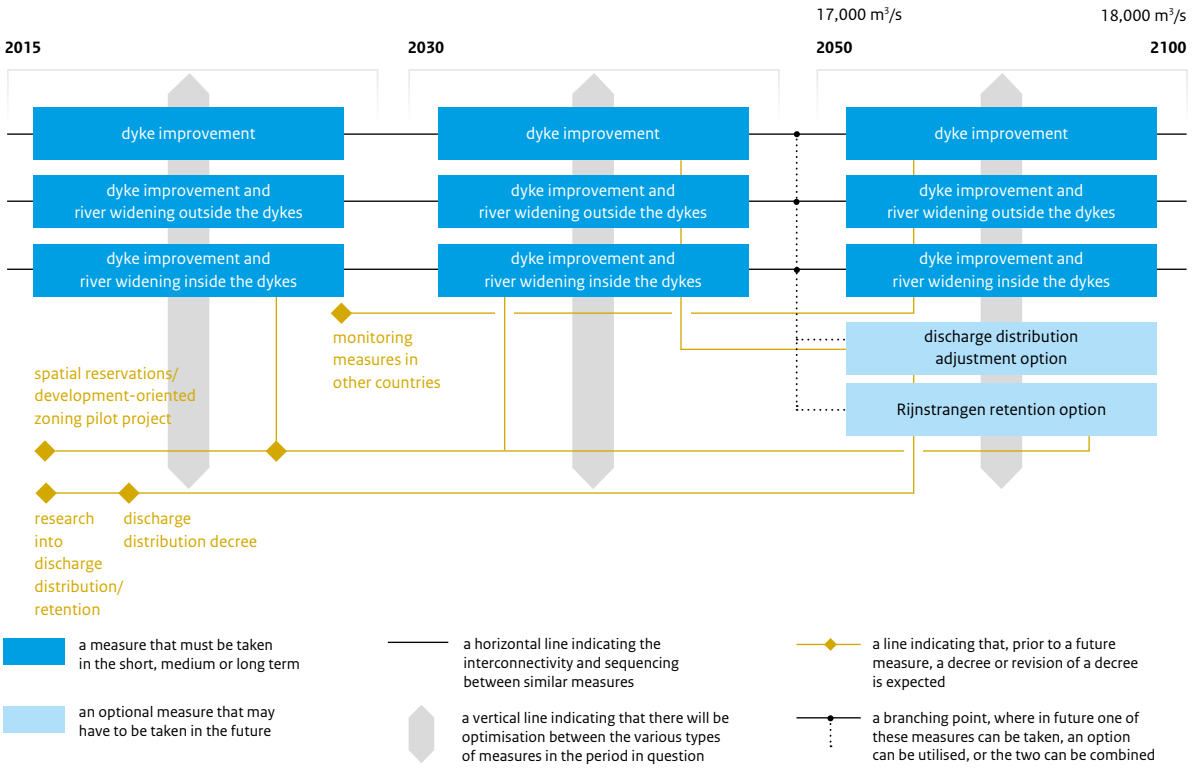
Explanation Map 7 Rivers

This ↗ map shows the essence of the preferential strategy for flood risk management for the Rhine distributaries and Meuse, for the period 2015-2050. It is based on information from Flood Risk and Safety in the Netherlands (for each dyke stretch). The flood risk management targets address tasking associated with dyke stretches failing inspection, new standard specifications for dykes, consequences of climate change (higher river discharge and sea level rises) and soil subsidence. The measures consist of dyke improvement (two categories*), increasing dyke height (two categories**) and river widening (five categories). The Spatial Planning (General Rules) Decree (Barro) lists various area reservations for any future measures. Given this preferential strategy, it is necessary to maintain a large part of them, drop a number of them and possibly add a few new ones. Together, targets and the combination of river widening and dyke improvement/increase in dyke height form the indicative framework for elaborating concrete measures on a local scale.

* Dyke improvement first and foremost entails improving stability. The ratio between the current risk of flooding and the new standard specification is used as a measure of the estimated volume of improvements. If this factor is greater than 50, it means 'major dyke improvement'.

** Increase in dyke height is indicated in places where the rise in sea levels and/or river discharge leads to higher normative high water levels that cannot be accommodated using river widening. Any rise in normative water levels ranging between 10 and 30 cm is tantamount to an increase in dyke height. Where more than 30 cm is required, this is indicated by 'substantial increase in dyke height'.

Figure 6 Rivers, adaptation path for preferential strategy for flood risk management



and 18,000 m³/s in 2100. In the vast majority of the Rhine distributaries, the preferential strategy consists of three categories of measures: 1) dyke improvements, 2) a combination of dyke improvement and river widening in areas outside the dykes, and 3) a combination of dyke improvement and river widening in areas inside the dykes. As part of the adaptive strategy, the combination of the three categories can be optimised on a regional scale for the various periods up to 2100 (↗ figure 6). For future measures in areas inside the dykes, it is important to reserve areas, including a retention area (Rijnstrangen). The basic principle is that retention will not be necessary in the Rijnstrangen until 2050, and after 2050 the use of this area as retention will be deliberated, based on insights into the peak discharges of the Rhine distributaries and any decisions on changing the discharge distribution and limited rise in the winter water level of the IJsselmeer lake. Although this area will not be needed for retention purposes in the coming decades, it is best to only allow developments that do not impede the future use as retention area. As such, it is proposed to carry out a development-oriented reservation pilot project in the short term. In 2017, it will be decided whether options for changing the discharge distribution after 2050 should be left open (↗ Delta Decision on the Rhine-Meuse Delta). For long-term decisions, it is also important to keep an eye on the implementation of measures in the strategy for flood risk management in Germany, especially because they impact the maximum discharge. Based on the preferential strategy for the Rhine distributaries, a number of spatial reservations can ultimately either be dropped or added (↗ see under 'Implementation' below). Dyke improvements are elaborated in the Flood Protection Programme based on the preferential strategy for rivers.

2. IJssel

The following flood risk management tasking needs to be addressed for the IJssel: part of the dykes does not meet the current standards; in a number of places, the dykes are susceptible to piping; dyke ring 53 requires significant improvements in order to meet the new standard specifications (near Zwolle, for example) and as a result of climate change, discharge in the IJssel may increase up to 2,650 m³/s in 2050 and 2,850 m³/s in 2100 (based on the expected increase in the Rhine discharge at Lobith, as described ↗ under 1).

The following basic principles apply to the IJssel:

- resolve the flood risk tasking until 2050 without using the Rijnstrangen area as a retention area; after 2050, reconsider on the basis of decisions on retention in Rijnstrangen area, discharge distribution across Rhine distributaries and limited rise in IJsselmeer water level (↗ see also 1, All Rhine distributaries);
- tailor safety measures to the characteristics of the river: small-scale, interwoven with areas inside and outside the dykes, significant landscape and nature values, town/city facades of great economic and cultural-historical value').

For the IJssel, the indicative framework for the combination of dyke improvement and river widening (↗ map 7) provides for dyke improvements in order to meet the current standards and new standard specifications, as well as for dyke improvements in places where the water level cannot be lowered enough by means of river widening (at Deventer, for example). The proposals for river widening are based on the urgency of flood risk management, regional opportunities to link in and cost-effectiveness.

A general exploration that forms part of the Mastenbroek IJssel project (Flood Protection Programme) examines the relationship between the Reevediep 2nd phase spatial measure and the Around Kampen project (also a Flood Protection Programme), with the preferential strategy serving as an indicative guide and bearing in mind the urgency of dyke improvements (Flood Protection Programme 2015-2020). In addition, it is proposed to work towards starting a MIRT Study in 2015 for the prioritisation of measures along the IJssel and the Pannerdens Kanaal canal. It is expected that a MIRT exploration can soon be started for the Klimaatpark IJsselpoort plan phase 1. For the IJssel, the research into 'smart combinations' in the IJssel-Vecht delta is also important (↗ preferential strategy for IJsselmeer Region). ↗ Background document B6 provides the substantiation for these projects (↗ Synthesis Document on Rivers (in Dutch)).

3. Nederrijn-Lek

The following flood risk management tasking needs to be addressed for the Nederrijn-Lek: a part of the dykes does not meet the current standards; in a number of places, the dykes are susceptible to piping; the new standard specifications mean tasking for a large part of the dykes; especially in the west, soil subsidence means major tasking; and as a result of a rise in sea levels, the normative water level may rise up to 60 cm at Krimpen and up to 20 cm at Schoonhoven until 2100. In accordance with the current policy, discharges over 16,000 m³/s do not lead to a higher discharge across the Nederrijn-Lek.

The following basic principles apply to the Nederrijn-Lek:

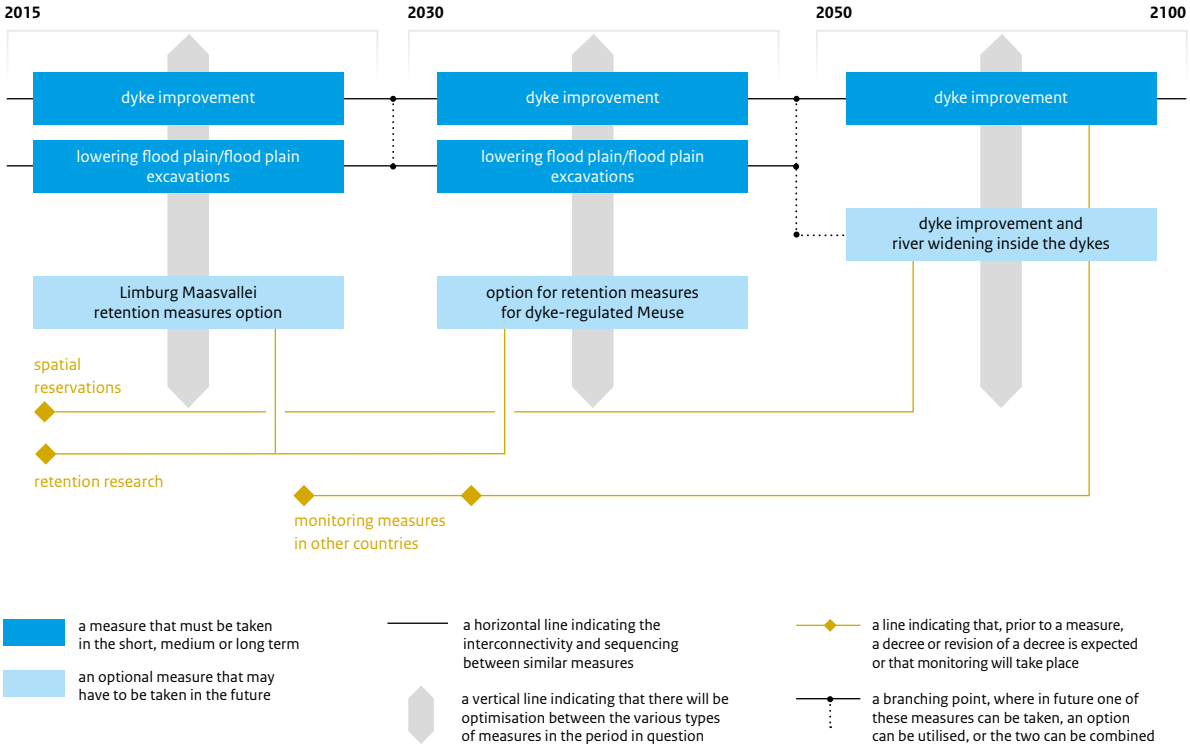
- with regard to dyke improvements: if there is not enough space inside the dykes or if it is very expensive, use options and innovative solutions in the areas outside the dykes;
- consider the river, dyke and surroundings concordantly, use opportunities to link in and consider dyke improvements as spatial tasking;
- consider multifunctional solutions in places with considerable spatial dynamics and a significant flood risk management tasking;
- tailor measures to the quality images of the region for the various landscapes along the river.

For the Nederrijn-Lek, the indicative framework for the combination of dyke improvement and river widening (↗ map 7) provides chiefly for dyke improvements and, locally, for river widening options in areas outside the dikes. Improving the northern Lek dyke has proved to be a cost-effective solution for safety in Central Holland. As a result, a part of the C-dykes in this area will ultimately lose its primary status (↗ Delta Decision on Flood Risk Management). It is proposed that DP2017 at the latest should include a decision on the start of an exploration of a so-called Delta Dyke at the Grebbe Dyke (near Wageningen), in connection with the major flood risk management tasking over a limited dyke stretch and the opportunities for combinations with area development. ↗ Background document B6 provides the substantiation for these projects (↗ Synthesis Document on Rivers (in Dutch)).

4. Waal and Merwedes

The following flood risk management tasking needs to be addressed for the Waal and Merwedes: a substantial part of the dykes does not meet the current standards; in many places, the dykes are susceptible to piping; and a large part of the dykes does not meet the standard specifications. As a result of climate change, the Waal discharge at Lobith may increase up to 10,970 m³/s in 2050 and 11,760 m³/s in 2100 (based on the expected increase in the Rhine discharge at Lobith as outlined ↗ under 1).

Figure 7 Area around the major rivers, adaptation path for preferential strategy for flood risk management – Meuse



The following basic principles apply to the Waal and the Merwedes:

- resolve the flood risk tasking until 2050 without using the Rijnstrangen area as a retention area; after 2050, reconsider, if advisable, on the basis of decisions on retention in Rijnstrangen area; and discharge distribution across Rhine distributaries (↗ under 1, All Rhine distributaries);
- use major river-widening measures at bottlenecks in rivers as the backbone; in addition, adaptive programming of, for example, flood-plain measures with opportunities for linking in with third-party initiatives;
- tailor safety measures to the characteristics of the river: large-scale, industrial, interwoven with areas inside and outside the dykes, significant landscape and nature values, economic and cultural-historical values; and town/city facades of great historical value.

For the Waal, the indicative framework for the combination of dyke improvements and river widening (↗ map 7) provides for dyke improvement and river widening in a large number of places.
It is proposed to work towards starting MIRT explorations in 2015 for the following broad, combined solutions, with the preferential strategy serving as an indicative guide and bearing in mind the urgency of dyke improvements (Flood Protection Programme 2015-2020): the Varik-Heesselt bypass and possibly the secondary channel at Sleeuwijk. At the start of an exploration, there should be sufficient certainty about the financing from the government authorities involved. It is important to include this in the Flood Protection Programme. Follow-up research will be carried out for the Brakel and Werkendam sites, including the secondary channel at Sleeuwijk. These studies will be taken up by the region and elaborated in coordination with the Flood Protection Programme. In addition, urgent dyke improvement projects will devote special attention to river-widening measures in areas outside the dykes.
↗ Background document B6 provides the substantiation for these projects (↗ Synthesis Document on Rivers (in Dutch)).

Main features of the preferential strategy for flood risk management - Meuse

In addition to the preferential strategy for the entire area around the major rivers, the preferential strategy for the Meuse comprises the following main features (↗ map 7):

1. Entire Meuse
In the preferential strategy for the Meuse (from Eijsden to Hollandsch Diep), the climate tasking and the tasking resulting from the new standard specifications combine dyke improvements and river widening, with the emphasis on river widening (↗ map 7 and ↗ figure 7). River widening may entail taking measures in areas outside the dykes (such as flood plain lowering and secondary channels) and inside the dykes (such as dyke realignment, bypass, retention). One point meriting special attention is the transmission effect along the Meuse.

The following flood risk management tasking needs to be addressed for the Maasvallei and the dyked river Meuse: a part of the dykes does not meet the current standards; in a number of places, the dykes are susceptible to piping, a large part of the dykes does not meet the new standard specifications; and as a result of climate change, the normative discharge of the Meuse may, it is expected, increase from 3,800 m^3/s to a maximum of 4,200 m^3/s in 2050 and 4,600 m^3/s in 2100. The latter discharge is also the expected maximum physical discharge.

To be able to choose wise solutions for the long-term tasking, it is necessary to keep an eye on the implementation of measures and the flood risk management strategy in Belgium, upstream from and along the Grensmaas. To this end, the existing collaboration can be used and broadened. Another point meriting attention is coordination between the preferential strategy for the Meuse and the replacement tasking for the weir and lock complexes (↗ sub-section 4.2, Replacement Tasking for Hydraulic Structures project (VONK)).

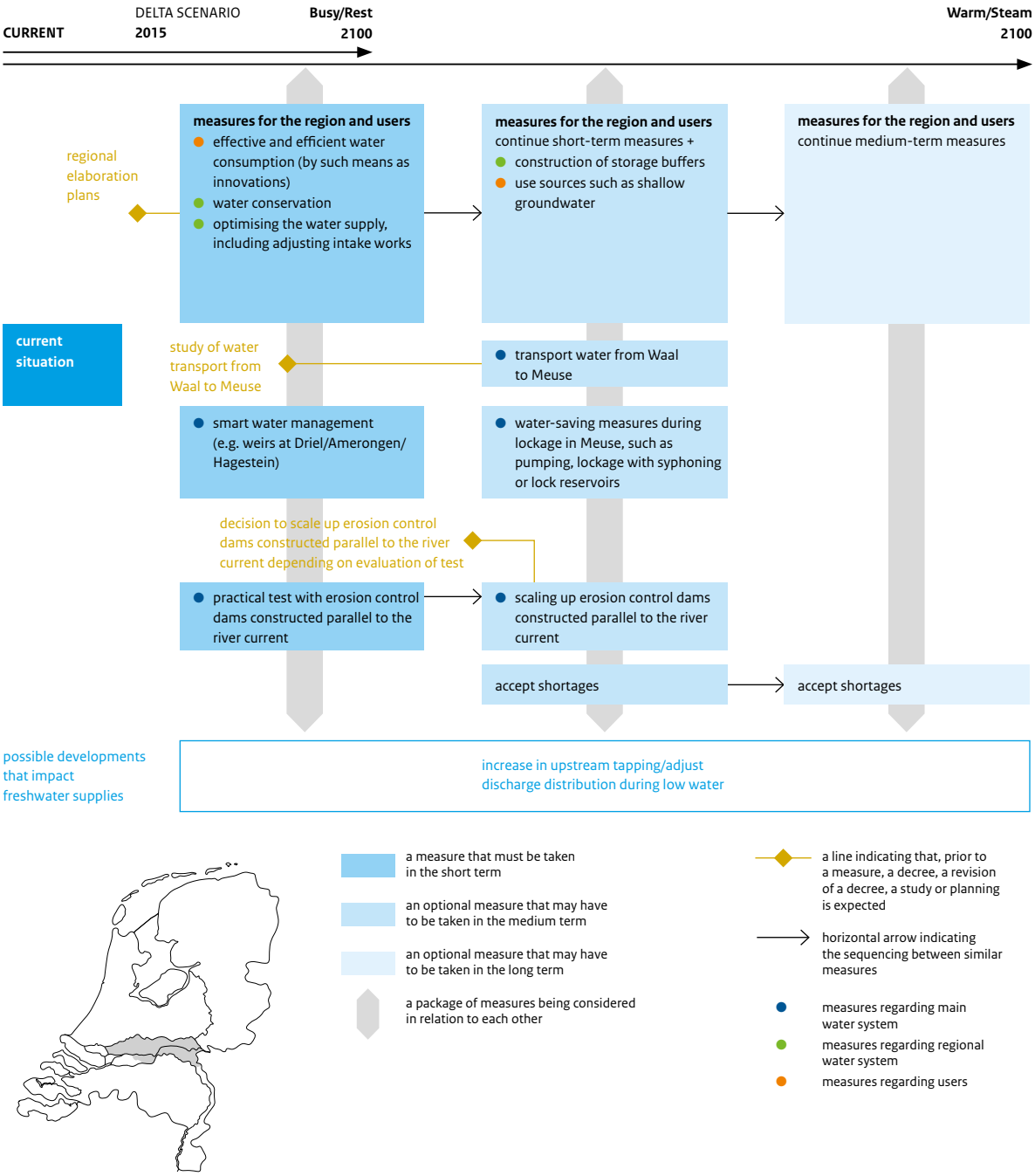
In the Maasvallei, there are 42 dyke rings in the winter bed that are still used for peak storage along the entire Meuse. At present, these dyke rings are supposed to retain river water up to retain water with rising flood levels from 1/250 or more extreme and be flooded. This system is insufficiently robust and reliable, also in the light of the new flood risk management policy. As such, in the process of working towards new standardisation, the preferential strategy moves away from the specific design requirements for primary flood defence systems in the Meuse, which are related to the retention effect of the Limburg dyke rings. As such, flood defence systems will be assessed and dyke improvements prioritised and designed along the entire Meuse in accordance with the national elaboration of the standard specifications. This does, however, require measures to compensate for the negative effects of the loss of retention in the Maasvallei. For this reason, the preferential strategy provides for seven dyke realignments in the current-carrying part of the Maasvallei, retention and optimisation of the storage function of (a part of) five dyke rings in the Maasvallei and improvement of the flood defence systems along the dyked river Meuse in order to compensate for the remaining rise in water level. Flood risk management projects that are already being prepared and carried out will be implemented in accordance with the current arrangements. The ongoing administrative agreements will also remain in force. These interventions are designed to be no-regret measures.

2. Limburg Maasvallei
The following basic principles apply to the Maasvallei:
- a comprehensive approach to flood risk management tasking, with safety, regional development and spatial quality going hand in hand;
- create space where possible, dykes where required;
- in the case of urban development or restructuring, anticipate future dyke improvements now to allow the dykes to be integrated into the urban area in a high-quality, organic fashion.

For the Limburg Maasvallei, the indicative framework for the combination of dyke improvement and river widening (↗ map 7) provides for various types of dyke improvement, some of which are already part of the Flood Protection Programme.

3. Dyked river Meuse
The following line of reasoning applies to the dyked river Meuse:
- at locations that are vulnerable – for example, because of landscape, use, cultural history or traffic – try to eliminate the need for dyke improvement on top of river widening; bearing this in mind, assume a maximum increase in dyke height of 30 cm in adjacent dyke stretches;
- reconsider the possibility of an increase in dyke height if the values can be maintained using (innovative) techniques, appropriate to the basic principles of the preferential strategy;
- use retention areas upstream where possible because that is where they are most effective and find large open areas for this between Katwijk and Keent;
- reserve areas inside the dykes that may be required for river-widening measures in the future.

Figure 8 Area around the major rivers, adaptation path for preferential strategy for freshwater (including region name)



In the indicative framework, dyke improvements and river widening along the dyked river Meuse will remain largely in balance (↗ map 7).

It is proposed to start more in-depth research for the entire Meuse in 2015, to elaborate the preferential strategy for this river. To this end, the Limburg Maasvallei and dyked river Meuse will be considered together. It is proposed to decide in DP2017 at the latest whether and when to start MIRT explorations. For the Limburg Maasvallei, the explorations concern promising river-widening projects, for example at Maastricht and Venlo, and/or dyke realignments to compensate for transmission effects.
For the dyked river Meuse, these explorations concern measures such as flood plain excavations combined with dyke improvements between Grave and Lith and Maasoeverpark Den Bosch-Heusden, Maasheggen/Oeffelt and addressing the bottleneck at Ravenstein. ↗ Background document B6 provides the substantiation for these projects (↗ Synthesis Document on Rivers (in Dutch)).

Main features of the preferential strategy for freshwater

The Delta Decision on Freshwater forms the framework for the preferential strategy for freshwater in the area around the major rivers (↗ sub-section 2.3). ↗ Figure 8 shows the preferential strategy for freshwater in rivers as an adaptation path. In the short term, the regional water managers and users seek to optimise the water supply to the region and to promote frugal water consumption, by introducing innovations, for example. Rijkswaterstaat applies 'smart water management' to facilitate better control and use of the water, at the weirs at Driel, Amerongen and Hagestein, for example (↗ sub-section 2.3, Delta Decision on Freshwater). Moreover, measures to anticipate low water levels in the rivers are also required. The region ensures that the intake works can feed enough water into the regional water system during low river water levels as well. Longitudinal groynes constructed parallel to the river can help prevent drying out and increases in groundwater levels along the river, as well as contribute to flood risk management and navigability. Rijkswaterstaat will be conducting a practical test with longitudinal groynes constructed parallel to the river in the period 2015-2021. Given the possibility of major water shortages arising in the area south of the major rivers in the medium term, options to transport water from the Waal to the Meuse – for example via the Maas-Waalkanaal canal – will be left open. In the short term, the Ministry of Infrastructure and the Environment will conduct research into the advisability of this measure, its side effects and its cost-effectiveness compared with the alternative of relocating regional intake points to the Waal. This last option would require substantial and very costly modifications to the regional water system.

The proposal for the Delta Decision on Freshwater and this preferential strategy, with the choices and measures noted therein, form the basis for detailing the supply levels in the area around the major rivers.

Implementation

The Delta Plan on Flood Risk Management and the Delta Plan on Freshwater contain the measures from this preferential strategy that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. For the implementation of the flood risk management tasking, it is wise to distinguish between stretches where wide-ranging, combined solutions involving river widening are envisaged and stretches involving 'regular' dyke improvements with opportunities to link in. Stretches with wide-ranging, combined solutions will be selected on the basis of preferential strategies ('demarcation'). Dyke improvements are prioritised and programmed in the Flood Protection Programme. Their use in a wide-ranging, combined solution will require prompt coordination with the necessary dyke improvements. DP2015 contains an initial programme of planned explorations and essential in-depth studies for the wide-ranging, combined solutions. DP2016 will elaborate on the potential wide-ranging, combined solutions, partly with a view to ensuring the prompt coordination with the necessary dyke improvements.

It is proposed to programme and prioritise measures for the availability of freshwater concordantly too (↗ section 2, Delta Decision on Freshwater). The programming for freshwater currently only comprises the explorations for the most urgent measures for the coming period; DP2016 will contain a more detailed programming of the freshwater measures.

The central government will lay down the essence of the preferential strategy for the rivers in the National Water Plan. The parties in the area around the major rivers will lay down the combination of dyke improvement and river widening, as outlined and illustrated above, plus the preferential strategy for freshwater, in their own plans. The provinces will do so in the regional water plans or framework visions that will be

adopted in 2015. Municipal councils will incorporate the preferential strategy in framework visions. The water boards will adopt the preferential strategy for their management territory in the water management plans.

It is proposed to work towards starting MIRT explorations in 2015 for:
- the bypass at Varik-Heesselt and possibly the secondary channel at Sleeuwijk, because river widening in this section may have consequences for dyke improvement explorations that will be launched soon as part of the Flood Protection Programme.

At the start of an exploration, there should be sufficient certainty about the financing from the government authorities involved. The Mastenbroek IJssel project (part of the Flood Protection Programme) incorporates a general exploration of how this project relates to the Reevediep 2nd phase spatial measure and the Around Kampen project (also part of the Flood Protection Programme).

It is proposed to start further MIRT Studies in 2015 for:
- the prioritisation of measures along the IJssel and Pannerdens Kanaal canal; it is expected that a MIRT exploration can be launched soon for phase 1 of the Klimaatpark IJsselpoort plan.
- the potential interference with other measures in the Zaltbommel-Gorinchem-Werkendam section;
- the connection between river-widening measures in areas outside the dykes and urgent dyke improvement projects along the Waal and Merwedes;
- the entire Meuse (dyked river Meuse and Limburgse Maasvallei), aimed at a further elaboration of the preferential strategy, including the impact of the decisions about transmission effects.

↗ Background document B6 provides the substantiation for these projects (↗ Synthesis Document on Rivers (in Dutch)).

The spatial Planning (General Rules) Decree (Barro) includes various area reservations for the long term. These reservations concern areas inside the dykes which, it is expected, might be added to the riverbed in the long term in order to give the river more room. These reservations ensure that these areas do not undergo any large-scale or capital-intensive developments that seriously impede the implementation of any future river-widening measures. In the coming years, it will become clear – through, for example, the MIRT explorations referred to – for a number of areas where and in what term river-widening measures will be necessary. Based on the current knowledge, it is proposed to maintain the following existing spatial reservations, as laid down in map appendix 3 to the Spatial Planning (General Rules) Decree: Rijnstrangen, flood channel at Deventer, dyke realignment at Brakel, dyke realignment at Oosterhout, dyke realignment at Loenen-Dodewaard, dyke realignment at Bokhoven, dyke realignment at Overasselt, dyke relocation at Kraaijenbergse Plassen, retention at Kraaijenbergse Plassen, retention at Keent-Zuid, retention at Overasselt (further research will demonstrate whether this reservation can be dropped), dyke relocation at Alem, dyke relocation at Moordhuizen, dyke relocation at Hedel and the dyke relocations on the northern bank of the Bergse Maas. It is proposed to drop the area reservations for the flood channel at Zutphen, the dyke realignment at Noorddiep, Reevediep Kampen (flood channel at Kampen) and the dyke realignment at Heesselt. Research into the regional preferential strategy has shown that there may be enough other measures available around Zutphen to be able to fulfil the climate tasking in the long term (in accordance with intermunicipal framework vision on IJsselsprong Middengebied). The dyke realignment at Noorddiep is an expensive measure that, moreover, can have detrimental effects in the event of a north-westerly gale causing flooding. Reevediep 2nd phase falls within the boundaries of the space claimed by Reevediep 1st phase, which is now being implemented as part of Room for the River; consequently, this reservation is no longer necessary. The spatial reservation for the dyke realignment at Heesselt can be dropped on condition that an area reservation for the bypass at Varik-Heesselt is added to the Barro in order to secure sufficient space in this section of the Waal for any river-widening measures in the short or long term. It is therefore proposed, based on the preferential strategy, to add a new area reservation for the flood channel at Varik-Heesselt. In the coming years, studies will be conducted for a number of areas that may lead to additional reservations. These studies concern the following locations: dyke realignment at Werkendam, dyke realignment at Ooij and retention at the ENCI quarry in the municipality of Maastricht.

It is proposed to start a development-oriented reservation pilot project for the Rijnstrangen, focusing on its function as a retention area after 2050, in order to ascertain whether the drawbacks of long-term reservation can be mitigated.

The province of Gelderland, the central government and regional parties (water board, municipal councils) will take this up together.
A large part of the river-widening measures will be implemented in the areas outside the dykes. The major rivers policy prevents permits being issued for activities in areas outside the dykes that may actually impede an expansion of the area around the major rivers in the future.

The parties involved in implementing the preferential strategy for freshwater have agreed the following:

- Rijkswaterstaat will conduct a study to identify suitable sections for constructing longitudinal groynes parallel to the river flow.
- As part of 'smart water management', Rijkswaterstaat and the water boards will optimise the management of the weirs during low water in the rivers.
- The Rivierenland water board will ensure that the intake points are adjusted.
- The Rivierenland water board will elaborate the measures in the regional water system in regional elaboration plans and new water level decrees, establishing a link with the tasks to be carried out in the area by other parties.
- The government authorities will encourage economical and effective water consumption by supporting innovations, with such initiatives as the climate pilot project Sustainable Use of Shallow Groundwater.

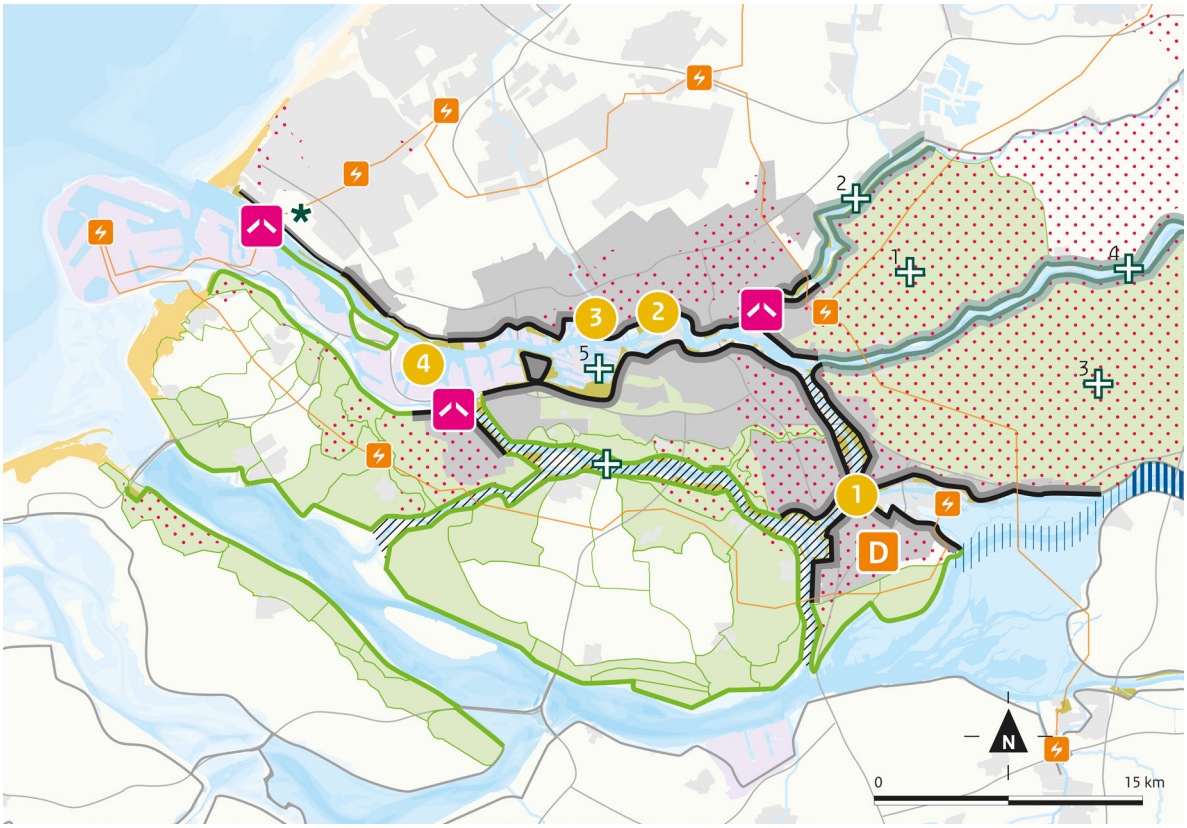
Knowledge

More knowledge of the various themes is needed to elaborate the preferential strategies. Area-specific knowledge is generated by studies of the transmission effects in the Meuse, the side effects of river widening at IJsselpoort on discharge distribution, and the development-oriented reservation pilot project in the Rijnstrangen. Knowledge of flood risk management in a general sense is generated by research into spatial reservations, compartmentalisation, the effects of longitudinal groynes constructed parallel to the river flow and the continued development of the Delta model. Moreover, knowledge is needed to support intergovernmental collaboration and decision-making at the level of river systems (prioritising and programming measures). The development of serious games may support the decision-making on complex issues. In the short term, research will be conducted into the supply of water from the Waal to the Meuse, focusing on use and necessity, various versions (such as Maas-Waalkanaal canal and Heerewaarden), side effects and cost-effectiveness.

In addition, the central government will roll out research into the stretches of the Waal and IJssel that are suitable for the construction of longitudinal groynes parallel to the river flow (↗ sub-section 4.3).
These studies are listed in the Delta Programme Knowledge Agenda (↗ background document A (in Dutch)) and, if financed from the Delta Fund, in ↗ section 4.

The Cabinet endorses the preferential strategy for rivers. The Cabinet will embed the policy choices to be made by the central government and the government actions needed to implement the preferential strategy in the interim revision of the National Water Plan. The Cabinet notes that there is substantial flood risk management tasking in the area around the major rivers, and this is being addressed by continuing to build on the pillars of dyke improvement and river widening. The Cabinet will participate actively in the regional elaboration of the combination of river widening dyke and improvement. As such, it is important that the costs of river widening are commensurate with the benefits for safety and other social goals. The Cabinet has earmarked €200 million in the Delta Fund to contribute to river-widening initiatives. One condition for the utilisation of these resources is that the initiatives contribute significantly to safety and that the costs are shared.

Map 8 Rhine Estuary-Drechtsteden, preferential strategy for flood risk management (until 2100)



Flood risk management

1. Prevention as the basis for flood risk management

- areas that are very rapidly and deeply submerged in case of flooding
- preserve coast by means of replenishments

2. Always an optimal combination of preventive measures

- replace storm surge barrier
- dykes – also consider forelands in testing and designing dykes
- before 2050: river widening – Merwedes optimum combination of river widening and dyke improvement
- after 2050: river widening – Merwedes optimum combination of river widening and dyke improvement

3. Safety and spatial development

- strong urban dykes
- robust marine-clay islands
- future-proof river dykes

4. Limit risks in areas outside dykes with customised regional measures

develop adaptation strategy, starting with:

1. historical Dordrecht dock area
2. Rotterdam Noordereiland
3. Rotterdam Merwe-Vierhavens
4. Rotterdam Botlek

5. Multi-layer safety

- D Dordrecht (MIRT)

protection of vital and vulnerable objects:

- power grid

6. Knowledge and research

1. Krimpenerwaard pilot
2. Hollandsche IJssel area process
3. Alblasserwaard area process
4. Building with Nature pilot for Lek
5. exploration of river as tidal park

- erosion prevention and control
- partial functioning of Maeslantkering storm surge barrier

Basic map

- freshwater
- saltwater / brackish water
- flood area
- urban area
- docks
- primary flood defence outside area covered by the plan
- motorway
- power grid cables

3.4
Rhine Estuary-Drechtsteden

Area and tasking

The Rhine Estuary-Drechtsteden region is a densely populated and industrial area along the lower reaches of the rivers, surrounded by countryside. Water is always nearby. The economy is closely related to the water and the economic core consists of the port area extending from the Tweede Maasvlakte to Moerdijk. Good waterways and waterway connections and excellent freshwater supplies are of great importance to this region. They also determine the competitive position of the Netherlands in the world.

The population and economic values in this region have grown immensely over the last 50 years. Together with the rise in sea levels, higher river discharges and ongoing soil subsidence, this development has determined the new standard specifications for the flood defence system (↗ section 2, Delta Decision on Flood Risk Management). Due to the great natural variation in the river discharge and the long preparation time for the dyke projects, 'fixed values' for the peak discharges have been assumed (for the Rhine 17,000 m^3/s in 2050 and 18,000 m^3/s in 2100 at Lobith; ↗ sub-section 3.3). The required level of protection means a major tasking in the entire area. There is tasking for freshwater supplies as well, as a result of saltwater seepage, increasing demand and salinisation of key intake points due to the ongoing rise in sea levels.

Main features of the preferential strategy for flood risk management

The proposals for the Delta Decision on Flood Risk Management, the Delta Decision on Spatial Adaptation and the Delta Decision on the Rhine-Meuse Delta form the framework for this preferential strategy (↗ section 2). The main features of the preferential strategy (↗ map 8 and ↗ figure 9):

1. Prevention as the basis for flood risk management
Most of the areas in the region lie at a depth where they would be submerged very rapidly and deeply in the case of a flood. As such, the prevention of floods continues to be the basis for achieving the required level of protection.

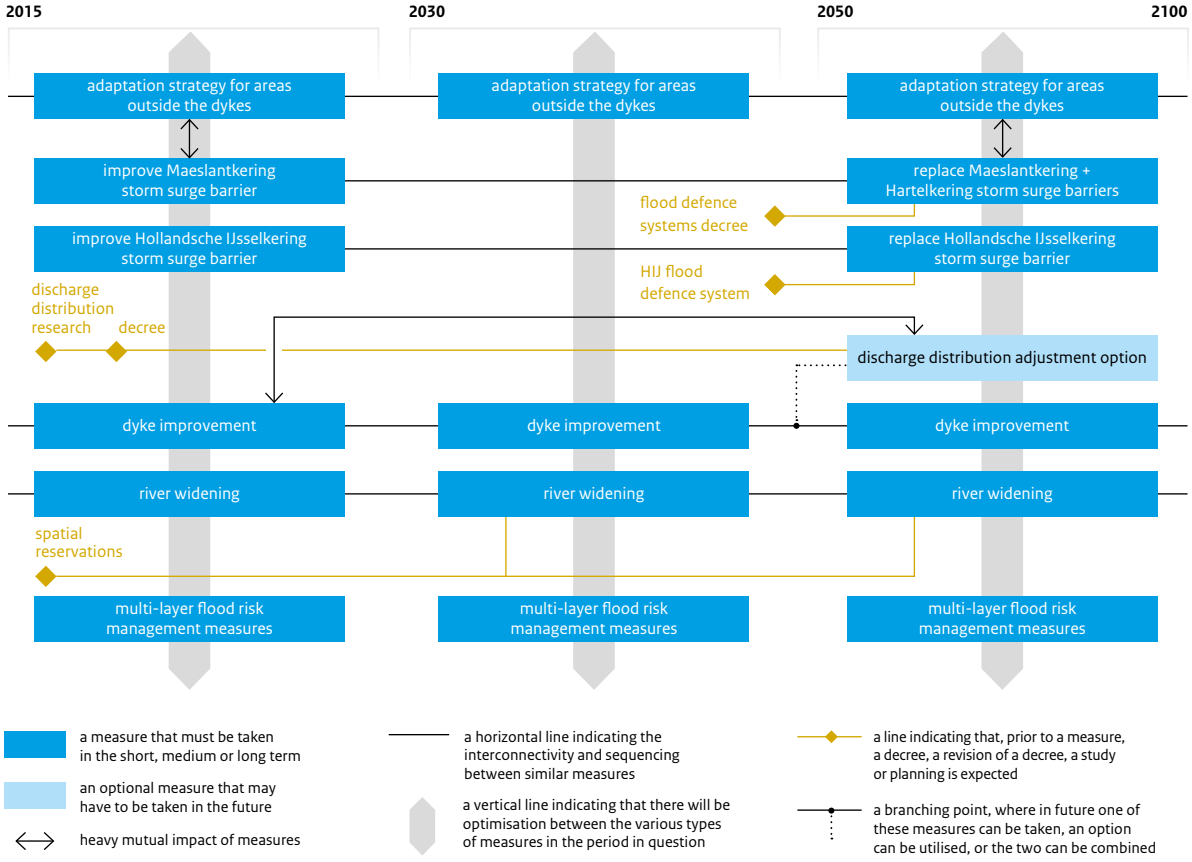
2. Always an optimal combination of preventive measures
A smart combination of three types of preventive measures forms the foundation for the level of protection: storm surge barriers, dykes and river widening. When the Hollandsche IJsselkering and Maeslantkering storm surge barriers are replaced in the second half of the 21st century, a new optimal balance between the requirements set for the storm surge barriers and the system of dykes will be sought. The basic premise for this is that the Hollandsche IJssel and Nieuwe Waterweg remain open rivers, with maximum opportunities for shipping and tidal nature. This solution is the most cost-effective one and affects the natural dynamics the least. If these storm surge barriers need to be replaced, their replacements will once again be open and closable storm surge barriers. For the Maeslantkering storm surge barrier, this decision is part of the Delta Decision on the Rhine-Meuse Delta. The optimum combination for the Merwedes consists of river widening and dyke improvement.

There are 'forelands' in front of most dykes in the Rhine Estuary-Drechtsteden, and these forelands have a positive effect on safety in the hinterland. The new assessment tools will be geared to the current topography, including the forelands and other elements that influence waves and water levels. The flood defence manager has to include the forelands in the assessment. This applies to forelands located within the core zone or protection zone and also to forelands located outside that zone, insofar as they impact the flood defence system (↗ section 2, Delta Decision on Flood Risk Management). In Spui, Noord and Oude Maas, riverbed erosion needs more attention, as this process threatens to undermine the stability of the dykes.

3. Safety and spatial development
The dykes are an integral feature of both the rural and the urban landscape. Each dyke improvement is a measure that will always be linked to other spatial developments. The region has formulated three perspectives for working on safety and space that do justice to the scenic features and the dynamics of the areas:

- Strong urban dykes: from the Rotterdam metropolitan region, via the Drechtsteden, to Gorinchem. Urban dykes can be improved by further integration of dykes into the built-up area, which offers opportunities for combinations with urban development on both sides of the dyke.
- Robust marine-clay islands: Voorne-Putten, Hoeksche Waard and the Eiland van Dordrecht. These islands have regional flood defence systems that will slow down and hold back any unwanted floods. As a consequence, the centres of these islands are particularly safe. Any new spatial developments there will not entail a substantial increase in risks. In those cases, it is essential that the regional flood defence systems remain in place.

Figure 9 Rhine Estuary-Drechtsteden, adaptation path for preferential strategy for flood risk management



- Future-proof river dykes: Lek (Krimpenerwaard and Alblasserwaard-Vijfheerenlanden) and Hollandsche IJssel. Any decisions relating to spatial planning in these areas need to take the flood risk management tasking in the long term into account to ensure that future dyke improvements do not lead to high social costs or meet with considerable opposition. That requires a long-term policy for spatial organisation and building. Moreover, it is advisable to use financial resources in a flexible manner to be able to seize opportunities to link in. This is crucial to the spatial quality of these polders and the affordability of the safety measures. A pilot project in the Krimpenerwaard can provide insight into that aspect.

4. Limit risks in areas outside dykes with customised regional measures

For areas outside the dykes, a 'strategic adaptation agenda for areas outside the dykes' is being developed. Elements of that strategic adaptation agenda include concrete measures that mitigate damage, combined with risk communication. Municipal councils and security regions are seeking to develop disaster plans for flood risk management and communication about flood risk management. In consultation with the central government, the regional governments and site managers are developing plans for areas where the risks and costs of appropriate measures are high, starting with the Noordereiland in Rotterdam, the historical port area of Dordrecht and the Botlek.

5. Multi-layer flood risk management

Flood risk management can be made more robust by means of a spatial organisation that takes the flood risks into account. A MIRT Study is being rolled out for the Eiland van Dordrecht for the purpose of ensuring sufficient protection by means of a 'smart combination' of preventive measures, spatial organisation and a greater emphasis on evacuation. Various vital and vulnerable objects in Rhine Estuary-Drechtsteden are susceptible to floods. A better protection of these objects requires customised solutions (↗ Delta Decision on Spatial Adaptation). A higher standard specification for the dykes would not be an efficient solution. The electricity grid and companies

governed by the Hazards of Major Accidents Decree (BRZO) should be given priority when taking measures.

As far as disaster management is concerned, evacuation and coping capacity merit attention. In the event of an (imminent) flood from the sea, it will be difficult to leave Rhine Estuary-Drechtsteden in good time (preventive evacuation): There is not enough time and the roads are low-lying and have insufficient capacity. Seeking refuge in high locations within the area is a better option. This requires a satisfactory coping capacity of the population. The security regions can encourage this by delivering good communication in advance and providing enough information in relation to disaster management (↗ section 2, Delta Decision on Flood Risk Management).

Main features of the preferential strategy for Freshwater

The Delta Decision on Freshwater and the Delta Decision on the Rhine-Meuse delta form the framework for the preferential strategy for freshwater. The preferential strategy for freshwater and the potential development over time are shown in ↗ figure 10. The freshwater supply to the western Netherlands is maintained by gradually expanding the emergency supply from the Waal and the Amsterdam-Rijnkanaal canal (KWA). The central government and the water boards are responsible for this. The freshwater supply to the western Netherlands does not require the emergency supply to be expanded into a permanent supply route in the short term. This may, however, present opportunities for nature and the economy. The freshwater supply from the Brielse Meer lake is gradually becoming more robust. Optimising the existing system will suffice for the time being; this can be done by using an enhanced monitoring system and an alternative water intake at Spijkenisse. 'Smart water management' is being used to combat salinisation (↗ section 2, Delta Decision on Freshwater) in such places as the Hollandsche IJssel, the Amsterdam-Rijnkanaal canal, the Noordzeekanaal canal and the weir at Hagestein. Moreover, the strategy provides for a more economical consumption by such means as innovations in the regional water system and among users. When the Maeslantkering storm surge barrier is replaced after 2070, the new flood defence system may be designed to prevent salt intrusion as well. The preferential strategy is sufficiently flexible to incorporate new developments, such as deepening the Nieuwe Waterweg for shipping, opportunities for nature in the delta and the decision regarding freshwater or saltwater in the Volkerak-Zoommeer lake.

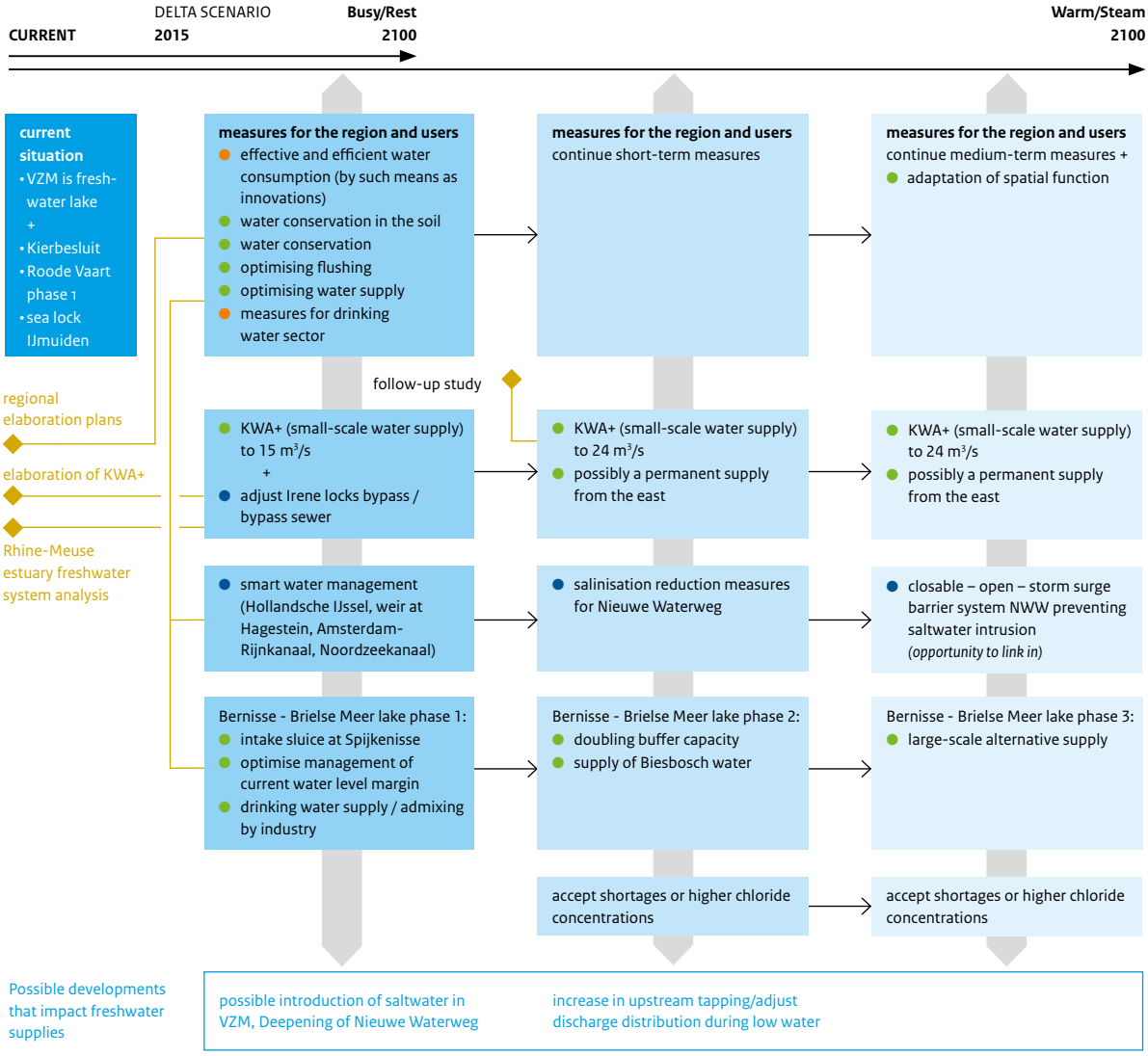
The Delta Decision on Freshwater and this preferential strategy, with the choices and measures noted therein, form the basis for detailing the supply levels in Rhine Estuary-Drechtsteden.

Implementation

The Delta Plan on Flood Risk Management and the Delta Plan on Freshwater contain the measures from this preferential strategy that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. Flood risk management measures are prioritised and programmed mainly in the Flood Protection Programme. It is proposed to programme and prioritise measures for the availability of freshwater concordantly too (↗ section 2, Delta Decision on Freshwater). The programming for freshwater now only comprises the most urgent measures for the coming period; DP2016 will contain a more detailed programming of the freshwater measures and an initial programming of new river-widening measures. The programme for the Replacement Tasking for Hydraulic Structures (VONK) outlines the replacement tasking for the storm surge barriers (↗ sub-section 4.2, VONK programme). The flood defence managers want to roll out research into the possibilities of a proactive and innovative method of preventing riverbed and bank erosion.

The central government, the province of Zuid-Holland and the water boards in Rhine Estuary-Drechtsteden will lay down the preferential strategy in their own plans. The preferential strategy for Rhine Estuary-Drechtsteden requires the central government, provinces, municipal councils and water boards to look beyond the boundaries of areas, deadlines and responsibilities set forth in their plans. By considering different kinds of tasking in relation to each other and linking them to spatial developments, they can come up with cost-effective solutions. This is promoted by means of joint area visions and pilot projects. The preferential strategy is gradually taking shape through area processes aimed at striking the perfect balance between dykes, storm surge barriers and room for the river. Water boards, provinces and municipal councils are already preparing area processes in the Alblasserwaard and the area around the Hollandsche IJssel. The area processes may take the form of a MIRT Study, involving the central government where necessary. A pilot project is being launched in the Krimpenerwaard on the capabilities of the spatial and financial resources to build future-proof river dykes. In Dordrecht, the water board, the municipal council, the security region, the

Figure 10 Western Netherlands, adaptation path for preferential strategy for freshwater (including region name)



Note:
In the event of salinisation problems, implement measures from the proposed adaptation path sooner or more frequently.

a measure that must be taken in the short term

an optional measure that may have to be taken in the medium term

an optional measure that may have to be taken in the long term

a package of measures being considered in relation to each other

a line indicating that, prior to a measure, a decree, a revision of a decree, a study or planning is expected

horizontal arrow indicating the sequencing between similar measures

measures regarding main water system

measures regarding regional water system

measures regarding users

VZM Volkerak-Zoommeer lake

province and the central government have started a MIRT Study on the application of a 'smart combination' near Dordrecht (↗ section 2, Delta Decision on Flood Risk Management). The perspectives for action outlined in the preferential strategy form the framework for these activities.

In 2015, the province, municipal councils and water boards will take the initiative to draw up an integral area plan for the historical port area of Dordrecht, the Noordereiland, Merwe-Vierhavens and the Botlek. Given its responsibility for the A15 motorway, the storm surge barrier and the quality of the water, the central government will contribute to the integral area plan at Botlek from the outset.

In places where forelands are used for safety, water managers and foreland managers will reach clear agreements on the function, management and assessment of the forelands.

The parties involved in implementing the preferential strategy for freshwater for Rhine Estuary-Drechtsteden have agreed the following:

- Rijkswaterstaat and the water boards in the western Netherlands will elaborate on the expansion of alternative supply routes (first step of KWA+, including the alteration of the Irene locks) and implement these measures.
- Rijkswaterstaat and the water boards will roll out actions to optimise management during low water.
- The Hollandse Delta water board will optimise the management of Brielse Meer lake, using an improved measurement and monitoring system and an alternative intake at Spijkenisse.
- The water boards in the western Netherlands will implement measures in the regional water system based on a regional elaboration plan yet to be drawn up.
- The government authorities will encourage economical and effective water consumption, by such means as the Delft Blue Water pilot project, a feasibility study into effluent post-treatment.
- Drinking water companies invest in the lasting quality of drinking water, for example by improving purification and changing intake locations.

Knowledge

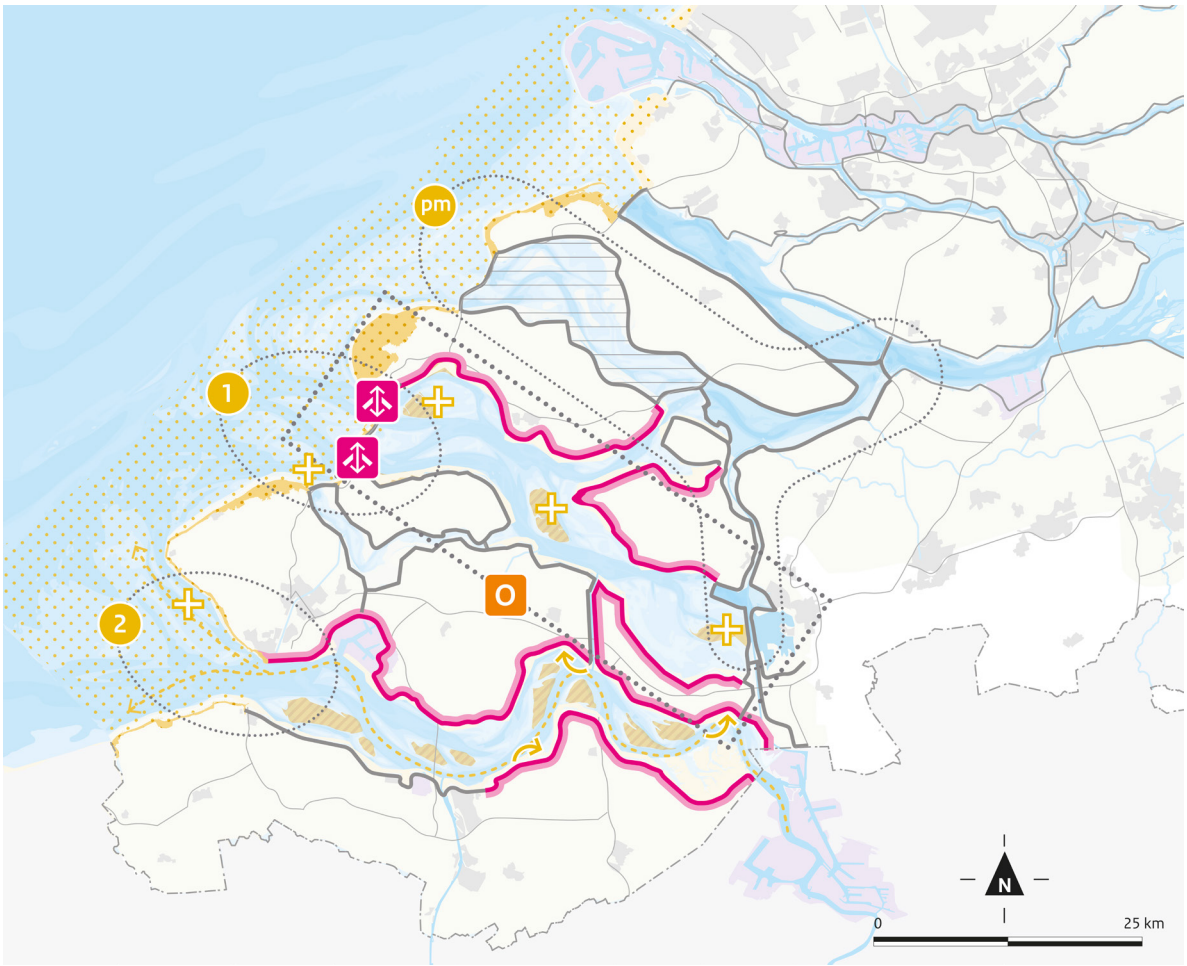
Safety in Rhine Estuary-Drechtsteden can be improved in the short term by reducing the failure probability of the Maeslantkering storm surge barrier or taking the partial functioning of this flood defence system into account. Research into this will start in 2015. Any link between solutions for flood risk management and spatial developments requires a new flexible funding strategy, with a different distribution of costs and benefits over time. This applies to the areas both inside and outside the dykes. A pilot project for the Krimpenerwaard will provide insight into the question of whether existing spatial and financial policy tools are able to sufficiently support the preferential strategy. The area processes in the polders and the area around Hollandsche IJssel will utilise this knowledge.

On the initiative of Dordrecht municipal council, a Multi-Layer Safety Expertise Centre will be set up where stakeholders can learn and work jointly on water-robust spatial organisation. Water managers and municipal councils will develop opportunities for linkage in forelands into actual pilot projects, such as the Building with Nature pilot project for the Lek. In the long term, knowledge is required for the design of the new storm surge barriers in the Hollandsche IJssel and the Maeslantkering storm surge barrier. In the coming years. The parties involved will carry out joint fact-finding research into a further increase in the small-scale water supply (KWA) in the medium term and any alternatives for this, such as a permanent supply from the east. The Hollandse Delta water board and Rijkswaterstaat will conduct research into potential follow-up measures for the Brielse Meer lake. Rijkswaterstaat will conduct a Rhine-Meuse estuary system study to gain a better understanding of the combined effect on the main water system of all programme measures and potential developments, such as a saltwater Volkerak-Zoommeer lake, deepening of the Rotterdam port, the new sea lock at IJmuiden and upstream tapping.

These studies are listed in the Delta Programme Knowledge Agenda (↗ background document A (in Dutch)) and, if financed from the Delta Fund, in ↗ section 4.

The Cabinet endorses the preferential strategy for Rhine Estuary-Drechtsteden. It is important that the water tasking is closely coordinated with the intensive use of space in this area for residential, industrial, agricultural, horticultural and nature purposes. The Cabinet will embed the policy choices, follow-up studies, area processes and measures that are required to implement the preferential strategy and for which the central government is to take action in the interim revision of the National Water Plan. Where possible, the further elaboration will seek to create synergy with other spatial developments and ambitions, for the purpose of coming up with the most cost-effective solutions possible for both water and other spatial sectors.

Map 9 Southwest Delta, preferential strategy for flood risk management



Flood risk management

Room for innovative dykes

preserving current primary flood defence systems and dams

Peak water storage and tide Grevelingen

No future peak water storage necessary

PM government framework vision on the Grevelingen and Volkerak-Zoommeer lakes

Oosterschelde: flood defence system, dykes and sand

ongoing sand replenishment to control sand demand

(innovative) dyke improvement

Oosterschelde MIRT study

optimising management regime of Oosterschelde storm surge barrier

Westerschelde: dredging and dumping strategy

(innovative) dyke improvement

optimisation of the dredging and depositing strategy

Coast and Voordelta

Preserve coastal foundation zone, replenish locally

until 2020, continue the sand replenishment programme; after 2020, gradually adjust sand replenishment based on rise in sea levels if necessary

possible sand replenishment pilot project

comprehensive vision of Oosterschelde (1) and Westerschelde (2)

Basic map

freshwater

saltwater / brackish water

floodable area

urban area

docks

primary flood defence outside area covered by the plan

motorway

border

3.5
Southwest Delta

Area and tasking

The Southwest Delta is where the Rhine, the Meuse and the Schelde discharge into the sea. After the 1953 flood disaster, the Delta Works greatly reduced flood risk in this area in a number of ways, such as significantly shortening the coastline. This created markedly different water basins: freshwater and saltwater, tidal and non-tidal. The Delta Works also caused new problems, such as algal bloom in the Volkerak-Zoommeer lake and the delta border lakes (Binnenschelde and Markiezaat), sand demand in the Oosterschelde and oxygen deficiency in the Grevelingen lake bed. Consequently, the region is losing out on opportunities for sustainable development of the regional economy. The managers in the Southwest Delta have prioritised safety, the economy and ecology in future developments.

Climate change presents the area with challenges in terms of flood risk management and freshwater supplies. Haringvliet, Oosterschelde and Westerschelde will ultimately face tasking for flood risk management, as a result of rising sea levels and higher river discharges. Climate change (lower river discharges) will also result in tasking for the freshwater supply at the intake points. Changes in precipitation will result in tasking in areas that are surrounded by saltwater and do not receive freshwater from the main water system.

Main features of the preferential strategy for flood risk management

The proposals for the Delta Decision on Flood Risk Management and the Delta Decision on the Rhine-Meuse Delta and the Decision on Sand form the framework for this preferential strategy (↗ section 2). The main features of the strategy are (↗ map 9):

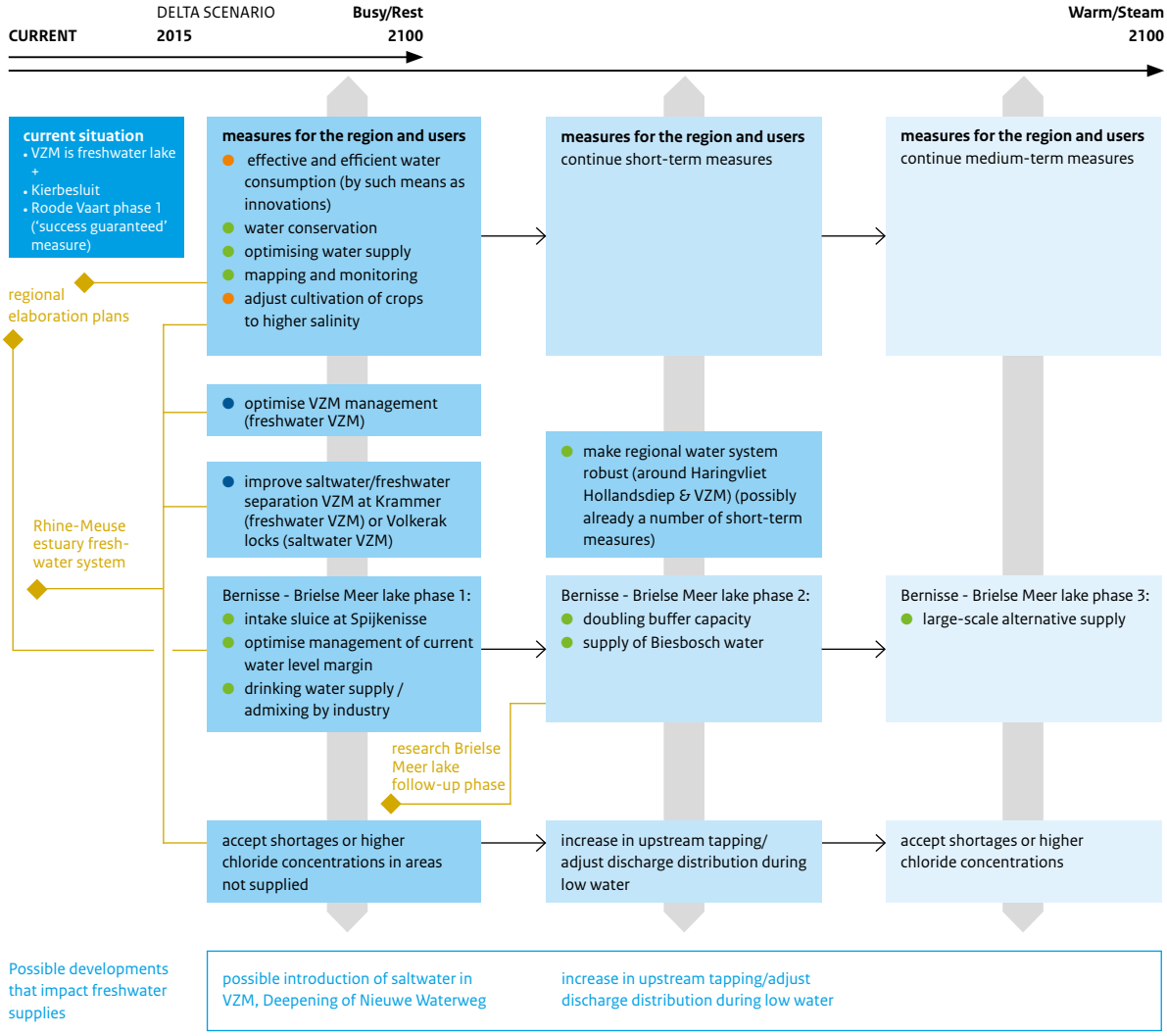
1. Room for innovative dykes
In various places in the Southwest Delta, the new standard specifications for the flood defence systems will lead to dyke improvements. The basic principle is that the current dams and flood defence systems that are designed to shorten the coastline will remain in place so as to safeguard flood risk management. There will, however, be room for customised work to promote estuarine dynamics. In many areas, the concept of innovative dykes presents opportunities, under the motto of 'do more with dykes'. All dyke improvements in the flood protection programme are being reviewed to ascertain whether there are opportunities for innovative dykes with a versatile use of space, for example for nature, recreation and living, and what technical, financial and administrative agreements are required to capitalise on these opportunities.

2. Peak water storage and tides in Grevelingen
For the framework vision on the Grevelingen and Volkerak-Zoommeer lakes, the central government and the region jointly investigated whether peak water storage in the Grevelingen is an option to ensure effective flood risk management in the long term. The conclusion is that there is no need to keep this option open. The parties do not have to allow for any water storage in the Grevelingen. In the future, system changes may once again be worth considering.

3. Oosterschelde: flood defence system, dykes and sand
The preferential strategy for the Oosterschelde is designed to offer a future-proof approach to the flood risk management tasking that also helps to tackle erosion in the intertidal zone (sand demand) and the economic use of the Oosterschelde. This can be achieved, provided that a combination of three controls is always selected: adjusted management of the Oosterscheldekering storm surge barrier, systematic bank and shoal replenishments in the Oosterschelde, and (innovative) dyke improvements. The central government and the region will conduct an Oosterschelde MIRT Study in the coming years to establish the most effective combination of these controls. To combat erosion in the intertidal zone of the Oosterschelde (sand demand), the central government will adopt the framework vision on sand demand in 2014, including a decree on sand replenishments on Roggenplaat. Together, the Oosterschelde MIRT Study and the framework vision on sand demand offer a comprehensive perspective on decisions on dyke improvements, a systematic approach to the sand demand and an adjusted management regime for the Oosterscheldekering storm surge barrier.

4. Westerschelde: dredging and dumping strategy
Optimisation of current flood risk management is also advisable for the Westerschelde. This can be achieved by combining (innovative) dyke improvements with optimisation of the dredging and dumping strategy, and using deposits to allow shore faces of dykes to adapt to rising sea levels. This also presents opportunities for nature recovery. In the long term, measures will have to be taken to mitigate the increasing difference between tides.

Figure 11 Southwest Delta, adaptation path for freshwater (including region name)



Note:
In the event of salinisation problems, implement measures from the proposed adaptation path sooner or more frequently.

a measure that must be taken in the short term

an optional measure that may have to be taken in the medium term

an optional measure that may have to be taken in the long term

a package of measures being considered in relation to each other

a line indicating that, prior to a measure, a decree, a revision of a decree, a study or planning is expected

horizontal arrow indicating the sequencing between similar measures

measures regarding main water system

measures regarding regional water system

measures regarding users

VZM Volkerak-Zoommeer lake

This strategy requires that the Westerschelde and the estuarine area be considered together. This strategy will be elaborated and implemented as part of the Agenda of the Future, which the Netherlands and Flanders drew up in the Flemish-Dutch Scheldt Commission [Vlaams-Nederlandse Scheldecommissie, VNSC].

5. Coast and Voordelta
The proposal for the Decision on Sand provides for continuing the sand replenishment programme. Until then, it is proposed to draw up integral visions for the mouths of the Westerschelde, Oosterschelde, Grevelingen and Haringvliet. It is also possible to carry out various pilot projects in the Southwest Delta in this period to acquire more knowledge of sand replenishments, such as the sand replenishment on Roggenplaat in the Oosterschelde, the effective management in the Oosterschelde innovation project, the Veersedam reorganisation and nature recovery, channel margin replenishments near Southwest Walcheren and a sediment pilot project in conjunction with Flanders in the Schelde estuary. If necessary, the sand replenishments will be adjusted after 2020 to balance the sandy system with the rise in sea levels. Using other funding sources, sand replenishments may also contribute to other goals, such as nature and economic use.

Main features of the preferential strategy for freshwater

The proposals for the Delta Decision on Freshwater and the Delta Decision on the Rhine-Meuse Delta form the framework for the preferential strategy for freshwater in the Southwest Delta (↗ section 2). The preferential strategy for freshwater is presented in a diagram in ↗ figure 11. One key component is establishing supply levels. In the face of climate change, maintaining – and, where possible, improving – the current supply levels in the Southwest Delta requires a coordinated set of measures in the main water system, the regional water systems and among freshwater users (including agriculture, industry and drinking water supply).

The Zuid-Holland islands, West-Brabant, Tholen and Sint Philipsland and the Reigersbergsepolder receive freshwater from the main water system. For these areas, it is important to maintain the strategic supply route and water buffer via Biesbosch, Hollandsch Diep and Haringvliet and to counter salinisation. The freshwater supply from the Brielse Meer lake is gradually becoming more robust. Optimising the existing system will suffice for the time being; this can be done by using an enhanced monitoring system and alternative water intake at Spijkenisse. For both a freshwater and a saltwater Volkerak-Zoommeer lake, measures have been proposed to make the regional water system more robust, such as the Roode Vaart canal. It is, however, necessary to continue paying attention to the delivery reliability at the intake points in the area when salinisation increases. If a freshwater Volkerak-Zoommeer is chosen, this decision should come in tandem with innovative freshwater/saltwater separation at the Krammer locks. If a saltwater Volkerak-Zoommeer is chosen, innovative freshwater/saltwater separation at the Volkerak locks and additional measures for freshwater supplies will be needed. Zeeuws-Vlaanderen, Walcheren, Noord- and Zuid-Beveland and Schouwen-Duiveland do not receive any freshwater from the main water system. Instead, an innovative strategy aimed at more economical freshwater consumption has been chosen. Measures consist of water conservation in the soil, a more efficient use of excess precipitation, making freshwater lenses more robust and researching the reuse of freshwater. The users take the initiative for these innovations, often in collaboration with regional or local governments and knowledge institutes.

The Delta Decision on Freshwater and this preferential strategy, with the choices and measures noted therein, form the basis for detailing the supply levels in the Southwest Delta.

Implementation

The Delta Plan on Flood Risk Management and the Delta Plan on Freshwater contain the measures from this preferential strategy that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. Dyke improvements are prioritised and programmed in the Flood Protection Programme. It is proposed to programme and prioritise measures for the availability of freshwater concordantly too (↗ section 2, Delta Decision on Freshwater). The programming for freshwater now only comprises the most urgent measures for the coming period; the programming in DP2016 will be more detailed.

The central government, municipal councils and water boards will lay down the preferential strategy for the Southwest Delta in their framework visions and water plans, either by way of an interim revision or in the regular revision of these plans.

The Southwest Delta steering group will draw up a progressive implementation programme for the region, which will also include measures geared to an ecologically resilient and economically vital delta. Close coordination of this implementation programme with the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater would make it possible to take optimal advantage of linkage opportunities. The implementation programme consists of measures that require joint decisions, funding and implementation by the steering group parties: the central government, regional governments, social organisations and the private parties. The government authorities in the Southwest Delta cannot implement this comprehensive preferential strategy all by themselves. Social organisations and the private parties also play a role when it comes to implementation and funding. This is true for sand replenishments in the Oosterschelde, any tidal power plant in the Brouwersdam, freshwater supply projects through the Roode Vaart canal, and innovations for a more efficient freshwater consumption by users, to mention but a few examples. The parties will lay down the arrangements for each project in administrative agreements. The central government will restore the freshwater-saltwater separation at the Krammer locks.

The preferential strategy for the Westerschelde will be further elaborated and implemented in the Agenda of the Future, which the central government has drawn up with the Flemish authorities in the Flemish-Dutch Scheldt Commission.

The actual development of the climate will determine which measures will be needed for freshwater in future. Using a comprehensive approach, the measures may also help achieve the objectives for the Water Framework Directive and prevent pluvial flooding, particularly in the areas that do not receive water from the main water system.

Knowledge

The preferential strategies have led to various knowledge issues. Those for the Oosterschelde will be addressed in a MIRT Study into the combination of dyke improvements, sand replenishments and management of the storm surge barrier. In addition, more knowledge of innovative dyke concepts and failure mechanisms is needed. Monitoring is taking place to be able to evaluate the effects of the Kierbesluit. The knowledge of sand replenishments is increasing by running channel margin replenishment pilot projects and monitoring replenishments on the Galgenplaat in the Oosterschelde. These studies are listed in the Delta Programme Knowledge Agenda (↗ background document A (in Dutch)) and, if financed from the Delta Fund, in ↗ section 4. For the Agenda of the Future, the Netherlands and Flanders are conducting research into such things as measures for reducing the tidal range, such as the construction or expansion of shoals. Area-specific knowledge issues about freshwater are included in the Delta Plan on Freshwater (↗ sub-section 4.3).

The Cabinet endorses the preferential strategy for the Southwest Delta and will embed the government actions required to implement the preferential strategy in the interim revision of the National Water Plan. The Cabinet supports the proposal to also include ecological and economic measures in the implementation programme. Both the Cabinet and stakeholders are looking into joint implementation and funding.

3.6
Coast

Area and tasking

The Dutch coast consists of the Wadden coast and the islands and intertidal zones north of it, the coast along Noord- and Zuid-Holland with continuous dunes and the open delta coast with the (partly closed) inlets and estuaries. In terms of nature and intensity, the use of space differs greatly from location to location. These differences impact the tasking and the potential solutions.

Flood risk management tasking may arise along the coast as a result of a rise in sea level (change in wave heights and patterns). If sufficient effort is put into the management and maintenance of the basic coastline, the coastal foundation zone and flood defence systems, major interventions will probably not be necessary until 2050. Depending on the rate at which the sea level rises, various measures will have to be implemented in a number of places to be able to maintain the desired level of protection.

Main features of the preferential strategy for flood risk management

The proposals for the Delta Decision on Flood Risk Management and the Decision on Sand form the framework for this preferential strategy (↗ section 2). The main features of the strategy are:

1. A safe, attractive and economically robust coast

The preferential strategy for flood risk management for the coast is focused on the entire tasking of the National Coastal Vision (2013, ↗ www.nationalevisiekust.nl): a safe, attractive and economically robust coast.

2. Connecting flood risk management tasking and spatial ambitions

A comprehensive approach to the coast requires a connection between flood risk management tasking and spatial developments. For the flood risk management tasking along the coast, the locations requiring attention are known (Delta Programme Coast, 2012). Seventeen 'gems' have been designated along the coast: locations where municipal councils and provinces have ambitions for spatial developments, for nature, restructuring or recreation, for example. These gems will contribute to the development of the coast as an economic or ecological vehicle.

3. Decision tree and adaptation concept

For all these gems, the flood risk management tasking follows the development ambitions. To determine how the various types of tasking and ambitions can be linked, the parties involved follow a decision tree. The first step is that they determine where there is any relationship between the flood risk management tasking and the spatial ambition and when this relationship is active.

In cases where there is no relationship, management and maintenance only need to take the tasking or ambition of the other into account. If, however, there is a relationship and the flood risk management tasking and spatial ambition both play out within 50 years, the parties will jointly determine the adaptation concept. A key decision in this case concerns the direction of the future dyke improvement: offshore, onshore or consolidate. This decision will form the basis for integrating the tasking and the ambition. If the tasking and ambition do not coincide until 50 years have lapsed, the parties will carry out management and maintenance with due regard for the tasking or ambition of the other and establish on a regular basis when steps towards a comprehensive approach with an adaptation concept are possible (↗ figure 12).

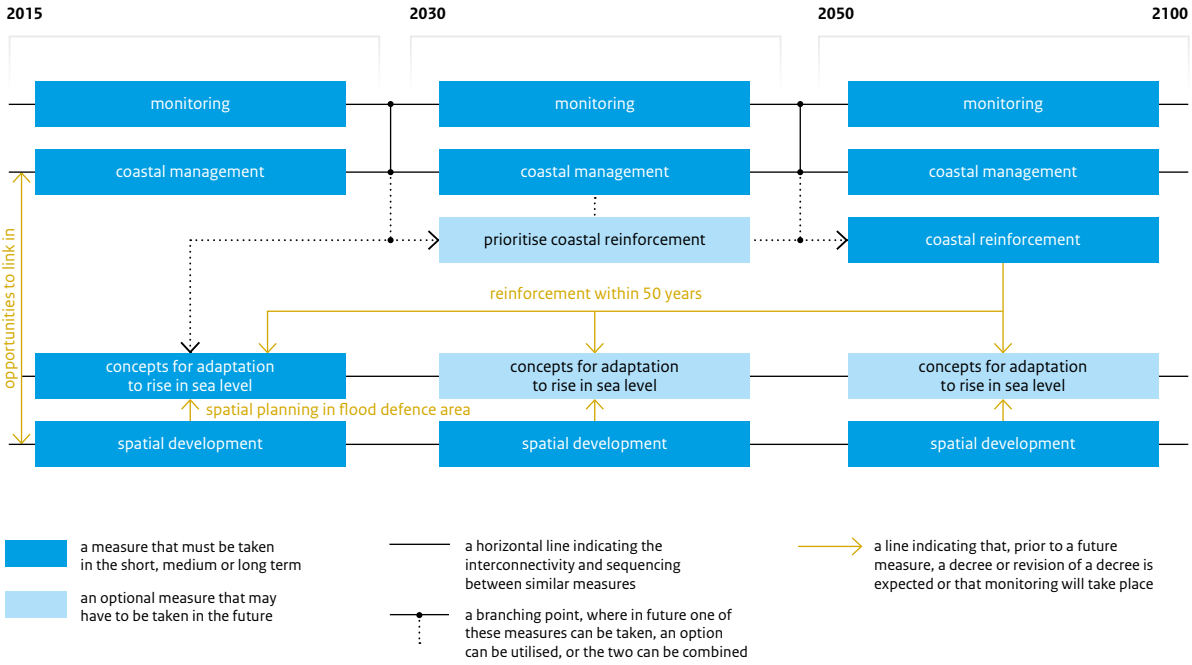
Implementation

The Delta Plan on Flood Risk Management contains the measures from this preferential strategy that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. For the coast, these measures chiefly consist of sand replenishments (management and maintenance).

The preferential strategy gives government authorities a framework to address the entire tasking along the coast at a local and a regional level. By using adaptation concepts (such as a multifunctional dyke), a connection is created between the long-term flood risk management tasking and restructuring or other ambitions for spatial developments. Each gem undergoes an area process, during which area-specific forms of cooperation are established.

Where possible, the parties involved will lay down the agreements arising from these area processes via existing policy tools, such as the MIRT area agenda, framework visions, zoning plans or the dyke boundary. The regular coastal management programme can also be used for this purpose, as is done at the Kop van Schouwen, for example. To facilitate this customised work, the central government will adjust the Coastal Policy and the water boards will adjust their policy and regulations. The water boards will

Figure 12 Coast, adaptation path for flood risk management



revise the reservation zones for 200 years of rising sea levels based on the new standardisation. The 'coastal community', a joint venture of government authorities and other parties along the coast that was announced in the National Coastal Vision, can facilitate the process and promote the comprehensive approach by sharing knowledge and experiences. A number of gems, such as Zandvoort and Den Helder, are already putting this comprehensive approach into practice.

Knowledge

To arrive at the desired comprehensive approach, more knowledge is needed about multifunctional flood defence systems and structures in dunes that are not used to retain water (such as car parks). The studies are on the Knowledge Agenda of the Delta Programme (↗ background document A (in Dutch)). Decisions on the definitive programming have yet to be made and also relate to the Water and Climate Knowledge and Innovation Programme (↗ section 6).

The Cabinet endorses the preferential strategy for the coast and will embed the government actions required to implement the preferential strategy in the interim revision of the National Water Plan. An important action is adjusting the Coastal Policy, as already included in the implementation agenda of the National Coastal Vision. This may result in more development opportunities along the coast, while safeguarding flood risk management and the coastal area.

3.7
Wadden Region

Area and tasking

The Wadden region consists of the mainland shore of the provinces of Noord-Holland, Fryslân and Groningen, the Wadden Sea, the Wadden Islands with the coast in front (coastal foundation zone), the Eems-Dollard and the outer deltas of the inlets.

The islands and the intertidal zone act a buffer against the high waves of the North Sea. It is essential to preserve this buffer in the face of climate change, using the most natural measures possible. The flood defence system along the Wadden Sea coast on the mainland as well as on the islands offers protection against floods. However, a stretch of about one hundred kilometres of these flood defences does not meet the standard specifications. As the home to the gas production and storage, a part of this area will be subject to a higher standard specification. Climate change will lead to tasking to keep the Wadden region permanently safe, while preserving its values: the Wadden region has such unique values that it is included in UNESCO's World Heritage List and almost all of it has been designated as a Natura 2000 area.

Main features of the preferential strategy for flood risk management

The proposals for the Delta Decisions on Flood Risk Management and the Decision on Sand form the framework for this preferential strategy (↗ section 2). The approach of learning about sand replenishments in the outer deltas as we go and monitoring are of particular importance to the Wadden region. In addition to that, the following main features of the preferential strategy apply to the intertidal zone, the hard flood defence systems and the island (↗ map 10 and ↗ figure 13):

1. Intertidal zone: adapt to rise in sea levels

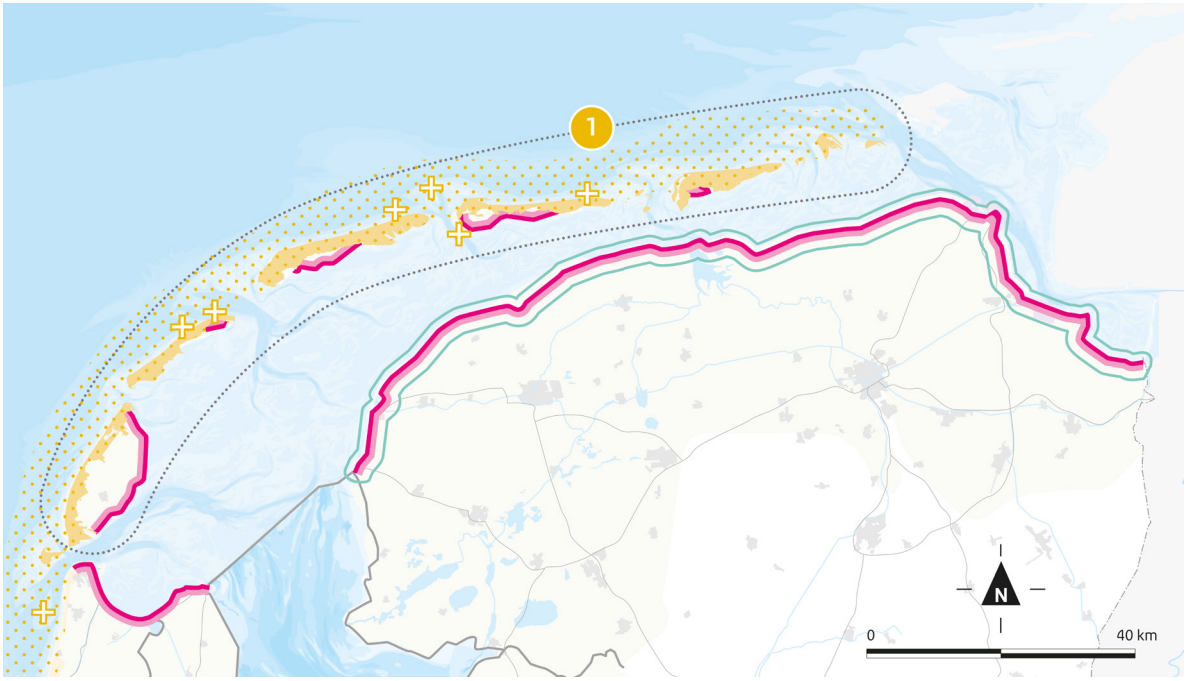
The vast intertidal zone in the shallow Wadden Sea (mud flats, salt marshes and channels) provides a natural mitigation of the waves. Without this intertidal zone, the flood defence systems would have to be stronger and higher. The intertidal zone in the Wadden Sea requires extra sand, because the sea level is rising. If this rise accelerates, the intertidal zone may not be able to keep up and may lose some of its buffer effect. This may lead to extra work on the primary flood defence systems in order to keep the mainland protected against floods. It would be preferable to carry out replenishments on the coastal foundation zone and, for the basic coastline, to preserve the buffer effect of the intertidal zone as much as possible. This will help limit the future flood risk management tasking and help preserve the nature values.

The current replenishment programme, involving a total of 12 million m^3 of sand per annum, will be continued and, if necessary, adjusted on the basis of the results of Coastal Genisis 2.0 Research program (↗ section 2, Decision on Sand). In addition to this, the natural accretion in the Wadden Sea can be increased by means of adapted salt marsh management, if that is in line with the conditions of the Wadden Sea PKB, the Wadden Sea's designation as a world heritage site and the Natura 2000 preservation goals. After 2020, on the basis of learning as we go and thorough monitoring, replenishment management may have to be adjusted to preserve the outer deltas (with the sand banks between the islands) and the sand banks and salt marshes in the Wadden Sea and to prevent the tidal channels from moving too close to the coast and undermining the flood defence systems. Small-scale pilot projects to guide the channels in a natural manner and a large-scale experiment will be needed to gain a better understanding of the system and develop appropriate measures. Based on current knowledge, it will not be until 2100 that sand replenishments are needed for flood risk management purposes in the Wadden Sea and Eems estuary. These sand replenishments would also have an adverse effect on the nature values. For the time being, it will suffice to continue replenishing sand on the North Sea side of the Wadden Islands (in the coastal foundation zone) and, in addition to that, in the outer deltas. The learning as we go approach will demonstrate whether this sand migrates enough to the sand banks and salt marshes of the Wadden Sea in a natural manner.

2. Primary flood defence systems: innovative and comprehensive

For dyke improvements, the preferential strategy provides for an area-based and comprehensive approach. This will be achieved by aligning the adjustments to the flood defence systems with area developments and by creating added value for functions such as nature, recreation and the regional economy. Along the coast of Fryslân and Groningen, this can be done using innovative dyke concepts, such as wide green dykes, multifunctional dykes and overtopping-resistant dykes. Den Helder and Den Oever are likewise eligible for innovative dyke concepts with added value for other functions. Until 2020, explorations will be carried out according to the MIRT system, as part of

Map 10 Wadden region, preferential strategy for flood risk management



Flood risk management

Intertidal area:
develop in line with rise in sea levels

preserve coastal foundation zone, replenish locally

until 2020, continue sand replenishment programme; after 2020, gradually adjust sand replenishment to preserve outer deltas and salt marshes and control the drifting of tidal channels

possible sand replenishment pilot project

Primary flood defence systems:
innovative and comprehensive

Innovative dyke improvement, such as wide green dykes, multifunctional dykes and overtopping-resistant dykes

1 comprehensive safety strategy for each Wadden island

general exploration

Basic map

freshwater

saltwater / brackish water

floodable area

urban area

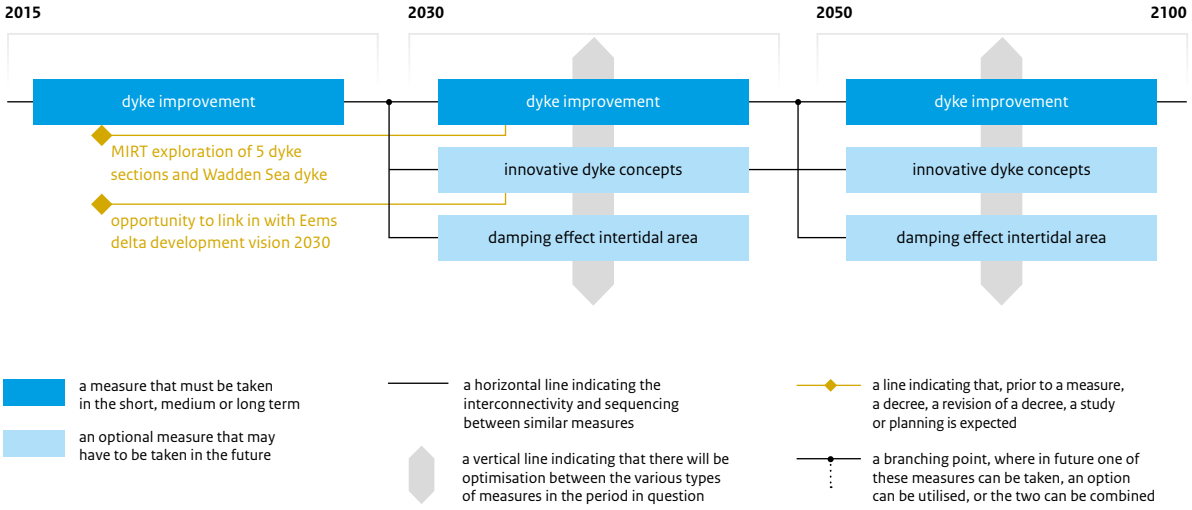
docks

primary flood defence outside area covered by the plan

motorway

border

Figure 13 Wadden region, adaptation path for preferential strategy for flood risk management



the Flood Protection Programme (↗ sub-section 4.2), to study the improvement of five dyke stretches along the shore of Fryslân and Groningen. In addition, in the period 2014-2017, a general exploration will be conducted spanning the entire Wadden Sea dyke along the shore of Fryslân and Groningen, using this preferential strategy as the basis.

A comprehensive strategy has been drawn up for each Wadden island, which covers sand replenishment (before and after 2020), coastal management, innovative dyke concepts and disaster management, also with a view to 'smart combinations' (↗ section 2, Delta Decision on Flood Risk Management). The areas outside the dykes will become more robust in relation to flood risks by taking these risks into account in spatial (re)developments, as outlined in connection with the Delta Decision on Spatial Adaptation (↗ section 2).

Main features of the preferential strategy for freshwater

The shores of Groningen and Fryslân receive freshwater from the IJsselmeer region. The preferential strategy for these areas is outlined in the preferential strategy for the IJsselmeer region (↗ sub-section 3.2). In the case of the Wadden Islands, the proposal for the Delta Decision on Freshwater forms the framework for the preferential strategy. The Wadden Islands receive no freshwater from the main water system. The islands' ambition is to have a sustainable, sufficient drinking water supply by 2020.

The aim is to increase the coping capacity with regard to other uses of freshwater, such as agriculture. To minimise water shortages in the face of climate change, measures can be taken to use rainwater and freshwater lenses even more effectively and make more economical use of water. The islands can do pioneering work in this regard for other parts of the country.

Implementation

The Delta Plan on Flood Risk Management and the Delta Plan on Freshwater contain the measures from this preferential strategy that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. Dyke improvements are programmed in the Flood Protection Programme. It is proposed to programme and prioritise measures for the availability of freshwater concordantly too (↗ section 2, Delta Decision on Freshwater).

The parties involved in the preferential strategy for flood risk management for the Wadden region will lay down their strategy in their own plans. The Delta Plan on Flood Risk Management contains the measures that the central government has programmed for flood risk management in the Wadden region (↗ sub-section 4.2). In the management plan for Natura 2000, the central government allows for adjusted vegetation management in the salt marshes by nature managers, to optimise natural accretion and preserve the salt marshes for flood risk management

(enhanced resistance to erosion). The province of Groningen will lay down the part on innovative dyke concepts from this preferential strategy in the new environmental plan that will be adopted in 2015. The provinces of Fryslân and Noord-Holland are adopting parts of the strategy in regional agendas and regional water plans or environmental visions and the associated programmes. The municipal councils will do this in their framework visions and the zoning plans based on them. The water boards will adopt parts of the strategy in the water management plans. The current regional Delta Programme Wadden Region steering group will remain active after 2014 and assess whether the prioritisation of dyke improvements in the Flood Protection Programme is sufficiently in keeping with area developments.

A comprehensive strategy has been drawn up for each Wadden island. The current strategy for the physical flood defence systems can be continued for decades. Where possible, the transition from the Wadden Sea to the flood defence system zones will be made more gradual. Managers of connections with the shore (ferry causeways, landings, vital infrastructure) will allow these to adapt to the rise in sea levels and the frequency of floods. The islands do not have enough capacity to shelter evacuees in higher parts in the event of a flood or an imminent flood, which is why the municipal councils and security regions have further elaborated the evacuation strategy for each individual island.
The municipal councils of the islands, the provinces, the water boards and Rijkswaterstaat are responsible for implementing parts of these strategies. They will embark on implementing each part as soon as there is reason to do so. One reason to do so may be a programming proposal for the Flood Protection Programme or the preparation of spatial plans.

Knowledge

In terms of any adjustment to the replenishment management in 2020, knowledge is being acquired on the volume required, the technique, the frequency and the locations of the replenishments. More system knowledge is needed to be able to carry out sand replenishments more effectively in the future while preserving the value of the Wadden region. This knowledge will be acquired from a long-term knowledge programme aimed at research, system knowledge and monitoring. The programme will commence in 2015 with, for example, small-scale pilot projects until 2020 and larger-scale pilot projects after 2020. This research is part of the Sand Knowledge Programme and, if financed from the Delta Fund, has been included in ↗ section 4.

The Cabinet endorses the preferential strategy for the Wadden region and will embed the government actions required to implement the preferential strategy in the interim revision of the National Water Plan. The Cabinet endorses the decision to preserve the wave-mitigating effect of the intertidal zone and salt marshes – and hence the positive effects on the strength of the flood defence system – as much as possible. In the Natura 2000 management plan, the central government will opt for an adjusted form of management that helps optimise natural accretion.

3.8
Elevated sandy soils

Area and tasking

In the Netherlands elevated sandy soils are found in Drenthe, the eastern parts of Overijssel and Gelderland, Utrecht, Noord-Brabant and Limburg. These areas are typically intersected by small valleys. They consist of a mosaic of well-developed and capital-intensive farmlands, less capital-intensive farmlands and valuable wet and dry nature reserves. Approximately 60% of the Elevated sandy soils does not receive freshwater from the main water system. Drinking water companies, foodstuff companies, other industries and farms use deep and shallow groundwater for their business processes.

The Elevated sandy soils have had experience with drying out for decades. If the climate changes rapidly, water shortages will increase, groundwater levels will fall and stream valleys may run dry, which will harm agriculture, the urban area and nature in particular. Water quality may deteriorate as well.

Main features of the preferential strategy for freshwater

The proposal for the Delta Decision on Freshwater forms the framework for this preferential strategy (↗ section 2). The main features of the strategy are (↗ figure 14):

1. Water conservation (saving and retention)
The first is water conservation in the area itself, which can be done by storing part of the annual precipitation excess, which is currently discharged in the winter months and early spring. Measures for this include: improving the soil structure, raising the groundwater level prior to a period of drought in combination with level-driven drainage, reorganising stream valleys to increase the groundwater buffer and constructing green-blue structures in urban areas (buffers). It is also important to save water, by using the available water as economically as possible.

2. Supplying water
The supply of water from outside the area is a welcome addition, especially in dry periods. Parts of the Elevated sandy soils are currently also supplied with groundwater: the southern Elevated sandy soils through the Meuse and the canals in Central Limburg and Brabant, and the eastern Elevated sandy soils through the IJssel and the IJsselmeer lake. The efficiency of this supply may be enhanced by increasing the number of throughput options and effecting the self-evident expansions. This supply may contribute to water savings, especially by replenishing the groundwater buffer in times of plenty. A number of areas that already receive freshwater from the main water system will soon receive a limited additional supply, combined with measures to optimise the supply and the agreements on increasing the capacity of the Noordervaart canal from 4.3 to 5.4 m^3/s. In the medium and long term, there will still be an option to extract a limited additional supply from the main water system in a number of cases, through a further increase in the capacity of the Noordervaart and additional supply from the IJssel and the IJsselmeer lake to the eastern Elevated sandy soils of Overijssel and Gelderland, via the Twente-kanalen canals, for example, and by connecting the Liemers to the supply area.

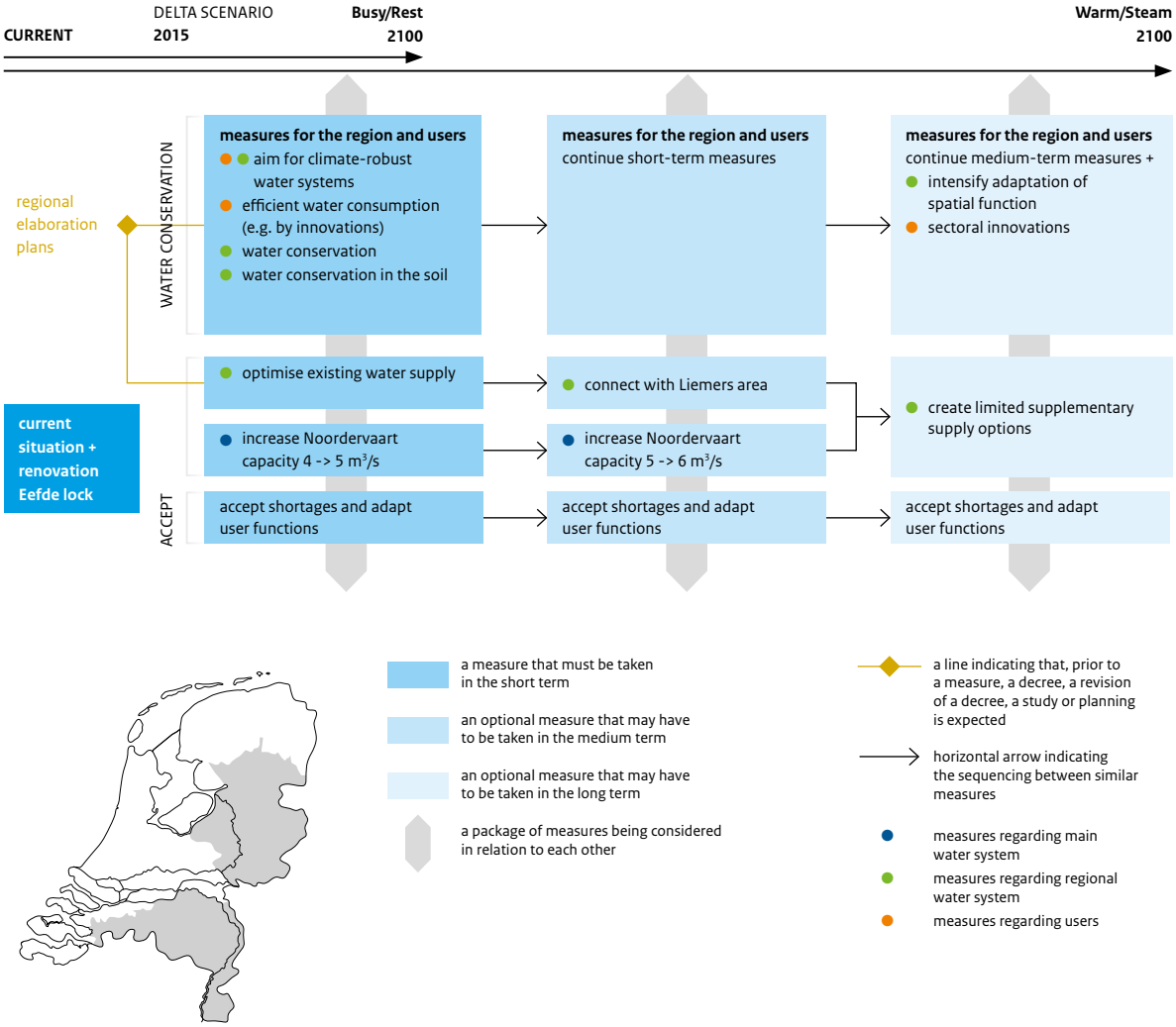
3. Accept water shortages and adapt
Periods during which an area's own water buffer has been exhausted or supply is limited or non existant will become increasingly frequent, with differences in the availability of water occurring in the area as well. In those situations, it may be necessary to accept the shortages and adapt consumption, by adjusting operational management and possibly the types of nature objectives as well. In certain cases, it may be possible technically to prevent shortages, but wiser economically to accept the shortages. Measures may comprise: reusing rinse water and waste water, converting coniferous forest into deciduous forest or switching to climate-proof cultivation.

The Delta Decision on Freshwater and this preferential strategy, with the choices and measures noted therein, form the basis for detailing the supply levels for the Elevated sandy soils.

Implementation

The central government, municipal councils and water boards will lay down the preferential strategy for Elevated sandy soils in their own plans. The measures in the main water system, in the regional water system and among the users are closely connected and should be considered accordingly. The central government will implement the agreements on increasing the capacity of the Noordervaart. The implementation of the other measures from the preferential strategy is largely the responsibility of the regional parties. These parties will implement the measures on the basis of a (progressive) implementation programme, viewing the tasking in relation to and linking it with spatial developments. The strategy is further elaborated in area

Figure 14 Elevated sandy soils, adaptation path for preferential strategy for freshwater (including region name)



processes and work programmes that involve close collaboration and coordination between the parties. The government authorities promote the development and use of innovations among users, with such things as a climate pilot project aimed at more efficient and smarter irrigation.

The Delta Plan on Freshwater contains the measures that have been programmed for the short term and the measures that have been put on the agenda for the short, medium and long term. The programming now only comprises the explorations for the most urgent measures for the coming period; the programming for freshwater in DP2016 will be more detailed. It is proposed to programme and prioritise measures for the availability of freshwater concordantly (↗ section 2, Delta Decision on Freshwater).

In June 2014, the partners of the Delta Plan Elevated sandy soils steering group and the Rijn-Oost Regional Consultation Committee signed a letter of intent. In doing so, they are underlining the regional collaboration, endorsing the commitment to the implementation of the measures and taking further steps to proceed to the actual implementation in 2015.

Knowledge

The elaboration of this preferential strategy requires more knowledge of new solutions, costs and benefits of measures and practicability of (new) tools. The knowledge issues and possibilities for innovative pilot projects are included in the Knowledge Agenda of the Delta Programme (↗ background document A (in Dutch)). Decisions on the definitive programming have yet to be made and also relate to the Water and Climate Knowledge and Innovation Programme (↗ section 6).

The Cabinet endorses the preferential strategy for the Elevated sandy soils and will embed the government actions required to implement the preferential strategy in the interim revision of the National Water Plan. For a number of areas receiving freshwater from the main water system, both the need and possibilities for a limited additional supply in the short and long term will be looked into.

4 Delta Plan on Flood Risk Management and Delta Plan on Freshwater

Oesterdam/Kreekrak locks, Zeeland, May 2014 *The Oesterdam was built to protect nature in the Oosterschelde. This compartmentalisation dam separates the Schelde-Rhine link from the Oosterschelde, creating a safe shipping link between Rotterdam and Antwerp. The Kreekrak locks consist of two locks that process approximately 80,000 ships every year.*

4.1 Introduction

The Delta Programme's annual report provides an overview of all programmed measures in the field of flood risk management and freshwater supplies. New to this year's report are the first measures, studies and other preparatory activities arising from the proposed Delta Decisions and preferential strategies. Also new is the division into a Delta Plan on Flood Risk Management and a Delta Plan on Freshwater.

The Delta Programme Commissioner is legally obligated to issue an annual proposal for the Delta Programme that contains "studies, measures and provisions" for flood risk management and freshwater supply. The proposal is 'detailed' for the first six years, 'indicative' for the next twelve years and presents a look ahead to 2050 and beyond. This section provides an overview and description of all studies, measures and provisions of the Delta Programme. These are funded (in part) from the Delta Fund and, in specific cases, from budget chapter XII, the budget of the Ministry of Infrastructure and the Environment. Regional measures without state funding are also included wherever relevant. The measures and studies have been brought together in the Delta Plan on Flood Risk Management (↗ sub-section 4.2, including spatial adaptation) and the Delta Plan on Freshwater (↗ sub-section 4.3), in line with the two central tasks of the Delta Programme. This is what the Dutch House of Representatives[14] wanted is (and is in accordance with) the Administrative Agreement on Water.

This year, the proposals for Delta Decisions (↗ section 2) and preferential strategies (↗ section 3) have led to the programming of a number of new measures, knowledge issues, further studies and pilot projects, the elaboration of new tools and instruments and, especially, to preparatory activities to be able to programme and implement new measures. In addition, various measures and knowledge issues to be addressed in the short, medium and long term have been put on the agenda.

Programmed measures

The programmed measures have been classified according to the phases of the MIRT system: studies (including knowledge development and pilot projects), explorations, plan elaborations and implementation. The programmed knowledge development comprises those knowledge issues and pilot projects from the Delta Programme Knowledge Agenda (↗ background document A (in Dutch)) that are urgent and that are eligible for complete or partial funding from the Delta Fund or budget chapter XII. The parties (Directorate-General for Space and Water of the Ministry of Infrastructure and the Environment, Rijkswaterstaat, water boards, provinces and/or other parties) will address the other knowledge issues as part of their regular duties or introduce them in the cooperate Water and Climate Knowledge

14 Van Veldhoven motion, Parliamentary document 33000-XII, no. 81.

and Innovation Programme (↗ sub-section 6.2). The programming not only includes new projects, but also ongoing projects and the (new) Flood Protection Programme. The projects and programmes for management, maintenance and replacement have also been included. Details of the programming for each project or implementation programme have been included for the next six years, with indicative programming for the next 12 years where possible and applicable (in accordance with Section 4.9(5) of the Water Act amended by the Delta Act).[15] The information is based on the 2015 draft budget of the Delta Fund, the MIRT Projects Book and – where applicable – the available progress reports. These documents provide more information on the projects referred to and their financing.

The programmed projects and implementation programmes have also been literally mapped out: The 'Delta Programme map', on the inside cover, presents an overview of all the measures that will be implemented, prepared or researched in 2015 (↗ map 1). The numbering and colour of the measures on the map are the same as the numbering and colours of the projects in the tables in this section.[16]

The programming in the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater will be interconnected to ensure synergy. The Delta Programme Commissioner will monitor this interconnectivity and oversee the progress of implementation. The political responsibility for the measures and contributions from the central government lies with the Minister for Infrastructure and the Environment.

Measures on the agenda

The measures on the agenda are measures that have not yet been included in the programming and the budget, but which may be included in the future. The time at which this may occur differs for each measure. First of all, these measures include those that will be programmed before the end of this cabinet period (next 12- 24 months) and that will not exceed the resources that have been provisionally earmarked for them (↗ see section 5). Secondly, there are measures on the agenda whose financing remains unclear and which may be addressed in the next cabinet period. Thirdly, these measures may be measures that will be relevant in the medium term (2029-2050), beyond the current horizon of the 2028 Delta Fund. Finally, the measures on the agenda include those that will not be relevant before the long term (after 2050). In addition to measures, knowledge issues have also been put on the agenda. These are outlined in the Delta Programme Knowledge Agenda (↗ background document A (in Dutch)).

15 Projects that have already been completed are not in the tables.

16 ↗ This map also shows, in the colour green, the completed projects. Information on finalised projects can be found in 'Water Mapped Out', Parliamentary document 27625, no. 317.

4.2
Delta Plan on Flood Risk Management

The Delta Plan on Flood Risk Management encompasses all programmed measures and those on the agenda, as well as knowledge issues, further studies and pilot projects that contribute to the tasking for flood risk management of the Delta Programme, including spatial adaptation, and that are funded in whole or in part from the Delta Fund. A number of knowledge issues are funded from budget chapter XII. Below, the programmed studies and tools that are important to be able to take new steps with the Delta Programme will be addressed first, including measures that have not yet been programmed but have been put on the agenda for a later date. The new programming of the Flood Protection Programme, the programme for 2015-2020, is discussed after that. This is followed by an overview of the other measures programmed – mostly ongoing implementation programmes – divided into explorations, plan elaborations and implementations and finally maintenance and replacement. ↗ Table 1 provides an overview of the projects and implementation programmes.

Studies: knowledge, elaboration of tools and preparation for projects

The programmed studies and those on the agenda form – together with most Flood Protection Programme projects – the new measures in the Delta Plan on Flood Risk Management. The results of these studies can be used as meaningful follow-up to proposals for the Delta Decisions and preferential strategies.

Below, the programming of knowledge development in the area of flood risk management and spatial adaptation will be discussed first: the development of new tools and instruments, in-depth follow-up studies, other knowledge issues and pilot projects. The Knowledge Agenda of the Delta Programme 2015 (↗ background document A (in Dutch)) provides a complete overview of the knowledge issues.

Table 1 Projects and implementation programmes in the Delta Plan on Flood Risk Management

Studies	Explorations	Plan elaborations	Realisation	Management, maintenance and replacement
New studies and measures in the Delta Programme (↗ table 2 and ↗ 12)	Oosterschelde sand demand	IJsselmeer Closure Dam	(new) Flood Protection Programme	Management, maintenance and water management
Pilot projects on 'smart cominations' at Dordrecht, Marken and IJssel-Vecht delta	Markermeer lake-IJmeer lake	WaalWeelde	Second Flood Protection Programme (including Weak Links on the Coast)	Programme for Replacement Tasking for Hydraulic Structures (VONK)
		Ooijen-Wanssum area development	Room for the River (including IJssel delta and IJsselsprong)	
		Vlieland and Terschelling dyke boundary	Further elaboration of area around the major rivers (NURG)	
			Meuse Projects (Grensmaas and Zandmaas)	
			Repair stone cladding Oosterschelde and Westerschelde and shore face deposits Zeeland	

Table 2 Programming of new studies and preparation for projects (MIRT Studies) for flood risk management and spatial adaptation

New studies and (preparation for) Delta Programme measures		2015	2016	2017	2018	2019	2020	>
	Flood risk management							
	Tools and instruments							
101	WTI (statutory review tools, including the legal spatial safeguarding of forelands)			■				
102	Delta model	■	■	■	■	■	■	
	Optimisation issues							
111	Discharge distribution of the Rhine distributaries	■						
112	Transmission effects of the Meuse	■						
113	Oosterschelde safety strategy	■	■					
114	Comprehensive of the IJsselmeer region	■	■	■	■			
115	Maeslantkering storm surge barrier	■						
	Preparation for projects							
121	MIRT study into river widening (for each distributary)	■	■					
122	Alblasserwaard MIRT Study	■	■	■				
123	Hollandsche IJssel MIRT Study	■	■	■	■			
	Fundamental research							
131	Additional monitoring and study of sandy system	■	■	■	■	■	■	
132	Morphological behaviour of river systems and stability of bifurcation points (budget chapter XII)		■	■	■	■	■	
	Recently launched studies into smart combinations for flood risk management							
141	Dordrecht MIRT Study	■						
142	Marken MIRT Study	■						
143	IJssel-Vecht delta MIRT Study	■						
	Spatial adaptation							
151	Stimulation Programme for Spatial Adaptation	■	■	■				
	Further area-based elaboration							
161	Krimpenerwaard	■						
162	Westpoort	■	■					
163	Areas outside the dykes (starting with the Botlek)	■	■					

■ Study

Apart from knowledge development, new MIRT Studies have been programmed to prepare the implementation of new measures and studies. These potential new measures have not yet been programmed in the Delta Fund Budget 2015 and the Delta Programme 2015 (DP2015).

↗ Table 2 provides an overview of the programmed knowledge issues and the preparation for projects (MIRT Studies) for flood risk management and spatial adaptation. All of the remaining research money in the Delta Fund earmarked for flood risk management will be used for this. The resources that have been earmarked for 'increasing the sand replenishment volume for the coast' will also be used. In total, close to €20 million worth of knowledge issues and MIRT Studies have been programmed for the 2015-2020 period, with the bulk of the work to be done over the next three years.

The Minister for Infrastructure and the Environment has decided – in addition to research money – to provisionally earmark part of the programme money in the Delta Fund that is available for the Delta Programme for the additional costs of river-widening measures (↗ section 5). The programming of these resources will be addressed in the following Delta Programme reports. Programme resources had also previously been earmarked for sand and the Flood Protection Programme. The resources for river widening, sand and the Flood Protection Programme offer prospects for carrying out projects whose preparation has been programmed in the Delta Fund and in this DP2015.

Flood risk management

In terms of flood risk management, the proposal is to programme the following studies (↗ table 2):

Tools and instruments

- The development of the new statutory review tools (abbreviated as WTI in Dutch), which links in with the proposed flood risk management approach, still requires further research. Although the required resources had been included in the budget for 2015 and 2016 at an earlier stage, additional resources are required for 2017. This is now being organised in the Delta Fund budget 2015. To date, forelands have not been included in the review procedures, but they do have a positive effect on flood risk management. In the development of the new WTI, the mitigating effect of the so-called forelands on flood risks is considered in a realistic and explicit fashion. The study also addresses the legal and spatial assurance of the contribution of forelands, thus safeguarding that forelands will continue to play their part in flood defences. Resources will be available for this in 2015.
- The Delta model will be further developed, so that it can be used in plan elaborations for flood risk management and freshwater projects. The Delta model is at the heart of all water management analyses of the Delta Programme (freshwater waterways).

Optimisation issues

- The Rhine Distributaries Discharge Distribution study is designed to allow a decision to be taken in 2017 on whether or not the option of changing the discharge distribution is to be left open after 2050.
- Additional research is needed to adjust the preferential strategy for the Meuse according to the decisions on enhanced transmission effects. This research further optimises previously selected sets of measures for the Meuse. Enhancing the transmission effects of the Meuse consists of abandoning the peak storage function of a large number of the dyke rings in Limburg and the associated measures taken in this province and along the dyked river Meuse to compensate for the effects that this will have on the downstream water level.
- The Oosterschelde Safety Strategy study is designed to allow a coordinated strategy to be formulated for an alternative management of the storm surge barrier, the approach to the dyke improvement tasking and the sand replenishments required.
- The objective of the comprehensive study of the IJsselmeer lake is to make it possible to compile a cohesive package of measures, including additional pumps, strategic storage in the Markermeer lake and the regional systems and the required improvement of flood defence systems in this area.
- For the Maeslantkering storm surge barrier, this means research into partial functioning and optimising the failure probability.

Fundamental research

- 2015 will see the launch of multi-year fundamental research into the long-term behaviour of the sandy system of the Southwest Delta, the coast of Noord- and Zuid-Holland and the Wadden region (Coastal Genesis 2.0). This research pertains to the behaviour of the coastal foundation zone, the interaction with the outer deltas and the associated inlets and estuaries and the required

replenishment volumes. It involves a combination of research, pilot projects (channel margin replenishments and outer deltas) and monitoring.
- For the period after 2015, research into the morphological behaviour of river systems and the stability of bifurcation points has been placed on the agenda. Some of resources for this will come from budget chapter XII. The strategy for both knowledge issues is to seek collaboration between Rijkswaterstaat, NWO, flood defence managers and companies involved in the Water and Climate Knowledge and Innovation Programme (↗ sub-section 6.2).

Recently launched studies into 'smart combinations' for flood risk management
- In late 2013, three MIRT Studies into the use of 'smart combinations' in Dordrecht, Marken and the IJssel-Vecht delta were launched. On the one hand, the objective is to explore the options of a 'smart combination' for flood risk management in the area in question, and, on the other, to gain more insight into how to use 'smart combinations'. More information on these studies can be found in section 2 (↗ sub-section 2.2, box).
- In terms of the research into 'smart combinations' in Dordrecht, the proposal is to include the plan to start up a Multi-layer Safety Expertise Centre in that research. The resources that the parties involved in mulit-layer flood risk management should contribute will have to be reviewed. When the budget is prepared next year, a decision on a potential contribution from the central government may have to be taken.

Preparation for new projects
- Studies and explorations into river widening: the MIRT Study of the Delta Programme on Rivers has shown that, apart from dyke improvements, a number of promising river-widening projects are possible. The objective is to work towards a number of MIRT explorations along the Rhine distributaries and, if possible, to start them in 2015. Further long-term studies are needed for other stretches. For the Meuse, this will be a more in-depth MIRT Study in order to ensure regional fine-tuning of the preferential strategy.

  - *Rhine distributaries*

  The programming of the Flood Protection Programme 2015-2020 shows where the proposed river-widening projects will soon be connected with urgent dyke improvements. For these stretches, which may require a broad, combined solution, an elaboration must be ready before the start of a MIRT exploration in 2015. The further research required to arrive at a decision to start and a clear scope for the broad solution must be in line with this. This requires, for example, the formulation of the final tasking and the relationship with the Flood Protection Programme (clear frameworks for the planning of dyke improvements in the areas in question), prospects of co-financing, seizing opportunities for linking in with objectives other than flood risk ones and insight into the possibilities and preferences in terms of phasing.
  Additionally, further studies will be required for stretches that may be promising in the period up to 2030 or up to 2050. These studies address similar questions. Moreover, these studies should clarify the prioritisation of projects for each distributary and the potential need to include new or cancel existing spatial reservations. These studies will be combined for each distributary. The results can be used to demarcate, on the basis of the programming of flood protection measures, stretches where combined solutions may be relevant in the period until 2050.
  In addition, a start will be made with developing the pilot project on Development-oriented reservation in the Rijnstrangen area.

  - *IJssel and Pannerdens Kanaal canal*

  The promising Reevediep 2nd phase measure no longer requires any exploration, because a preferred alternative is already available. In a local general exploration, the Mastenbroek IJssel (Flood Protection Programme) project examines the connection with the Reevediep 2nd phase and the project Around Kampen (also Flood Protection Programme). It is expected that a MIRT exploration can soon be started for the Klimaatpark IJsselpoort plan phase 1. In addition, further research will be conducted into the prioritisation of other measures along the IJssel and the Pannerdens Kanaal canal. This research also addresses the effect of the bifurcation point, the cascade effect in dyke ring 42/48, the results of the international consultation about this in the German-Dutch High Water Working Group and the possibilities for compartmentalisation (Kanaal Hackfort canal).

- *Nederrijn-Lek*

As regards the Nederrijn-Lek, a lot of research has already been assigned and started as part of the Central Holland general exploration (↗ sub-section 2.3 in DP2014). Very recently, dyke improvement activities were started along the south side of this river as part of Room for the River, which include the testing of innovative dyke concepts. The follow-up, which is yet to be programmed, will be limited to the Grebbedijk in the short term. This requires (limited) research in the coming years, in anticipation of the next review (2017), before an exploration can be started.

- *Waal-Merwedes*

The proposal is to work towards starting MIRT explorations in 2015 for the bypass at Varik-Heesselt and possibly also for the secondary channel at Sleeuwijk, with the preferential strategy serving as an indicative guide and allowing for the urgency of dyke improvements for Waal-Merwedes (Flood Protection Programme 2015-2020). A MIRT exploration can only be started if there are prospects of financing by the government authorities involved. It is important to have results available in good time so that they can be taken into account in the Flood Protection Programme.
Follow-up research will be carried out for the Brakel and Werkendam sites, including the secondary channel at Sleeuwijk. These studies will be taken up by the region and elaborated in line with the Flood Protection Programme. In addition, urgent dyke improvement projects will devote special attention to river-widening measures in areas outside the dykes. The research should also clarify the potential need to include new spatial reservations or cancel existing spatial reservations.

- *Area-based MIRT Study of the Meuse*

Based on the results of the study into transmission effects of the Meuse (↗ sub-section 3.3), the preferential strategy for flood risk management for the Meuse will be further elaborated. This will make it possible to determine the fluvial effects on the entire Meuse system more accurately and to find the optimal solution in conjunction with river widening and dyke improvements. The further regional elaboration of compensatory measures will also be addressed, as will the coordination of measures in the Maasvallei and the dyked river Meuse, paying special attention to dyke ring 54 (Mook, Middelaar, Ottersum). It is expected that further research will need to be carried out into the consequences of the new standards and the preferential strategy for the dyked river Meuse, partly in relation to the functioning of the Lob van Gennep and necessary dyke improvements in Mook. This research will be done in close collaboration with parties in Noord-Brabant, Gelderland and Limburg.

- *Putting river-widening measures on the agenda after 2028*

The Rivers sub-programme has explored measures to resolve both the short-term tasking (e.g. dykes that have failed inspection, piping) and the longer-term tasking (e.g. climate change, new standard specifications). For the 2029-2050 period, too, the measures explored consist of a combination of river widening and dyke improvement. The frameworks for these measures have been laid down in the preferential strategy for Rivers according to the principle of adaptive delta management, but these measures have not yet been elaborated for the period after 2028. As a result, there is still flexibility when it comes to the final elaboration of dyke improvement and river widening and it is also possible to take new insights into consideration. The area ultimately needed for these measures will remain free of capital-intensive development thanks to spatial reservations (in areas inside the dykes) and to the major rivers policy (in areas outside the dykes) (↗ also sub-section 3.3, Implementation).

- MIRT Study Alblasserwaard: with a view to the considerable future dyke improvement tasking in Rhine Estuary-Drechtsteden, a preliminary phase is needed to explore the spatial tasking and the water tasking in relation to each other and to find the best solutions for the entire area. This is a preliminary phase for the actual programming of projects in the Flood Protection Programme. To this end, a MIRT Study Alblasserwaard will be rolled out. Time and money can be saved and inconvenience limited by taking the flood risk management tasking into account in the spatial planning within the Alblasserwaard-Vijfheerenlanden dyke ring. A concrete elaboration of this requires area-based research focusing on the integration of spatial planning and flood risk management. This research should be finished before the fourth fourth flood defence assessment, so that the dyke improvements to be programmed can start by then with no delays. Attention should be paid to the coordination with the programming of measures for each distributary, for the Nederrijn-Lek and for the Waal-Merwedes.

- MIRT Study Hollandsche IJssel: the Hollandsche IJssel also requires a preliminary phase to explore the spatial tasking and water tasking in relation to each other. A basic principle of the preferential strategy for Rhine Estuary-Drechtsteden is that the flood risk management along the Hollandsche IJssel be maintained by improving the Hollandsche IJsselkering storm surge barrier and dykes concordantly. By improving the failure probability of the flood defence system, the hydraulic load on the regional dykes and hence the dyke improvement tasking is eased. The area-based study not only addresses the inter-connectivity between measures for flood risk management (e.g. flood defence system dykes), but also the link with ambitions in terms of preserving the tidal dynamics, shipping and the approach to the road traffic bottleneck of Algerabrug/accessibility of Krimpenerwaard.

Spatial adaptation

A central part of the proposed Delta Decision on Spatial Adaptation is that the central government, provinces, municipal councils and water boards agree to fully consider climate-proofness in spatial developments. The ambition in that regard is that by 2020, climate-proof action and water-robust organisation form an integral part of the policy and actions of these parties (↗ also sub-section 2.4). To this end, a number of supporting tools will be developed: an stimulation programme with a corresponding digital knowledge portal, assistance in spatial adaptation and proper embedding of the already existing Water Review tool. A programme for monitoring and evaluation will also be set up.

Stimulation Programme for Spatial Adaptation

- The objective of the Stimulation Programme for Spatial Adaptation is the actual inception of the desired climate-proof and water-robust spatial organisation. The working method developed together with the partners may help the parties take follow-up steps. The starting point here is performing the steps 'knowing, wanting, working' as formulated in the Delta Decision on Spatial Adaptation. This is being done with a large variety of (pilot) projects that are running simultaneously at various locations and on different scales.

Further area-based elaboration

- For three areas, water-robust and climate-proof construction is further elaborated (the second layer of multi-layer flood risk management):

  - *Krimpenerwaard*

  Local customised work and a joint vision on the kind of dyke development from the perspective of the flood risk management tasking are of major importance to this area. This creates synergy and saves costs. Conditions for this are flexibility in planning and financing projects for the spatial planning and flood risk management and the joint development of these projects. A pilot project will be launched in the Krimpenerwaard to examine whether there are enough tools available to actually achieve this: do the existing policy tools suffice to ensure that there is enough room for more substantial developments? The utilisation of (financial) tools to integrate spatial development with dyke improvement and vice versa is paramount in this regard. The results may be useful for all areas east of Rhine Estuary-Drechtsteden, which jointly account for 40% of the (financial) tasking of this region and where the tasking is also the most urgent.

  - *Westpoort*

  There is a concentration of (economically) vital and vulnerable infrastructure in Westpoort, the western port area of Amsterdam. The area is home to a purification plant that treats all of Amsterdam's sewage and a waste power plant that heats part of the city. It is also home to a power plant with a switchyard, which is crucial to the distribution of power in Amsterdam and the supply of kerosene to Amsterdam Airport Schiphol. A survey among fifteen companies on the site has shown that most of them do not bear the flood risk in mind. However, the risk of a flood on this site appears to be greater than the risk of any of the other disasters that are covered by the emergency plans. Accordingly, promising measures have been identified to improve flood risk management in the area. These measures specifically focus on the spatial organisation of the area itself (second layer of the multi-layer flood risk management approach), paying attention to vital and vulnerable functions in the port area. The pilot project focuses on the development of a preliminary design for these promising measures.

- *Areas outside the dykes/Botlek*

A strategic adaptation agenda will be drawn up for areas outside the dykes in Rhine Estuary-Drechtsteden. In a number of areas outside the dykes in Rhine Estuary-Drechtsteden, the risks and costs of the measures required are so high and the situation so complex that a comprehensive plan is needed (the situation is so complex). A number of focal areas have been designated that will be tackled in an initial phase: the Botlek (including the Europoortkering and Hartelkering storm surge barriers), Noordereiland (Rotterdam) and Merwe-Vierhavens (Rotterdam). The experiences gained in these focal areas can, in turn, contribute to the Strategic Adaptation Agenda for areas outside the dykes (↗ sub-section 3.4). Although a decision has been made not to adopt a statutory flood risk management standard for areas outside the dykes, it is of great importance that the parties set to work to minimise the risks in densely built-up areas outside the dykes.

Budget resources have been earmarked for the entire plan for the Botlek area. This area is home to vital infrastructure (e.g. A15) and vulnerable functions (e.g. petrochemical plants). Considering the nature of the area, a flood could have major consequences. The exact probability and consequences are, however, unknown at present. Solutions can be found in improving the Tuimelkade or Hartelkering storm surge barrier and local adaptive measures. Moreover, research is conducted into the effect that the Europoortkering storm surge barrier has on safety in the area and the possibilities to improve that effect.

The regional initiatives for a comprehensive area plan for the area outside the dykes in Dordrecht (i.e. the historical port area) and for flexible construction in areas outside the dykes in the IJsselmeer region are included in the Stimulation Programme for Spatial Adaptation outlined above. The same applies to the initiative to set up a Multi-Layer Safety Expertise Centre (↗ see above under 'smart combinations').

Flood Protection Programme[17]

Introduction

In the coming decades, the new Flood Protection Programme will be the most important implementation programme of the Delta Programme in the area of flood risk management. The central government and water boards work closely together in the Flood Protection Programme to protect the Netherlands against floods. They implement measures to ensure that the primary flood defence systems meet the safety standard, now and in the future. The Flood Protection Programme contains measures for improving flood defence systems that failed the (extended) Third Assessment. From 2017 onwards, the Flood Protection Programme will also include projects on the basis of the Fourth Assessment that will start that year based on the new standards (↗ section 2). Last year, the first programming of the new Flood Protection Programme was presented to the Dutch House of Representatives in ↗ DP2014: the programme 2014-2019. DP2015 presents the new programme for 2015-2020.

In the Administrative Agreement on Water, the central government, provinces, municipal councils, water boards and drinking water companies laid down the basis for a new and close form of collaboration, with shared financing and a common organisation. The central government and the water boards have agreed that, from 2014, they will pay an equal share (50:50) of the costs of current and future flood protection measures. They will each contribute €131 million in 2014 and from 2015 €181 million annually. The water board contribution of 50% is split into a solidarity portion of 40%, which is apportioned among all water boards, and an efficiency incentive in the form of a project-related share of 10% in the costs of an improvement measure incurred by the water board that is responsible for that measure. This agreement was embedded in the Water Act on 1 January 2014. Further agreements have been made about the financing and incorporation of measures to meet the new standards. The 50:40:10 ratio has been retained (↗ sub-section 5.3 for explanation).

17 Projects 201-321 in ↗ Map 1 Delta Programme Mapped out.

Ambitions and approach

The new Flood Protection Programme has different ambitions and it will take a different approach than the previous flood protection programmes. By utilising the experience gained from such things as the Second Flood Protection Programme (HWBP-2), the new Flood Protection Programme has been organised differently with ongoing programming and new basic principles for implementation. The ongoing nature of the programme means that the programme is updated and extended annually. This is in accordance with the Water Act amended by the Delta Act, which stipulates a detailed programming for the next six years and an indicative programming for the subsequent twelve years (Section 4.9(5)). This approach allows the latest insights to be incorporated into the programming every year. This is particularly important in the coming years, because the decision-making on the Delta Decisions and preferential strategies – the new standard specifications in particular – will have consequences for the programming of the Flood Protection Programme. The ongoing nature of the programme means that safety can be maximised using the financial resources available. This increases the efficiency of the Flood Protection Programme.

Interconnectivity between the short term and long term and between the various tasking and ambitions is of utmost importance. Investments in the Flood Protection Programme will be made relatively soon, but (apart from any partial reinforcements that have shorter lifecycles) the measures (investments in infrastructure) will generally have to be long term, often extending well into the 21st century. As such, it is important for an effective approach that all tasking and ambitions be considered and other types of solutions investigated. This requires an adaptive approach by explicitly linking short-term decisions to long-term tasking, setting the best time for investment opportunities and connecting the various investment agendas (↗ sub-section 6.4). When developing preferential strategies, the sub-programmes and water boards actively sought this interconnectivity. It will also be important in the coming decades to continue to do justice to the interconnectivity between the short and long term and between the various investment agendas.

In line with the new flood risk management approach and the Van Veldhoven-Lucas motion[18], this year the programming of the Flood Protection Programme is also based on the urgency of the various projects. In other words, the likelihood of a flood and the extent of the potential consequences of a flood determine the priorities in the implementation. In the first few years, the emphasis in the Flood Protection Programme will be on explorations and plan elaborations. That is standard at the start of an implementation programme, and in this case also necessary, because over the next few years, increasingly larger budgets will become available, especially after 2020. This run-up also presents a good opportunity to anticipate the Delta Decisions and the preferential strategies.

The Flood Protection Programme Management, a joint organisation of water boards and the central government, has prepared and drawn up the programming. The water boards "have had their say" at an administrative level, in accordance with the Water Act. After being discussed in the Flood Protection steering group, the draft programme was submitted to the boards of all water boards on behalf of the Minister for Infrastructure and the Environment. The programming was then discussed in the regional steering groups of the area-based sub-programmes, the Flood Protection steering group comprising the water boards and central government, and the Delta Programme National Water Consultation Committee (NBO), respectively. Following the discussions in the regional steering groups and in the NBO, the provinces were involved in the programming in line with the agreements from the Administrative Agreement on Water. This programming was finally adopted in the Council of Ministers as part of DP2015.

Changes compared to last year

In the programme 2015-2020, the length of flood defence systems to be improved has been extended by approximately 300 kilometres compared to last year. The flood defence systems that need to be improved now span a length of over 700 kilometres. In contrast to last year's programme, virtually all (99%; 1% requires further research) flood defences that failed the Third Assessment (2011) are now included in the programming as well as a number of projects from the extended Third Assessment. The programme now comprises 726 kilometres of primary flood defence systems

18 Parliamentary document 27625, no. 262.

and 232 engineering structures, divided among 177 projects. As in last year, the budget is a precondition for the programming. Approximately €500 million is available for the 2015-2020 period. Another €80 million is available for the 'Administrative Agreement on the Meuse' projects between 2017 and 2020. That is significantly less than the entire budget available for flood protection measures in this period. The lion's share of the money for flood protection will continue to go to the ongoing HWBP-2 up until 2020. From 2021, the scope for the Flood Protection Programme will increase significantly (↗ section 5, figure 15). Although the Flood Protection Programme is an ongoing programme, for the sake of stability, part of the programming should be regarded as fixed. For the programming for 2015-2020, it has been decided to at least continue with projects that were already programmed last year and that will be launched in 2014 and 2015.

Prioritisation and programming for 2015-2020
One of the innovations of the Flood Protection Programme is the general – i.e. non-project-based – exploration (abbreviated as POV in Dutch). The programme 2014-2019 contained three general explorations: the explorations for Central Holland, the piping issue and the Wadden Sea dykes (↗ DP2014). These explorations are each linked to one or more of the most urgent projects, and multiple managers and regional government authorities are involved in each exploration. This approach can deliver more efficient solutions and provide additional opportunities for innovation.

This year one general exploration will be added: the POV Macrostability. The failure mechanism of macrostability affects approximately 300 kilometres of the current total dyke improvement tasking, which will cost an estimated € 2 billion. The most urgent project involving this failure mechanism is almost at the top of the programming list: Lingewaal-Neerijnen, at number 2. Various innovations are available for this failure mechanism and new knowledge has been acquired for the review tools. This POV can help reduce the total tasking and ensure that innovations are put into practice, cutting costs as well as lead time.

Other problems will be addressed in the coming years as well. The approach to tackle the failure mechanism of flow slide, which the Hollandse Delta water board in particular drew attention to, will be addressed in a national exploration.

↗ Table 3 provides an overview of the schedule of the projects that have been included in the 2015-2020 programming of the Flood Protection Programme. ↗ Map 1 shows these projects (projects have been marked with a circle, general explorations with a line). ↗ Background document E (in Dutch) provides further details on all the programmed projects.

Interaction with proposed Delta Decisions and preferential strategies
The draft programme 2015-2020 has been discussed in the steering groups of the area-based sub-programmes of the Delta Programme. It has been agreed that the area-based preferential strategies for the various regions form the indicative framework for the implementation of the programmed projects and for the projects to be programmed in the future. On the basis of the preferential strategies, a distinction can be made for flood risk management measures between broad, combined solutions, such as river widening and 'smart combinations', and 'regular' dyke improvements with opportunities to link in (↗ section 3 for more information on the preferential strategies).

Progress
On 1 April 2014, the financing scheme for the Flood Protection Programme came into effect. Since then, the programme has gained real momentum. Thirteen projects have been launched with the explorations and in the course of 2014 the first decisions were issued.
In Q1 2014, four projects were launched on schedule: Genemuiden Hasselt, Capelle/Moordrecht, Randmeerdijk and IJsseldijk Gouda. Three other projects were started on the basis of advance financing: Strijensas, Emanuelpolder and Dalfsen. Actions plans for three general explorations were completed and these have also been launched. The Projects Book 2015, which will be published in the autumn of 2014, provides more information on progress.

Table 3 Programming of measures for Flood Protection Programme

Flood Protection Programme		2015	2016	2017	2018	2019	2020	>
Budget: total €3,768 million, plus project-related share relating to water-board projects (10%), of which €3,732 million from 2015 onwards (up to and including 2028).								
Available budget for water board projects only including project-related share (10%) in millions of € a year in the 2015-2020 period		9.6	39.5	40.6	129.5	132.6	150.4	
201	Central Holland	see POV Central Holland (no. 273)						
202	Lingewaal - Neerijnen							2022
203	Opijnen-Ophemert							2021
204	Waardenburg-Opijnen							
205	Gorinchem							
206	Vuren-Haaften							2021
207	Diefdijk							
208	Vecht and Steenen dykes							2023
209	Mastenbroek IJssel							2021
210	Wolferen-Sprok							
211	Zwolle							
212	IJsselzone Zwolle							2023
213	Mastenbroek Zwarte Water							2022
214	Gouderak							2022
215	Eemshaven-Delfzijl							2023
216	Krimpen/Ouderkerk							2023
217	Neder-Betuwe							2023
218	Around Kampen							2025
219	Noordzeekanaal canal							
220	Lingewaard							2021
221	Capelle/Moordrecht							
222	Remaining tasking for Hollandsche IJssel	potential remaining tasking						
223	Werkendam-Giessen							2024
224	Mastenbroek Zwarte Meer							2026
225	Olst-Wijhe							2026
226	Culemborg							2024
227	Randmeerdijk							
228	Genemuiden-Hasselt							
229	IJsseldijk Gouda (phase 2)							2024
230	Peerenboom-Genderen							
231	West Holwerderpolder-Lauwersmeer							2024
232	IJssel 1 stretches	potential remaining tasking						
233	Tiel							2023

Exploration Plan elaboration Realisation

Table 3 *Programming of measures for Flood Protection Programme (continued)*

Flood Protection Programme		2015	2016	2017	2018	2019	2020	>
234	Pannerden/Loo							
235	Leeuwen-Oude Maasdijk							2024
236	Zuid-Beveland Oost, Oosterschelde							
237	Winssen-Drutensche Waarden							2024
238	Flow slide V3T							2024
239	Gameren							
240	IJsseldijk Gouda (urgent part)							
241	Wieringermeer (C-dyke)							
242	IJssel 2 stretches	potential remaining tasking						
243	Lauwersmeer/Vierhuizergat							2024
244	Capelle/Zuidplas							2024
245	Burghsluis-Schelphoek							
246	Drongelens kanaal (P52)	central government flood defence budget						
247	SVK Hollandsche IJsselkering storm surge barrier (gate)	central government flood defence budget						
248	SVK Hollandsche IJsselkering storm surge barrier (dyke + 2 kw)	central government flood defence budget						
249	Flaauwershaven/Borendamme							
250	Ooij and Millingen							2024
251	Loswal Hattem and Apeldoorns kanaal							
252	Zuid-Beveland-West, Westerschelde							2023
253	Markermeer lake engineering structures							2023
254	Krimpen aan de Lek	potential remaining tasking						
255	IJssel 3 sections	potential remaining tasking						
256	Koehool-West Holwerderpolder							2024
257	Emanuelpolder							2023
258	Bruinisse							2022
259	Zuidersluis ARK	central government flood defence budget						
260	Eemdijk/Spakenburg							
261	Zuid-Beveland Oost, Westerschelde							
262	Bank Erosion at Klaphek							
	Meuse agreement projects*			€	€	€	€	€
	Advance financing scheme							€

* The Meuse agreement projects will be included in the programming for 2016-2021 next year. The first projects will be programmed from 2017. These projects are: Alexanderhaven (281) / Heel/Thorn (282) / Venlo (283) / Lomm/Velden (284) / Arcen (285) / Baarlo (286) / Well (287) / Nieuw Bergen(288) / Blerick (289) / Belfeld (290) / Buggenum (291) / Beesel (292) / Swalmen/Kessel/Wellerlooi (293).

Exploration Plan elaboration Realisation

Table 3 *Programming of measures for Flood Protection Programme (continued)*

General explorations		2015	2016	2017	2018	2019	2020	>
271	*Piping*							
272	Wadden Sea							
273	Central Holland							
274	Macrostability	action plan will be drawn up						

Pre-financing for second wave of projects		2015	2016	2017	2018	2019	2020	2021
301	Dalfsen							€
302	Randmeerdijk Noordoostpolder							€
303	Geertruidenberg/Amertak							€
304	Randmeerdijk Flevopolder							€
305	Delfzijl-Chemiepark							€
306	Chemiepark-Punt van Reide							€
307	Delfland-1							€
308	Wieringer Zeewering							€
309	Jannezand							€
310	Markermeerdijk connection							€
311	Delfland-2							€
312	Lemsterhoek							€
313	De Whaa guard lock							€
314	Stolwijker lock							€
315	WIJD-Koegraszeedijk connection							€
316	WIJD-engineering structures connection							€
317	Strijensas							€
318	Vollenhove engineering structures							€
319	De Schans pumping station							€
320	WIJD-dyke sections connection							€
321	Noorderhaven Harlingen							€

Exploration

Integrated contracts
The Flood Protection Programme Management knowledge and PPSsupport is a joint venture within the central government in which various ministries share knowledge and experience in the area of public-private collaboration with regional and local government authorities and (semi-) public clients. Together with the Hollands Noorderkwartier higher water board, the Rivierenland water board, the Schieland and Krimpenerwaard higher water board and Rijnland higher water board, the programme management has worked on identifying and clarifying the opportunities for integrated contracts within the Flood Protection Programme. This has been done to follow up on the research into the (im)possibilities of integrated contracts in the Delta Programme, which was carried out on the initiative of the Delta Programme Commissioner (see DP2013). This work ties in with the ambitions of the Delta Programme and the Administrative Agreement on Water for more efficiency and cost awareness, lifecycle optimisations and innovative contract forms.

The final result is an evaluation framework for integrated contracts for the projects of the Flood Protection Programme. The water boards can use this framework in the exploratory phase of a project to choose between various contract forms, ranging from conventional to integrated. The evaluation framework is helpful in gaining insight into, for example, the involvement of the private parties, and risks and consequences for the environment, such as disruption and damage. The evaluation framework is part of the guide to explorations, issued by the Flood Protection Programme Management. Various water boards have already used the evaluation framework.

Exploration

Oosterschelde sand demand[19]
As expected, less water flows into and out of the Oosterschelde since the construction of the Oosterscheldekering storm surge barrier. Because the tidal channels are too large for the smaller amount of water, the water does not flow as quickly as it did and is not powerful enough to shift sediment from the channels to the intertidal zone. While the water still has an eroding effect, it no longer has any constructive effect. This process is known as 'sand demand' and it negatively affects flood risk management, designated uses and the environmental value of this Natura 2000 area. At present, approximately 50 hectares of intertidal zone is eroded every year. Expectations are that the current 11,000-hectare intertidal zone will shrink to only about 7,000 hectares by 2060 and to less than 5,000 hectares by 2100. 2007 saw the launch of an exploration with pilot projects to tackle sand demand. In 2013, based on this exploration, a preferential approach was developed, whereby sand replenishment in the intertidal zones counters the sand demand. In the short term, dealing with the Roggenplaat sand demand is the most urgent issue. Erosion is rapidly reducing the surface area and height of this sand bank, jeopardising functions in the areas of nature, recreation and landscape. In 2013, the Zeeland MIRT Consultation Committee agreed that the province of Zeeland (lead), Natuurmonumenten, Oosterschelde National Park and the central government will draw up a financing proposal for the Roggenplaat together. In 2014, the Zeeland MIRT Consultation Committee will consider the financing proposal in its decision-making on the follow-up to measures taken to manage sand demand in the Oosterschelde. According to the exploration, other locations will not be addressed until 2025, and this will be done in the broader MIRT Study into optimising the current flood risk management strategy that will take place in 2015 and 2016 (see the description under optimisation issues in sub-section 4.2, Studies).

The Ministry of Infrastructure and the Environment is carrying out this exploration together with the Ministry of Economic Affairs, with involvement from the province of Zeeland, the Southwest Delta steering group and the Oosterschelde National Park.

19 Project 401 in Map 1 Delta Programme Mapped out.

Map 11
Flood Protection Programme 2015-2020

Project numbering refers to programmed measures in the Delta Programme (↗ tables 2 to 12 in section 4). Any inner colour in the symbol indicates the plan phase.

2015-2020 Flood Protection Programme

- 200/300 project number
- programmed dyke improvement project
- prefinanced dyke improvement project
- dyke section
- General explorations:
  - Piping (271)
  - Wadden Sea dykes (272)
  - Central Holland (273)
  - Macrostability (274, linked to project 202)
- Meuse agreement project

Current status per project: plan phase as of 2015

- not yet at plan phase
- exploration
- plan elaboration
- realisation

Basic map

- freshwater
- saltwater / brackish water
- flood area
- area outside the dykes
- urban area
- docks
- border

Table 4 Programming of measures for IJsselmeer Closure Dam

IJsselmeer Closure Dam		2015	2016	2017	2018	2019	2020	>
Budget: €854 million for improvement of IJsselmeer Closure Dam, increase in discharge capacity and ambitions.								
421	IJsselmeer Closure Dam							2021

Table 5 Programming of measures for WaalWeelde

WaalWeelde		2015	2016	2017	2018	2019	2020	>
Budget: €30 million from the central government (from NURG and the National Waters Improvement Programme) and €30 million from the province of Gelderland.								
	Central government projects							
431	Heeseltsche flood plains							
432	Hurwenensche flood plains							
	Province of Gelderland projects							
433	Ruyterwaard							
434	Fluvia Tiel							
435	Loenensche Buitenpolder							
436	Beuningse flood plains							
437	Oosterhoutsche plains							
438	Stadswaard							
439	Gendtsche Polder							

Table 6 Programming of measures for Vlieland and Terschelling

Vlieland and Terschelling dyke boundary		2015	2016	2017	2018	2019	2020	>
Budget: €3 million.								
441	Vlieland and Terschelling dyke boundary							

Plan elaboration Realisation

Plan elaborations

IJsselmeer Closure Dam[20]

The Future of the IJsselmeer Closure Dam project aims to improve the safety of this flood defence system, to increase the discharge capacity from the IJsselmeer lake to the Wadden Sea and, at the same time, create space for other ambitions. The Second Assessment of the primary flood defence systems (2006) showed that the IJsselmeer Closure Dam no longer meets the statutory flood risk management requirements. In late 2011, the Cabinet decided on a preferential solution, adopting the framework vision for the Future of the IJsselmeer Closure Dam. The framework vision ensures a phased approach to flood risk management, by strengthening the top layer of the dyke across its entire length (i.e. making it 'overtopping-resistant') and reinforcing the discharge sluices and navigation locks. The provinces of Fryslân and Noord-Holland and the municipal councils of Hollands Kroon and Súdwest Fryslân are committed to the ambitions in the areas of sustainability, nature, recreation and tourism. The central government promised a maximum amount of €20 million to encourage sustainable and innovative initiatives, provided that the region would match this amount.

In connection with the Future of the IJsselmeer Closure Dam project, Rijkswaterstaat was involved in the Additional Discharge Capacity of the IJsselmeer Closure Dam project, the aim of which is to increase the dam's discharge capacity. This is necessary because the target level of the IJsselmeer lake in winter (NAP -0.40m) is increasingly exceeded, both in terms of frequency and volume. The project first looked into the construction of an additional discharge sluice complex in the IJsselmeer Closure Dam and then, as an alternative, the use of pumps. Installing pumps appears to be the best and most efficient solution, and this was adopted in 2012 as a decision on a preferred solution. A decision was made to install the pumps in the Den Oever discharge sluice complex in stages.

Given that the reinforcement of the IJsselmeer Closure Dam and the increase of the discharge capacity of the IJsselmeer Closure Dam are closely connected, a decision was made to combine the two projects into one IJsselmeer Closure Dam project. The common plan elaboration started in 2012. The plan is expected to be carried out between 2017 and 2021.

20 Project 421 in ↗ Map 1 Delta Programme Mapped out.

WaalWeelde[21]

In WaalWeelde, regional parties, the central government, the business community and private citizens, headed by the province of Gelderland, are working together on a safe, natural and economically robust Waal river. A MIRT Study was carried out in 2011. This showed that a number of projects which contribute to the water tasking as well as spatial development could start before 2015. The central government and the province of Gelderland are both investing €30 million in these promising projects. This will be used in any case to implement the projects in Heesselt and Hurwenen, the plan studies for which have already been completed. A plan for Beuningen will be developed under the direction of the province. The central government and the region are also jointly working on a soil strategy for WaalWeelde and for the sustainable and effective management of the flood plains.

The MIRT Study on WaalWeelde concluded that WaalWeelde can make a major contribution to the flood risk management tasking. The study also clearly showed that the Delta Decision on the Rhine-Meuse Delta and the Delta Decision on Flood Risk Management will impact WaalWeelde. As such, WaalWeelde played an important role in the MIRT Study of the Rivers sub-programme and also offers inspiration for the further elaboration of the preferential strategy developed for the area around the major rivers.

Vlieland and Terschelling dyke boundary[22]

A portion of the built-up area on the island of Vlieland is located outside the dykes. This area includes holiday homes and a 1970s extension of the village of Oost-Vlieland. The State Secretary for Transport and Water Management has previously promised to bring this area inside the dykes by rerouting the primary flood defence system. Terschelling would also like to have the primary flood defence system relocated.

To meet the wishes of the municipal councils and the province of Fryslân, the central government launched a study to explore potential solutions for the location of the primary flood defence system. The decision on a preferred solution was taken in 2012. It was decided to relocate the primary flood defence systems on Vlieland and Terschelling

21 Projects 431-439 in ↗ Map 1 Delta Programme Mapped out.
22 Project 441 in ↗ Map 1 Delta Programme Mapped out.

Table 7 Programming of measures for the Second Flood Protection Programme

Second Flood Protection Programme	2015	2016	2017	2018	2019	2020	>
Budget: total €3,218 million, of which €2,040 million remains as of 2015.							
501 Lekdijk-KIS							
502 Coastal reinforcement at Katwijk							
503 Markermeerdijk Hoorn-Edam-Amsterdam							2021
504 Wadden Sea dyke at Texel							
505 Koegraszeedijk							
506 Dyke improvement at Spui-West							
507 Dyke improvement at Spui-Oost							
508 Flood defence system at Den Oever							
509 Dyke improvement at Hoeksche Waard Zuid							
511 Houtribdijk							
512 Ipenslotersluis and Diemerdammersluis							
513 Weak links in the province of Noord-Holland							
514 Wadden Sea dyke, Frisian coast							
515 Eemdijken and Zuidelijke Randmeren lakes							
517 Markermeerdijk Marken, south and west embankment							
518 Dyke improvement on Eiland van Dordrecht (West and East integrated)							
519 Ameland, Wadden Sea storm surge barrier							
520 Dyke improvement at Hellevoetsluis							
521 Dyke improvement at Hoeksche Waard-Noord							
522 Dyke improvement at Krimpen							
523 Merwededijk in Werkendam							
528 Bergambacht-Ammerstol-Schoonhoven (BAS)							
529 Guard lock in Meppelerdiep Zwartsluis							
530 IJsselmeer lake, clay cladding and piping measures							

Plan elaboration Realisation

in part towards the sea. Plan elaboration started in 2013. In consultation with the municipal councils of Vlieland and Terschelling and the province of Fryslân, a detailed elaboration will be drawn up for the preferred routes. Implementation can start in 2014 following the project decision and the amendment to the annexes to the Water Act. Completion is scheduled for 2015.

Ooijen-Wanssum area development[23]

Budget: €210 million for the entire area plan; a maximum of €135 million from the central government and €75 million from the province of Limburg and the municipal council. The central government's budget comprises €10 million from the Meuse Projects budget and a reserve of up to €123 million in the Delta Fund from 2021 onwards. The central government's contribution is earmarked for flood risk management purposes.

Ooijen-Wanssum is located on the west bank of the river Meuse in northern Limburg. The 10km former distributary of the Oude Maas located here plays an important role in discharging high water into the Meuse. After the floods in 1993 and 1995, a decision was made to build embankments in this area, offering a protection level of approximately 1/50 a year (Delta Plan for the Major Rivers). These embankments cause a bottleneck in the river, which hinders the flow. This, in turn, causes elevated flood levels.

On 10 November 2011, the central government, the province of Limburg, the Roer and Overmaas water board and the Peel and Maasvallei water board concluded the administrative agreement on Flood Risk Management in the Meuse, which contains agreements on sustainable solutions. The Dutch House of Representatives was updated on this.[24]

After this, the MIRT exploration started and was then completed in mid-2012. A decision on a preferred solution was taken on 2 November 2012. The then State Secretary for Infrastructure and the Environment and the administrators of the province of Limburg, the municipal councils of Venray and Horst aan de Maas and the Peel and Maasvallei water board signed the administrative agreement on the Ooijen-Wanssum Plan Elaboration. The spatial impact is brought about using the Provincial Zoning Plan.
As far as flood risk management is concerned, the project consists of constructing and improving primary flood defence systems and taking river-widening measures (reactivating the distributary of the Oude Maas and constructing two flood channels). By 2020, a protection level of 1/250 a year will have been achieved. This project also makes a major contribution to the long-term objective for flood risk management, as the fall in water level occurs in the area itself, upstream up to Roermond..

Realisation

All flood risk management projects in this section are part of an implementation programme (except the Vlieland-Terschelling Dyke Boundary). The Dutch House of Representatives has classified three of these programmes as Major Projects: the Second Flood Protection Programme, Room for the River and Meuse Projects. The Cabinet uses progress reports on the Major Projects to update the Dutch House of Representatives every six months.

The Second Flood Protection Programme[25]

The Second Flood Protection Programme (HWBP-2) mainly comprises projects stemming from the First and Second Assessments of the primary flood defence systems (9 and 71 projects, respectively). These projects seek to ensure that flood defence systems that failed inspection comply with flood risk management standards again. The Weak Links on the Coast approach is also part of this programme (eight of the nine projects have been completed or are nearing completion). All in all, (after combining two projects) HWBP-2 comprises 88 projects, which together amount to 366.2 km of dykes and 18 engineering structures. The water boards will do the lion's share and carry out 78 projects; Rijkswaterstaat will be in charge of eight projects and the province of Groningen will have two. The programme has advanced to the implementation phase, now that (financially) substantial projects have been decided on and awarded. Since 31 December 2013, 17 projects have been rolled out, while 12 projects are nearing completion of the plan study phase. The other 59 projects have already been completed. Although a large number of the projects have been finished, a considerable number of the financially substantial projects still need to be completed.

The majority of the projects will be finished in 2017. Five projects are expected to be finished at a later stage. To help the projects finish on time, the central government and the

23 Project 451 in Map 1 Delta Programme Mapped out.
24 Parliamentary document 18106, no. 208.
25 Projects 501-529 in Map 1 Delta Programme Mapped out.

Table 8 Programming of measures for Room for the River

Room for the River		2015	2016	2017	2018	2019	2020	>
Budget: total €2,382 million, of which €913 million remains as of 2015.								
601	Additional flood plain excavation at Millingerwaard	■						
602	Dyke realignment at Lent	■						
603	Groyne lowering at Waal Fort St. Andries	■						
604	Groyne lowering at Beneden Waal	■						
605	Flood plain excavation and dyke relocation at Munnikenland	■						
606	Depoldering of Noordwaard	■						
607	Depoldering of Overdiepse Polder	■						
608	Dyke improvement along Amer/Donge	■						
609	Dyke improvement at Steurgat/Land van Altena	■						
610	Dyke improvement at Bergsche Maas/Land van Altena	■						
611	Dyke improvement at Oude Maas/Hoeksche Waard	■						
612	Dyke improvement at Oude Maas/Voorne Putten	■						
613	Water storage at Volkerak-Zoommeer lakes	■						
614	Flood plain excavation in Huissensche Waarden	■						
620	Flood plain excavation in Honswijkerwaarden, weir island at Hagestein, Hagesteinse Uiterwaard and Heerenwaard	■						
621	Dyke improvement at Neder-Rijn/Betuwe/Tieler- and Culemborgerwaard	■	■					
622	Dyke improvement at Lek/Betuwe/Tieler- and Culemborgerwaard	■	■					
623	Dyke improvement at river Lek/Alblasserwaard and Vijfheerenlanden	■	■					
624	Dyke relocation at Cortenoever	■	■					
625	Dyke relocation at Voorsterklei	■	■					
626	Flood plain excavation in Bolwerksplas, Worp and Ossenwaard	■						
627	Flood plain excavation in Keizers- and Stobbenwaarden and Olsterwaarden	■						
628	Flood channel in Veessen-Wapenveld	■	■					
629	Flood plain excavation in Scheller and Oldener Buitenwaarden	■						
630	Dyke relocation at Westenholte	■						
631a	IJssel delta: the summer bed lowering part	■						
631b	IJssel delta: the Reevediep part	■	■	■	■	■		

■ Realisation

Table 9 Programming of measures for further elaboration of area around the major rivers

Further elaboration of river region (I&M projects)		2015	2016	2017	2018	2019	2020	>
Budget: total €189 million, of which €48 million remains as of 2015.								
701	Flood plain excavation of Rijnwaardense flood plains	■						
702	Flood plain excavation in Millingerwaard	■						
703	Flood plain excavation Afferdensche and Deestsche plains	■	■	■	■			
704	Flood plain excavation in Welsumerwaarden and Formonderwaarden nature	■						

■ Realisation

water boards have increased administrative collaboration in the programme. For more information, see the fifth progress report. [26]

Room for the River[27]

This programme comprises 34 measures (originally 39, but five have been cancelled) set out in the 2006 Room for the River Key Planning Decision (PKB). These measures are intended to reach the Rhine distributary discharge target of 16,000 m³/s (measured at Lobith) in accordance with the statutory level of protection by 2015. Measures in the downstream section of the Meuse are also part of the programme. The second objective is to enhance the spatial quality in the area around the major rivers.

The majority of the 34 measures of Room for the River will have been completed by 2015 (↗ table 8). Seven measures will not be completely finished by then, primarily because of the complexity of these projects. These are IJssel delta (Reevediep in conjunction with the lowering of the summer bed in the Beneden-IJssel), the flood channel in Veessen-Wapenveld, two dyke relocations along the IJssel (Cortenoever and Voorsterklei), a dyke improvement along the Nederrijn (Nederrijn/Betuwe/Tieler- and Culemborgerwaard) and two dyke improvements along the Lek (Alblasserwaard and De Vijfheerenlanden and Betuwe/Tieler- and Culemborgerwaard). In addition to the two dyke relocations at Cortenoever and Voorsterklei, the IJsselsprong plan at Zutphen (not part of Room for the River) will make an additional contribution to flood risk management, with money from the Policy Document on Spatial Planning, by altering the riverbank.

The Catch Up on Stroomlijn project is designed to sort out the vegetation in the flood plains for flood risk management purposes. The project is closely affiliated with Room for the River and the Meuse Projects: proper vegetation management is a condition for achieving the lower water levels that these programmes intend to achieve. As such, the project contributes to the general aims of water policy in the area around the major rivers: the safe processing of a normative discharge of 16,000 m³/s at Lobith. Maintenance of vegetation on sites managed by private persons, companies, government authorities and various nature conservation organisations is overdue. In 2007, a start was made to tackle this. In October 2012, the Minister for Infrastructure and the Environment embedded the approach to catch up on vegetation maintenance in a policy letter.[28] The Catch Up on Stroomlijn project requires numerous (nature) permits, for which long application periods apply. On 5 March 2014, the Minister for Infrastructure and the Environment took the decision to use the Central Government Coordination Scheme for the Catch Up on Stroomlijn project. This will lead to a measure of control over the permit application processes and will reduce the risk of delays. In addition to Catch Up on Stroomlijn, the Further Elaboration of Area around the Major Rivers will contribute to achieving the flood risk management objective in good time (↗ see below). Further information on Room for the River, Catch Up on Stroomlijn and NURG can be found in the progress reports.[29]

26 Parliamentary document 32698, no. 15.
27 Projects 601-631 in ↗ Map 1 Delta Programme Mapped out.
28 Parliamentary document 31710, no. 27.
29 The 23rd progress report is the last one, Parliamentary document 30080, no. 69.

Table 10 Programming of measures for Meuse Projects

Meuse Projects		2015	2016	2017	2018	2019	2020	>
Zandmaas								
Zandmaas budget: total €407 million, of which €134 million remains as of 2015.								
801	Retention of Lateraalkanaal West, southern part +							
802	Deepening at Sambeek							
803	Flood channel at Lomm							
804	Flood channel at Well-Aijen							
805	South channel at Well-Aijen							
Grensmaas								
Grensmaas budget: total €150 million, of which €81 million remains as of 2015.								
806	Grensmaas project (11 locations)							2024
807	Final remaining embankments, Roer and Overmaas water board							
808	Final remaining embankments, Peel and Maasvallei water board							
809	Permanent Fluvial Measures (Berg a/d Maas)							

Table 11 Programming of measures for repairs of stone cladding in Oosterschelde and Westerschelde and shore face deposits

Repairs of stone cladding in the Oosterschelde and Westerschelde		2015	2016	2017	2018	2019	2020	>
Repairs of stone cladding								
Budget: total €854 million, of which €132 million remains as of 2015.								
902	Zuidhoek Zierikzee							
904	Philipsdam-Zuid							
906	St. Annaland							
909	St. Pieterspolder							
911	Roompot							
912	Hansweert							
Shore face deposits								
913	Breskens							
914	Borssele							
915	Zierikzee							
916	Burghsluis							
917	Schelphoek							
918	Ellewoutsdijk							
919	Nieuw-Neuzenpolder							

Plan elaboration Realisation

Table 11 *Programming of measures for repairs of stone cladding in Oosterschelde and Westerschelde and shore face deposits (continued)*

Repairs of stone cladding in the Oosterschelde and Westerschelde	2015	2016	2017	2018	2019	2020	>
Shore face deposits (continued)							
920 Margarethapolder		■	■				
921 Kleine Huissenspolder		■	■				
922 Eendragtpolder		■	■				
923 Molenpolder		■	■				
924 Waardepolder and Westveerpolder		■	■				
925 Vlissingen		■	■				
926 Oost-Bevelandpolder		■	■				
927 Wemeldinge-West		■	■				
928 Wemeldinge-Oost		■	■				

■ Realisation

Further elaboration of area around the major rivers (NURG)[30]
NURG is a joint programme of the Ministry of Economic Affairs and the Ministry of Infrastructure and the Environment. The programme comprises measures that enhance the safety of the river region and produce 7,000 hectares of new nature in the flood plains of the Rhine distributaries and the dyked river Meuse. Those projects with a flood risk management objective, as stated in the Room for the River PKB, must be completed by 2015 at the latest. The ministries are looking into the question of whether flood plain excavation projects in the Afferdensche and Deestsche flood plains and the Rijnwaardense flood plains can be accelerated to ensure that they are completed in good time.

Meuse Projects (Zandmaas en Grensmaas)[31]
The Meuse Projects comprise 56 projects in the Grensmaas and Zandmaas; more than 20 of these have been completed. The programme's combined objectives are flood risk management, nature development, improving shipping and mineral extraction. According to the schedule, the projects for the flood protection objective in the Zandmaas should be completed by 2015 at the latest and those for the Grensmaas by 2017, except for the final remaining embankments.

In late 2011, the central government and the region concluded an administrative agreement on the completion of the Meuse Projects and its successor. This administrative agreement primarily lays down agreements on the Ooijen-Wanssum area development, the necessary remaining construction or increase of embankments after completion of Zandmaas and Grensmaas and resolving the financial issues in the Grensmaas as a result of the declining private parties for gravel. As a result, the schedule for completing the projects for the flood protection objective in the Grensmaas in 2017 has not changed. Until 2020, a normative budget will also be used to realise the prioritised part of the required embankments, as the 'final activity' for flood protection alongside fluvial measures.

The decentralisation of policies on the natural environment and the re-evaluation of the ecological main structure (EHS) have led to a number of projects being revised; the Dutch House of Representatives has been updated on this.[32]
The entire Meuse Projects programme is expected to be completed by 2024.[33]

Repairs of stone cladding in Oosterschelde and Westerschelde and shore-face cladding in Zeeland[34]
The dykes along the Oosterschelde and Westerschelde are clad in placed stones. The Repairs of Stone Cladding project covers reinforcing this cladding along a total length of 321 km (181 km along the Oosterschelde and 140 km along the Westerschelde), so that this dyke cladding once again meets

30 Projects 701-704 in ↗ Map 1 Delta Programme Mapped out.
31 Projects 801-808 in ↗ Map 1 Delta Programme Mapped out.
32 Parliamentary document 18106, no. 216.
33 For more information, see the 25th progress report, Parliamentary document 18106, no. 223 (in Dutch).
34 Projects 902-928 in ↗ Map 1 Delta Programme Mapped out.

the statutory standards. The work will be finished in 2015. The project will not only be completed within the set time, but, thanks to economical contracts, within budget too. In addition to repairing stone cladding, Rijkswaterstaat will deposit sand on shore faces to improve the underwater bank and counter bank erosion of the dykes and breakwaters in Zeeland. The water current is washing sand away, eroding the shore faces. To prevent this erosion from advancing towards the secondary dykes and breakwaters, sand will be deposited on the shore faces.

Management, maintenance and replacement

Management, maintenance and water management
The management and maintenance of the main water system includes such activities as water management, regular management and maintenance, and renovation and replacement. Regular management and maintenance include such activities as and the supply and discharge of water sand replenishments to preserve the coastline and vegetation maintenance in the flood plains, as well as preserving the 'managed area' (including flood defence systems, such as storm surge barriers, weirs, discharge sluices and pumping stations). The management of facilities for water quality, such as fish ladders and banks, are also part of this. In doing so, Rijkswaterstaat primarily keeps flood risk management and freshwater supplies in good order, allowing other roles of the main water system, such as shipping and nature development, to link in. For shipping, separate arrangements are made with Rijkswaterstaat in connection with the management and maintenance of the main waterways system, financed from the Infrastructure Fund.

Programme of Replacement Tasking for Hydraulic Structures (VONK)
In the Replacement Tasking for Hydraulic Structures programme, Rijkswaterstaat is working on a programme-based approach to replace approximately 650 hydraulic structures it manages (↗ background document F (in Dutch)). One of the goals of this approach is to provide better substantiation for the central government's multi-year programming for the replacement of these hydraulic structures, for the short and the long term (forecast until 2100).

One part of VONK is the development of the Susceptibility Test for Hydraulic Structures. The susceptibility test will lead to a forecast about the end of the lifespan of all 650 structures. This method provides a more detailed picture of the replacement tasking than the current 'basic method' (construction year + design lifespan).[35] The outcome of the susceptibility test consists of time windows for the technical and functional end of the lifespan. This ensures that a better substantiation of the forecasts for the replacement tasking in the longer term and the required resources can be made.

One of the objectives of VONK is to connect the replacement tasking for the hydraulic structures with the preferential strategies of the Delta Programme, by way of an elaboration of adaptive delta management. This connection has resulted in the IJmuiden pumping station and discharge sluice complex case study (↗ background document F (in Dutch)), which was conducted to determine when the pumping station and discharge complex should be replaced, given its role in the main and regional water system. The case study has shown how the Susceptibility Test for Hydraulic Structures can be applied to the development of strategy and the drafting of adaptation and investment paths. Insight into the end of the lifespan of engineering structures at the various water system levels may help to link decision-making on short-term measures to the water tasking and spatial tasking in the long term.

35 More information can found in ↗ DP2013 and ↗ DP2014.

4.3
Delta Plan on Freshwater

The Delta Plan on Freshwater comprises all measures, studies and knowledge issues relating to sustainable freshwater supplies that have been programmed or placed on the agenda and that are financed in whole or in part from the Delta Fund. This sub-section also names the measures for the regional water system that are not financed from the Delta Fund.

Below, the programmed studies and pilot projects and the required tools that are important to be able to take new steps with the Delta Programme will be addressed first. These are included in the Delta Fund Budget 2015. After that, the Freshwater Investment programme is discussed. That investment programme is compiled on the basis of a national investment agenda (measures in the main water system), regional implementation programmes of the freshwater regions and a number of implementation programmes of user functions (↗ table 13). It comprises two periods or waves: the first wave (2015-2021 period) consists of measures that can be covered by the budget earmarked in the Delta Fund for freshwater investments. These measures have not yet been programmed in the 2015 budget and will be programmed in the coming years. The second wave (period 2022-2028) comprises measures that are placed on the agenda for decision-making by the next Cabinet.

In the Delta fund budget, €10.5 million worth of research resources will be available for studies, pilot projects and elaborating the required tools in the period 2015-2020. For the implementation of measures under the Freshwater Investment Programme, the Minister for Infrastructure and the Environment has provisionally earmarked another €150 million of the budget available for the Delta Programme (↗ section 5).

The investments will mainly be used to resolve the current bottlenecks and utilise opportunities with no-regret measures. These measures will make the system more flexible and robust (less vulnerable) against extremes, without obstructing the long-term ambitions. In addition, innovations and changes aimed at an economical and effective use of water are encouraged. In areas that are not supplied by the main water system, the aim is to switch from a system designed to discharge water to a system designed to retain water. In areas with a water supply, the supply will be safeguarded and salinisation countered.

The Delta Plan on Freshwater concludes with a concise overview of ongoing freshwater projects and the regular management and maintenance relating to freshwater.

Table 12 Programming of new studies into freshwater

Freshwater		2015	2016	2017	2018	2019	2020	>
Tools and instruments								
171	Elaboration of supply level							
172	Method for determining costs and benefits of freshwater supplies							
Preparation of/more in-depth studies for projects or different management								
181	Small-scale water supply in the western Netherlands							
182	Flexibilisation of IJsselmeer lake water level							
183	Climate adaptation pilot projects							
191	Smart water management (optimise management)							

Programming of studies, pilot projects, tools and preparation for new projects and different management (2015-2020)

The results of the studies programmed and placed on the agenda here can be used for meaningful follow-up to the proposals for the Delta Decisions and preferential strategies for freshwater. These are listed in ↗ table 12.

The programmed studies in the area of freshwater include first and foremost the elaboration of new tools for the introduction of supply levels. In addition, new studies have been programmed to prepare for the implementation of new projects or a different form of management. Finally, a study into the use of 'smart water management' has been programmed to optimise the freshwater supplies.

Elaboration of tools:

- The parties (central government, provinces, water boards, municipal councils and users) will elaborate the supply levels in all regions and for the main water system in the coming years. The central government will take the initiative for supply levels for the main water system. The provinces will take the initiative to start up the process of establishing supply levels for regional water systems. The national guidance group (Freshwater Steering Group) coordinates the elaboration and implementation of supply levels to safeguard interconnectivity.
- A method will be developed for determining the benefits of freshwater supplies. The Freshwater sub-programme has gained experience with economic analyses for substantiating the decision-making, which include applying the Comparison System of the Delta Programme. As economic analyses will also be used for decision-making in the future, it would be advisable to incorporate the experience gained into an adjusted approach or method. This is not about determining the costs, but about the manner in which costs should be shown for the various designated uses and made comparable.

Preparation of/more in-depth studies into new projects or different management:

- Small-scale water supply in the western Netherlands: this study (KWA) focuses on increasing the capacity of the small-scale supply from 7 to 15 m^3/s, with the aim of keeping water supplies in the western Netherlands at the required level. This study is a necessary interim step to be able to programme a project exploration. It also focuses on the construction of a bypass or bypass sewer at the Irene locks, as part of the KWA+ and aims to counter salinisation in the Amsterdam-Rijnkanaal canal.
- Flexibilisation of IJsselmeer lake water level: this study supports the performance of the first step of flexible water level management; that is, to achieve a permanently available freshwater buffer of 20 cm IJsselmeer, Markermeer and Zuidelijke Randmeren lakes (between NAP-0.10 and NAP-0.30 m).
- Climate adaptation pilot projects: the implementation of innovative pilot projects in the area of climate adaptation, which are already up and running in many places in the freshwater regions, will soon get a further boost in the Delta Plan on Freshwater. Pilot projects are about to be launched in various freshwater regions:
  - Elevated sandy soils: more efficient and smarter irrigation;
  - Western Netherlands: feasibility study of effluent post-treatment (Delft Blue Water);
  - Southwest Delta: experimental pilot area for areas without supply;
  - Rivers: sustainable use of shallow groundwater;
  - IJsselmeer region: Spaarwater phase 2.

Smart water management (optimise management):

- Rijkswaterstaat and the water boards are introducing 'smart water management' in order to improve the supply and buffering of water together. With new tools for monitoring, information exchange and decision-making support, they can better control or retain water in case of any imminent shortages. This is happening in such places as the Hollandsche IJssel, the Amsterdam-Rijnkanaal canal, the Noordzeekanaal canal and at the weir at Hagestein.
- The Western Netherlands System Study will provide insight into the effect on the main water system of the entire package of programmed measures and potential developments, such as a saltwater Volkerak-Zoommeer lake, deepening of the Rotterdam entrance channel and the new sea lock at IJmuiden.

Agenda for decision-making on programming in this cabinet period

Based on regional proposals, a concrete investment programme has been drawn up for the short term that can be covered by the budget earmarked in the Delta Fund for freshwater investments (↗ table 13). For this period, the following investments are projected in the various regions (↗ table 13 for contributions from regional governments and the central government in the form of the Delta Fund):

- *Elevated sandy soils:* in those areas of the eastern and southern Netherlands that are not supplied by the main water system, the aim is to switch from a system designed to discharge water to a system that is also designed to retain and save water. A substantial package of various (relatively small-scale) measures has been put together to effect this system switch. In the Elevated sandy soils that are able to receive water from the main water system, the objective is to maintain the current water supply and the option of limited expansion.
- *Western Netherlands:* for the Western Netherlands, measures will be taken in the regional system and in this period efforts will be focused on carrying out phase 1 of the increase in the Small-Scale Water Supply (KWA+) to 15 m^3/s. In addition, the parties involved have concluded that joint research on the basis of joint fact-finding will have to be carried out into the increase of the Small-Scale Water Supply (from 15 to 24 m^3/s) and any alternatives for this, including any permanent supply from the east. The aim is also to make the Brielse Meer lake more robust by using an improved monitoring system and alternative water intake at Spijkenisse.
- *Southwest Delta:* in the part of the Southwest Delta that is supplied by the main water system, the aim is to preserve the freshwater supply via Biesbosch/Hollandsch Diep/Haringvliet. The regional system will undergo measures to limit the demand for water supply from the main water system, increase the buffer capacity and create a robust water supply for areas around the Volkerak-Zoommeer lake. The aim is to start with the restoration and further optimisation of the supply routes via the Roode Vaart canal. The current freshwater-saltwater separation at the Krammer lock (navigation locks) will be modified, as it needs to be modernised. In the part of the Southwest Delta where water supply from the main water system is not possible, the region will aim for a more economical and efficient use of freshwater and a greater coping capacity. The area serves as an experimental pilot area for an economy that has to adjust to situations in which water shortages and salinisation will be more frequent.
- *IJsselmeer region (northern Netherlands, Noord-Holland and Flevoland*[36]: the strategic function of the IJsselmeer region as a freshwater reservoir will be reinforced by working towards a permanently available extra layer of water of 20 cm for freshwater supplies. A number of mitigating measures will be implemented to this end, Moreover, for dyke improvement purposes, the construction of shore faces will be considered with a view to further increasing the buffer. This will be done in conjunction with measures in the regional water system and among users. A study is being conducted to ascertain whether it is possible to scale up the pilot projects in the regional water system in the area of buffering by means of water level management and to run them in all areas in the IJsselmeer region.
- *Area around the major rivers:* In the area around the major rivers, a study will be conducted into the supply of water from the Waal to the Meuse, focusing on use and necessity, various versions (such as Maas-Waalkanaal canal and Heerewaarden), side effects and cost-effectiveness. In addition, the central government will roll out a study of the stretches in the Waal and IJssel that are suitable for the construction of longitudinal groynes parallel to the river flow. In the area around the major rivers, the aim is to optimise the water supply from the main water system to the regional water systems and, at the same time, to increase the coping capacity and apply innovations to use freshwater sparingly.

Agenda for decision-making on programming the next cabinet period

Based on regional proposals, concrete measures have been placed on the agenda for the 2022-2028 period (↗ table 13). This concerns the second wave of measures, for which the government contribution may come from the policy budget in the Delta Fund. The next cabinet may decide on this. This list of measures has also been compiled on the basis of a national investment agenda (measures in the main water system), regional implementation programmes of the freshwater regions and (a number of) implementation programmes of user functions. The measures are primarily a follow-up step to the measures from the first period (2015-2021). For example, measures have been placed on the agenda for this period for a possible further increase in the KWA+ (from 15 to for 24 m^3/s) in the western Netherlands. In the Elevated sandy soils, the focus is on phase 2 of adaptation of the water system. The Southwest Delta aims to further enhance the robustness of the regional system, with the help of such programmes as the Kreken Vision. In the area around the major rivers, the focus on innovations will continue. The IJsselmeer region will continue to work on flexible water level management in conjunction with measures in the regional system.

36 This concerns the following parts of the IJsselmeer region: the IJsselmeer, Markermeer and Zuidelijke Randmeren lakes.

Agenda for programming after 2028

For the medium term (2028-2050) and long term (2050-2100), measures that should be taken in the adaptation paths for the preferential strategy have been placed on the agenda (↗ section 3). An adaptive approach is the starting point here: the actual implementation of these measures and the time of implementation depend on the climatological and socio-economic developments. The goal is to always be prepared for the future and to gradually take the required measures.

Ongoing projects

A number of ongoing projects also contribute to sustainable freshwater supplies. The costs of most projects have already been covered. These projects are as follows:

Western Netherlands: Decision on management of Haringvliet sluices (water-quality project with freshwater investments)

If a small number of the Haringvliet sluices are left ajar during high water, migratory fish will be able to reach the catchment areas of the Rhine and Meuse. This is part of the Kierbesluit. The western part of the Haringvliet will become saltwater as a consequence. The intake points of the Hollandse Delta water board located there will have to be moved to the east to ensure that the use of freshwater from the Haringvliet does not change. At times of a low Rhine discharge (lower than 1,500 m^3/s at Lobith), the sluices will be closed during high water and the freshwater content of the Haringvliet will increase. The province of Zuid-Holland will construct part of the new freshwater route at Voorne-Putten in the Beningerwaard nature development project. The freshwater supply to the agricultural area will double here, creating a robust situation. For Goeree-Overflakkee, the water board will create a canal and Evides will lay a separate pipeline. Here, supply and discharge will also be separated, which is a more robust and efficient solution in terms of freshwater and ecology. The water supply will be brought to the same level as at Voorne-Putten.

Elevated sandy soils: agreements on increasing the capacity of the Noordervaart

Within the various area-based processes in De Peel, preservation of the freshwater supply, to both nature and the agricultural industry, is paramount. The Noordervaart canal plays an important role in this regard. The objective is to improve the water supply from the Noordervaart to the hinterland. On the one hand, this requires a satisfactory water supply from the Meuse, via the canals in Limburg and Brabant, and, on the other, an increase in the discharge capacity of the Noordervaart from 4.3 to 5.4 m^3/s. At present, the (technical and financial) approach and agreements are being elaborated.

Elevated sandy soils: preservation of current water supply from Twentekanalen, including renovation of the Eefde pumping station

The implementation agenda of the Oost-Nederland Freshwater Supply Project (abbreviated as ZON in Dutch) provides that the freshwater supply, as currently regulated in the Water Agreement on Twentekanalen canals and Overijsselsche Vecht, should be preserved for the future. As the agreed water supply volumes through the Twentekanalen can no longer be guaranteed with the outdated Eefde pumping station, renovation of this pumping station is imperative. The Eefde pumping station renovation project has already commenced. It will be awarded in September 2014 and implementation will start in the spring of 2015 (completion in 2016). When this renovation is complete, the water supply from the IJssel to the eastern Netherlands will have been safeguarded, as laid down in the water agreement. Moreover, the capacity of the renovated pumping station will offer room for the limited increase in the water supply from the region that is envisaged until 2050. Accordingly, this part of the freshwater supplies is future-proof.

Rivers: pilot project with longitudinal groynes constructed parallel to the river flow at the Waal

In 2012, it was decided to run a pilot project with longitudinal groynes constructed parallel to the river flow at the Waal. The pilot project is designed to provide more insight into the influence on the sedimentation and stabilisation of the river bed. The ultimate goal is to minimise maintenance dredging and to halt soil river bed erosion in the Waal. The construction of longitudinal groynes parallel to the river flow is part of Room for the River.

Southwest Delta: freshwater-saltwater separation at the Krammer locks (yacht lock pilot project)

An innovative freshwater-saltwater separation system is being tested in the northernmost yacht lock of the Krammer locks. The objective is to ensure effective freshwater-saltwater separation between the Volkerak-Zoommeer lake and the Oosterschelde. Based on the results of this pilot project, a decision will be taken in the autumn of 2014 on

the introduction of the new freshwater-saltwater separation system in the entire Krammer locks complex.

International: freshwater-saltwater separation at Terneuzen

The 'Grote Zeesluis' project will be in the plan elaboration phase until 2015. As a result of the larger volume of the new sea lock to be built, the canal may become more salinised, the effects of which are being investigated. Various technical options are being considered to minimise the exchange of salt between the lock chamber and the canal.

Table 13 Freshwater Investment Programme (put on the agenda for this cabinet period and the next one)

Region	Agenda for programming for this cabinet period 2015-2021			
	Measure	Financial arrangement (mln €)		
		Total	Region	Delta Fund
Elevated sandy soils	Water system adaptation phase 1 (including increase in supply from Noordervaart)	250-290*	193	60
	Climate pilot project: more efficient and smarter irrigation	0.4	0.3	0.1
Western Netherlands	Measures regarding regional water system	27.5	27.5	0
	Adjust supply (KWA phase 1)	40	0	40
	Adjust Irene lock (for the purposes of KWA phase 1)	3	0	3
	Optimise Bernisse (intake at Spijkenisse)	2	0.5	1.5
	Climate pilot project: Feasibility study of effluent post-treatment (Delft Blue Water)	tbd	tbd	0.5
Southwest Delta	Measures regarding regional water system	70	70	0
	Krammer locks (management and maintenance)	17.5	0	B&O
	Roode Vaart discharge to West-Brabant and Zeeland	25	15	10**
	Climate pilot project: Southwest Delta experimental pilot area for areas with no supply	3	1.5	1.5
IJsselmeer Region	Making 20 cm buffer available phase 1	18	0	18
	Shore faces first phase	2.5	0	2.5
	Elevated sandy soils Noord	2.7	1.7	1
	Start of effective and economical water consumption, including **Climate pilot project:** Spaarwater phase 2	2.6	2.1	0.5
Rivers	Study of Maas-Waalkanaal/Longitudinal groynes constructed parallel to the river flow	0.25	0	0.25
	Start of measures in area around the major rivers	1.5	1	0.5
	Climate pilot project: Sustainable use of shallow groundwater	0.6	0.4	0.2
Study (nationwide)	Supply level & Smart water management (e.g. including IJsselmeer region 2 million, Western Netherlands 1 million, Southwest Delta 1 million, Rivers 0.1 million, Elevated sandy soils 0.7 million)	6	0	6
Total	Measures for 2015-2021	Approx 470-510	Approx 315	Approx 145
Total cumulative		Approx. 470- 510	Approx 315	Approx 145
Innovation	**Climate pilot projects and Water and Climate Innovation Programme**			2.8

N.B. The total costs associated with turning the Volkerak-Zoommeer lake into a saltwater lake again are €180 million, €59 million of which is for compensatory freshwater measures, which are not included in the table.

N.B. For the IJsselmeer lake, the measures in the second phase are linked to those in the first phase, which is why the total budget has been stated for phase 1.

N.B. A number measures are still being studied and cannot be budgeted at this time. This means that the amount of approximately €105 million should be regarded as a provisional estimate.

* The ambition is €290 million; based on a regional bid, financing up to €253 million has been projected in this phase.

** Depending on regional contribution.

Table 13 *Freshwater Investment Programme (put on the agenda for this cabinet period and the next one) (continued)*

Agenda for programming in the next cabinet period

Measure	Estimated costs (mln €)		
	Total	DF demand	1st DF estimate
Water system adaptation phase 2	473	158	60
Adjust supply (KWA phase 2)	30-60	30-60	10
Making regional system more robust, e.g.			20
- Roode Vaart discharge to West-Brabant and Zeeland	25	12.5	
- Kreken Vision for West-Brabant	20	10	
- Relocating intake points at Oostflakkee	8.8	6.8	
- Alternative freshwater supply to Reigersbergsche Polder	1.5	1.1	
Pilot project with experimental pilot area for areas without supply	3	1.5	1.5
Making 20 cm buffer available phase 2	See phase 1	See phase 1	
Shore faces second phase	10	10	10
Measures regarding regional water system	18	4	
Measures for Elevated sandy soils Noord	4.6	2.3	
Encouraging users: pilot projects/innovation	1.6	0.8	
Measures in regional system, e.g.			
- Measures in area around the major rivers	5	2.5	2.5
Supply level, smart water management	3	3	3
Measures for 2022-2028	Approx. 605-635	Approx. 240-270	Approx. 105
	Approx. 1.1 billion	Approx. 400	Approx. 250

5 The Delta Fund: the financial basis of the Delta Programme

Zwolle, Westenholte, June 2014 *As part of Room for the River, the dyke will be relocated and secondary channels dug in the flood plains of the IJssel to give the IJssel enough room. The new homes for those currently living in the flood plains will be built on knolls, which will later form part of the new dyke.*

A robust and safe delta requires continual investment. The Delta Fund is the essential financial basis for this investment. It is a solid foundation, with an average annual budget of €1 billion until the end of 2028. The financial investment in the Delta Fund for the period after that is yet to be arranged. The Delta Programme Commissioner assumes that this investment will continue, given the tasking outlined in this DP2015, which will ensure that the protection against floods can be maintained at a satisfactory level and freshwater supplies made more robust.

5.1 Introduction: analysis by Delta Programme Commissioner

This DP2015 is an appendix to the 2015 Delta Fund budget. This section outlines the connection between the Delta Fund and the Delta Programme by comparing the available resources with the expected (financial scope of the) tasking of the Delta Programme. As such, the Delta Programme Commissioner provides insight into the financial guarantee of the Delta Programme for the fourth year in a row.

At the request of the Dutch House of Representatives, ↗ DP2012 included a detailed analysis and a recommendation from the Delta Programme Commissioner on "safeguarding the long-term financing of the Delta Programme". The financial resources that were then available in the Delta Fund were mapped out and compared with the expected flood risk management and freshwater tasking. It was concluded that the cost of ongoing implementation programmes was covered and that at least during that cabinet period (through 2015[37]) sufficient financial resources were available for flood risk management, partly pursuant to the arrangements laid down in the Administrative Agreement on Water. The Delta Programme Commissioner did not, however, rule out an additional financial tasking for the state budget in the somewhat longer term, given the extensive flood risk management tasking following the conclusion of the ongoing implementation programmes HWBP-2, Room for the River and Meuse Projects (largely completed by 2017; ↗ section 4), and even beyond the current Delta Fund horizon of 2028. This conclusion was drawn again in the years thereafter, in ↗ DP2013 and ↗ DP2014. Now that the proposals for Delta Decisions and preferential strategies are clear, it is obvious that investment in the Delta Fund should continue in order to be able to take the required measures in good time and to be able to meet the new standards for the flood defence systems in 2050 (in accordance with the objective outlined in the 2009 National Water Plan). This section explains this conclusion in more detail.

Economic importance

A dynamic implementation of the Delta Programme is important for various reasons. It ensures that people, both individuals and groups, receive the required protection. A dynamic implementation also has a significant economic impact. One of the factors to be considered in the implementation of the Delta Programme is that a safe country

37 The expected final year of the then cabinet period.

5.2
The current status of the Delta Fund

with plenty of freshwater attracts a sizeable number of businesses. As evident from the 'Social cost-benefit analysis of 21st century flood risk management', targeted investment in flood risk management is economically profitable and good for our national economy (↗ sub-section 2.2). Moreover, the leading 'Top Sector Water' ensures that investment in the Delta Programme will mostly benefit Dutch companies, with a limited amount ending up in other countries. At the same time, this investment incentivises the Dutch water sector to demonstrate to the world its innovative strength and, based on its strong home private parties, to conquer the world and make money. .

The Delta Fund comprises financial resources to finance investment in flood risk management, freshwater, water quality and the associated management and maintenance. This analysis only addresses water quality to the extent that there is a connection with the tasking of the Delta Programme (flood risk management and freshwater supplies). ↗ Section 4 – Delta Plan on Flood Risk Management and Delta Plan on Freshwater – provides an overview of all Delta Programme studies and measures plus the associated budget.

The Delta Fund budget is split over seven budget articles:
- article 1: Investing in flood risk management;
- article 2: investing in freshwater supplies;
- article 3: management, maintenance and replacement;
- article 4: experimenting in accordance with section III of the Delta Act (the integrality article of the Delta Fund);
- article 5: network-related costs and other expenses;
- article 6: contributions from other central government budgets;
- article 7: water quality.

Just like the Infrastructure Fund, the Delta Fund (DF) has a financial lifecycle that runs through 2028. For the 2015-2028 period, more than €16 billion is available, which means the annual budget is on average over €1 billion (↗ table 14). The table shows that at present there is €935.2 million remaining in investment scope through 2028, divided into €660.2 million in programme scope and €274.9 million in policy scope. ↗ Figure 15 presents the budgets of the Delta Fund article by article for the years 2015-2028, distinguishing clearly between the programme and policy scope and the budget for the Flood Protection Programme (excluding the project-related share of 10% that is borne by the water boards and does not form part of the Delta Fund).

The development of the Delta Fund (DF) budgets has been accurately described in recent years in the consecutive Delta Programme reports. In the ↗ DF/DP2014, the remaining investment scope still amounted to close to €1.1 billion. In accordance with the coalition agreement, this amount was divided into €0.8 billion of programme scope for this cabinet and €0.3 billion of policy scope for the next cabinet. The policy scope has of course been left intact, but under the influence of the 2014 price adjustment deduction in particular, the programme scope has shrunk to a mere €0.7 billion. The programme scope has largely been detailed in the 2015 draft budget. Part of the programme scope is

available for providing meaningful follow-up to the proposals for Delta Decisions and preferential strategies. The minister has decided to provisionally earmark €150 million for freshwater and €200 million for the extra costs of river widening. The €150 million for freshwater is available for the first wave of measures included in the Delta Plan on Freshwater. The amount earmarked is more than enough to be able to provide the central government's contribution to the first wave of freshwater measures (2015-2020), as outlined in the ↗ Delta Plan on Freshwater in section 4. The provisional reservation of €200 million for the extra costs of river widening are available for new river-widening measures that make a major contribution to safety and offer opportunities to create synergy at a regional level, with, for example, spatial-economic ambitions, nature and recreation and with measures that are co-financed. More information about the potential new river-widening measures is provided in ↗ sub-section 3.4 and ↗ section 4. On a previous occasion, resources were already reserved for 'increasing the sand replenishment volume for the coast' and the Delta Fund includes research resources for flood risk management, spatial adaptation and freshwater, which have been programmed in DF/DP2015 (for an overview and description, ↗ section 4).

In the Delta Fund budget 2015 and the Delta Programme 2015 respectively, over €30 million worth of new measures, follow-up studies and elaboration of tools in the areas of flood risk management, spatial adaptation and freshwater (and any preparation of the above) have been programmed. This amount comes from the available research resources. The existing reservation for sand only had to be drawn on for the extra monitoring and research effort for sand (↗ section 4). The resources provisionally earmarked for river widening and freshwater will be further programmed in the coming years. The Dutch House of Representatives will be updated on this in DP2016 and subsequent reports.

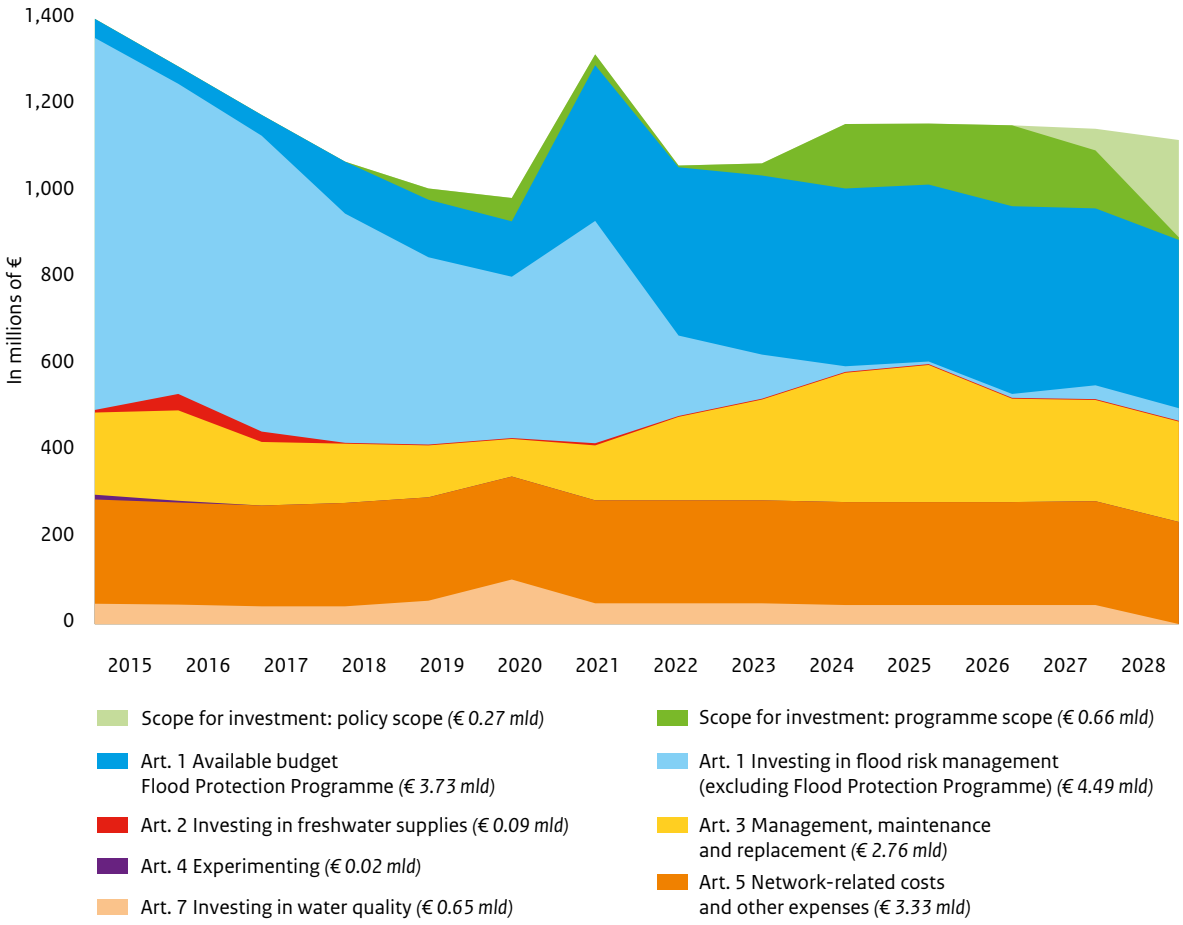
The largest part of the Delta Fund budget yet to be programmed is part of the series earmarked for the Flood Protection Programme. This amounts to a total of approx. €3.7 billion through 2028 and, including the so-called project-related 10% share of the water boards, to €4.1 billion. This budget is shown in ↗ Figure 15 under the header 'art. 1: budget available for the Flood Protection Programme'. The programming of the Flood Protection Programme for the 2015-2020 period is given in ↗ section 4.

Table 14 Delta Fund budgets in 2015 and total based on the 2015 Draft Budget *(in millions of €)*

	2015	Total (2015-2028)
Art. 1: investing in flood risk management	903.7	8,218.3
Art. 2: investing in freshwater supplies	6.2	91.6
Art. 3: management, maintenance and replacement	190.0	2,764.2
Art. 4: experimenting	11.5	15.0
Art. 5: network-related costs and other expenses (net)	241.3	3,331.1
Scope for investment: programme scope	-25.0	660.2*
Scope for investment: policy scope	0.0	274.9
Art. 6: contributions from other budgets of the central government	-	-
Art. 7: investing in water quality	46.8	649.0
Total	**1,375**	**16,004**

* The programme scope calculation has taken the 2014 programme deficit into account.

Figure 15 Budgets Delta Fund 2015-2028 based on Draft budget 2015



5.3
Resources from other partners

The Delta Programme works with effective, integrated solutions for the flood risk management and freshwater tasking of national importance. In accordance with the Water Act amended as per the Delta Act, the central government's resources in the Delta Fund are meant for flood risk management and freshwater tasking (including the legally required implementation costs) and the associated management and maintenance (and, since this budget, also for water quality). Financially speaking, however, the Delta Programme is broader than the Delta Fund. In comprehensive projects that serve more goals than just flood risk management and freshwater supplies, financial responsibility is usually shared by more partners of the Delta Programme. Even when flood risk management and freshwater solutions generate additional costs but also additional benefits, a contribution from other financial sources than the Delta Fund is expected.

Water boards

Pursuant to the Water Act, the central government and the water boards have the financial responsibility to pay for improving the primary flood defence systems. In the period 2014-2017, the water boards expect to invest an average of €1.3 billion every year, of which 34% will go to flood risk management (approx. €0.45 billion).[38] A substantial part of this is made up of the so-called water boards' contribution to the flood risk management measures for improving the primary flood defence systems, as agreed in the Administrative Agreement on Water. This contribution amounts to €131 million in 2014 and €181 million a year from 2015 onwards (plus, in principle, annual indexation).

Additional agreements between the central government and water boards on the incorporation of new standards

In the Administrative Agreement on Water, the funding of the revised flood risk management policy had been left open, because the financial consequences of the new standard specifications were not yet known at the time. It has since become clear that the new flood risk management policy not only offers more safety in the future, it is also more efficient as it allows more targeted investment in flood risk management. Carrying on with the current outdated system would entail a considerable increase in the costs associated with flood risk management in the coming period.

Within the framework of the Delta Decision on Flood Risk Management, the central government and the Unie van Waterschappen (Union of Water Boards) have reached agreements on the funding and incorporation of new standard specifications, in accordance with the plan from the Administrative Agreement on Water. The Dutch House of Representatives was updated on these agreements in the run-up to the General Meeting on Flood Risk Management held on 19 June 2014.[39]

The basic premise for these agreements is that all primary flood defence systems must meet the new standards by 2050, in accordance with the National Water Plan dating from 2009. The current cost allocation on the basis of the Administrative Agreement on Water (50% Central Government, 40% solidarity share of water boards, 10% project-related share of implementing water board) will also apply to the costs associated with meeting the new standard specifications. This underscores the joint responsibility of the central government and water boards for flood risk management. Until 2028, any resources that become available from the former Flood Protection Programme (HWBP-2) will be added to the budget for the new Flood Protection Programme, in accordance with the Administrative Agreement on Water. In this way, the investment level of the new Flood Protection Programme can be gradually increased. In the coming period, an analysis will be made of the risk reservations and the successes and failures in the HWBP-2. This is expected to lead to a change in scope between budget and estimate. Changes will be explained in HWBP-2 Progress Report 6. Moreover, it has been agreed that any savings on dyke improvements as a result of river widening or 'smart combinations' can be used for such measures. The contributions to the Flood Protection Programme from the central government and the water boards will not be increased until 2028.

As the approach to flood risk management will change fundamentally from 2017 onwards, there is a lot of uncertainty surrounding the estimates of the costs that have to be incurred. This uncertainty is partly related to the confrontation between the new standards and the existing tasking, which will change the picture of the safety shortage and prioritisation on the basis of cost-effectiveness. As such, it has been agreed that, based on the results of the National

38 This information comes from the publication 'The water board taxes in 2014. Why do the water boards charge tax and what do they do with it?', a publication by the Unie van Waterschappen.

39 Parliamentary document no. 33750 J, no. 20.

Assessment Report 4 (ready by 2023), the need for any additional agreements will be ascertained.

Provinces, municipal councils and social organisations

Flood risk management
The Delta Programme already includes a number of good examples of comprehensive projects to which various government authorities make a financial contribution, each from its own sector and with its own responsibility. For instance, area developments such as Ooijen-Wanssum, IJsseldelta-Zuid and WaalWeelde (↗ sub-section 4.2) enjoy substantial financial support from the provinces of Limburg, Overijssel and Gelderland, respectively. These contributions from provinces did not really pertain to the safety aspects of the measures. The request for a contribution to river-widening measures is now at issue, however. Not only do these measures entail additional benefits, they also entail substantial additional costs. Moreover, contributing jointly to measures is in line with the trend of co-financing that has been set for flood risk management with the Administrative Agreement on Water. As outlined above, since 2011 the improvement measures of primary flood defence systems managed by water boards have no longer been funded by the central government alone; 50% is paid by the water boards.

The added value for spatial quality and nature, for example, forms the basis for agreements on the co-financing of the river-widening measures by provinces, municipal councils and any other partners. Agreements on co-financing will be made in the run-up to the actual programming of projects and will determine in part the feasibility of the plans.

A prime, recent example of a comprehensive project in which several parties contributed to the desired flood risk management solution is the sand-related improvement of the Prins Hendrikdijk on Texel. Instead of a less expensive traditional dyke improvement covered by the budget for HWBP-2, which would have required compensation for the negative impact on either agriculture and buildings or nature, a sand-related improvement of the Prins Hendrikdijk with a positive impact on nature and no negative impact on agriculture and buildings is now being carried out. This improvement is possible thanks to contributions from the Hollands Noorderkwartier higher water board, the province of Noord-Holland, the municipal council of Texel and the Wadden Fund for both the construction and the management and maintenance (↗ sub-section 4.2).

Social organisations can also contribute financially to the measures they want. For instance, Natuurmonumenten has helped pay for the improvement of the Oesterdam in Zeeland, together with the central government and the province of Zeeland. The dam was reinforced with sand in 2012, which also helps fight the sand demand in this part of the Oosterschelde. Promoting safety and nature go hand in hand here.

Freshwater
The responsibility for measures to improve freshwater supplies is mostly shared by the central government, the region and users. As such, the Freshwater Investment Programme, as outlined in the Delta Plan on Freshwater (↗ sub-section 4.3), contains clear agreements on contributions from both the central government (Delta Fund) and the region. In terms of freshwater supplies, the modification to the Roode Vaart canal in West-Brabant is a prime, recent example of a joint financial effort made by the central government and the region.

5.4 The financial tasking of the Delta Programme

Flood risk management
This year, the Delta Programme is presenting a system change for flood risk management (↗ section 2, Delta Decision on Flood Risk Management). The proper protection of the Netherlands will require several billion euros in investment over the next few decades. By dealing with the varied flood risk management tasking in conjunction with and based on the flood-risk-based approach can, however, ensure that more efficient and effective work is done than is presently the case. More information on this is provided in ↗ section 2.

Freshwater supplies
Freshwater tasking is not as extensive as flood risk management tasking. Whereas flood risk management involves billions of euros, the amount involved in freshwater supplies is in the order of millions of euros. However, for economic development, investing in freshwater supplies is of much greater importance: approximately 16% of the Dutch economy depends on the easy availability of freshwater in the Netherlands. In the coming decades, freshwater supplies can be made more robust with investments in a number of targeted measures (↗ sub-section 4.3, Delta Plan on Freshwater).

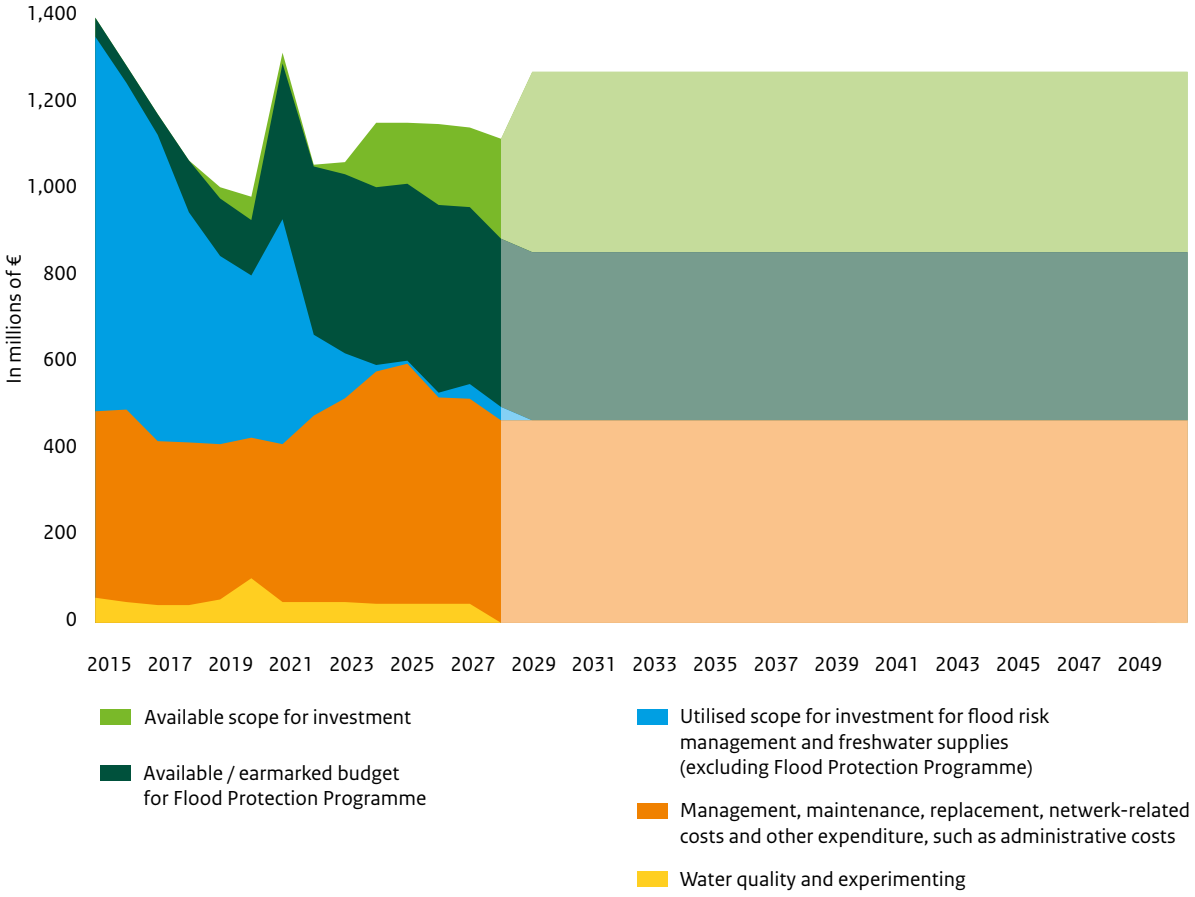
Financial picture of Delta Programme tasking until 2050
↗ Table 15 provides an estimate of the total tasking of the Delta Programme through 2050. At this stage, the estimate can only be an initial indication of the costs at a very high level of abstraction. The amounts presented each have a significant bandwidth and are presented as nominal amounts.

According to the current cost estimates, meeting the new standards by 2050 will probably cost €15 billion. On completion of the Fourth Assessment in 2023, it will be possible to make a more accurate estimate, allowing for any cost-saving innovative solutions for piping (↗ sub-section 5.3). This cost estimate is only based on dyke improvement measures. As the preferential strategy for the area around the major rivers is aimed at a close relationship between dyke improvement measures and river-widening solutions and extra costs are associated with river-widening measures, this has been taken into account in the cost estimate. The extra costs associated with the Rhine distributaries (Waal-Merwedes, Nederrijn-Lek and IJssel) and the Meuse amount to €1.3 billion and €2.2 billion respectively. At this stage, a 70% reliability interval applies to both estimates. Moreover, these estimates have not yet allowed for the savings resulting from

Table 15 Delta Programme tasking until 2050

Financial picture of Delta Programme tasking until 2050 (in billion €)	
Flood Protection Programme including new standard specifications	approx. € 15
Extra costs of Rhine river widening	approx. € 1.3
Extra costs of Meuse river widening	approx. € 2.2
Sand	approx. € 0.6 - 1
Freshwater	approx. € 0.8 - 1
Reservation for other projects, growth in surface area, risks	tbd
Total needed	**approx. € 20 + tbd**

Figure 16 Budgets Delta Fund 2015-2050



linkage opportunities and the so-called 'creating work from work'. The €0.6-€1 billion cost estimate for sand pertains to the extra costs that have to be incurred for sand replenishments until 2050 on top of the current average annual sand replenishment volume of 12 million m^3. The future sand replenishment volume is linked to the actual rise in sea levels, which explains the bandwidth in particular. The estimate for the central government's contribution required for freshwater supplies of €0.8 billion until 2050 is explained in more detail in the Delta Plan on Freshwater (↗ subsection 4.3). A more detailed explanation of the cost estimates is provided in the ↗ synthesis documents in Dutch, which include the substantiation of the Delta Decisions and preferential strategies (↗ background document B (in Dutch)).

Tasking and ambitions versus the resources

At present, almost €0.7 billion worth of programme scope is available from the Delta Fund for new investments in the Delta Programme through 2028. Furthermore, through 2028, there is €3.7 billion in investment budget set aside for the new Flood Protection Programme (including the resources for the 2015-2020 Flood Protection projects programmed in this DP2015, plus the project-related share). There are no resources available from the Delta Fund for the period after 2028. It is clear that with the resources currently available, the tasking outlined above will not have been implemented by then. That is not essential either: the objective in the National Water Plan is that all primary flood defence systems meet the new flood risk management standards by 2050.

Given this objective, the Delta Programme Commissioner included a graph of the Delta Fund in ↗ DP2012, in which the budgets were extrapolated until 2050 on his own authority. Based on the 2015 draft budget, the Delta Programme Commissioner updated this graph (↗ figure 16).

The extrapolation is based on the year 2028. In the extrapolation, the Delta Programme Commissioner also took into account the €1.2 billion cash shift from the 2021-2028 period to the 2014-2020 period effected in 2011 as part of the Administrative Agreement on Water. He also assumed that the earmarked series for the new flood risk management measures would continue after 2028 (the dark green area in the graph). The extrapolation shows that of the approx. €1.25 billion annual sum in the Delta Fund for the 2029-2050 period, close to €0.5 billion is needed every year for management, maintenance and replacement (art. 3) and network-related and other expenses (art. 5). In terms of investment budget, approximately € 0.8 billion a year is available in the 2029-2050 period (art. 1 and 2, including the monies available and set aside for new flood risk management measures at the water boards) . The investment budget that will become available in the 2029-2050 period would then amount to €17.5 billion. As such, approximately €22 billion would become available in the Delta Fund for flood risk management and freshwater supply tasking of national importance from now until 2050 – that is, taking into account the budget for the Flood Protection Programme and the investment scope through 2028.

Based on this, the Delta Programme Commissioner has drawn the conclusion that, provided that the Delta Fund is continued after 2028, the tasking and available resources still appear to be in balance, at least according to the extrapolation shown. The importance of co-financing has been described in the ↗ previous sub-section. As such, it should be possible to achieve the flood risk management and freshwater objectives by 2050: flood risk management on the basis of new standard specifications and robust freshwater supplies. As previously stated by the Delta Programme Commissioner, the question of whether this is an acceptable period is a political one.

6 Delta Programme organisation and approach

Katwijk, June 2014 *For the small town of Katwijk, a dyke has been built in a dune to reinforce the weak spot in the coastal defence. A new underground car park is being built between the dyke and the town. At a later stage, the dyke and the car park will form part of a new, wider dune.*

6.1
Inform, consult and participate

The proposed Delta Decisions and preferential strategies are the result of pooling the knowledge and expertise of many parties. This approach has led to close involvement in the tasking, at all levels of government and in social organisations and the business community. It is precisely this interaction between region and central government, between research and policy and between the various sectors that gives the Delta Programme extraordinary added value. Essential in this regard are the role of the Delta Programme Commissioner, who connects all the parties; the Delta Act, which ensures continuity; and the Delta Fund, which serves as the basis for the flood risk management and freshwater supply tasking. These will continue to be characteristics of the Delta Programme in the follow-up phase. This approach has enjoyed considerable global attention.

A safe delta with enough freshwater requires the support and commitment of all levels of government, the business community and a wide range of social parties. All these parties have contributed to the proposals for Delta Decisions and preferential strategies from the outset. This has resulted in innovative and cost-efficient proposals for measures that are sound in terms of content and are supported by a large part of the population. ↗ Sub-section 6.2 will outline the role of the private parties in the Delta Programme in more detail.

Joint fact-finding

Since 2010, the central government, provinces, municipal councils and water boards, with active input from social organisations and the business community, have worked on the proposed Delta Decisions and preferential strategies, under the leadership of the Delta Programme Commissioner. Using joint fact-finding, the parties have identified the tasking for flood risk management and freshwater supplies, focusing on the horizon years 2050 and 2100 (↗ DP2012). This process gave all parties involved the opportunity to contribute, share and examine relevant facts. Subsequently, the parties first explored the range of solution strategies broadly and went on to narrow it down further and further: from possible strategies (↗ DP2013) to draft Delta Decisions and promising strategies (↗ DP2014). Less cost-effective solutions were abandoned with proper reasoning. This year, the transition has been made to preferential strategies and a proposal for new frameworks, standards and choices in the form of Delta Decisions (DP2015).

The Teisman and Van Buuren study demonstrated that the approach taken and the close involvement are widely appreciated (↗ sub-section 6.4).

Administrators

Administrators of provinces, water boards and municipal councils and representatives of the central government take part in regional steering groups of the Delta Programme. In the schedule for DP2015, the Delta Programme has given administrators opportunities – as it did for ↗ DP2014 – to update and consult fellow administrators in the Provincial Council, general boards of water boards and municipal councils about the proposals in the Delta Programme. The first round of consultations demonstrated that the approach is generally supported. The water boards have subjected the standard specifications to an initial assessment and they support the new flood risk management policy. The process followed gives the constituency confidence for the future. The

regional steering groups discussed the questions and points for consideration from the first round of consultations. Based thereon, the Delta Programme provided additional information in the second round of consultations, on such things as the status of the proposals for standard specifications. The regional steering groups used the points for consideration to fine-tune their regional final recommendations. The responses during the second round of consultations generally confirm the previous impression of support for the path taken. Some parties do have some specific concerns however. Another recurring aspect during the second round of consultations is that the parties want to be involved in the follow-up process of the Delta Programme, particularly the elaboration of the protection levels for flood risk management and the supply levels for freshwater. There is also a need for a shared approach to communication for the future.

Municipal ambassadors helped administrators and civil servants from the municipal councils contribute to the area-based elaboration of the Delta Programme and the consultations.

Effective flood risk management also calls for effective disaster management during a flood (the third layer of multi-layer flood risk management). The Ministry of Security and Justice is responsible for the systems for disaster management; the Ministry of Infrastructure and the Environment is responsible for directing the crisis organisations within the water column, employing main infrastructure and countering environmental consequences. Security regions, water boards and Rijkswaterstaat are jointly responsible for disaster management in the event of a flood and for the required planning. The latter is done under the direction of the Flood Management Steering Group, chaired by the director-general of Rijkswaterstaat. The new flood risk management policy, which is based on multi-layer flood risk management, has increased the involvement of the security regions. The Delta Programme Commissioner and the security regions can discuss progress in the Veiligheidsberaad.

Social parties

At a national level, social parties made recommendations on the Delta Programme in the Infrastructure and Environment Consultation Committee (abbreviated to OIM in Dutch). Previously, the OIM had drawn attention to linkage with other ambitions, room for experiments and connecting the short and long terms. In the OIM's opinion, these topics have been given a proper place in the proposals. Other important points of the recommendation are the position of drinking water, the importance of social quality and the role of social parties after DP2015. The Delta Programme Commissioner responded to the recommendation on behalf of the Delta Programme Steering Group. The full recommendation and the response are included in ↗ background document G (in Dutch).

At a regional level, each sub-programme involved the social parties in its own way, as appropriate to the regional context. For instance:

- In the Rhine Estuary-Drechtsteden sub-programme, social organisations, together with the business community and knowledge institutes, actively contributed to the process up to and including the preferential strategy, through the efforts of the Social Advisory Group for four years and contributions on the annual day for the sub-programme ('the day of the preferential strategy' in 2014). In early 2014, the Social Advisory Group issued the recommendation to consider spatial developments in relation to water tasking, using customised work in each area.
- The New Urban Development and Restructuring sub-programme spawned four coalitions of government authorities, companies and residents: in the areas of urban water; public space and green areas; construction; and urban development. These coalitions published the Climate-Proof City Manifesto. Various organisations contributed at a local level to experimental pilot areas for research by design, which has prompted the move towards climate-proof and water-robust cities.
- For the Coastal sub-programme, the social parties of the OIM advised on the Decision on Sand. They also recommended focusing research and monitoring on the effects of sand replenishments on the dynamics in dunes and the interactions between shore face, beach, outer dunes and rear dunes. Social organisations have also contributed to the elaboration of the coastal community accounted in the National Coastal Vision.
- As an advisory council/reflection group for social organisations, the Regional Consultative Body for the IJsselmeer Region (abbreviated to ROIJ in Dutch) subjected the proposed Delta Decision and preferential strategy for the IJsselmeer region to a critical and constructive review. In the consultative body, various parties made recommendations on the implementation of flexible water level management, paying attention to

the control of water level management, the parties that should be involved in that, the timing of that involvement and the monitoring and evaluation of flexible water level management. In addition, the ROIJ has indicated that it would also like to be involved in the implementation phase of the Delta Programme.

- In the Wadden Region sub-programme, social organisations were invited once or twice a year to discuss the progress of the Delta Programme. The Delta Programme was also addressed during meetings on port developments in Delfzijl and Lauwersoog and during meetings on the gas infrastructure and in the Management Consultation Groups on the Wadden Islands. The social organisations drew attention to the consequences of soil subsidence and earthquakes for flood risk management. They also indicated that having a proper understanding of the Wadden system remains essential.
- During the consultation on the preferential strategy, the social parties in the Southwest Delta drew special attention to the connection with the ecological and economic issues in the short term.
- In the Rivers sub-programme, social organisations were involved through the Rivers reflection group, the regional processes organised by the provinces and the annual Rivers Days, allowing them to contribute to the preferential strategy, the standardisation and the input for the Delta Decisions. The social organisations drew attention to spatial quality, both in connection with spatial measures and measures affecting dykes, by seizing linkage opportunities. They also drew attention to a clear explanation of the new standards and the effects of the measures during low water.

Framework for Second Delta Plan and Senseless Salinisation

Various types of strategies and measures are conceivable for the water tasking of the Dutch Delta. In recent years, the Delta Programme has received a variety of proposals from interested citizens and experts. One example of this is the comprehensive vision on future water management in the Netherlands from Adviesgroep Borm and Huijgens, as formulated in 'Raamwerk Tweede Deltaplan' [Framework for Second Delta Plan] and 'Zinloos verzilten' [Senseless Salinisation]. This vision consists of proposals to complete the coastline shortening (with a storm surge barrier Westerschelde), protect the coastline permanently with floating breakwaters (which are also capable of generating energy), strong dykes along the Waal and flood gates to protect the Rhine Estuary-Drechtsteden, peak storage in the Southwest Delta in case of circumstances where the discharge of rivers is blocked by closed storm surge barriers, sea locks in the Nieuwe Waterweg to prevent salinisation of the western Netherlands and measures to restore the connection between sea and rivers by extending the estuaries and the flow of the IJsselmeer.

The Delta Programme Commissioner has had these proposals assessed with regard to cost-effectiveness, side effects, technical feasibility and adaptivity. This assessment has shown that the proposed measures require substantial investments in the short term, without these being necessary. The benefits do not outweigh the costs, which is not in line with the adaptive approach of the Delta Programme. More specifically, closing the Westerschelde for safety reasons is not necessary. Moreover, this measure also requires measures guaranteeing shipping to Antwerp. Flood gates are expensive, their operation technically complex and they create backwater/ raised flood levels upstream. Local dyke improvement in the form of delta dykes is more effective. Furthermore, in many locations, excess height and forelands outside the dykes reduce the water tasking considerably. There is no need to counter salinisation of the western Netherlands with sea locks in the Nieuwe Waterweg. It is more cost-effective to increase the eastern freshwater supply to Gouda (KWA+), which also produces fewer side effects for shipping. The technical and financial feasibility of the floating breakwaters has been submitted to the Top Sector Water.

6.2
Quality, knowledge, private parties and innovation

Public, young people and delta community

Citizens can remain abreast of developments in the Delta Programme by going to ↗ www.deltacommissaris.nl or reading the annual Delta Programme and the Deltanieuws newsletter. In the autumn of 2014, citizens can respond to the draft for the interim revision of the National Water Plan, in which the central government's policy arising from the proposed Delta Decisions is embedded. Citizens may also express their points of view when the government authorities embed the policy from proposed Delta Decisions and preferential strategies in their plans. The Deltaviewer gives everyone the opportunity to discover how the Netherlands has dealt with water issues over the centuries. This game has already been at various museums and visitor centres and can now also be found on the internet (↗ www.deltaviewer.nl).

In recent years, special attention has been paid to young people, especially because the Delta Programme is also about flood risk management and freshwater supplies for future generations. The Youth Water Board has advised the Delta Programme Commissioner on the Deltaviewer, the use of social media and the manner in which water can feature more in Geography lessons.

Since 2010, the entire delta community has met every year at the Dutch Delta Congress. Administrators, companies, social organisations, knowledge institutes and citizens attend the congresses to learn about the progress of the Delta Programme and the latest ideas, to enter into discussions with one another, and to provide input. With around 1,900 visitors, the 2013 Dutch Delta Congress (once again) attracted considerable interest.

In the coming period, it will be important to explain the new approach to flood risk management and freshwater properly to the community. All Delta Programme partners will contribute from their own fields of responsibility.

An essential aspect of the Delta Programme approach is the deployment of all available knowledge and expertise, the development of new knowledge and the encouragement of innovations. Government authorities, social organisations, knowledge institutes and private parties contribute to this. The large number of parties involved and the contributions from the various sub-programmes to the proposals for decisions and strategies place special demands in terms of safeguarding consistency and quality.

Set of Delta tools and Delta scenarios

The set of Delta tools comprises all models and methods employed in the Delta Programme to substantiate proposals for decisions, strategies and measures. All sub-programmes use this set of tools, to ensure that mutual consistency is safeguarded.

The Delta model, one element of the set of Delta tools, forms the core of the water management analyses. The Delta model has been used in recent years to determine how substantial measures from the preferential strategies for Rhine and the Meuse contribute to reducing the water tasking (also outside the sub-region in question). In the next phase of the Delta Programme, the development of the Delta model will be continued to also make it suitable for use in plan elaborations for flood risk management and freshwater measures. Another element of the set of Delta tools is the Comparison System, a method for describing strategies in an unequivocal manner and comparing them according to a fixed set of criteria. Last year, version 3.0 of the Comparison System was applied, which involved an assessment of the practicability of the strategies. Version 3.0 is consistent with the manner in which the Delta Decisions and preferential strategies are described in the Environmental Impact Statement for the interim revision of the National Water Plan.

The Delta Programme looks ahead to a future that is still uncertain in many respects. That uncertainty has been rendered manageable by using several plausible pictures of the future in the form of Delta Scenarios. The preferential strategies and the proposals for Delta Decisions in DP2015 are based on the revised 2012 Delta Scenarios. In 2013 and 2014, the IPCC issued reports with the latest insights into the nature, the magnitude and the consequences of climate change. These reports confirm the assumptions underlying the Delta Scenarios. The KNMI (Royal Netherlands Meteorological Institute) has incorporated the latest IPCC

insights into the 2014 KNMI climate scenarios (May 2014). These scenarios are very similar to the 2006 KNMI climate scenarios, which form the basis for the Delta Scenarios. The maximum rise in sea levels will increase slightly (2050: maximum was 35 cm and will be 40 cm; 2100: was 85 cm – adjusted for a similar definition as for 2014, this is 95 cm – and will be 100 cm); the minimum rise in sea levels remains the same. According to the latest insights, the expected summer drought will be somewhat less severe, which is due in part to the fact that the freshwater supply from the Rhine catchment area decreases to a lesser extent than previously expected.
All in all, the changes in figures compared to the 2006 KNMI scenarios are marginal. The expected trends in warming, rise in sea levels and precipitation are now based on a more solid substantiation. The changes in the new KNMI scenarios are so marginal that they have not led to revisions of the Delta Scenarios and the proposals for Delta Decisions and preferential strategies. The Delta Scenarios still have the same bandwidth of the plausible future changes. Moreover, the preferential strategies are adaptive in nature and resistant to slower and faster climate change than in the Delta Scenarios. Based on knowledge and measurements, the implementation of measures, such as sand replenishments and dyke improvements, can be slowed down or accelerated and can also be adjusted to scope and design.

The Delta Scenarios also reflect the soil subsidence, specified for each area. On average, this is 10 cm per century, with peaks of up to 60 cm in the Flevopolder and Groningen. The new standard specifications for the flood defence systems take the expected degree of soil subsidence into account. The effect of soil subsidence on the freshwater bottlenecks has been calculated using the Delta Scenarios; the effect of the corresponding measures is shown in terms of quality. Soil subsidence has been incorporated into the problem analysis in a qualitative manner for spatial adaptation.

The preferential strategies have been subjected to a robustness assessment on the basis of the relevant worst-case events that are beyond the scope of the Delta Scenarios. These events specifically include a rise in sea levels by more than 85 cm in 2100 and river discharges of more than 18,000 m³/s in the Rhine and 4,600 m³/s in the Meuse. The robustness assessment shows that the Delta Decisions on the Rhine-Meuse delta and on the IJsselmeer Region, the Decision on Sand and the adaptive preferential strategies are satisfactory even in the case of these worst-case events (see Robustness Assessment box).

Robustness Assessment

The proposed Delta Decisions and preferential strategies are based on the four delta scenarios and the corresponding bandwidth of the future climatological and socio-economic circumstances. These circumstances can, however, turn out differently from what is forecast in the Delta Scenarios. The adaptive nature of the strategies makes it possible to act accordingly by accelerating or slowing down the implementation of measures. The magnitude of the annual replenishments along the coast and the increase in pump capacity in the IJsselmeer Closure Dam can be adjusted to the measured rise in sea levels, for example. Short-term measures for freshwater supplies consist of flexible management and limited measures in the regional systems and among users. Thorough monitoring enables us to identify in good time whether the implementation should be accelerated or slowed down. Large-scale interventions in the main water system do not take place until they are inevitable. Flood risk management in the area around the major rivers can be made and kept effective with a combination of dyke improvement and river widening. By already reserving space, these measures can later be supplemented with dyke realignments, bypasses and retention, if required. In this region, the work rate cannot be based on monitoring, by 'keeping a finger on the pulse'. Signs of climate change are hard to detect in the area around the major rivers due to the great natural variation in river discharge. This may lead to measures being implemented too late, also because dyke improvement projects take a long time to prepare. As such, the strategies developed for the area around the major rivers assume 'fixed values' for the peak discharges of the Rhine at Lobith (17,000 m³/s in 2050 and 18,000 m³/s in 2100) and the Meuse at Eijsden (4,200 m³/s in 2050 and 4,600 m³/s in 2100).

Economic analysis

Proper economic substantiation is essential for the Delta Programme. Although it is not mandatory in a MIRT Study, the sub-programmes of the Delta Programme have used various economic assessment tools, especially to properly substantiate the costs of potential measures. Analyses have

produced essential economic information that can be used in decision-making on the proposals for Delta Decisions and preferential strategies. The Delta Programme's Expertise-centrum Kosten en Baten assisted the sub-programmes in drawing up cost-effectiveness analyses (CEAs) and cost-benefit analyses (CBAs).[40] The independent Klankbordgroep Economische Analyse [Economic Analysis Reflection Group], comprising various professors and staff of the CPB Netherlands Bureau for Economic Policy and the PBL Netherlands Environmental Assessment Agency, provided reflections on the economic analyses.

Discount rate

The social cost-benefit analysis (SCBA) is a tool that is frequently used to support decision-making. In late 2013, a new guide for SCBAs became available, which the Minister for Finance presented to the Dutch House of Representatives.[41] The tool also provokes discussion, however, because of the way in which it incorporates long-term effects. In the Netherlands, an annual discount rate of 5.5% is normally applied; it consists of a 2.5% risk-free discount rate and a 3% risk load.[42] With this discount rate, the costs and benefits occurring after a few decades barely count, whereas it is particularly the long-term effects that play a major role in the Delta Programme. To illustrate this: if a project generates a €100 benefit in 100 years' time and this amount is discounted at 5.5%, the present net cash value of that €100 over 100 years will amount to a mere €0.47. At a discount rate of 4%, the cash value will still amount to no more than €1.98. Significant differences occur particularly if much lower discount rates are applied. In certain climate studies, for example, the discount rate is 1%: in that case, the cash value of that €100 over 100 years will be €37 today, which is 79 times more than with the standard discount rate of 5.5%.

If the benefits occur much later in time than the costs, the discount rate largely determines the outcome of the analyses. As such, the Delta Programme Commissioner has asked the CPB to study whether the long-term effects could be weighted in a better way and/or differently in the CEAs and the SCBAs. That research has resulted in a CPB memo.[43] On behalf of the Cabinet, the Minister for Finance has also announced additional research into the discount rate in the letter on the new SCBA guide to the Dutch House of Representatives. The Cabinet has decided to form a Discount Rate Working Group that is required to issue "specific advice" in 2015 "on the discount rate for policy proposals whose benefits and risks will only become apparent in the distant future if policy is not changed and whose effects will be irreversible". Based on that, the Cabinet will decide whether or not to change the current discount rate. The CPB memo that has been drawn up at the behest of the Delta Programme Commissioner will be presented to the working group, accompanied by a reflection from the Economic Analysis Reflection Group of the Delta Programme, allowing the working group and the Cabinet to take advantage of the insights.

The discount rate impacts the present Delta Programme in various ways:

- General: The discount rate is particularly relevant to the question of whether or not investments in a certain project are useful and necessary. The discount rate may decide the question of whether a project is assessed as being profitable or unprofitable. In drawing up the preferential strategies, the question was not so much which measures are useful and necessary as how many measures are necessary and when. The answer to this question depends less on the discount rate: a lower discount rate ensures that investments will be made sooner and in larger amounts than if the discount rate is high.
- Flood risk management standards: Special attention should be paid to the effect that the discount rate has on the standard specifications. The basic version of the Safety sub-programme assumes a discount rate of 5.5%. The susceptibility analysis of 2011 Flood Risk Management in the 21st Century (abbreviated as WV21 in Dutch) shows that the economically optimal protection level becomes approximately 25% higher at a discount rate of 4% and about 25% lower at a discount rate of 7%. This distinction largely disappears in the classification of standard specifications into standard classes (↗ sub-section 2.2).

40 The Expertisecentrum Kosten en Baten Deltaprogramma (ECK-B) is a joint venture of economists and cost experts of Rijkswaterstaat, Deltares, LEI, DLG and PBL.

41 CPB and PBL (2013), General Guideline for Social Cost-Benefit Analysis. Parliamentary document 33750 IX, no. 9.

42 In principle, the risk load should be determined for each specific project. The actual amount depends in part on the degree to the which the projectresult is correlated to economic growth. If specific project effects mitigate negative external effects (such as climate change), a case can be made for a lower risk load. In fact, such a project can be regarded as insurance against irreversible, unwanted external developments. In practice, the risk load is halved for these types of effects, in accordance with the advice from the Long-Term Discount Rate Working Group (Werkgroep Lange Termijn Discontovoet) (2009).

43 Memo has been finalised but has yet to published.

Key points from the CPB concerning discount rate and the long term

The discussion on the right discount rate is not merely a technical and theoretical one. The discount rate establishes a relationship between the current value and future value of the costs and benefits of an investment. As such, ethical and political considerations also play a role in the choice of discount rate: what valuation do we assign to future generations in choices that we have to make now? With a view to these questions, the United Kingdom and France apply a discount rate that decreases over time, which is also recommended by the Organisation for Economic Co-operation and Development (OECD) (see DP2014 for more information on the discount rate that decreases over time in these countries).

The CPB analysis does not lead to a definitive recommendation for dealing with the discount rate in the face of uncertain futures. However, two main directions become apparent, both of which can be substantiated theoretically:

1. Maintaining a constant discount rate. This is primarily based on interest rates and risk loads on capital private parties, with a limited downward adjustment for irreversible external effects to reflect long-term risks. This adjustment can be revised if required.
2. A discount rate that decreases the longer the period is. This option also assumes capital market interest rates for periods spanning a few decades, but a downward adjustment is made for the longer term. The adjustment may be based on the uncertainty in long-term developments, irreversible effects, the unlikelihood of very significant effects or on the ethical premise that the prosperity of future generations should be considered to be just as important as our current interests.

In the case of either option, empiricism is partly lacking; in option 1, this problem is limited to irreversible external effects. Option 2 takes uncertainty about the future into account in the discount rate and may also reflect sustainability considerations.

Flexibility

In the Delta Programme, adaptive delta management is the basic principle. Typical features of this approach are that interventions are not necessarily dimensioned on the basis of the worst-case scenario and that no fixed final picture is assumed for 2100 (↗ sub-section 6.4 and previous Delta Programme reports). The major uncertainties connected directly to future developments and the desire for responsible financial investment have led to a flexible and realistic approach.[44]

At the request of Rijkswaterstaat and the Delta Programme Commissioner, the CPB therefore ascertained in what way the value of flexibility can be weighted in investment decisions in the face of uncertain futures. To this end, the CPB homed in on the use of the Real Options Analysis Approach (ROA) for major maintenance and (replacement) investments in bridges, storm surge barriers, locks and pumping stations.[45]

A characteristic feature of the realistic-option approach is that differences in the degree of flexibility are taken into account and that an attempt is made to value this as accurately as possible. There are two components to the benefits of flexibility: The minimisation of costs if circumstances, knowledge and preferences change, and the generation of additional benefits by being able to respond flexibly to these changes. The discussion on the practicability of the ROA in the Delta Programme focused amongst others on the question of whether a distribution of probability for future scenarios is possible and permissible. This probablility distribution yields a weight, after which the value of specific options can be determined using the 'probability-times-consequence approach'. This conflicts somewhat with the manner in which the scenarios are used within the Delta Programme, i.e. to lay out the playing field for plausible futures. It has been expressly decided to not assign any distribution of probability to the scenarios.
According to the CPB study, it would be wise to consider flexibility in a more practical manner prior to conducting extensive research into the distribution of probability of scenarios: by means of a thorough problem analysis, by

44 Stratelligence, van Rhee (2012), Handreiking Adaptief Deltamanagement [Guideline for Adaptive Delta Management].

45 CPB background document, F. Bos and P. Zwaneveld, 2014, Reële opties en de waarde van flexibiliteit bij investeringen in natte infrastructuur; lessen op basis van de vervangingsopgaven rondom het Volkerak-Zoommeer en de Grevelingen *[Realistic options and value of flexibility when investing in hydraulic infrastructure; lessons based on replacement tasking around the Volkerak-Zoommeer and Greveling lakes]*.

dividing investment issues into small chunks each with their own consideration (investment paths) and, especially, substantiating the first step well and seeking out no-regret options. In a number of cases, this already provides sufficient insight. According to the CPB, an indicative valuation of options is often equally valuable for the decision-making process as substantiation based on extensive research into the distribution of probability.

Quality assurance and archiving

The scientific substantiation of the proposed Delta Decisions and preferential strategies has been given special attention. A panel of forty independent experts that has reviewed the substantiation under the auspices of the Knowledge for Climate programme has concluded that the Delta Decisions and preferential strategies have been presented and substantiated in a clear manner. The reviewers do not refer to any need to look for fundamentally different solutions. This means that the Delta Decisions can generally count on support in scientific circles (background document C for the results of the review and the Delta Programme Commissioner's response (in Dutch)). In the synthesis documents, the sub-programmes have described on the basis of what studies, methods and assumptions they have arrived at their proposals (background document B (in Dutch)). The panel focused particularly on the substantiation of the proposals and the traceability and the scientific quality of the underlying studies. The panel also evaluated the manner of dealing with uncertainties. The knowledge issues identified have been included in the Knowledge Agenda DP 2015 (background document A (in Dutch)) and form the building blocks for the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater to the extent that they are eligible for financing from the Delta Fund (sub-sections 4.2 and 4.3). In addition to this, a number of sub-programmes have organised the quality assurance for their own sub programme. The Rhine Estuary-Drechtsteden sub-programme, for example, has formed a reflection group to look at content.

In the follow-up phase, the Delta Programme will continue to build on the results thus far. As such, proper archiving is necessary. The most relevant calculations, reports and maps, which are referred to in the synthesis documents (in Dutch), are kept in three systems: at the Nationaal Modellen en Data Centrum (NMDC: National Models and Data Centre) at the KNMI (calculations), at the National Archives of the Netherlands (reports) and at the Delta Portal (maps).

Knowledge development

A great deal of new knowledge has been developed for the inception of proposals for Delta Decisions and preferential strategies, linking up wherever possible with ongoing knowledge programmes and studies, such as Knowledge for Climate and Deltaproof (STOWA). A knowledge conference is organised every year for the purpose of establishing this link. The 2014 knowledge conference was held on 23 June and was organised together with Deltares and NLingenieurs. The emphasis was on the knowledge and the innovations that are necessary and available for the implementation of the Delta Decisions and preferential strategies. The results have been incorporated into the Knowledge Agenda DP2015. In the follow-up phase of the Delta Programme, knowledge development will also be important for the further elaboration, preparation and implementation of the measures from the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater, plus the management and maintenance of these measures. The Knowledge Agenda DP2015 comprises practice-oriented innovations, strategic studies and fundamental studies that are required for this. This agenda continues to build on the Knowledge Agenda described in DP2013. The additional knowledge issues are based on the synthesis documents of the sub-programmes (in Dutch), meetings with government authorities, knowledge institutes and the business community about freshwater and flood risk management and the knowledge conference held on 23 June 2014.

Parts of the Knowledge Agenda DP2015 that have been elaborated by one specific party have been assigned to the party in question. The Delta Plan on Flood Risk Management and the Delta Plan on Freshwater comprise the elements that are funded from the Delta Fund in whole or in part. Elements that are relevant for various parties have been assigned to the new Water and Climate Knowledge and Innovation Programme. The participants in this programme are the Ministry of Infrastructure and the Environment (DG for Space and Water and Rijkswaterstaat), STOWA, NWO, KNMI, Deltares, Alterra, TNO, the PBL Netherlands Environmental Assessment Agency, the Top Sector Water and staff of the Delta Programme Commissioner. Representatives of these parties jointly form the Supervisory Committee. At the request of these parties, the Delta Programme Commissioner has been appointed chairman of the Supervisory Committee and the new research programme. These parties will play a key role in the

continuation of the Delta Programme. They harmonise their programmes for knowledge development and innovation in the area of water, space and climate change and also align them with the knowledge and innovation issues of the Delta Programme. At the start in late 2014, the entire programme will have a budget of €10 million, but it may grow if other parties join or if it is combined with EU programmes. The involvement of the business community, particularly in practice-oriented innovations, increases the opportunities to export the knowledge and expertise acquired.

The Water and Climate Knowledge and Innovation Programme focuses primarily on:

- linking pilot tests, strategic research and fundamental research (in this way, the 'Sand Engine' pilot test may also generate new fundamental knowledge);
- involving end users, from the formulation of the question, via the research, to the practical implementation of the knowledge acquired;
- creating synergy between the research programmes of the participating parties in the areas of content, phasing and financing.

Private parties and innovation

The Cabinet remains fully committed to encouraging innovations in the water sector, via the Top Sector Water. Innovative solutions are of crucial importance for the Delta Programme to be able to make the tasking for flood risk management and freshwater supplies more efficient, less expensive and more attractive. The Teisman and Van Buuren study (↗ sub-section 6.4) demonstrates that in recent years the Delta Programme has yielded mostly innovations in the method of collaboration and the administrative processes. The Delta Programme has encouraged these innovations through close collaboration between the central government and the region. The private parties's involvement was still limited at this stage. The Vereniging van Waterbouwers (hydraulic engineering organisation) participated in the innovation project Kansen en de Markt (Opportunities and the private sector) in Rhine Estuary-Drechtsteden. As the Delta Decisions are taking shape, the business community can take advantage by developing concrete, technical innovations. The Water and Climate Knowledge and Innovation Programme – and through that programme the Top Sector Water as well – plays a key role in the development of innovative solutions. The Netherlands can distinguish itself internationally and create opportunities for the business community with innovations.

Innovations in the area of flood risk management may pertain to building with nature (such as the 'Sand Engine', the Green Dollard Dyke, the Prins Hendrik Dyke, the Oesterdam and Sophiastrand safety buffer), multifunctional solutions (such as the multifunctional combination dyke at the Scheveningen promenade), innovative dyke improvements (such as the use of geotextiles to prevent piping in dykes) and 'smart dykes' (ICT applications for monitoring dyke stability in Livedijk XL and IJkdijk). For freshwater, innovations may consist of multifunctional solutions (e.g. climate buffers), innovative freshwater measures (e.g. storage of freshwater in the soil) and 'smart water management' (e.g. ICT applications in water management to be able to act on any excess or shortage of water in a smart manner, such as Watersense). There are also innovations conceivable in disaster management, such as the use of apps for prompt alerts in the case of emergency situations and evacuations, and 3D simulations to facilitate decision-making in case of a disaster (3D Water Management). The use of technical innovations often also requires innovative contracts, with proper agreements on the division of risks between government and private parties. Rijkswaterstaat wants to apply innovative contracts in the implementation of the new Flood Protection Programme. The water boards are committed to innovation-oriented purchasing (↗ sub-section 4.2).

In the spring of 2014, the Ministry of Infrastructure and the Environment, Rijkswaterstaat and the Unie van Waterschappen published the brochure 'Waterinnovaties in Nederland' (Water Innovations in the Netherlands).[46] This brochure provides an overview of innovative projects in the areas of flood risk management, availability of freshwater, water quality and climate-proof cities. The projects are the result of new forms of collaboration between the government, private parties and knowledge institutes in the top sectors.

46 ↗ http://www.rijksoverheid.nl/documenten-en-publicaties/brochures/2014/03/20/waterinnovaties-in-nederland.html

Innovations for flood risk management and freshwater

Innovations in the area of safety

1. Remote monitoring of dyke stability
   Identifying the instability of a dyke at an early stage is of crucial importance to safety and efficient maintenance. Using new technologies based on digital information, dyke stability can be monitored remotely (with Live Dijk XL and IJkdijk, for example). Digital monitoring of dykes may yield substantial cost savings.

2. Vertical anti-piping filters
   Piping is an erosion mechanism that may undermine a dyke and cause it to collapse. Geotextiles have been used in hydraulic engineering for quite some time, but their use in relation to piping is new. This method of countering piping can help save space.

3. Innovations in dyke cladding
   In the Deltares Delta Flume, experts test the strength and wave-inhibiting effect of the various types of stones that are used for dyke cladding. The more the stones inhibit the waves, the lower the dyke can be to meet the statutory standards. The tests are expected to lead to cost savings in dyke improvements and to benefits for the environment and surroundings.

4. 3D simulations for decision-making in cases of disasters
   The new 3D Water Management software is geared to very fast and accurate water calculations and realistic three-dimensional visualisations and calculation results. It should be possible to use this innovation on a large scale in operational management, disasters, water system analyses and drawing up spatial plans.

5. Flood-alert app
   Dordrecht wants to increase the coping capacity in the face of an imminent flood. Given the high flood risk, a flood disaster drill is held with all residents every year. To increase the coping capacity, a warning system has been set up that notifies the residents at an early stage. The residents receive notifications via an app based on new information technology and social media.

Innovations in the area of freshwater

1. Spaarwater
   The Spaarwater project focuses on measures to use freshwater more efficiently, increase the freshwater buffer, improve hydrology (freshwater lenses) and increase the water-storage capacity of the soil.

2. Improving crops to make them more salt tolerant
   Improving freshwater crops to make them more tolerant to saltier water conditions. This research is already being done by companies. There are opportunities to improve the tests with soil analysis, focusing on the salt dynamics during the growth season.

3. More efficient and smarter irrigation
   Moisture deficiencies in the soil and the water deficiencies of the crops can be monitored using field and satellite observations. This information can be used to apply irrigation more efficiently, especially for grasslands and arable farming. This measure may save water as well as costs.

4. Pilot project with reuse of effluent
   This pilot project involves the sustainable production of pure water by using the water from the wastewater purification plant.

5. Sustainable use of shallow groundwater
   Shallow groundwater may be used in a sustainable and responsible manner. During periods with excessive precipitation, buffers may be created in the subsoil, which can be used during dry periods. The results of this research may form the basis for an adjustment to the shallow groundwater extraction policy.

6.3
International collaboration

Flood risk management is one of today's greater social, political and economic challenges worldwide. This is one of the conclusions of the World Economic Forum's report 'Global Risks 2013'. In many countries, the Delta Programme approach, which explicitly takes the long-term tasking and uncertainties into account, is regarded as state of the art in the areas of climate adaptation, flood risk management and freshwater supplies. International interest in the 'Dutch Delta Approach' is evident from many international missions to the Netherlands and requests for collaboration.

International collaboration

The Netherlands uses the international appeal of the Delta Programme by intensifying collaboration with other Delta countries, providing advice and seizing opportunities for the Dutch business community and Dutch knowledge institutes. In recent years, there have been major floods in many places in the world. As such, sharing Dutch knowledge and expertise is an urgent matter. The Ministry of Infrastructure and the Environment and the Ministry of Foreign Affairs are updating the international water policy and incorporating the method used by the Delta Programme into the Dutch Delta Approach. Together with the Dutch water sector, the ministries have formed the Dutch Risk Reduction Team. At the request of foreign government authorities, this team can make Dutch knowledge and expertise available in the areas of pluvial flooding, drought and pollution, and provide support in reconstruction and prevention.

After both hurricane Katrina and hurricane Sandy, the Netherlands and the United States started collaborating closely, something which has also benefited the Dutch business community. After the recent floods in the United Kingdom (2014), the Dutch business community provided assistance with pumps and dredging.

In the Water Mondiaal [Global Water] programme of Partners for Water, the Netherlands collaborates closely with the delta countries Vietnam, Bangladesh, Indonesia, Egypt and Mozambique. In late 2013, the Netherlands presented a Delta Plan for the Mekong to the Vietnamese government. The collaboration is currently being expanded with the World Bank and other international parties. The Netherlands is also preparing a Delta Plan for the Red River (Vietnam) and Bangladesh. Under a Memorandum of Understanding (MoU), the Netherlands is elaborating a national strategy for comprehensive water management for Myanmar (formerly known as Burma). For Colombia, which was devastated by floods in 2011, the Netherlands is working on warning systems and solutions based on natural processes (building with nature).

In March 2015, the third UN World Conference on Disaster Risk Reduction (DRR) will be held in Japan. In recent years, the Netherlands had made an impression in this field with the Delta Programme approach: a preventive rather than a reactive approach and multi-layer flood risk management. In early 2014, an international review team of the UN Climate Treaty visited the Netherlands. The team expressed its great appreciation of the approach used by the Delta Programme and recommended making the experiences available to the international community.

International catchment area committees

The Netherlands is coordinating the management of the major border-crossing rivers Rhine, Meuse, Schelde and Eems with other countries in the catchment area by way of the international catchment area committees, which also consult on the European Directive on the assessment and management of flood risks . The Wadden Sea is also a subject of international consultation. The results and the adaptive approach of the Delta Programme form the Netherlands' input for these consultations. Conversely, the Delta Programme incorporates the agreements reached by these committees into the preferential strategies for the Dutch sub-regions.

In a statement issued in October 2013, the Rhine ministers emphasised the importance of climate adaptation. They consider investments in high-water retention and paying more attention to low-water events essential. The International Commission for the Protection of the Rhine (ICPR) will draw up low-discharge plans, for which the Netherlands will provide the results of the Delta Programme. The Action Plan for High Water in the Rhine (Actieplan Hoogwater Rijn) presents four objectives for 2020. It has become clear that not all objectives will be attained and that the implementation of measures will take longer. The ICPR is coordinating the formulation of international objectives and measures for limiting flood risks in the catchment area of the Rhine, under the European Directive on the assessment and management of flood risks (henceforth referred to as EU Floods Directive or EFD, see below). The measures from the Action Plan for High Water in the Rhine and the implementation of measures will be presented in the

successive flood risk management plans of the European Floods Directive.

In September 2013, the International Meuse Commission (IMC) completed the Interreg project AMICE on climate change in the international catchment area of the Meuse. In November 2013, the commission adopted a follow-up approach, highlighting the consequences of high and low discharge for the various designated uses and the potential adaptation strategies and measures. The partners in the Meuse Commission believe a follow-up to AMICE will be necessary to jointly determine the strategy for the long term, for example as part of LIFE, Interreg or Horizon 2020. The IMC is coordinating the formulation of international objectives and measures for the catchment area of the Meuse for the EU Floods Directive.

In the International Scheldt Commission (ISC), France, Belgium (with the three Walloon, Flemish and Brussels-Capital regions) and the Netherlands are coordinating the entire water policy at the level of the complete catchment area of the Schelde. Together with the Flemish-Dutch Scheldt Commission and the Permanent Committee of Supervision on Scheldt Navigation, the ISC also contributes to the bilateral Flemish-Dutch collaboration. The ISC coordinates the management of water quality and water quantity, with special observance of the Water Framework Directive and the EU Floods Directive. To safeguard the alignment between the two directives, the ISC is drawing up overall management plans. The common topics for the entire Scheldt catchment include drought, floods and climate change.

The International Steering Committee for the Eems coordinates the implementation of the EU Floods Directive between the Netherlands, Lower Saxony and North Rhine-Westphalia. The steering committee has prepared international flood hazard and flood risk maps for the catchment area of the Eems.

As part of the Trilateral Collaboration for the Protection of the Wadden Sea, the Netherlands, Denmark and the German states of Schleswig-Holstein and Lower Saxony have drawn up a strategy document for climate adaptation. The document was signed as part of a Ministerial Council Declaration during the 12th Trilateral Governmental Conference held in Denmark on 5 February 2014.

Bilateral cross-border collaboration

The Netherlands and North Rhine-Westphalia are working on flood risk management along the Rhine in the border area between the Netherlands and Germany through the existing collaboration (i.e. the German-Dutch High Water Working Group). Two cross-border dyke rings require a joint approach. In late 2014, the working group will organise a High Water Symposium in Rees about topics such as the use of the risk-based approach in these dyke rings and the Delta Programme.

In the Flemish-Dutch Scheldt Commission, the Flemish Region and the Netherlands are implementing the Schelde Treaties, aimed at a safe, accessible and natural Schelde estuary. In late 2013 the collaboration for the Schelde Estuary Policy and Management Treaty was evaluated and an Agenda for the Future was prepared. This agenda provides for a connection with the Dutch Delta Programme and Flemish Master Plan Flemish Bays. The evaluation report of the Flemish-Dutch collaboration was presented to parliament in March 2014.

In the Flemish-Dutch Bilateral Meuse Commission, the Netherlands and Flanders work together on flood risk management along the Grensmaas in the border area. This common part of the Meuse requires a shared vision and approach to the flood risk management tasking. Both the Netherlands and Flanders are carrying out work to improve the protection against floods and promote the development of nature.

European Union

The member states of the European Union are using directives to work on climate adaptation, limiting flood risks and ensuring healthy water. There is a considerable overlap between these directives and the Delta Programme. The Netherlands contributes the results and the adaptive approach of the Delta Programme. In this respect, the administrative initiative KlimaatActieve Stad (KAS - Climate-Active City) may present opportunities. With this initiative, the administrators of water boards and municipal councils seek to consider climate adaptation and mitigation concordantly, with water as the connecting element.

With the European strategy for adaptation to climate change, the European member states seek to step up the implementation of adaptation measures in Europe. In addition, EU policy promotes adaptation in the important vulnerable sectors. The digital platform Climate-ADAPT helps to reinforce the knowledge basis and to bridge the knowledge gap. Member states are expected to have an all-encompassing National Adaptation

Strategy (NAS) by 2017 at the latest. The Netherlands has set itself the target to have a NAS by 2016. This NAS will address not only the water-related approach of the Delta Programme, but also other climate-susceptible developments, such as developments in health, in transport, power and ICT grids, and in agriculture, horticulture and the fishing industry.

The European Directive on the assessment and management of flood risks requires member states to include targets and measures for limiting flood risks in flood risk management plans. These are revised every six years, if necessary, with special attention paid to the probable effects of climate change on the probability of floods. This is an important legal tool for member states to align targets and measures in the catchment area. An important principle is that member states do not take measures that increase the probability of floods in other countries (do not pass the bucket). The EFD also promotes the multi-layer flood risk management approach of the Delta Programme. In late 2014, the Netherlands will present the management plans for public participation, including the new developments arising from the Delta Decisions. The management plans for the EFD and Water Framework Directive (see below) may be combined in the future.

The Water Framework Directive is designed to improve the water quality and ecosystems. The Netherlands' 2010-2015 catchment area man-agement plans include concrete targets and measures for this period. The updated plans will be presented for public participation in late 2014; they will come into effect one year later.

OECD

In early 2014, the OECD reported on the future-proofness of Dutch water management. The Ministry of Infrastructure and the Environment sent the report, accompanied by a policy response, to the Dutch House of Representatives. The OECD supports the approach of the Delta Programme via multilevel governance and endorses the need to involve decentralised organisations in water policy and to enhance the alignment between ministries. The Delta Programme Commissioner has incorporated the recommendations in the advice on the follow-up organisation of the Delta Programme (↗ sub-section 6.4). The Dutch partners will contribute the approach of the Delta Programme to the OECD Water Governance Initiative. This is a global network in which all stakeholders exchange innovations, learning experiences and examples from the field of water management. As such, the Delta Programme will receive international attention.

In the coming years, the Delta Programme will focus less on preparing framework-creating decisions and more on their elaboration, the continued development of the adaptive approach and the implementation of measures in the regions. This will also require a high-quality programme-based approach of the Delta Programme after 2014, as this will allow the Delta Decisions to be elaborated and implemented in a smart manner.

The Delta Programme Commissioner has based his proposal for the follow-up process on the advice from Teisman and Van Buuren, the OECD report on water governance, the advice from the Advisory Committee on Water to the Minister for Infrastructure, and the pictures that the national and regional steering groups have drawn of the collaboration in the next phase of the Delta Programme.[47] The close collaboration between the central government and the region, which is appreciated widely, will be continued.

Advice from Teisman and Van Buuren and the Advisory Committee on Water

The Delta Programme Commissioner asked Teisman and Van Buuren to evaluate the organisation of the Delta Programme and make recommendations for the organisation after 2014, addressing two questions: What is the added value of the current organisation of the Delta Programme and which approach supports a smart, high-quality implementation of the Delta Decisions? For their report, Teisman and Van Buuren held in-depth interviews with the administrators and staff of government authorities, social organisations and companies involved in the Delta Programme. In addition, a survey was conducted among the participants of the Delta Congress.

The parties involved believe that the approach of the Delta Programme has great added value. The national approach with an area-based interpretation for each region gives all

47 Advice from Teisman and Van Buren: Teisman G.R. and Buuren A. van, 2014. Samen verder werken aan de Delta, de governance van het Nationaal Deltaprogramma na 2014 [Continuing to work together on the Delta, the governance of the National Delta Programme after 2014]. Erasmus University Rotterdam,
↗ http://www.deltacommissaris.nl/nieuws/Governance_Deltaprogramma_na_2014.aspx
↗ OECD report: OECD, 2014. Water Governance in the Netherlands: Fit for the Future? OECD Studies on Water, OECD Publishing,
↗ Advice from the Advisory Committee on Water: Advisory Committee on Water, 2014. Advice on governance of Delta Programme. Advice from Advisory Committee on Water-2014/110077, 3 June 2014

government authorities significant powers. All links, from local to national governance, are directly involved. This collaboration is effective. The programme-based approach also contributes to this. The parties involved also see great added value in the concept of 'adaptive delta management', which renders the uncertain tasking for the long term manageable. The interaction with social groups and the business community generates creativity and support. The parties also greatly appreciate the role of the Delta Programme Commissioner as a figurehead and guardian of standards.

Subsequently, the Minister for Infrastructure and the Environment asked the Advisory Committee to issue advice on the governance of the Delta Programme after the Delta Decisions. The advice is generally consistent with the evaluation and recommendations by Teisman and Van Buuren. The Advisory Committee found that the organisational form that the Cabinet has selected for the major tasking in the Dutch Delta has worked well in the past period. Important parts of the organisational form are a national Delta Programme, a Delta Fund and a Delta Programme Commissioner. In the opinion of the Advisory Committee on Water, the Government Commissioner is a special figure who has more than proven his worth. In the next phase, there is still a lot of work to do for the further elaboration, implementation and execution. The Advisory Committee on Water considers it important that collaboration in the national programme continues and sees yet further added value in the Delta Programme Commissioner for the coming period. The Advisory Committee identifies the following roles for the Delta Programme Commissioner: monitoring progress, facilitating the process where necessary and taking action by clearly identifying bottlenecks and holding parties to account.

The Advisory Committee on Water advises the minister to have the effectiveness of the current institutional framework evaluated in 2016, paying attention to the effect of the Delta Fund and Delta Act and the figure of the Delta Programme Commissioner, and to decide on that basis what the best set-up will be for the organisation in the period after 2017. This advice is in line with the evaluation that is required by law: the Delta Act came into full effect on 1 January 2012 and the Cabinet must send a report on the effectiveness of the Delta Act to parliament before 1 January 2017.

Follow-up organisation

Adaptive implementation requires an ongoing search for new, more efficient and more effective combinations of tasking and ambitions, to achieve the same goals for area development, flood risk management, freshwater supplies and nature with less money. This calls for close coordination between the implementation programmes in the realms of water and space ('combined programming'). When selecting measures, it is also necessary to take the expected circumstances in the long term explicitly into account ('future-oriented dimensioning'). Essential activities for this are monitoring, developing knowledge systematically and keeping an overview of decisions, developments, uncertainties and assumptions ('targeted monitoring').

New insights into climate change, the behaviour of water systems and the effect of interventions will lead to periodical adjustments to policy, implementation programmes and the design of measures ('periodical adjusting'). The organisational set-up and working method in the next phase of the Delta Programme should provide room for such a 'learning system': *structure follows strategy.*

Design criteria

Based on the recommendations from Teisman and Van Buuren and the Advisory Committee on Water and the pictures drawn by the partners, the key design criteria for the organisational set-up and working method in the next phase of the Delta Programme are:

- retaining the importance and added value of a national programme, through close collaboration between the central government and the region on the basis of shared goals;
- connecting space and water and realising linkage opportunities, for example by means of adaptation strategies (local, regional and national);
- programming adaptive measures, bearing the long term in mind;
- establishing a connection with existing inter-governmental consultation bodies;
- establishing a connection with existing and new implementation organisations for flood risk management and freshwater supply;
- a continuous exchange between implementation, policy development and monitoring.

These design criteria safeguard a proper performance of the statutory tasks of the Delta Programme Commissioner: developing annual proposals for concrete measures and provisions for flood risk management and freshwater supplies, in detail for the first six years and with a look ahead at the next twelve years. The criteria are also consistent with the recommendations from the OECD concerning multilevel governance (↗ sub-section 6.3).

Administrative associations

After 2014, a national approach will continue to be essential, with room for regional interpretation and the involvement of all parties. Shared responsibility and shared ownership by central government, provinces, municipal councils and water boards form the basis for this approach. This is in keeping with the current division of responsibilities between these parties and with the Administrative Agreement on Water. The Delta Programme Steering Group will continue to be important for national administrative embedding and providing advice to the Delta Programme Commissioner. The National Water Consultation Committee for the Delta Programme can ultimately be linked to the Steering Group on Water, which discusses the progress of Administrative Agreement on Water. The regional administrative associations of these government authorities, too, will continue to be of great importance in the next phase to facilitate a discussion of the Delta tasking in conjunction with other area tasking. The intensity of the tasking and its elaboration will differ from region to region in the coming years and, as such, the deployment of administrative resources may also differ for each region. For this reason, each area will choose an appropriate (intergovernmental) association, in which the government authorities involved also organise the professional and substantive support. The provinces may take the lead in this, in consultation with the water boards and in close collaboration with the municipal councils and the central government. It is important that administrators from the spatial realm also take part in the intergovernmental associations. Early involvement of municipal councils is a point meriting attention; municipal ambassadors may play a role in this. The security regions will also be involved.

All areas have indicated that they will continue or set up an intergovernmental association. The Wadden Region and Coast expect a somewhat mitigated continuation of the existing administrative collaboration in a National Consultation Committee on the Coast. The parties in the Southwest Delta will continue the current regional steering group. The administrative association for the IJsselmeer region will adjust the regional demarcation of the supply area to be able to implement the Pact of the IJsselmeer Region effectively. The administrative consultation on the tasking in the area around the major rivers will take place for each distributary, supplemented by overall consultation for the Rhine distributaries. Rhine Estuary-Drechtsteden will organise the administrative platform on the same scale as in previous years. River-widening measures require consultation between Rhine Estuary-Drechtsteden and Rivers. The administrative associations safeguard the mutual consultation on transitional areas such as the IJssel-Vecht delta, Alblasserwaard and Krimpenerwaard and the Amsterdam region.

The 'line of command' between the area-based sub-programmes and the Ministry of Infrastructure and the Environment or the Ministry of Economic Affairs will disappear. The generic topics will be managed by the line organisation of the Ministry of Infrastructure and the Environment. Intergovernmental collaboration will continue to be essential in these programmes as well. For spatial adaptation and freshwater, the national steering groups will remain in place. The Steering Group on Freshwater will consult with users approximately twice a year.

The international administrative consultation on the Delta Programme will take place in the international catchment area committees and bilateral cross-border collaboration.

Implementation organisation

Implementation projects go through various phases, such as exploration, plan elaboration and realisation. Each phase requires organisational customised work, with form following content. Where necessary, an intermediate step is taken, by elaborating the preferential strategy with an in-depth MIRT Study that focuses primarily on the preparations for concrete MIRT explorations.

For flood risk management tasking resulting from the statutory assessment, a selection will be made – on the basis of preferential strategies and the urgency of the planned dyke improvements – of stretches where dyke improvements can be exchanged for wide-ranging, combined solutions such as river widening ('demarcation') and stretches of 'regular' dyke improvements with linkage opportunities. Both types of solutions are part of the Delta Plan on Flood Risk Management.

For stretches where river widening may take place and where there may also be an urgent need for dyke improvement, there should soon be clarity about the effect and the magnitude of the river widening, the safeguarding and financing, and the consequences for the dyke improvements to be carried out. When feasible preferred alternatives to spatial measures are not available in time, dyke improvement will be an appropriate solution.

Regular dyke improvements are prioritised and programmed in the Flood Protection Programme on the basis of the urgency in terms of safety. The water boards are mostly responsible for the implementation. The programme management of the Flood Protection Programme facilitates and boosts this process with knowledge and expertise and provides quality assurance. The draft programming of the planned dyke improvements is discussed annually in the regional intergovernmental associations (i.e. regional steering groups). The purpose of this is to identify linkage opportunities and to ascertain whether in the long term any opportunities will arise for new, wide-ranging, combined solutions that may replace regular dyke improvements. The water boards attend to the implementation in accordance with the MIRT system. This begins with a project exploration which pays explicit attention to the possibilities for linking in with the ambitions of other government authorities and parties. The Flood Protection Programme examines how the exploration phase can be used optimally for this purpose. The programming spans the next twelve years, giving administrators sufficient time to anticipate.

Provinces and municipal councils, as well as water boards and the central government, may lead wide-ranging, combined projects. The leading party may change during the various phases of a project (exploration, plan study, realisation). In many cases, teams with expertise from different government authorities will have to be formed. The expertise and experience gained in the Room for the River programme is of great importance in these projects. In virtually all cases, there is interconnectivity with dyke improvement. As such, it is efficient that the programme management of the Flood Protection Programme organises the input of the required knowledge and expertise plus quality assurance for these projects and encourages a wide-ranging approach. To be able to provide this support, the programme management of the Flood Protection Programme should be extended a little. The government authorities involved will conclude further agreements on this. Agreements on the financing of wide-ranging, combined projects will be reached on a project-by-project basis. Delta Fund resources have been earmarked to contribute to the additional costs of river widening. Moreover, resources saved on dyke improvement will become available for river widening where this is appropriate ('exchange'). Co-financing by provinces and any other partners will probably be necessary. The added value for spatial quality and nature, for example, forms the basis for co-financing of the additional costs by the responsible government authorities.

The selection ('demarcation') of stretches where wide-ranging, combined solutions are anticipated, such as river widening, and stretches of 'regular' dyke improvements with linkage opportunities takes place in the regional steering group of the central government, province, municipal councils and water boards in the area in question. This also helps to steer wide-ranging, combined projects where space and safety meet and to identify and seize opportunities to link in with regular dyke improvements. The steering based on the programming of the regular dyke improvements in the Flood Protection Programme takes place via the Flood Protection Programme steering group in which the central government and water boards are represented. Where necessary, the Flood Protection Programme steering group and regional steering groups will consult one another on wide-ranging projects and on linkage opportunities. All administrative lines come together in the Delta Programme steering group. Multi-hatting in the various administrative bodies will contribute to a proper connection and effective interaction.

Freshwater measures will be implemented mostly in the region, using the regional associations for freshwater. The partners involved have drawn up an investment programme together to make the freshwater supplies more robust and water consumption more economical and efficient. The investment programme has been compiled on the basis of a national investment agenda (measures in the main water system), regional implementation programmes of the freshwater regions and (a number of) implementation programmes of designated uses. The parties look for linkage opportunities for these measures too. National coordination is important to safeguard interconnectivity. A lightweight form may suffice, supported by a small national programme office with staff from various organisations. The Ministry of Infrastructure and the Environment will take the initiative for this. The aim is to set up a comparable programme office for

spatial adaptation, also with staff from the various organisations involved.

The implementation requires more interconnectivity between water and space, for example by improving the connection between the Flood Protection Programme and the Multi-year Programme for Infrastructure, Space and Transport (abbreviated to MIRT in Dutch). A practical working method is for the administrators to discuss all initiatives in an area in one administrative group before they make choices in the decision-making bodies in question. The parties can discuss how measures for flood risk management and freshwater fit in with the comprehensive spatial agenda of the region and how this spatial agenda fits in with the Flood Protection Programme. They can do so when updating the water tasking and water projects in the area agendas and the MIRT Projects book. This can then be taken into account in the decision-making in the administrative associations linked to the Delta Programme tasking and in the administrative associations linked to the MIRT. What further form this takes will be elaborated in the MIRT update. Multi-hatting will also ensure a proper connection in this regard. The aim is to develop into one national structure within a few years and to have this structure address all delta issues comprehensively according to the MIRT method. At a regional level, developing into one national administrative association for safety and freshwater would seem the obvious way to go.

Delta Programme Commissioner

The staff of the Delta Programme Commissioner remains a small organisation that establishes the links between regions themselves, between the regions and the central government and between safety, freshwater and spatial adaptation. Liaison officers of the staff of the Delta Programme Commissioner maintain contact with the (regional) intergovernmental associations and all the parties involved. Supported by a small number of staff, the Delta Programme Commissioner remains available to perform his statutory task for an average of three days a week. The statutory task is formulated along the lines of the advice from the Advisory Committee on Water, by such means as monitoring progress, facilitating where necessary, intervening by clearly identifying bottlenecks and holding parties to account. The Delta Programme Commissioner and his staff monitor interconnectivity, the comprehensiveness and consistency in the adaptive approach to elaborating the Delta Decisions and the preferential strategies and the progress of the programmed measures and the Knowledge Agenda.

Adaptive delta management and programming

Adaptive delta management – the integrative and adaptive approach that the Delta Programme has developed in recent years – places new demands on how the programme is managed. Responding to new insights and developments will explicitly become part of the implementation of the preferential strategies and the Delta Decisions. This requires a preparing sufficiently broad scope for decision-making for the long term, plans for use in good time, a steering model that is in line with the adaptive approach and a properly embedded monitoring and evaluation programme.

Continued development of adaptive delta management

The method of adaptive delta management was developed largely within the Delta Programme, with active support from the knowledge institutes and specialised consultancies. Until now, the focus was on the use of adaptive delta management in the development of the preferential strategies and the proposals for Delta Decisions. The emphasis of the Delta Programme has shifted towards elaboration and implementation. This new phase asks for additional knowledge of the adaptive approach. Research into this will be conducted within the new Water and Climate Knowledge and Innovation Programme. Knowledge issues include the management of long-term options, the influence that changing institutional and socio-cultural conditions have on adaptive strategies and the appreciation of flexibility for trend-based developments and for extreme weather conditions. The existing Adaptive Delta Management Network, concentrating on exchanging research results between suppliers and consumers of knowledge, will be strengthened. The staff of the Delta Programme Commissioner aligns the research line with the other activities in the Delta Programme.

Decision-making scope for the long term (after 2050)

A key principle of the proposed Delta Decisions and preferential strategies is that it should also be possible to take additional measures in the long term (after 2050) to address the challenges following from climatological and socio-economic developments. The options for these are ready. These have been included in the adaptation paths of the preferential strategies (↗ section 3).

A number of these options can be considered in due course without having to do any work at this stage:

- when replacing the Maeslantkering storm surge barrier, include additional design requirements, for the prevention of salinisation, for example;

- using flexible water level management, increase the freshwater buffer in the IJsselmeer region to include an extra layer of water of more than 40-50 cm;
- discharge more water across the IJssel in the event of low water in the rivers;
- transport water from the Waal to the Meuse in the event of drought.

To be able to take a number of other options into consideration after 2050, current spatial policy must already take these into account:
- allow the winter water level in the IJsselmeer region to rise with the sea level to a limited extent;
- if necessary, change the discharge distribution across the Rhine distributaries (depending on the decision in 2017, ↗ sub-section 2.6);
- use Rijnstrangen as a retention area.

Spatial or policy-based reservations are made for these options using the appropriate tools (Implementation in sections ↗ 2 and ↗ 3). The aim is to minimise the drawbacks of reservations. A development-oriented pilot project will be run for Rijnstrangen (↗ sub-section 3.3).

In the Krimpenerwaard, a pilot project will be run to ascertain whether the set of spatial and financial tools is sufficient to develop future-proof dykes (↗ sub-section 3.4).

A number of options for the long term have proved not to be effective or efficient and have therefore been abandoned. These include a dam with sea lock in the Nieuwe Waterweg which should replace the Maeslantkering storm surge barrier and peak water storage in the Grevelingen. Depending on developments, in time it may be necessary to take these kinds of system changes into consideration again.

Many measures that may be necessary for flood risk management and freshwater supplies in the medium and long term require land. As such, the Delta Programme is related to the central government's property strategy.

Adaptive programme steering

The essence of adaptive delta management is that research (into, for example, long-term developments and uncertainties), policymaking and implementation of measures be conducted at the same time and influence each other. The programme steering should facilitate this..

Adaptive delta management requires continuous alertness during the implementation phase of the Delta Programme. A regular robustness assessment seems a suitable tool to safeguard that the measures agreed upon, are timely adjusted to provide a satisfactory answer to the climate changes observed and forecast. This assessment will also address circumstances that are beyond the scope of the Delta Scenarios. As part of the programme steering, the Delta Programme analyses whether there is sufficient room for decision-making in the long term, whether additional resources are needed and whether innovations can help to achieve the selected goals more quickly. The Delta Programme checks periodically whether new insights and developments are sufficiently reflected in programming, implementation and policy. It also makes sense to periodically review the adaptation paths outlined.

Another essential aspect of adaptive delta management is connecting implementation programmes in the fields of water and space management, so as to arrive at cost-effective total solutions. The approach to this has been described above under the heading ↗ Follow-up organisation in this sub-section.

Monitoring and evaluation

The Delta Programme Commissioner directs the development of a monitoring and evaluation system that matches with the adaptive and area-based approach advocated by the Delta Programme. Adaptive delta management requires proper monitoring of effects and, based thereon, regular evaluation of the strategies followed. Monitoring for the Delta Programme spans a wide range of effects and developments; the evaluation may have consequences for a large number of parties, which places special demands on the organisation.

The monitoring and evaluation programme of the Delta Programme will tie in with ongoing programmes and anticipate the monitoring for the new National Adaptation strategy (envisaged for 2016). Additional efforts will be incorporated into the Water and Climate Knowledge and Innovation Programme (↗ sub-section 6.2). Monitoring and evaluation will tie in with the various modules of the proposed Delta Decisions and preferential strategies. Which linkage opportunities are taken advantage of will also be monitored. In this way, the Delta Programme Commissioner remains abreast of measured and forecast effects and

developments and how these are incorporated in the revision of policy and implementation programmes.

Various organisations play a role in monitoring and evaluation. One of the regular duties of the planning agencies is to analyse thematic information about developments and interventions in a scientifically responsible manner. Given the Delta Programme's focus on flood risk management, freshwater and spatial adaptation, the role of the Netherlands Environmental Assessment Agency is naturally an evaluative one.

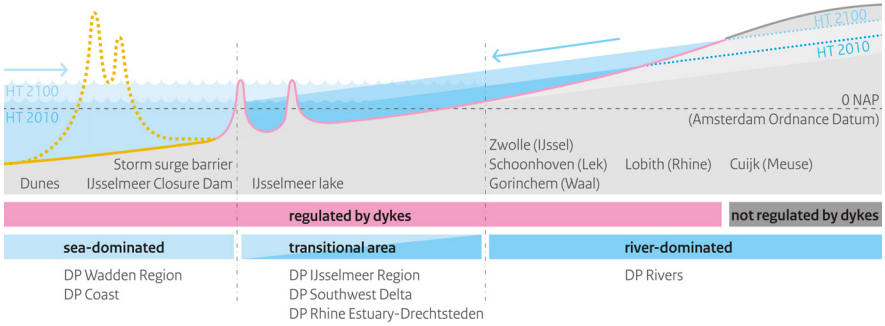
Specialist monitoring will chiefly be a responsibility of knowledge institutes such as KNMI, Deltares and Alterra. To prevent duplication, there will be consultation with ongoing monitoring programmes for related policy programmes, such as the National Policy Strategy for Infrastructure and Spatial Development, Climate Agenda, 'Water in Beeld', EU Water Framework Directive and EU Marine Framework Directive. As recommended by the Netherlands Environmental Assessment Agency in 'The energetic society' (2013), social organisations, business and citizens are also involved in the monitoring.

Continuing to work on a resilient delta

The Delta Programme is intended to ensure that the Netherlands is well prepared for the future. We are updating the policy for flood risk management, freshwater and spatial organisation. We keep a close eye on how society and the climate are changing, to which we respond adaptively. We have potential measures at hand if things change faster than expected and we ensure that we have sufficient elbow room for them. Being practical, alert and prepared. The Delta Programme represents our ongoing work on a safe and robust delta that is resilient enough to withstand the extremes of nature. With a high-quality programme-based approach, the Delta Programme after 2014 can ensure an effective and smart elaboration and implementation of the Delta Decisions.

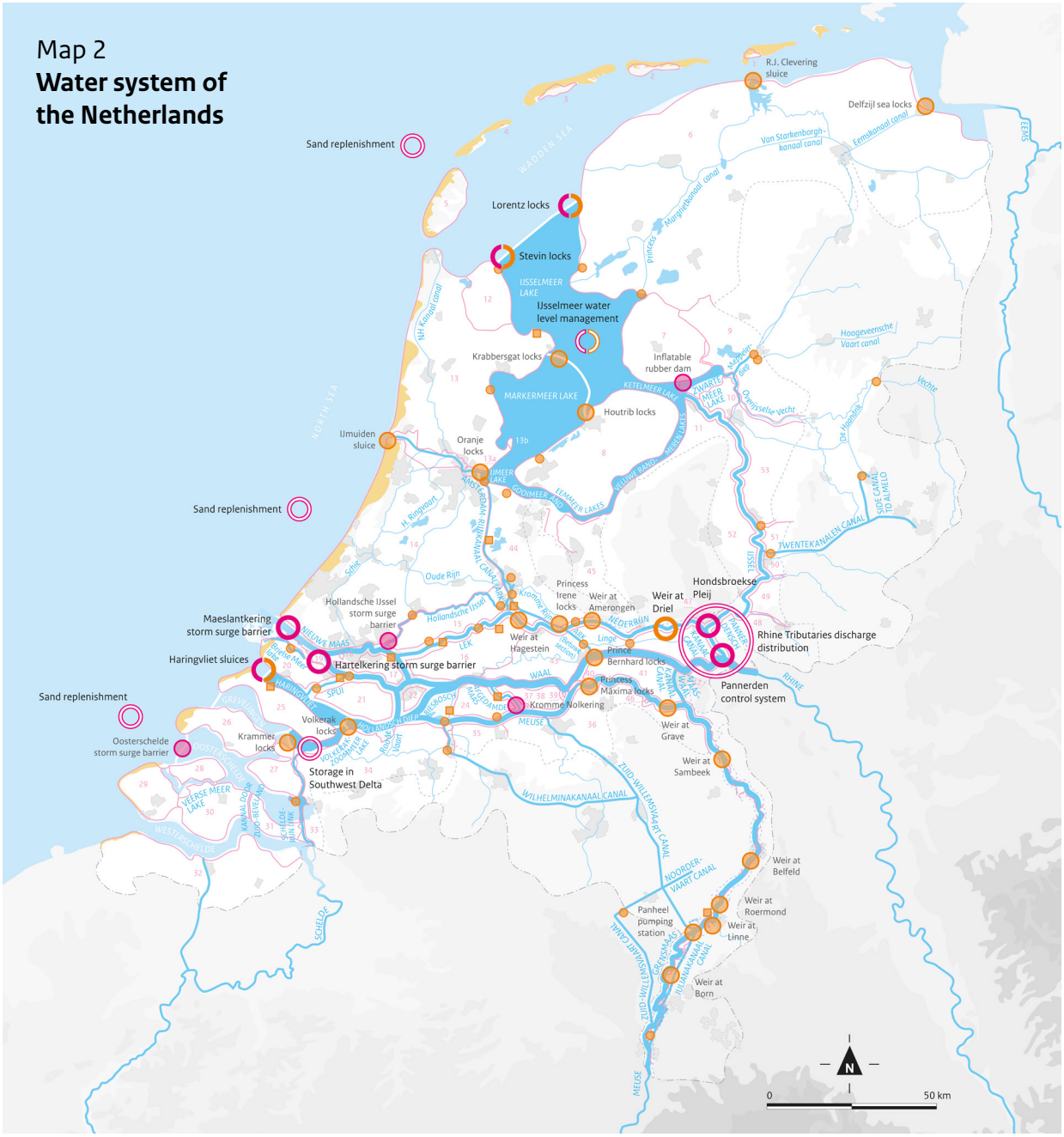
Figure by map 2
Schematic cross-section of the Dutch delta (high water level)

Map 2



Map 2

Water system of the Netherlands



Water system

MAAS main water system

Schie regional water system

Control with supraregional effect on the water management system

- physical control system (flood risk management)
- physical control system (freshwater)
- control via management (flood risk management)
- control via management (freshwater)

Control with regional effect on water management system

- physical control system (flood risk management)
- physical control system (freshwater)

Key intake and outlet points in main and regional water systems

- intake or outlet point
- drinking water extraction intake point

Primary flood defence systems

- dunes
- 34 primary flood defence system with relevant dyke ring number

Basic map

- freshwater
- saltwater / brackish water
- area outside the dykes
- urban area
- relief
- demarcation of elevated soils
- border

Appendices

Hagestein, June 2014 *Sluice and weir complex in the Lek. The lock locks ships to bridge the difference in water level upstream and downstream of the weir. At times of limited water supply from the river, the weir ensures that the level behind the weir remains high enough for shipping, and that there is enough freshwater for drinking water and agricultural purposes. Three weirs in the Rhine and Lek at Driel, Amerongen (Maurik) and Hagestein regulate the distribution between the water in the Waal, IJssel and Nederrijn.*

Appendix 1
Standard specifications for each dyke stretch

This appendix contains proposals for standard specifications for A-dykes that serve as the basis for the embedment into legislation. The overview is part of the Delta Decision on Flood Risk Management.

The standard specification is expressed in a standard class. Six standard classes are used: 1:300, 1:1000, 1:3000, 1:10,000, 1:30,000 and 1:100,000. This is the probability of a flood for the dyke stretch in question that has been derived from the designed protection level for the area to be protected, based on the following goals (↗ sub-section 2.2, Delta Decision on Flood Risk Management): everyone living behind dykes and dunes in the Netherlands may expect a protection level of at least 10^{-5} by 2050 (meaning that the probability of dying as a result of a flood is no higher than 1:100,000 a year) and more protection will be provided in places where there is a risk of:

- large groups of victims and/or
- serious economic damage and/or
- serious damage as a result of the failure of vital and vulnerable infrastructure of national importance.

These new standard specifications for each dyke stretch form the basis for new flood probability standards in the current Water Act, instead of the current overtopping probability standards per dyke ring.

The tables below show the standard specification for each dyke stretch in each area. There is a 'TBD' for one dyke stretch (Marken), because an HWBP2 programme and a MIRT Study on 'smart combinations' are being conducted. There are also MIRT Studies ongoing at Dordrecht and the IJssel-Vecht delta and the standard specification serves as a reference for research into 'smart combinations'. These stretches and a number of stretches requiring further research are marked with an asterisk (*). The outcomes of the studies may impact the standard class. The results are being processed for the purpose of being embedded in legislation.

Appendix 1A
Standard specifications for A-dykes

Wadden Region

Stretch	Standard specification	Explanation
1-1	1,000	Regional advice adopted (evacuation fraction of 0%); for the safety strategies drawn up for the individual islands, a multi-layer approach is considered.
1-2	1,000	Regional advice and national calculation are consistent
2-1	1,000	Regional advice and national calculation are consistent
2-2	1,000	Regional advice adopted (evacuation fraction of 0%); for the safety strategies drawn up for the individual islands, a multi-layer approach is considered.
3-1	3,000	Regional advice adopted (evacuation fraction of 0%); for the safety strategies drawn up for the individual islands, a multi-layer approach is considered.
3-2	1,000	Regional advice and national calculation are consistent
4-1	300	Regional advice and national calculation are consistent
4-2	1,000	Regional advice and national calculation are consistent
5-1	3,000	Regional advice adopted (evacuation fraction of 0%); for the safety strategies drawn up for the individual islands, a multi-layer approach is considered.
5-2	3,000	Regional advice adopted (evacuation fraction of 0%); for the safety strategies drawn up for the individual islands, a multi-layer approach is considered.
6-3	3,000	Regional advice and national calculation are consistent
6-4	3,000	Regional advice adopted; the standard specification calculated is on the boundary between two classes; similar circumstances as in adjacent dyke stretches.
6-5	3,000	Regional advice and national calculation are consistent
6-6	3,000	Regional advice and national calculation are consistent
6-7 and 6-8	10,000	Regional advice and national calculation are consistent

Coast

Stretch	Standard specification	Explanation
13-1	3,000	Regional advice and national calculation are consistent
13-2	3,000	Regional advice and national calculation are consistent
13-3	3,000	Regional advice and national calculation are consistent
14-4	30,000	Regional advice and national calculation are consistent.
14-5	30,000	Regional advice and national calculation are consistent
14-6	30,000	Regional advice and national calculation are consistent
14-7	30,000	Regional advice and national calculation are consistent
14-8	30,000	Regional advice and national calculation are consistent
14-9	30,000	Regional advice and national calculation are consistent
14-10	10,000*	Further research into the B-dyke at IJmuiden
20-1	30,000	Regional advice and national calculation are consistent
25-1	3,000	Regional advice and national calculation are consistent
26-1	3,000	Regional advice and national calculation are consistent
29-1	10,000	Regional advice and national calculation are consistent
29-2	100,000*	Regional advice adopted. Customised work for Ritthem and Buitenhaven-Oost is still being elaborated, which will lead to a lower standard specification for this stretch and additional protection in two places, subject to legal safeguarding.
32-1	1,000*	Further research into damage relating to recent recreational development

IJsselmeer Region

Stretch	Standard specification	Explanation
6-1	3,000	Regional advice and national calculation are consistent
6-2	3,000	Regional advice adopted; the standard specification calculated is on the boundary between two classes; similar circumstances as in adjacent dyke stretches.
7-1	3,000	Regional advice and national calculation are consistent
7-2	3,000	Regional advice and national calculation are consistent
8-1	30,000	Regional advice and national calculation are consistent
8-2	30,000	Regional advice and national calculation are consistent
8-3	30,000	Regional advice and national calculation are consistent
8-4	30,000	Regional advice and national calculation are consistent
9-1	1,000	Regional advice and national calculation are consistent
9-2	3,000	Regional advice and national calculation are consistent
10-1	3,000*	MIRT Study into 'smart combination' at the IJssel-Vecht delta
10-2	3,000	Regional advice and national calculation are consistent
10-3	10,000	Regional advice and national calculation are consistent
11-1	3,000	Regional advice and national calculation are consistent
11-2	3,000	Regional advice and national calculation are consistent
12-1	1,000	Regional advice and national calculation are consistent
12-2	3,000	Regional advice and national calculation are consistent
13-4	1,000*	Customised work for Den Helder (additional protection for urban area) is being elaborated.
13-5	3,000	Regional advice and national calculation are consistent
13-6	3,000	Regional advice and national calculation are consistent
13-7	3,000	Regional advice and national calculation are consistent
13-8	3,000	Regional advice and national calculation are consistent
13a-1	300	Multi-layer safety solution; for the construction of IJburg 2, a suitable standard specification for that area will again be looked into.
13b-1	PM*	MIRT Study into ‘smart combination’ for Marken
44-2	300*	Further analysis required. New calculations will be made on the basis of flood risk scenarios to be supplied by the province.
45-2	300	Regional advice and national calculation are consistent
46-1	300	Regional advice and national calculation are consistent

Rhine Estuary-Drechtsteden

Stretch	Standard specification	Explanation
14-1	100,000	Due to group risks, the standard specification is one class up from the value calculated.
14-2	10,000	Regional advice and national calculation are consistent
14-3	10,000	Regional advice adopted on account of illogical, significant discrepancies
15-1	30,000	Division into stretches is in accordance with Central Holland approach
15-2	10,000	Division into stretches is in accordance with Central Holland approach
16-1	100,000	Due to group risks, the standard specification is one class up from the value calculated.
16-2	30,000	Due to group risks, the standard specification is one class up from the value calculated.
16-3	30,000	Regional advice and national calculation are consistent
16-4	30,000	Regional advice and national calculation are consistent
17-1	3,000	Regional advice and national calculation are consistent
17-2	3,000	Regional advice and national calculation are consistent
17-3	100,000	Regional advice and national calculation are consistent
18-1	10,000	Regional advice and national calculation are consistent
19-1	100,000	Due to group risks, the standard specification is one class up from the value calculated.
20-2	10,000	Regional advice and national calculation are consistent
20-3	30,000	Due to group risks, the standard specification is one class up from the value calculated.
20-4	1,000	Regional advice and national calculation are consistent
21-1	3,000	Regional advice and national calculation are consistent
21-2	300*	Following research into the relationship with the frequency of using the Volkerak-Zoommeer lake for storage, the standard specification will be adjusted as necessary.
22-1	3,000*	MIRT Study into ‘smart combination’ for Dordrecht
22-2	10,000*	MIRT Study into ‘smart combination’ for Dordrecht and bearing in mind that the value calculated for the standard specification may have to be one class up on account of the group risk.

Soutwest Delta

Stretch	Standard specification	Explanation
25-1	3,000	Regional advice and national calculation are consistent
25-2	1,000	Regional advice and national calculation are consistent
26-1	3,000	Regional advice and national calculation are consistent
26-2	3,000	Regional advice and national calculation are consistent
26-3	10,000	Regional advice and national calculation are consistent
27-1	3,000	Regional advice and national calculation are consistent
27-2	10,000	Regional advice and national calculation are consistent
28-1	1,000	Regional advice and national calculation are consistent
28-0 and 29-1	10,000	Based on stretches being joined. Regional advice and national calculation are consistent.
29-2	100,000*	Regional advice adopted. Customised work for Ritthem and Buitenhaven-Oost is still being elaborated, which will lead to a lower standard specification for this stretch and additional protection in two places, subject to legal safeguarding.
30-1	3,000	Regional advice and national calculation are consistent
30-2	100,000*	Regional advice and national calculation are consistent. Customised work for Borssele and Hansweert is still being elaborated, which will lead to a lower standard specification for this stretch and additional protection in two places, subject to legal safeguarding.
31-1	30,000	Regional advice and national calculation are consistent
31-2	10,000	Regional advice and national calculation are consistent
32-1	1,000*	Further research into damage relating to recent recreational development
32-2	1,000	Regional advice and national calculation are consistent
32-3	1,000*	Accelerated research into what possibilities the series of consequences has to offer for the protection of companies governed by the Hazards of Major Accidents Decree.
32-4	3,000	Regional advice and national calculation are consistent
34-1	1,000	Regional advice and national calculation are consistent
34-2	1,000	Regional advice and national calculation are consistent
34a-1	3,000	Regional advice and national calculation are consistent

Rivers

Stretch	Standard specification	Explanation
Waal		
16-1	100,000	Due to group risks, the standard specification is one class up from the value calculated.
16-2	30,000	Due to group risks, the standard specification is one class up from the value calculated.
38-1	30,000	Regional advice and national calculation are consistent
40-1	30,000	Regional advice and national calculation are consistent
41-1	30,000	Regional advice and national calculation are consistent
41-2	10,000	Regional advice and national calculation are consistent
42-1	10,000	Regional advice and national calculation are consistent
43-4	30,000	Regional advice and national calculation are consistent
43-5	30,000	Regional advice and national calculation are consistent
43-6	30,000	Regional advice and national calculation are consistent
48-1	30,000	Regional advice and national calculation are consistent
Nederrijn-Lek		
43-1	30,000	Regional advice and national calculation are consistent
43-2	10,000	Regional advice and national calculation are consistent
43-3	30,000	Regional advice adopted. Standard specification one class up to ensure that the bifurcation point continues to function (transmission effects).
44-1	30,000	Regional advice and national calculation are consistent
45-1	100,000	Regional advice and national calculation are consistent
16-3	30,000	Regional advice and national calculation are consistent
16-4	30,000	Regional advice and national calculation are consistent
IJssel		
47-1	3,000	Regional advice and national calculation are consistent
48-2	10,000	Regional advice and national calculation are consistent
48-3	10,000	Regional advice and national calculation are consistent
49-1	300*	Final proposal depends on the outcome of the research into the option of a B-dyke at the Doesburg sluice/weir complex.
49-2	1,000	Regional advice and national calculation are consistent

Rivers

Stretch	Standard specification	Explanation
50-1	30,000	Regional advice and national calculation are consistent
50-2	3,000	Regional advice and national calculation are consistent
51-1	1,000	Regional advice and national calculation are consistent
52a-1	3,000	Regional advice and national calculation are consistent
52-1	3,000	Regional advice and national calculation are consistent
52-2	3,000	Regional advice and national calculation are consistent
52-3	3,000	Regional advice and national calculation are consistent
52-4	3,000	Regional advice and national calculation are consistent
53-1	3,000	Regional advice and national calculation are consistent
53-2	10,000	Regional advice and national calculation are consistent
53-3	10,000	Regional advice and national calculation are consistent
10-1	3,000*	MIRT Study into 'smart combinations' at the IJssel-Vecht delta
10-2	3,000	Regional advice and national calculation are consistent
10-3	10,000	Regional advice and national calculation are consistent
11-1	3,000	Regional advice and national calculation are consistent
11-2	3,000	Regional advice and national calculation are consistent
Bedijkte Maas		
36-1	10,000	Regional advice and national calculation are consistent
36-2	30,000	Regional advice and national calculation are consistent
36-3	30,000	Regional advice and national calculation are consistent
36-4	10,000	Regional advice and national calculation are consistent
36-5	10,000	Regional advice and national calculation are consistent
41-3	3,000	Regional advice and national calculation are consistent
41-4	10,000	Regional advice and national calculation are consistent
40-2	10,000	Regional advice and national calculation are consistent
36a-1	3,000	Regional advice and national calculation are consistent
39-1	3,000	Regional advice and national calculation are consistent
38-2	10,000	Regional advice and national calculation are consistent
37-1	3,000	Regional advice and national calculation are consistent

Rivers

Stretch	Standard specification	Explanation
23-1	3,000	Regional advice and national calculation are consistent
24-1	10,000	Regional advice and national calculation are consistent
24-2	1,000	Regional advice and national calculation are consistent
24-3	10,000	Regional advice and national calculation are consistent
35-1	10,000	Regional advice and national calculation are consistent
35-2	3,000	Regional advice and national calculation are consistent
Limburgse Maas		
54-1	1,000	Regional advice and national calculation are consistent
55-1	1,000	Regional advice and national calculation are consistent
56-1	300	Regional advice and national calculation are consistent
57-1	300	Regional advice and national calculation are consistent
58-1	300	Regional advice and national calculation are consistent
59-1	300	Regional advice and national calculation are consistent
60-1	300	Regional advice and national calculation are consistent
61-1 and 62-1	300	Regional advice and national calculation are consistent
63-1	300	Regional advice and national calculation are consistent
64-1	300	Regional advice and national calculation are consistent
65-1	300	Regional advice and national calculation are consistent
66-1	300	Regional advice and national calculation are consistent
67-1	300	Regional advice and national calculation are consistent
68-1	1,000	Regional advice and national calculation are consistent
68-2	300	Regional advice and national calculation are consistent
69-1	1,000	Regional advice adopted following further social cost-benefit analysis (SCBA)
70-1	300	Regional advice and national calculation are consistent
71-1	300	Regional advice and national calculation are consistent
72-1	300	Regional advice and national calculation are consistent
73-1	300	Regional advice and national calculation are consistent
74-1	300	Regional advice and national calculation are consistent
75-1	300	Regional advice adopted following further social cost-benefit analysis (SCBA)

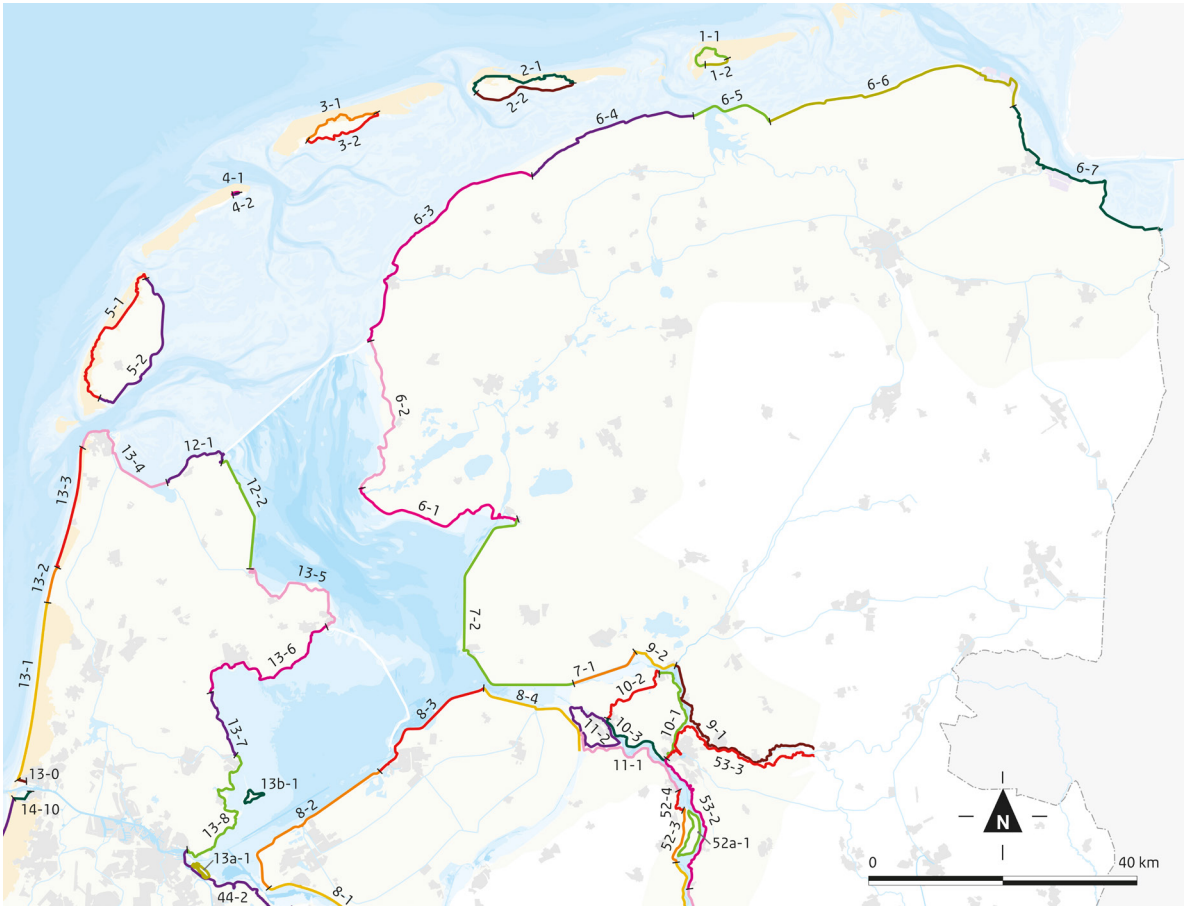
Rivers

Stretch	Standard specification	Explanation
76-1	300	Regional advice and national calculation are consistent
76-2	300	Regional advice and national calculation are consistent
76a-1	300	Regional advice and national calculation are consistent
77-1	300	Regional advice and national calculation are consistent
78-1	300	Regional advice and national calculation are consistent
79-1	300	Regional advice and national calculation are consistent
80-1	300	Regional advice and national calculation are consistent
81-1	300	Regional advice and national calculation are consistent
82-1	300	Regional advice and national calculation are consistent
83-1 and 84-1	300	Regional advice and national calculation are consistent
85-1	300	Regional advice and national calculation are consistent
86-1	300	Regional advice and national calculation are consistent
87-1	300	Regional advice adopted following further social cost-benefit analysis (SCBA)
88-1	300	Regional advice and national calculation are consistent
89-1	300	Regional advice and national calculation are consistent
90-1	3,000	Regional advice and national calculation are consistent
91-1	300	Regional advice and national calculation are consistent
92-1	300	Regional advice and national calculation are consistent
93-1	1,000	Regional advice and national calculation are consistent
94-1	300	Regional advice and national calculation are consistent
95-1	300	Regional advice and national calculation are consistent

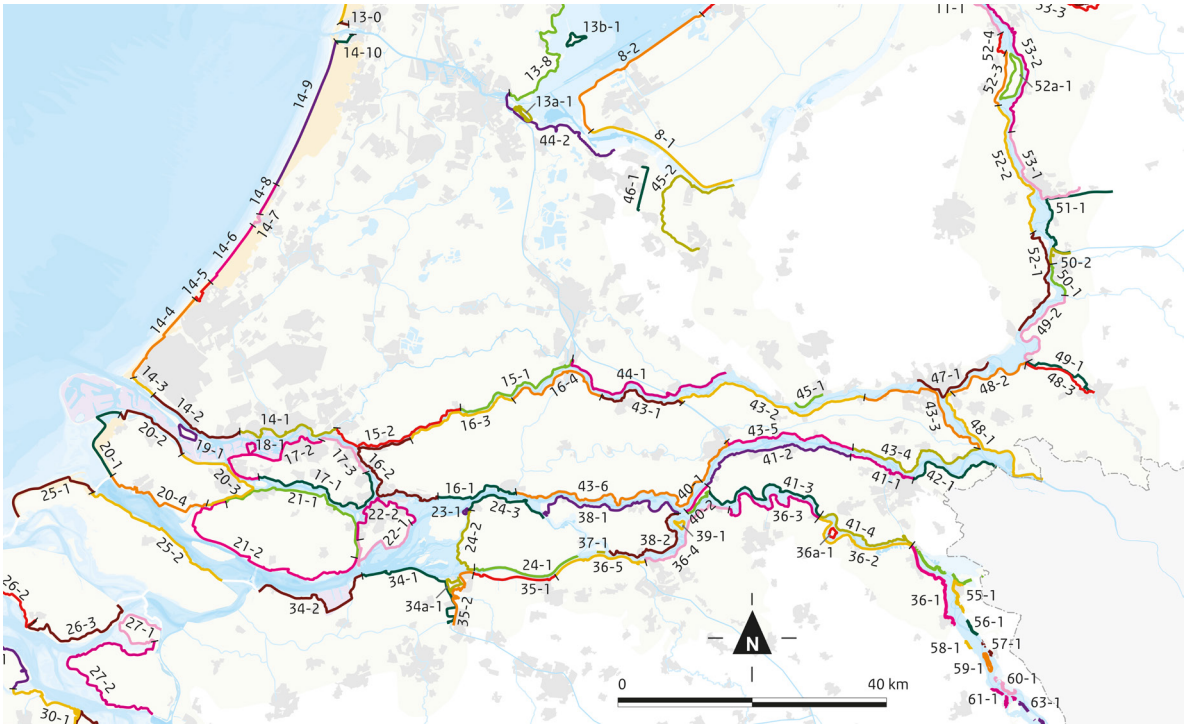
Appendix 1B
Maps with the locations of dyke stretches (accompanying the table with standard specifications)

Colours mark the demarcation of the dyke stretches.

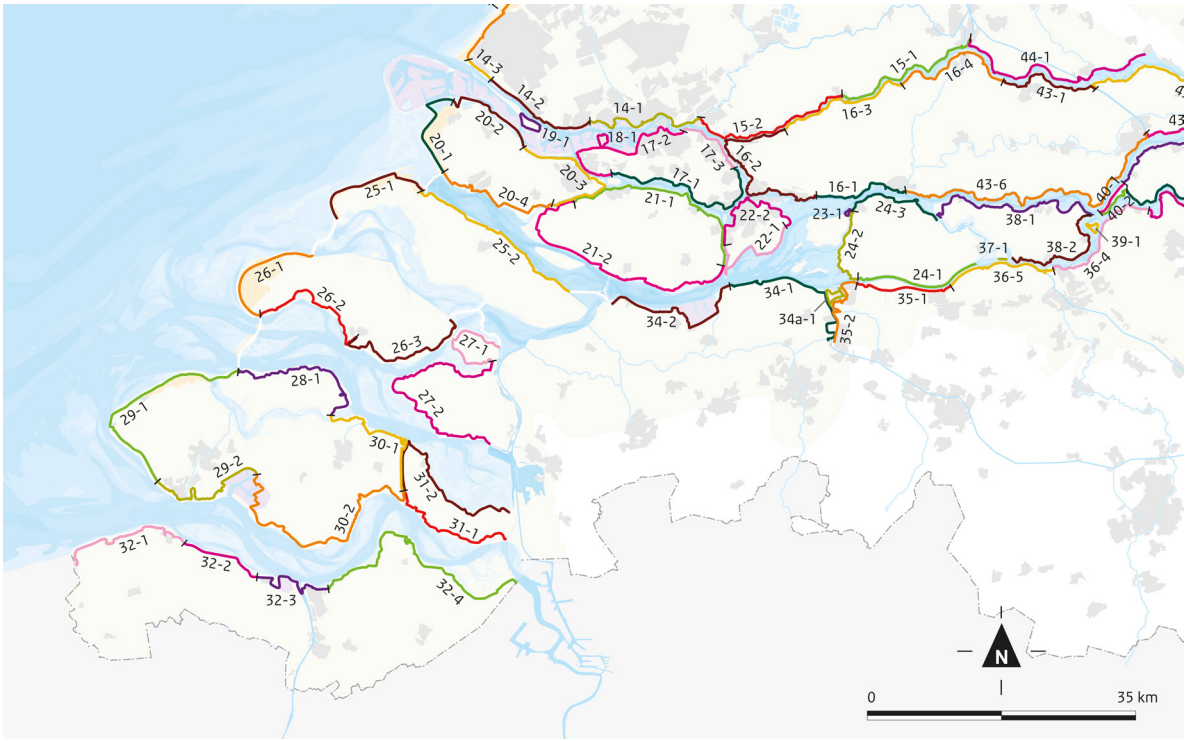
Map appendix 1B Northern Netherlands



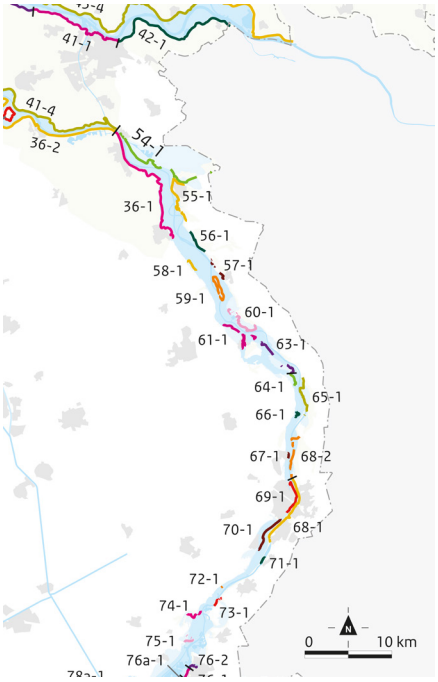
Map appendix 1B Central Netherlands



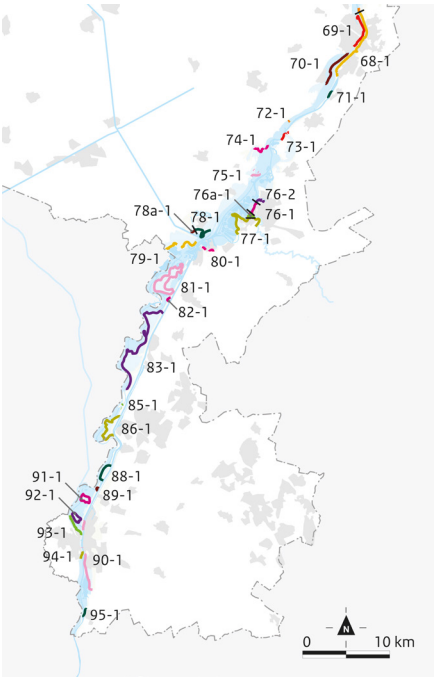
Map appendix 1B South-western Netherlands



Map appendix 1B Northern Limburg



Map appendix 1B Southern Limburg



Appendix 2
Explanation of generic principles of Delta Decision on Spatial Adaptation

Introduction

As part of the Delta Decision on Spatial Adaptation, provinces and municipal councils are responsible for a regional and local elaboration of the ambition. As such, together with the water boards and possible any social organisations and private parties, they will complete three steps based on the following generic principles:

1. 'knowing': analysis of the water-robustness and climate-proofness of the area (covered by the plan) and the functions. To the extent that the required data is available, this analysis is made within the bandwidth of the Delta Scenarios, using the most recent data sets on which they are based, with 2030 and 2050 as reference years. The government authorities will select an appropriate scale for this analysis.
2. 'wanting': translation of the threats and opportunities found in the analysis into a supported ambition and adaptation strategy. The government authorities will formulate concrete objectives for this. They will establish a relationship between the adaptation strategies at a regional and a local level, and safeguard the link with the preferential strategies for flood risk management and freshwater of the Delta Programme.
3. 'working': policy-related and legal impact of ambition. Each government authority indicates how the ambition impacts its own policy (for the entire physical domain), spatial plans and regulations, business cases, implementation, management and 'major' maintenance.

When completing these steps and assessments, the existing division of responsibilities and room for assessment of the parties will remain unchanged. This appendix provides an explanation of the three steps.

Knowing

Scale

The step 'knowing' involves an analysis of the water-robustness and climate-proofness of the (plan) area and the functions. This means looking at all four threats: flood, pluvial flooding, drought and heat. These different threats must be analysed on different scales. The flood risk, for example, is best analysed at a local level, whereas heat is best analysed locally.

Delta scenarios and reference years

The analysis is based on the bandwidth of the Delta Scenarios. These are four scenarios that combine climate development and socio-economic development. They are constructed by the PBL Netherlands Environmental Assessment Agency, the CPB Netherlands Bureau for Economic Policy, the KNMI and Wageningen UR/LEI under the leadership of Deltares. As the underlying data is updated periodically, the parties used the most recent data sets. For the climate, these are the 2014 KNMI climate scenarios[48], based on the reference years 2030 and 2050. The parties use these years in their analysis.

Recommendations

- The degree of water robustness and climate-proofness is not a statistical fact. As such, repeat the analysis once every four to eight years.
- Collaborate with (administrative) partners in the region. Many threats are not confined to a specific territory. Therefore, it is advisable to perform the analyses not only together with the water boards but also with, for example, adjacent municipalities. Social organisations or private parties could also provide help with their specific knowledge or experience.
- Involve the security region in the analysis of flood risks.
- Have external people (from outside the region or from an educational institute, for example) reflect on the results of the analysis.
- A good example of completing the step 'knowing' is the Breda Klimaatsensitief [Breda Climate-sensitive] report, for which a wide-ranging analysis of the four threats was performed, painting a clear picture of the potential bottlenecks and tasking. For more good examples, go to ↗ www.ruimtelijkeadaptatie.nl (in Dutch).

Wanting

Goals

Once the bottlenecks are known, the goals regarding the risks of nuisance and damage will be drawn up: where should the risks be reduced and where should they be accepted? What is an acceptable frequency for a street in a residential district to be flooded (without the water entering the houses)? What is an acceptable frequency for a main road to be flooded, causing significant traffic nuisance?

Adaptation strategy

The next step is to outline what the government authorities will do in the short and medium term to achieve these goals. The essence of an adaptive strategy is dealing sensibly with uncertainties, by looking ahead at the threats awaiting

48 Available on ↗ www.klimaatscenarios.nl (in Dutch).

us and formulating concrete goals for the degree to which the design is to be made water-robust and climate-proof. This makes it possible to accurately time the measures to be taken to achieve the goals. A good adaptation strategy has the following characteristics:

- Short-term decisions are linked to long-term tasking for drought, heat, pluvial flooding and the probability of a flood.
- The adaptation strategy comprises goals, measures and a schedule. The schedule shows when decisions need to be taken or when there are opportunities to take a decision, given the goals set for the medium to long term and the uncertainties on the development of the threats.
- Flexibility is provided for through the types of measures selected and by leaving options for adjustment or switching to other measures open for the future. In this way, measures can be adjusted to new insights and circumstances.
- Various investment agendas will be linked to each other. When programming important planned (replacement) investments, such as those for the sewer system, it is always imperative to ask how these investments may help to achieve the goals set. Connecting social goals helps to improve support, financial feasibility and social return.

Interconnectivity

Together with the water boards, the central government, provinces and municipal councils make adaptation strategies for a water-robust and climate-proof design, at the same time and on different scales. To increase the likelihood of mutual synergy, it is important to ensure interconnectivity between these strategies on the various scales. The Delta Decisions on Flood Risk Management and Freshwater have been elaborated into regional preferential strategies. For a water-robust (re)design, a link has been made with the strategy for flood risk management, and for drought with the freshwater strategy. This shows what options there are to have spatial developments link in with each other and reinforce each other to the fullest extent possible.

Recommendations

- Consider conducting research by design or organising an experimental pilot area in this phase. Advice for this is available on ↗ www.ruimtelijkeadaptatie.nl (in Dutch).
- Consider what form of collaboration with social organisations, residents and companies is possible and how the goals can be linked to goals and initiatives of these parties.
- A good example of completing the step 'wanting' is the Rotterdam Adaptation Strategy, for which the city, together with stakeholders, drew up a set of clear-cut goals and a clear-cut strategy. For more good examples, please go to ↗ www.ruimtelijkeadaptatie.nl (in Dutch).

Working

In this step, the government authorities translate the goals and strategies into their own policy and practice. This spans the entire physical domain: for construction and urban development, infrastructure, water (precipitation, surface water and groundwater) and public space and green areas. Examples are the framework vision, the zoning plan, the water management plan, the environmental permit, the traffic and transport plan, the green matrix plan, the long-term budget for major maintenance and the municipal sewer plan. The parties will translate the outcomes of the steps 'knowing' and 'wanting' into concrete actions for which they are responsible and set to work on them.

Recommendations

- Adaptive measures can be taken cost-effectively by finding common ground with the many major and minor interventions that are made more or less regularly. Consult the Guide to Linkage for this on ↗ www.ruimtelijkeadaptatie.nl (in Dutch).
- A good example of completing the step 'working' is the Arnhem 2020 Framework Vision, look ahead to 2040, in which the municipal council of Arnhem included heat as one of the principal spatial themes. In the 2013-2028 Spatial Framework Vision, the province stipulates that spatial plans for new construction sites and new land use specify how vital and vulnerable structures as well as large residential districts and industrial estates are protected against flooding. For more good examples, please go to ↗ www.ruimtelijkeadaptatie.nl (in Dutch).

Appendix 3
Current status of and agreements on vital and vulnerable functions

Vital and vulnerable function	Current status	Agreement
1A Energy: electricity	Generally speaking, main grids (including power stations) are less vulnerable to floods than regional transport and distribution networks and plants. A flood exceeding a depth of 2.5 m may jeopardise the national or supraregional power supply. In areas subjected to smaller amounts (up to about 0.5 m), failure in the flooded area is likely. Failure may adversely affect the response in the flooded area and cause significant damage to the grid, both directly and indirectly (loss of turnover). Emergency supplies are essential for the continued functioning of aids for the response, but they are often in short supply and dependent on the supply of energy (diesel).	The Ministry of Economic Affairs will ensure that the power supply is sufficiently reliable by 2050 at the latest so as to safeguard all vital and vulnerable functions in case of a flood and that failure outside the flooded area is prevented. Intermediate steps are: before 2015, the Ministry of Economic Affairs will determine in consultation with the security regions, grid managers and the regulatory authority which functions are vital and vulnerable. For this purpose, agreements will be made about the limit that applies (in the region) for acceptable risks and acceptable repair times. The Ministry of Economic Affairs will also ensure that an action plan with a timeline is drawn up (2016), that any policy and supervision deemed necessary has been put in place by 2020 which by 2050 at the latest will result in measures ensuring a water-robust design for the functions deemed vital and vulnerable.
1B Energy: natural gas	Generally speaking, the high-pressure transport grid is less vulnerable to floods than the regional distribution grids and plants. It is not yet clear whether gas sources and storage are vulnerable. The high-pressure transport grid may experience less pressure and failure of metering, but the supply to households (heat) will generally continue. The distribution grid has a high probability of failure. The recovery time tends to be long, because all plants need to be checked before gas deliveries may resume (for reasons of safety).	The Ministry of Economic Affairs will ensure that by 2050 at the latest the natural gas supply is sufficiently reliable to safeguard vital functions in case of a flood. Intermediate steps are: before 2015, the Ministry of Economic Affairs will determine in consultation with the security regions which functions are vital and a timeline will have been plotted together with the sector; in 2020, policy and supervision will be focused on this objective; all measures will have been taken by 2050.
1C Energy: oil	The oil supply consists of the supply from the port in Rotterdam and, for petrol, also the port in Amsterdam, storage in large tanks, refining, transit to other countries by sea, inland shipping, pipeline (Antwerp, Ruhr regional and mainport Schiphol) and transit for the inland oil supply to approximately large regional depots. There is no up-to-date and reliable picture of the consequences of a flood for the oil supply. What is clear, however, is that a failure of the oil supply would disrupt social life and economic activity. If a flood causes oil to leak into the water, this may constitute a hazard to people and the environment.	The Ministry of Economic Affairs will ensure that by 2050 at the latest, the oil supply is sufficiently reliable to safeguard vital and vulnerable functions in case of a flood and that any oil spills will not harm people and the environment. Intermediate steps are: before 2015, the Ministry of Economic Affairs will determine together with the sector, ILT and chain-dependent sectors which parts of the oil supply chain are vital and vulnerable in case of a flood. This concerns both the delivery of oil that is considered essential and the potential hazard to people and the environment. The Ministry of Economic Affairs will also ensure that an action plan with a timeline is drawn up (2016), that any policy and supervision deemed necessary has been put in place by 2020 which by 2050 at the latest will result in measures ensuring a water-robust design for the functions deemed vital and vulnerable.

Vital and vulnerable function	Current status	Agreement
2A Telecom/IT: basic facilities for communication to allow a response in case of a flood	During a flood, (part of) the equipment and systems used for communication between and within government authorities and emergency response services and those used to inform the press and the public will fail. This failure will occur if the equipment is hit by the flood and the power fails as a result of the flood and/or overload. Whether any (government) information transmitted reaches citizens also depends on their reception equipment. The communication and provision of information are essential to the response and damage control.	Pursuant to its responsibility for the system of crisis and disaster management, the Ministry of Security and Justice promotes the continuation of communication between and within government authorities and emergency response services in case of a flood, to the extent that this communication and the means of communication required for the purpose have been designated as vital. The vital parts of the (means of) communication between and within government authorities and emergency response services will be designated as such by 2015 at the latest in the interdepartmental programme 'Rethink Vital', coordinated by the Ministry of Security and Justice. The Ministry of Security and Justice will also ensure that an action plan with a timeline is drawn up (2016), that any policy and supervision deemed necessary is put in place by 2020, which by 2025 at the latest will result in measures ensuring a water-robust design for the (means of) communication deemed vital and vulnerable.
2B Telecom/IT: public network	In case of a flood, the public telecommunications network in the flooded area will fail; this failure may be less serious outside the flooded area. It is expected that the failure will result from either a power failure (chain dependence) or pluvial flooding affecting, for example, switching centres and (home) connections. The failure will impede the communication and provision of information that are essential for an effective response to the flood. Apart from the direct costs incurred to replace equipment and cables, the time it takes to restore the public network is likely to disrupt social life and cause substantial indirect costs (see the 2008 National Risk Assessment Findings Report, appendix to Parliamentary Document 2007-2088, no. 6). In addition, there are IT facilities that form such an important link in internet communications that they may be regarded as vital. This will have to become clear from the results of the inter-departmental project Rethink Vital. There is as yet no information available on which of these links in internet communication are susceptible to a flood and its consequences.	Pursuant to its responsibility for the system of telecommunications, the Ministry of Economic Affairs promotes the continued operation and rapid recovery of the electronic communications network for telecommunications services in case of a flood, to the extent that these networks have been designated as vital. The vital parts of the telecommunications sector will be designated as such by 2015 at the latest in the interdepartmental programme 'Rethink Vital' coordinated by the Ministry of Security and Justice. The 'Rethink Vital' programme will also ascertain whether there are any internet communication links (such as data centres or internet nodes) that should be regarded as vital. The Ministry of Economic Affairs will determine by 2016 at the latest whether it is necessary and proportionate to take additional policy measures in 2020 to ensure that the design of parts of the telecommunications sector and the internet is so water-robust as deemed necessary and proportionate.

Vital and vulnerable function	Current status	Agreement
3A Drinking water (water chain) drinking water	The normal drinking water supply may fail if a flood hits the source, the purification and the pumping stations and/or transport and distribution to the consumers. Moreover, the pumps depend on electricity. The pumping stations and sources are fairly redundant (able to replace each other). To be able to survive during a flood, people need (emergency) drinking water. A prolonged disruption to the drinking water supply will cause disruption and (significant) social damage. Given the importance of the availability of drinking water, the Drinking Water Act sets requirements for the supply, reliability of the supply and the preparation for disasters. This also includes the delivery of emergency drinking water.	In collaboration with the drinking water sector, the Ministry of Infrastructure and the Environment will ensure that the (emergency) drinking water supply can continue to function in accordance with the Drinking Water Act. The risk of a flood-induced disruption to the drinking water supply should be minimal. The associated approach has been divided into phases. In the first phase (2015), updated flood scenarios and risks will be used to determine which promising solution strategies can be formulated and who will be the action owner for them. Certain measures can be taken by the drinking water sector, such as the flood-robust design of production sites; others by the water managers, such as limiting flood risks jeopardising the vital drinking water infrastructure, prioritising flood containment areas, etc. In addition, under the leadership of the Ministry of Infrastructure and the Environment, agreements have been made with the Ministry of Defence and the security regions on assistance and logistics with regard to the use of emergency drinking water during a flood. Important focal points are the dependence on the state of the infrastructure (accessibility and transport) and the speed at which an area can be completely drained. The next phase consists of performing disruption risk analyses and drafting the second round of delivery plans by the drinking water companies, in which measures are selected on the basis of the flood risk scenarios and risks (2016). The first phase comprises the implementation of the required measures (no later than 2020).
3B Drinking water (water chain): wastewater	The sewer and water treatment system has not been designed and constructed to continue to operate in case of a flood. During a serious flood, the system will fill up, the discharge of sewage will stop and polluted water may be released from road gullies, overflows and emergency outlets, and enter houses. From a practical point of view (i.e. relief and habitability), it is crucial in terms of the environment (e.g. preventing water pollution) and public health (e.g. preventing diseases) to repair the sewer and water treatment system as quickly as possible. The system also depends on the restoration of the energy supply and the IT/telecommunications facilities. Repair costs may be high.	The Ministry of Infrastructure and the Environment, in conjunction with the (waste)water chain partners and the sector, will ensure that by 2050 at the latest measures have been taken aimed at attempting to prevent failure of the wastewater system and at the fastest possible repair of the system in case of a flood. This will also limit the potential damage to the environment and health. The first step is that the central government, (waste) water partners and the sector will jointly study the vulnerability of the wastewater chain to (heavy) floods, with the aim of identifying measures that help to repair the wastewater chain. In 2017, an approach will have been launched designed to have policy, measures and supervision in place by 2050 which will ensure that the wastewater system can be repaired fast(er) in case of a flood. By way of an intermediate step, policy and supervision of this objective will have been prepared by 2020; to the extent that the approach requires measures, these will have been embedded in legislation by 2020.

Vital and vulnerable function	Current status	Agreement
4 Health	It is likely that both emergency and other medical care will be disabled in the flooded area because floors below or at ground level have been rendered unusable and because care institutions depend greatly on other links in the chain: energy (electricity and gas), drinking water, the discharge of wastewater, the supply of food and medication (access roads) and the deployability of staff (transport) and telecommunications/IT for communications. Care institutions have an emergency power supply for 3-10 days, which – like aids and tools – may be vulnerable to the location within the building. Due to the quantity and distribution of care institutions (redundancy), there are in principle opportunities for substitution outside the flooded area, on condition that these institutions are accessible (chain dependence of transport).	Pursuant to its responsibility for the system of health care, the Ministry of Health, Welfare and Sport promotes the continued operation and rapid recovery of the care institutions in case of a flood, to the extent that these care institutions have been designated as vital and vulnerable, adhering to the following timeline: • In 2015, the Ministry of Health, Welfare and Sport, in collaboration with the Health Care Inspectorate and care institutions, will complete a study of the specific vulnerability of the care institutions to floods, including this sector's chain dependencies. Based on this study, the Ministry, together with the Health Care Inspectorate and care institutions, will determine its ambition and approach, which may include any adjustments to policy and supervision. Part of this is answering the question whether and how water-robust design can be incorporated in new construction, restructuring and renovation of care institutions. • In 2020, emergency care will be as water-robust as deemed necessary and proportionate. • In 2050, the other care will be as water-robust as deemed necessary and proportionate.
5 Retaining and managing surface water	Depending on the area and the damage to the water system and the pumping stations and given the available discharge capacity and temporary measures, it will take a few hours up to one year before a flooded area has been completely drained. During this period, the flood situation remains and the magnitude of the disruption as well as the social and financial damage increases.	The Ministry of Infrastructure and the Environment will take the initiative to conduct joint fact-finding with the water boards and sketch a picture by 2015 at the latest of how in the current situation the (main) pumping stations managed by Rijkswaterstaat are prepared for a flood, how and at what rate flooded areas can be drained and what options are conceivable in the future to protect (main) pumping stations during a flood and drain the flooded areas. Following this research, the Ministry and water boards will decide by 2016 at the latest whether and which additional steps and measures they consider necessary to drain areas after a flood. The measures deemed necessary will be taken no later than 2050. If necessary, policy will be adjusted in 2050. In anticipation of the total picture, when major (replacement) investments are being made, owners and managers have been asked to already allow for the continued operation of storage basin pumping stations and discharge-by-gravity facilities.

Vital and vulnerable function	Current status	Agreement
6 Transport: main road network	During a flood, the (main) roads in the flooded area will be submerged and/or the road embankment and engineering structures may be damaged, which may lead to congestion and traffic jams. In that case, it will be hard to flee a flooded area and the provision of the necessary assistance and goods will also be severely impeded. When the water rises, people trying to escape by car are particularly vulnerable. After the flood, the roads and engineering structures will have to be repaired to restore access to the area. If the main roads are blocked for a long period of time, the costs of repair and indirect costs may be considerable. The Ministry of Infrastructure and the Environment has no specific policy in place and is currently not taking any specific measures to keep the main road network available during a flood. A pressing legal need is lacking, systematic construction measures are expensive, there is no party to bear the costs and it is unclear exactly which main roads would be useful during a flood.	No later than 2015, the Ministry of Infrastructure and the Environment will determine on the basis of research which parts of the main road network are vital and vulnerable in case of a flood, distinguishing between preventive evacuation, road transport during a flood and quick recovery after the flood. The use and necessity of the availability of the road network in the response phase will be determined in consultation with Rijkswaterstaat (Evacuation Module) and the security regions (such as the relationship with the underlying road network). Based on this analysis, an assessment of the economic damage when roads are out of use and a social cost-benefit analysis of measures, the Ministry of Infrastructure and the Environment will determine its ambition and approach. If necessary, policy and supervision will have been adjusted in 2020, and the measures deemed necessary for a water-robust design of the main road network deemed vital and vulnerable will have been taken in 2050 at the latest.

Vital and vulnerable function	Current status	Agreement
7A Chemical and nuclear: chemical	In case of a flood, hazardous substances from chemical companies (including storage, pipeline transport and waste management companies) may contaminate the water. Depending on the nature of the substance, the amount and the spread may cause a significant hazard to public health and the environment. However, there is not enough insight into the companies or clusters of companies that may pose a hazard during a flood and its consequences. A limited exploration from 2010 showed that, for example, diesel from companies governed by the Hazards of Major Accidents Decree can spread across more than 2,000 km2. Aside from the direct hazard to people and the environment, an area can, depending on the contamination, remain polluted. This can lead to limitations on the use of the area and the need to take (expensive) remediation measures.	Pursuant to its responsibility for the protection of people and the environment, the Ministry of Infrastructure and the Environment will promote that chemical companies (including storage, pipeline transport and waste management companies) take all measures that they may reasonably be required to take to prevent serious consequences for the environment and/or health. As such, in collaboration with the sector of chemical companies, the Ministry will perform an analysis of the nature and magnitude of the risks in the current situation. In keeping with the applicable regulations for companies governed by the Hazards of Major Accidents Decree and companies required to submit safety reports, this analysis will be complete for all chemical companies by 2017 at the latest and an appropriate approach will have been adopted by 2018. If necessary, policy, regulations and supervision will be amended in 2020 and all reasonable measures will have been taken in 2050. The analysis of the nature and magnitude of the risks of the chemical companies in case of a flood must lead to a shared picture of the vulnerability. Based on this picture, the desired protection level will be adopted, including an overview of the nature and magnitude of the measures required to achieve the protection level no later than 2050. Moreover, thorough research will go into question of which responsibilities the government and sector each have with regard to managing the residual risk of a flood (responsibility) and which measures may reasonably be required of a company to prepare for a flood (dimensioning).

Vital and vulnerable function	Current status	Agreement
7B Chemical and nuclear: nuclear	Floods can have adverse consequences for the safety of nuclear plants. The spread of radioactive substances and radiation may have serious effects on the environment and health. The probability of a flood differs for each location and the vulnerability differs for each plan. Policy, measures and supervision aim to ensure that even in the event of a flood, safety is not jeopardised and the risks in the surrounding areas remain below the established limits.	Pursuant to its responsibility for the system of nuclear safety and radiation protection, the Ministry of Economic Affairs will promote that the nuclear plants in the Netherlands meet all the safety requirements set, now and in the future. In accordance with these requirements, all plants will be able to withstand a flood, operate on a stand-alone basis during a flood if necessary or be shut down in a safe manner in good time. On the basis of international assessment, evaluation once every ten years and a system of continuous improvement, the operators of the nuclear plants will take measures to raise the protection level constantly. This will be supervised by the Kernfysische Dienst (Department of Nuclear Safety, Security and Safeguards). The tasks of the Nuclear Plants and Safety Policy Directorate and the Kernfysische Dienst will be transferred to the new Nuclear Safety and Radiation Protection Authority to be formed (set-up of organisation scheduled for late 2013, institution of independent administrative body effective in late 2015).
7C Chemical and nuclear: infectious substance/ genetically modified organisms	In the Netherlands, a small number of research laboratories are working with hazardous infectious substances, including genetically modified organisms. It is very unlikely that these hazardous substances are released during a flood. If, however, these substances should be released, bacteria would only be found in the flood water in low concentrations and viruses would not survive in the water for very long. The low probability of release combined with the low probability of infection mean that there is a negligible risk of damage to people and the environment. According to the Ministry of Infrastructure and the Environment and the Ministry of Health, Welfare and Sport, the laboratories that work with infectious substances, including genetically modified organisms, form a negligible risk to people and the environment. The Ministry of Health, Welfare and Sport will check these conclusions with the RIVM National Institute for Public Health and the Environment.	By 2014 at the latest, the Ministry of Health, Welfare and Sport and the Ministry of Infrastructure and the Environment will have asked the RIVM National Institute for Public Health and the Environment whether the assumption that laboratories form a negligible risk to people and environment in case of a flood is correct. Regardless of the outcome, both ministries will, as a precautionary measure, seek to increase the level of awareness of flood risks in laboratories. This will be done in conjunction with the planned increase in awareness in the area of biosafety. If, however, the risks for people and the environment should prove to be higher than thus far assumed, the Ministry of Health, Welfare and Sport and the Ministry of Infrastructure and the Environment will ensure that the competent authorities responsible for the Environmental Permitting (General Provisions) Act will be informed in late 2015 at the latest about the additional attention they need to pay to measures at laboratories as a consequence of a flood. Only if the municipal councils and provinces are not authorised to prescribe the potential measures will an appropriate approach be adopted in 2016 and policy, regulations and supervision be adjusted, if necessary, by 2020 at the latest in such a way that all measures deemed necessary will have been taken by 2050 at the latest.

Appendix 4
Overview of background documents

The following background documents (in Dutch) form part of DP2015:

Background document A	Knowledge Agenda of the Delta Programme
Background document B	Synthesis documents on sub-programmes B1 Synthesis Document on Safety B2 Synthesis Document on Freshwater B3 Synthesis Document on Spatial Adaptation B4 Synthesis Document on Rhine-Meuse Delta B5 Synthesis Document on the IJsselmeer Region B6 Synthesis Document on Rivers B7 Synthesis Document on Rhine Estuary-Drechtsteden B8 Synthesis Document on the Southwest Delta B9 Synthesis Document on the Coast B10 Synthesis Document on the Wadden Region
Background document C	Review of synthesis documents and response by Delta Programme Commissioner C1 Review of synthesis documents C2 Response by Delta Programme Commissioner
Background document D	Administrative advice on sub-programmes
Background document E	Explanation of programmed projects in the 2015-2020 Flood Protection Programme
Background document F	Replacement of Hydraulic Structures Programme
Background document G	Recommendation from the Consultative Body on Infrastructure and the Environment and the Delta Commissioner's response G1 Recommendation from the Consultative Body on Infrastructure and the Environment G2 Response by Delta Programme Commissioner

The background documents are available on the flash drive at the back of the printed version of this Delta Programme and on www.deltacommissaris.nl.

A Dutch version of the Delta Programme 2015 is also available.

Publication information

The Delta Programme 2015 is a publication of the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs.

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Map sources

Map 1 Delta Programme Mapped Out
Flood Protection Programme
Ministry of Infrastructure and the Environment

Map 2 Water system of the Netherlands
'De Bosatlas van Nederland Waterland', 2010 maps: Ongoing flood risk management implementation projects, August 2009 (p46), Main Watercourses (p56), 2010; 'Management and Development Plan for the National Waters 2010-2015', revised version (p16), Rijkswaterstaat.

Map 3 Flood risk management and freshwater tasking
Ministry of Infrastructure and the Environment
Delta Programme 2012 tasking map

Maps 4 and 5 Yield of new approach to flood risk management
Based on the "Technical elaboration of requirements for the primary defence systems (DPV 2.2, DPV work report) and proposed standard specifications per dyke stretch (↗ Appendix 1).

Maps 6, 7, 8, 9, 10 Preferential strategies for flood risk management
Delta Programmes on Freshwater, the Rivers, the Rhine Estuary-Drechtsteden, the Southwest Delta, the Wadden Region.

Map 11 Flood Protection Programme 2015-2020
Flood Protection Programme
The Ministry of Infrastructure and the Environment

Photo page 178-179:
Benthemplein Rotterdam, April 2014 *This water square is designed to relieve the sewer at times of heavy rainfall, while also making the city more attractive. When it rains really heavily, special basins in the square will collect the water. Once the rain stops, the water is drained off and the square provides plenty of room for sport and recreation.*

The Delta Programme

The Delta Programme is a national programme, in which the central government, provinces, municipal councils and water boards work together, involving social organisations and the business community. The objective is to protect the Netherlands from flooding and to secure a sufficient supply of fresh-water for the generations ahead.

The Delta Programme Commissioner promotes the formation and the implementation of the Delta Programme. He submits an annual proposal for the Delta Programme to the Minister for Infrastructure and the Environment and the Minister for Economic Affairs. This proposal comprises measures and provisions to minimise flooding and water shortages. The Delta Programme is presented to the Dutch States General on the annual budget day.

The Delta Programme has nine sub-programmes:
- Safety
- Freshwater
- New Urban Development and Restructuring
- Rhine Estuary-Drechtsteden
- Southwest Delta
- IJsselmeer Region
- Rivers
- Coast
- Wadden Region

www.rijksoverheid.nl/deltaprogramma
www.deltacommissaris.nl

This is a publication of:

The Ministry of Infrastructure and the Environment

The Ministry of Economic Affairs

September 2014

Contents

The first Delta Programme was published on 21 September 2010.
The second Delta Programme was published on 20 September 2011.
The third Delta Programme was published on 18 September 2012.
The fourth Delta Programme was published on 17 September 2013.
This fifth Delta Programme was published on 16 september 2014.