



Delta Programme 2019

Continuing the work on
the delta: adapting
the Netherlands to
climate change in time



Delta Programme 2019

Continuing the work on the delta: adapting the Netherlands to climate change in time

Including:

Delta Plan on Flood Risk Management

Delta Plan on Freshwater Supply

Delta Plan on Spatial Adaptation

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Date 18 September 2018
Subject Response to recommendations of the Delta Programme
Commissioner

Dear Madam Chairperson,

In his cover letter to Delta Programme 2019, the Delta Programme Commissioner has set down three recommendations:

1. To set up a national soil subsidence programme;
2. Climate-adaptive scheduling and development of the housing tasking;
3. Intensification of research into water and climate issues.

Below, I will indicate how I intend to accommodate the Delta Programme Commissioner's recommendations (as stipulated by Article 4.9, paragraph seven of the Water Act).

1. Setting up a national soil subsidence programme

Soil subsidence in urban and rural areas, caused by soft soils and mining activities, is adding to the societal taskings in such fields as flood risk management, spatial adaptation, freshwater supply and water quality, energy and climate, sustainable construction, agriculture, landscape, nature, biodiversity, and heritage. The national and regional governments, the business community, and NGOs acknowledge the combat (mitigation) of and adaptation to soil subsidence as an important societal (cross-sectoral) tasking. The Coalition Agreement lists the reduction of greenhouse gas emissions by peat soils through more efficient land usage as a priority, and in early 2018 initial agreements on a collective strategy were set down under the Inter-Ministerial Programme. I am committed to embedding soil subsidence ensuing from soft soils as an important tasking in the National Environmental Vision and to propagating my views on the tasking to point the way for further regional elaboration. This is because soft soil subsidence is largely determined by regional conditions and needs to be addressed in interconnection with other regional taskings. Consequently, the issue calls for regional elaboration under national direction, to be supported by the national government. I will expend my best efforts, in collaboration with my counterparts in the Ministries of the Interior & Kingdom Relations, Agriculture, Nature & Food Quality, Economic Affairs & Climate Policy, and Education, Culture & Science, and with the provinces, district water boards, municipalities, and the business community, to develop a concerted soil subsidence programme within the context of a more comprehensive soil and subsoil programme set up under the Environment Act.

In addition to addressing soil subsidence caused by soft soils and mining activities, such a programme will serve to substantiate the Subsoil Framework Vision and to collectively address issues such as cables and pipes, area-specific groundwater management and soil energy, and enhancing the expertise and information provision on soil and subsoil in a broad sense.

2. Climate-adaptive scheduling and development of the housing tasking

We intend to render the spatial planning of the Netherlands climate-proof and water-resilient, in order to be better prepared for extreme weather by 2050: both waterlogging and prolonged periods of drought and heat. The national government has set down agreements with the regional governments to this end in the Delta Plan on Spatial Adaptation. These agreements are collectively intended to expedite the spatial adaptation process. The national government is preparing an amendment to the Water Act in order to provide a legal basis for a contribution towards a temporary incentive scheme to expedite the combat of waterlogging in the regions.

The Delta Programme Commissioner and I believe, also from the perspective of spatial adaptation in the housing tasking, that it would be advisable to factor in the changing climate, with respect to both the selection of locations (environmental policy) and the construction methods employed.

Responsibility for the selection of locations for new housing developments and for the climate-adaptive design of new houses lies with municipalities and provinces. The national government will discuss the housing tasking with the regions whose housing markets are under the greatest pressure. First of all, such regions will be encouraged to ensure a sufficient and appropriate housing stock. It should be borne in mind here that the assessment of where and where not to build always involves an integrated societal consideration. It goes without saying that climate aspects must also be taken into account in this consideration. The outcomes of the stress tests and risk dialogues to be conducted by the municipalities in 2019 and 2020, respectively, in collaboration with the district water board and the provinces, can be used to map out potential risks in advance and may help to mitigate such risks for new housing projects.

With respect to the climate-adaptive design of houses, the Delta Plan on Spatial Adaptation sets out that the regional and local governments will examine, prior to 2022, whether local regulations need to be amended. Furthermore, this Delta Plan sets out that the national government will examine, prior to 2020, whether additional (building) regulations may be effective and useful to promote climate-proof design with sufficient scope for a tailored approach.

To this latter end, a working group has been set up, in collaboration with the Minister of the Interior & Kingdom Relations and the umbrella organisations – the Association of Netherlands Municipalities, the Association of Dutch Regional Water Authorities, and the Association of Provincial Authorities – that will conduct such an examination. Furthermore, a study will be conducted, in collaboration with the NEN Standardisation Institute and CROW – knowledge institute of the construction sector – to examine whether non-statutory guidelines and standards can be adjusted or drawn up to such an effect as to promote climate-proof construction and design.

In addition, this year will see the launch of a so-called adaptation dialogue, under the National Adaptation Strategy that pertains to the built-up environment. This dialogue is intended to acquire insight into the tasking and to identify appropriate practical solutions, in collaboration with stakeholders (in addition to governments, also including the business community, corporations, and interest groups). The dialogue(s) will address considerations regarding the selection of locations, planning choices for existing built-up areas and new developments, and climate-

adaptive construction methods. Such dialogues may also dictate amendments to the building regulations.

3. Intensification of research into water and climate issues

To support the development of new climate scenarios for the Netherlands, I am contributing to the launch of a new research programme pertaining to sea level rise, aimed at the reduction of uncertainties and the exploration of causes and effects for the Netherlands. This programme will accommodate the emphases placed by the Delta Programme Commissioner: the relation between global warming, the melting of Antarctic ice sheets, sea level rise, and the potential impact on the Netherlands. The Royal Netherlands Meteorological Institute KNMI will expressly participate in this new research programme.

Furthermore, I will take account of the findings of the Intergovernmental Panel on Climate Change (IPCC), which will publish its official report on new insights regarding an accelerated global sea level rise by the end of 2019. The KNMI (and other Dutch scientists) are closely involved in the establishment of this report. The KNMI will incorporate the insights developed (across the globe) in new scenarios for sea level rise (2019) and climate development (2021) for our region.

Furthermore, agreements regarding studies into the impact of climate change (sea level rise) on the Wadden Sea morphology, flora, and fauna have been set down in the "Declaration of Leeuwarden", drawn up within the framework of the Trilateral Government Conference on the Wadden Sea (May 2018) and co-signed by the Netherlands. An additional agreement in this context involves the pursuit of synergy by submitting joint, multiple-party proposals to apply for grants from the Netherlands Organisation for Scientific Research, Ministries, and international research budgets.

Research into increasingly extreme weather conditions is not just necessary with a view to an excess of water. This summer's prolonged period of drought and the expectation that the frequency, duration, and intensity of such droughts may increase in the future have emphasised the urgency to press ahead with the measures set out in the Delta Plan on Freshwater Supply and to continue to review the Delta Scenarios in this respect.

An important role in the development and dissemination of knowledge regarding climate adaptation, inter alia, relating to water issues, is played by the Global Centre of Excellence on Climate Adaptation. This centre, initiated by several countries, the World Bank, and UN organisations, is located in the Netherlands. We expect to be making major strides in the launch of this centre by this autumn.

Finally, I would like to address Mr Kuijken's announcement that he will resign as the Delta Programme Commissioner in November 2018. I am most grateful to Mr Kuijken for the manner in which he has substantiated the Delta Programme and initiated its implementation over the past eight years. The Delta Programme Commissioner plays a key role in monitoring the progress and continuity of the Delta Programme.

Yours sincerely,

THE MINISTER OF INFRASTRUCTURE AND WATER MANAGEMENT,

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Date
13 June 2018

Our reference
DC-2018/766

Annex (es)
1

Date 13 juni 2018
Subject Delta Programme 2019 (DP2019) cover letter

Your Excellency,

It is my pleasure to present to you – for the ninth time – the annual Delta Programme, Delta Programme 2019 (DP2019). By virtue of the Water Act, which was amended under the Delta Act, I submit an annual proposal for this nationwide programme. My proposal has been developed in close consultation with the government bodies, private sector parties, and NGOs involved. In DP2019, I also report on the progress made: are we on schedule and on track?

Thorough coordination and efficient collaboration with the administrative partners and the Ministries involved have once again enabled us to present you with a widely supported proposal. As stipulated by the Water Act, DP2019 sets out the concrete measures and provisions for the next six years, looking ahead to the subsequent twelve years, and with a focus on 2050 and 2100. By now, the programme comprises three implementation-oriented Delta Plans: pertaining to flood risk management, freshwater supply, and spatial adaptation. There is a great deal of work to be done.

This year too, I would like to take this opportunity to submit some directive recommendations to you and your counterparts in the Ministries of the Interior and Agriculture, Nature & Food Quality, supplementary to DP2019, regarding the work before us.

1. In view of the considerable stakes, I recommend that a "national soil subsidence programme" be developed, in order for the governments to adopt a programmatic and coherent approach in addressing soil subsidence issues in both urban and rural areas. Combating soil subsidence will reduce the long-term taskings of the Delta Programme, especially in the low-lying parts of the Netherlands, and will contain CO₂ emissions. Combating soil subsidence will serve the purposes on both sides of the climate coin: mitigation and adaptation. The parties involved would welcome some form of direction by one of the Ministries.
2. With a view to the substantial housing tasking, I recommend – from the spatial adaptation perspective – factoring in the changing climate, both in the selection of locations (environmental policy) and in the manner of implementation. This demands that this housing tasking be planned and developed in an expressly climate-adaptive manner. In my opinion, it would

be advisable to explore, in the very near future, whether any obstacles in the (building) regulations need to be removed or whether conducive regulations could be developed.

3. Recent signs indicate that the rise in sea level could accelerate in the second half of this century, compared to current assumptions. Although this acceleration is still subject to great uncertainty, it may have a major impact on our coastal foundation, the flood defence systems, flood risk management, and the freshwater supply. That is why I recommend a further intensification of the studies being conducted under the Water and Climate programme, with a focus on the relation between global warming, the melting of Antarctica, sea level rise, and the potential consequences for the Netherlands.

**Delta Programme
Commissioner**

Date
13 juni 2018

Our reference
DC-2018/766

In November 2018, I will resign as the (first) Delta Programme Commissioner as I will then reach retirement age. These past years, I have performed my duties full of energy and with great conviction, supported by you, the Cabinet, the House of Representatives, the representatives of the Association of Netherlands Municipalities, the Association of Provincial Authorities, and the Association of Dutch Regional Water Authorities, and the comprehensive "Delta Community" that has formed. The institutional framework of legislation (the Delta Act), funding (the Delta Fund), and a government commissioner (the Delta Programme Commissioner) is unique and appropriate to the long-term (adaptation) tasking ahead of us. This is garnering broad international attention. I am pleased that a successor will take office.

This year marks the tenth anniversary of the advisory report by the second Delta Committee regarding the approach we have now adopted. The positive review of the Delta Act in 2016 ("Up to Standard") has revealed that the Act satisfies the ambitions and requirements set by the legislator and has contributed to the further improvement of the approach now that we are gradually entering the implementation phase.

Mitigation and adaptation are the two sides of the same climate coin. If we manage to attain the goals of the Paris climate agreement and contain global warming to less than 2 degrees Celsius, the measures to adapt our country in time appear viable and feasible. Failure to attain these goals will present our country with a huge tasking involving far-reaching choices and major expenditure after 2050 and 2100. Although this may seem a long way off, the time frame is reduced when we realise that the preparation and implementation of major measures and physical interventions tend to take 20 to 40 years. Continuing the work and making headway, that is the motto, under the political direction of the Minister of Infrastructure and Water Management. Perseverance and decisiveness are indispensable. Nothing is achieved without effort.

W.J. Kuijken
Government Commissioner for the Delta Programme

CHAPTER 1

Administrative introduction

Sixty-five years ago, a disastrous flood hit the southwestern part of the Netherlands. It has left a profound and lasting impression in the memories of those who survived. It underscores the importance of flood risk management in our country. The fact that we were able to close five storm surge barriers during a heavy storm in January 2018 demonstrates that the Netherlands is currently well protected. With the Delta Programme, we are continuing to prepare for the future, because climate change can have a major impact on our low-lying country. We exercise common sense and remain alert to the trends in global warming. Along with all the parties involved, we must keep up the pace in the implementation of the National Delta Programme. Meeting the Paris climate agreements is crucial to keep our country's water taskings manageable: reducing global warming and climate-proofing our country. Two sides of the same coin, that demand a simultaneous and dynamic approach.

**Eight years of Delta Programmes:
unique approach, concrete successes**

Since 2010, the Netherlands has been tackling its water domain taskings in a unique fashion: collectively addressing common goals within the national framework of the Delta Programme; rather than waiting to be hit by a new (flood) disaster, keeping ahead of disaster, major damage, and social disruption. To this end, we have adopted adaptive delta management: looking ahead to the taskings that are facing us, setting down the measures required in concert, and persistently checking whether we are working at the right pace and in the proper direction. Keeping options open and, if need be, adjusting our strategies in time. We use the adaptive delta management approach in flood risk management, but also with respect to freshwater supply (water availability) and climate-proofing our living environment ("spatial adaptation"). This approach, that offers room for innovations among research institutes and businesses, is garnering increasingly more interest abroad.

From the very start, national and regional parties have been collaborating closely within the Delta Programme: the central government, provinces, district water boards, and municipalities. All these parties have committed to the pursuit of the collective national goals and the implementation of the Delta Programme, based on their own responsibilities. Overall control is exercised by the Delta Programme Commissioner, under the political responsibility of the coordinating Minister, the Minister of Infrastructure and Water Management. Businesses, security regions, knowl-

edge institutes, and NGOs all do their part. The organisational format of considerable regional involvement and national control has proven successful in developing widely supported strategies and ensuring a speedy implementation. This is also demonstrated by the independent evaluation of the Delta Act on Flood Risk Management and Freshwater Supply in 2016.¹

Meanwhile, significant concrete results have been achieved. For example, the new flood protection standards for flood defence systems have been embedded in law; preparations for the first dyke improvements based on these standards are under way. This year, a new water level ordinance for the IJsselmeer Region has been set down, enabling flexible water level management: exactly one hundred years after the enactment of the Zuiderzee Act, which has led, inter alia, to the construction of the IJsselmeer Closure Dam. The new water level ordinance will add considerably to the resilience of freshwater supply in a large section of the Netherlands. Since last year, the Delta Plan on Spatial Adaptation has been incorporated into the Delta Programme, supplementary to the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater Supply. The authorities are thus taking concrete steps in climate-proofing our country, in order to be better prepared for waterlogging, drought, heat, and the consequences of urban flooding.

¹ [Parliamentary Document 34 513 no. 1.](#)

Progress in a nutshell: well on schedule, additional attention for specific elements

The bulk of the measures scheduled are well on schedule. The district water boards and Rijkswaterstaat are keeping up the pace in the dyke improvements carried out under the Flood Protection Programme. Provinces and municipalities are actively collaborating. The Security Regions have embarked on mapping out the impact of urban flooding through impact analyses and are upgrading their evacuation plans. Two important measures in the field of freshwater supply are making headway: the introduction of a flexible water level in the IJsselmeer Region and the expansion of the Central Netherlands Climate-proof Water Supply system. All the regions are developing measures to ensure the availability of water during periods of drought. The majority of the regional governments have started to map out their vulnerabilities to weather extremes. This means that the goal – all the municipalities having conducted a full stress test by 2019 – is within reach; however, major efforts are still required.

Several activities require additional efforts. With a view to the long-term substantiation of the powerful interaction between dyke improvement and river widening in the area around the major rivers, the Minister of Infrastructure and Water Management intends to set up an integrated river management programme in the area, together with the Delta Programme partners (governments, the business community, and NGOs) and local stakeholders. The goal set out in the Delta Decision on Freshwater Supply – agreements on water availability for all the regions and the main water system – is feasible but calls for intensification of the efforts. The exploration of spatial planning options to reduce the impact of urban flooding (layer 2) is not sufficiently getting off the ground. For that reason, the Delta Programme Steering Group has set up a working group to focus attention on this issue. The climate-proofing of vital and vulnerable functions will be given impetus to better coordinate the national strategy with regional pilots. A wide range of parties is involved in these activities.

Integrated River Management programme

In the purview of the Integrated River Management programme, the Minister of Infrastructure and Water Management is developing, in collaboration with the Delta Programme partners, an evaluation framework for the choices to be made regarding measures in the area around the major rivers. One of the connective measures in the programme is river widening. River widening efforts further many purposes. Targeted investments in river widening at specific locations will achieve the flood risk management goals and contribute to other national (management) tasks, such as shipping, but also to area development and other regional tasks.

Alert to new developments: rise in sea level, housing tasking, and cyber security

Signs can be observed that the sea level is rising faster than has been assumed in the Delta Scenarios up to now.² The Delta Programme Commissioner has commissioned Deltares research institute to explore the potential consequences of an accelerated rise in sea level for the Delta Programme, in order to enable us to respond in a timely and adaptive manner. According to the exploratory study, a potential acceleration in sea level rise will not be noticeable

until 2050 at the earliest. If we manage to reduce global warming to a maximum of 2 degrees, as set out in the Paris Agreement, the sea level along the Dutch coast may rise by 1 to 2 metres by 2100. In that case, the flood risk management and freshwater supply taskings will be bigger than has been assumed up to now in the Delta Programme. Up until 2050, as a minimum, the preferential strategies will provide a sound basis for keeping our delta liveable and habitable. However, further research is imperative in order to gain more certainty regarding the impact of a rising sea level. In 2020, we will take stock during the first (six-year) review of the course steered by the Delta Programme. At that time, the Royal Netherlands Meteorological Institute KNMI may provide more information on the stability of the signs regarding the rising sea level, also based on the reports by the Intergovernmental Panel on Climate Change (IPCC).

In order to reduce the rise in temperature to a maximum of 2 degrees, the Cabinet is firmly committed to realising the agreements made in Paris. At the same time, we must adapt our delta's spatial planning and the use of land in our delta to the changes that are already affecting our climate. Waiting will prompt more radical choices at a later date and face us with much greater expense. The Environmental Visions of the central government, the provinces and the municipalities can and must provide a framework for measures aimed at rendering the Netherlands resilient and

² See [Delta Programme 2018](#) and [Background Document B to Delta Programme 2018, report and findings of the Delta Programme Steering Group 2018 including fact sheets and references](#).

climate-proof. The Delta Programme provides input to this end. A particular issue in which the changing climate needs to be factored in is the major housing tasking in the Randstad conurbation: new houses must not only be energy-neutral but also climate-adaptive, while the future water tasking (Water Review) must be taken into account in the selection of locations. In some sections of the country, soil subsidence is adding to the Delta Programme taskings. The importance of soil subsidence to the Delta Programme objectives calls for a further analysis of its causes and effects.

Cyber security is a hot topic all across the globe. In the Netherlands, too, cyber security is one of the Cabinet priorities. To follow up a promise to the House of Representatives³, the Minister of Infrastructure and Water Management is setting down agreements on cyber security with all the water authorities. These agreements will be set down in an addendum to the Administrative Agreement on Water. After all, the operation of our storm surge barriers, weirs, and pumping stations is increasingly dependent on IT and thus vulnerable to hacking. The risks this entails to our safety, health, and economy must not be underestimated. Efficient collaboration is crucial in order to be able to cope with the growing cyber threats. For that reason, Rijkswaterstaat and the district water boards have joined forces in the Computer Emergency Response Team Water Management (CERT WM) to draw up cyber recommendations and transfer knowledge on cyber security and monitoring. Both organisations are also affiliated with the Information Sharing and Analysis Centre (ISAC), enabling parties to actively exchange expertise and experience with the support of the National Cyber Security Centre (NCSC).

Delta Fund as a stable basis

The long-term financial security of the Delta Programme is currently up to par. In the cover letter to Delta Programme 2018, the Delta Programme Commissioner recommended adding a substantial sum to the Delta Fund for the implementation of the Delta Plan on Spatial Adaptation, and to set aside resources from the Delta Fund for river widening and the second round of freshwater supply measures.

Following the Geurts⁴ motion, the national government is preparing an amendment to the Water Act in order to create a legal basis for the allocation of Delta Fund grants to regional measures aimed at combating waterlogging, in the purview of a future temporary incentive scheme to expedite spatial adaptation efforts.

Within the framework of the Administrative Agreement on Climate Adaptation, as announced in the Coalition Agreement, the governments have engaged in consultations regarding the financial tasking involved in spatial adaptation.

In addition, a total of 20 million euros will be set aside within the Delta Fund, supplementary to the existing resources allocated to the climate adaptation incentive programme (5 million euros for 2018 - 2022). This reservation is intended for, in particular, knowledge development and sharing, pilot studies, and support to be provided to regional and local governments for, inter alia, conducting stress tests and risk dialogues in 2019 and 2020.

For the Integrated River Management programme, a sum of 375 million euros will be set aside within the Delta Fund. The unusual drought during the summer of 2018 (see box Drought) and the expectation that such droughts may occur more frequently in the future have emphasised the urgency to press ahead with the measures set out in the Delta Plan on Freshwater Supply. Following the Phase 1 Freshwater Supply Measures, a sum of 150 million euros will be set aside within the Delta Fund for the subsequent phase, 2022-2027. This next phase involves the implementation of further measures to contain damage caused by drought and salinisation.

Unabated commitment to a climate-proof delta

Since 2010, the Netherlands has launched a wide range of efforts within the context of the Delta Programme aimed at climate-proofing our delta. We have an ambitious, level-headed programme, we are achieving results, and we are well on schedule. At the same time, we are seeing developments that are augmenting the Delta Programme taskings: the sea level that could be rising faster than expected, soil subsidence, more extreme weather, and cyber crime threatening vital and vulnerable functions. If we want to keep the delta safe and resilient, we must continue to work on the Delta Programme, keeping up the momentum, yet at the same time respond and adapt to these new developments. Observing the Paris climate agreements is a precondition for keeping our nation's adaptation tasking feasible; the Cabinet is already energetically engaged in national and international efforts to this end. This is vitally important, especially in our low-lying delta.

³ [Proceedings of the House of Representatives 2017-2018, 33.](#)

⁴ [Parliamentary Document 27 625 no. 437.](#)

Drought⁵

The summer of 2018 was characterised by an unusually long period of drought, viz., 45 days, including a 13-day heatwave. Nationwide precipitation during this period only averaged 10 mm, whilst the high temperatures (over 35 degrees Celsius on 26 and 27 July) and the wind resulted in significant evaporation and a substantial demand for water. On 2 August, a precipitation deficit of 278 mm officially caused a national water shortage. In terms of severity, the drought at that time thus exceeded that of early August 1976, the driest summer ever recorded. Of note is the fact that this situation extended to the entire Rhine and Meuse catchment area, reaching all the way to Scandinavia.

As a result of the decreasing Rhine and Meuse discharges, in combination with the increasing demand for water, the western part of the Netherlands was faced with growing salinisation. Lake IJsselmeer contained

⁵ This text is based on the situation as of mid-August 2018; despite a period of changeable weather, the drought had by no means ended.

sufficient water to supply the IJsselmeer polders and the north-western and northern parts of the country with fresh water. From 24 July on, the climate-proof water supply system supplied Central Holland with additional fresh water. This helped to combat salinisation and to prevent the peaty dykes from drying out.

The drought made itself particularly felt on the elevated soils in the south and east, which cannot be supplied with fresh water from the main water system. These areas mainly depend on water in the deep or shallow subsoil. Farmers attempted to prevent crop failure by irrigating their fields, but as the summer progressed, increasingly more district water boards decided to ban irrigation.

The Delta Scenarios factor in such droughts, whose frequency, duration, and intensity may increase in the future, according to the Royal Netherlands Meteorological Institute KNMI. The Delta Plan on Fresh Water sets out measures aimed at optimally securing the freshwater supply during future periods of drought.

PART I

National level

CHAPTER 2

Developments in the Delta



The annual Delta Programme reviews the progress made in the elaboration and implementation of the Delta Decisions and Preferential Strategies⁶. This chapter provides an overview and addresses new developments in the Delta Programme governance, expertise, and innovation, as well as international collaboration.

⁶ The Delta Decisions and Preferential Strategies can be found in [Delta Programme 2015](#).

2.1 Main progress made in the Delta Programme

The Delta Programme uses the “[Monitoring, Analysing, Acting](#)” system to visualise the progress made. This system focuses on four key questions: 1) Is the implementation on schedule? 2) Are we on the right track? 3) Are we addressing the taskings in an integrated manner? 4) Are other parties participating on a wide scale, wherever necessary? An overall picture of the progress made, based on these questions, is provided below. More details regarding the progress are provided in Chapters 3-5 (progress in the fields of flood risk management, freshwater supply, and spatial adaptation) and Chapter 7 (progress per region).

On schedule

“On schedule” pertains to the question of whether the measures scheduled are being completed within the time frame agreed upon.

With respect to flood risk management, the measures aimed at preventing urban flooding (multi-layer flood risk management layer 1⁷) are on schedule. The dyke improvements scheduled and the ongoing studies and explorations regarding river widening are proceeding according to plan. Any slight delays will not interfere with the final completion date of the entire set of measures. The Delta Programme Commissioner has concluded that the area around the major rivers needs to enter a new phase in order to make sufficient progress with the elaboration of the Preferential Strategy for long-term flood risk management: the powerful interaction of dyke improvements and river widening. To this end, the central government is developing, in concert with the Delta Programme partners, an Integrated River Management programme, featuring river widening as a measure to tackle multiple issues in an interconnected manner (see [Paragraph 3.1](#)).

The assessment of primary flood defence systems according to the new standards is also on schedule. Completion of the assessment, in 2023, will generate a picture of the full flood risk management tasking. This will provide a

basis for mapping out the full programme tasking up to and including 2050; the tasking will be updated every twelve years based on a new round of assessments of all the flood defence systems. Expectations are that the flood risk management tasking for the Flood Protection Programme (HWBP) will increase in scope. For that reason, the Flood Protection Programme parties are continuously striving to further improve the efficiency of their efforts. The Flood Protection Programme is investing in efforts such as the De Dijkwerkers knowledge community to step up the pace of completion (the annual number of kilometres of dykes improved), in innovations, and in general explorations (POVs) to further cut down the costs per kilometre (see [Delta Plan on Flood Risk Management, Figure 2](#)).

Efforts to reduce the impact of urban flooding through spatial planning (layer 2) are still not sufficiently getting off the ground; the Delta Programme Steering Group has set up a working group to focus additional attention on such efforts. The Security Regions have made progress with respect to flood disaster management and are improving their evacuation plans (layer 3). The first four Security Regions have completed their impact analyses. The Water Crises and Floods Management Steering Group (SMWO) is keeping a finger on the pulse. In 2018, the National Crisis Plan - Evacuation (NCP-E) will be completed, featuring the national-level decision-making procedure for large-scale evacuations.

Two important measures aimed at climate-proofing the freshwater supply are well on schedule: flexible water level management in the IJsselmeer Region and the Central Netherlands Climate-Proof Water Supply (KWA) system. The new water level ordinance for the IJsselmeer Region was adopted on 14 June 2018. The plan elaboration for the expansion of the Central Netherlands water supply system is in full swing. With respect to water availability, regional elaborations have been launched in some 15% of the Netherlands (in dialogue with consumers), as has an overall elaboration for the main water system. The goal of the Delta Decision on Freshwater Supply – agreements on the availability of water in all the regions and for the main water system to be set down by 2021 – calls for intensification of

⁷ The three-layer approach to flood risk management: 1) prevention of urban flooding, 2) reducing the impact of urban flooding through spatial planning, and 3) reducing the impact through adequate crisis control.

the efforts being expended by the authorities concerned, yet is still within reach. The focus is on urgent regions, in order to take such findings into account in the decision-making process regarding measures for the second phase of the Delta Plan on Freshwater Supply.

Last year, the Delta Plan on Spatial Adaptation went into effect. As a first step, the local and regional government authorities are mapping out regional vulnerability to waterlogging, drought, heat, and the impact of urban flooding. To this end, they are conducting stress tests and risk dialogues. The majority of the governments have commenced by mapping out vulnerabilities to extreme weather; in many cases, however, they have not yet addressed all four issues or covered their entire territory. The target is to have stress tests conducted for all four issues across the entire territory of the Netherlands by mid-2019. This is feasible, but requires substantial efforts in the year ahead. In most cases, municipalities, provinces, and district water boards are joining forces in this process; the provinces and district water boards are conducting the stress tests in their area in collaboration with the municipalities.

Some front runners have already completed the next step in the field of spatial adaptation: the risk dialogue with all the relevant regional partners regarding identified risks and required measures. Expectations are that the other governments will be able to embark on this dialogue in 2019, if things go according to plan. In addition to the strategies addressing the thirteen national vital and vulnerable functions, four regional Vital and Vulnerable pilot studies have been launched in recent years: Botlek, Amsterdam Westpoort, IJssel-Vecht delta, and Zeeland. A collective study by governments and businesses in Amsterdam Westpoort illustrates the potential cascading effects of urban flooding and the importance of the continued operation of the electric power supply. The studies point out the need for more clarity in the division of responsibilities and for overarching coordination. In some cases, the National Approach to Vital and Vulnerable Functions project will be liaising the results of the national strategy and the regional pilots, in collaboration with the regions. The parties will share the insights from the regional pilots that are relevant to the national-level strategy and the national-level agreements that are relevant to the regions. The Spatial Adaptation Steering Group will assume a coordinating role in the implementation of the Delta Decision on Spatial Adaptation, which stipulates that the vital and vulnerable functions must be flood-proofed by no later than 2050, and in the manner in which this is achieved in the regions. The efforts will tie in more closely with the strategy set out in the Delta Plan on Spatial Adaptation (stress test, risk dialogue, etc.). The central government will remain responsible for the amendment of policy and regulations by 2020, if such is needed. This shift in coordination will generate a better

definition of what needs to be arranged at the national level and what can be substantiated at the regional level.

On track

“On track” indicates whether the proposed measures are sufficient in terms of attaining the flood risk management, freshwater supply, and spatial adaptation goals by 2050, or whether we need to change course. For example, a change of course may be dictated by new insights in the pace of climate change, the scope of the taskings, or the efficiency of measures. For the time being, the goals appear attainable with the proposed measures.

In the years ahead, we will gain a more exact picture of the scope of the three taskings: through the [assessment](#) of the primary flood defence systems (flood risk management tasking), [the Water Availability process](#) (freshwater supply tasking), and [the stress tests](#) (spatial adaptation tasking). In addition, the Signal Group⁸ is monitoring developments that could be relevant to the course we are steering. The Signal Group has selected eight indicators to enable the timely and reliable identification of any need for adjustment of the Preferential Strategies (see [Appendix](#)). These indicators have been reviewed internationally and found appropriate as initial instruments. The first overview of the Signal Group shows that measurements and new research hold indications of a potentially faster and more extensive rise in sea level than foreseen in the Delta Scenarios⁹. This may have a considerable impact on the Delta Programme. For that reason, Deltares research institute has explored the potential consequences for the Delta Programme in more detail (see box), in anticipation of a scientifically supported statement regarding the extent of sea level rise from the IPCC in 2019 and its subsequent translation into new forecasts by the Royal Netherlands Meteorological Institute KNMI. Among other things, this exploratory study is mapping out how climate change with and without the Paris Agreement may affect the rise in sea level along the Dutch coast and the consequences it may have for coastal protection and the liveability of the hinterland (motions by: Sienot-Geurts¹⁰, Van Raan¹¹, Laçin¹², and Van Tongeren¹³).

⁸ The Signal Group is made up of relevant experts from Rijkswaterstaat, the Netherlands Environmental Assessment Agency (PBL), Royal Netherlands Meteorological Institute KNMI, Deltares research institute, Wageningen University & Research Centre (WUR), and Statistics Netherlands (CBS). The Signal Group is chaired by the Staff of the Delta Programme Commissioner. For more information and the tasks vested with the Signal Group, see www.deltacommissaris.nl.

⁹ The Delta Scenarios are the climate change scenarios underpinning the current Preferential Strategies and Delta Plans

¹⁰ [Parliamentary Document 32 813 no. 168](#).

¹¹ [Parliamentary Document 32 813 no. 183](#).

¹² [Parliamentary Document 32 813 no. 172](#).

¹³ [Parliamentary Document 32 813 no. 174](#).

Signs regarding rise in sea level

There is still considerable uncertainty regarding the question of whether the rise in sea level is accelerating and if so, to what degree. According to the exploratory study¹⁴ conducted by Deltares research institute, a potential acceleration in sea level rise will not be noticeable until 2050 at the earliest. The potential acceleration is caused by the more rapid melting of Antarctic ice sheets, an effect that, as yet, has not been incorporated into the scenarios. The meeting or otherwise of the Paris climate agreements has no bearing on the occurrence of this effect. However, compliance with the agreements may reduce the acceleration.

In a scenario involving implementation of the Paris climate agreements, the sea level may rise by 1 and possibly 2 metres by 2100. This will increase the need for replenishment sand (currently 12 million m³/year) by a factor of 4 in 2050 and potentially by a factor of 20 in 2100, assuming current policy is continued. Depending on the rate at which natural sand import via tidal inlets is increasing or boosted by means of replenishment, we could be faced with an increasing loss of intertidal areas (shoals, mud flats, salt marshes) in the Wadden Sea, Westerschelde, Oosterschelde, and the tidal rivers area as early as around 2050. Around 2100, the structural use of pumps at the IJsselmeer Closure Dam and near IJmuiden could be a necessity. Depending on the climate trends (river discharge, evaporation) and water requirements, we may need to expedite the implementation of freshwater supply measures.

In a more extreme scenario – which is currently not expected to materialise, considering the Paris climate agreements – the temperature will have risen by 4 degrees in 2100. The sea level could then rise by 2 (to potentially 3) metres by 2100, after which the (accelerated) rise will continue. In this extreme situation, if current policy is continued, the need for replenishment sand will increase by a factor of 25 in 2100 – and possibly even more – vis-à-vis the current requirements. The closure frequency of storm surge barriers will increase to such an extent as to advance the need for replacement, different ways of operation, or other solutions

¹⁴ See [Background Document B](#), Deltares report: exploration of potential impact of accelerated and extreme sea level rise on the Delta Programme.

to a date earlier than assumed until now, also because of its impact on water levels, salinisation, and natural values in the hinterland. The IJsselmeer Closure Dam pumping capacity will need to be expanded earlier and continuous operation of the pumps may be required earlier as well. As a result of the increasing salinisation of the surface water, the implementation of freshwater supply measures in Southwest-Netherlands may need to be expedited with effect from 2070. Increasing groundwater salinisation will lead to a growing need for flushing and thus a growing demand for water, including from the IJsselmeer.

This initial exploration warrants the conclusion that the Preferential Strategies provide a sound basis for keeping our delta liveable, at least until 2050. In the meantime, we must give impetus to further research in order to reduce the uncertainty in processes and effects. The first review of the Delta Decisions and Preferential Strategies in Delta Programme 2021 is a good time to decide on studies, measurements, and policy options requiring elaboration. By that time, the Royal Netherlands Meteorological Institute KNMI will be able to provide more information on the stability of the signs observed. Relevant studies are, for example, research into long-term sediment management of the coastal foundation and connected waters such as the Wadden Sea, Eems-Dollard, Westerschelde, and Oosterschelde, and the tidal rivers area (in interconnection with the Coastal Genesis 2.0 research programme); salt intrusion; trends in failure probability of storm surge barriers in the event of increasing closure frequencies; and the consequences for water level management of the delta waters.

This initial exploration also shows that, whereas the sea level could rise at an accelerated rate vis-à-vis the current assumptions if the Paris climate agreements are observed, the Preferential Strategies would provide sufficient basis for keeping the delta liveable and habitable until 2050 as a minimum. In the event of a more extreme rise in sea level, fundamental choices regarding the protection and design of our delta appear inevitable. This illustrates the paramount importance of observing the Paris climate agreements for the Netherlands and other deltas and coastal areas across the globe.

A second indication pertains to the increase in torrential rain. In April 2018, the Dutch Foundation for Applied Water Research STOWA [presented updated precipitation statistics](#), in collaboration with bodies such as the KNMI, that confirm

this indication. The new statistical analysis of measurements by 31 stations between 2003 and 2016 shows a sharp increase in precipitation volumes and intensities, especially during extreme downpours with a duration of two to twelve

hours (probability of occurrence 1/50 per annum or less). This is in line with the conclusions in a recent publication by the [Environmental Data Compendium](#). The risks of waterlogging have recently been concretised in a Deltares study, conducted within the framework of a provisional risk assessment in the purview of the EU Directive on Flood Risks. The risks have been mapped out nationwide with peak downpour calculations in combination with current topographics and a standard sewer discharge capacity, and compared to actual peak precipitation events. According to the study, 10% of the number of buildings in the Netherlands may be prone to flooding from the street during extreme precipitation intensities of 140 mm/2 hours. The risk of damage in built-up areas ranges from 10 to 1000 euros per hectare, which is comparable to the risk of damage caused by flooding from regional waters; however, the probability of occurrence is higher. Without measures, the risks of damage due to pluvial floods caused by climate change are expected to double in the next 70 years. All these new insights are important for the design of measures to combat waterlogging and have been taken into account in the development of the stress tests.

With this working method, the Signal Group enables us to factor in the new insights in the proposals for the first six-year review of the Delta Decisions and Preferential Strategies in Delta Programme 2021. The governments will embed any ensuing policy decisions in their policy plans. Policy decisions relating to water issues will be embedded in the follow-up to the National Water Plan by the central government; the regional governments will do likewise in, inter alia, the subsequent provincial water plans and zoning plans.

Review

In the event of new insights showing that the current course will not enable achievement of the flood risk management, freshwater supply, and spatial adaptation goals by 2050, the Preferential Strategies may need to be adjusted; the Preferential Strategies are open to annual adjustment. In addition, the Delta Decisions and Preferential Strategies will be subjected to a systematic review every six years. The results of the first six-year review will be presented in Delta Programme 2021. The review will focus on target attainment: the extent to which the goals set out in Delta Programme 2015 are achieved in time. Criteria and indicators will be set down to be able to gauge target attainment and schedule interim reviews (see [Background Document A](#)).

In the purview of the first six-year review, the Freshwater Supply and Spatial Adaptation Steering Groups, the Flood Risk Management administrative partners, and the regional consultation committees are going to survey whether the timely achievement of such goals is jeopardised by developments. They will take account of:

- external developments in the fields of knowledge and innovation, the climate, socio-economic developments, and societal preferences (the Signal Group will inventory external developments that are relevant to the over-all Delta Programme, such as a potential acceleration in sea level rise and the increasing frequency of peak downpours);
- internal developments, such as the progress made with respect to implementation, preconditions, and support. These developments will be mapped out by the parties working on the implementation of the Delta Programme in the regions or with respect to the three themes.
- choices set out in Delta Programme 2015 still apply. If so prompted by the review, the Delta Programme Commissioner will draw up proposals for adjustment of the Delta Decisions and Preferential Strategies. The background document entitled Analysis Ambition Action provides further details regarding the six-year review procedure and specifies the status of the target attainment indicators. Figure 1 outlines the planning.

In the adaptation tracks¹⁵ of the Preferential Strategies, several options for additional or more comprehensive long-term measures¹⁶ have been kept open, in order to be able to respond, if need be, to new developments. The review process will encompass an assessment of the need for adding new long-term options and of the necessity of keeping all current long-term options open. The current options are:

- considering the construction of locks in the Nieuwe Waterweg as a fully-fledged alternative¹⁷ to the replacement of the Maeslant storm surge barrier;
- if the Maeslant storm surge barrier is once again replaced by a “closable open” barrier: taking additional design requirements into consideration, for example, with respect to the combat of salinisation, in addition to a potential accelerated rise in sea level and other flood risk management considerations;
- allowing a limited rise in the IJsselmeer Region winter water level along with the sea level (by a maximum of 10-30 cm and only if such is cost-effective from a flood risk management perspective);
- further expanding the freshwater buffer in the IJsselmeer Region, through flexible water level management, to an extra layer of water of 40 to 50 cm. In the event of rapid climate change and considerable demand, even this supply may prove insufficient; further research could then be conducted into additional measures, such as diverting more water via the IJssel at low Rhine water level;

¹⁵ The adaptation tracks outline the expected time frames for the required implementation of specific measures.

¹⁶ See [DP2015, p.148](#), Decision-making scope for the long term.

¹⁷ In accordance with [Delta Programme 2017](#).

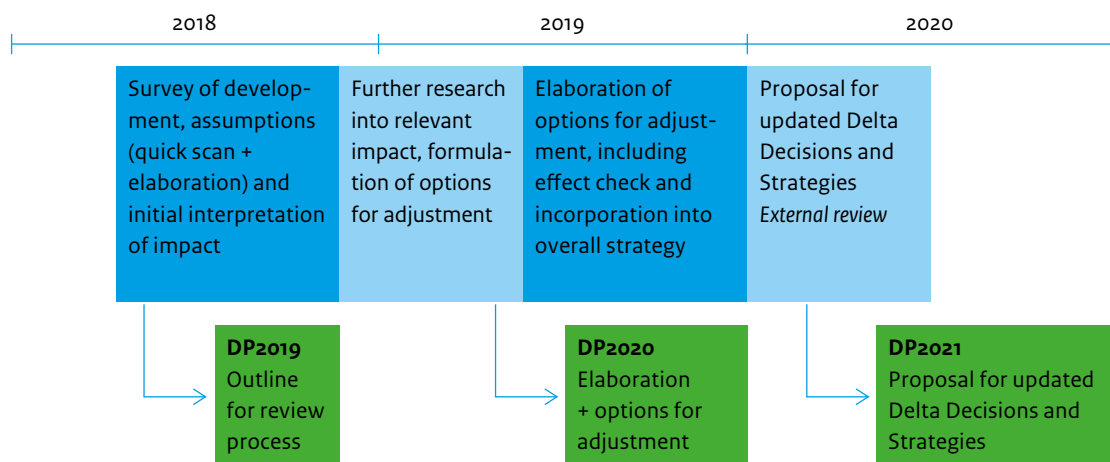


Figure 1 Outline schedule for first six-year review

- diverting Waal water to the Meuse to reduce potential major water shortages in the area south of the major rivers in the medium term;
 - if need be, changing the discharge distribution across the Rhine tributaries (see below);
 - utilising the Rijnstrangen nature reserve as a retention area.

Based on the current insights into climate change and socio-economic trends, the above options may be worthwhile after 2050. Any spatial components in the options (such as retention in the Rijnstrangen area and modifications in the IJsselmeer Region water level management) must already be taken into account in spatial policies. The spatial reservations for the major rivers, as set down in the General Spatial Planning Regulations Decree, will remain in force.

Discharge distribution among Rhine tributaries

Delta Programme 2015 states that the central government is going to explore whether there is reason to modify the discharge distribution among the Rhine tributaries after 2050 and to keep such an option open. [A cost effectiveness analysis](#) has mapped out the cost of a different discharge distribution (dyke improvements required and possibly a change in the potential number of flood victims) and its impact on the flood risk. The analysis has been conducted with several variants in terms of modification of the discharge distribution.

The study has shown that, based on the current knowledge and points of departure, cost effectiveness does not constitute reason for changing the discharge distribution after 2050. All the variants studied are either more expensive or involve the same expense as the reference situation (maintaining the current discharge distribution). However, the differences are small, considering the uncertainties in the study. We cannot rule out the possibility that in the future,

modifying the discharge distribution based on arguments other than cost effectiveness could nonetheless make sense. In addition, the study shows that unexpected developments may occur between now and 2050 which would possibly render modification of the discharge distribution cost-effective. For example, the cost and risks entailed in a different discharge distribution could work out differently if the flood risk management standards were raised, or if the Rhine discharge volumes were to increase on account of improved protection measures in Germany. Whether a modification of the discharge distribution would be cost-effective in these cases also depends on the necessity and costs of adaptations to the water control structures.

The main conclusion is that currently it would not seem wise to assume that the discharge distribution will be changed after 2050 and to anticipate such change in choices to be made. However, it remains sensible to keep the option open and, in the event of changing points of departure to re-explore whether a different discharge distribution would make sense. In addition, another study is being conducted in 2018 in the purview of the development of assessment and design tools for flood defence systems; this study will map out how the current agreements regarding the discharge distribution must be interpreted in the context of the new flood risk management system. 2019 will see a review of the impact on the points of departure for the discharge distribution.

Integrated approach

Wherever possible, an integrated approach to the measures would be advisable: an approach that is not only conducive to one or more Delta Programme taskings but also to other taskings and ambitions in the region concerned. The partners engaged in the implementation of the Preferential Strategies in the regions are virtually unanimous in their appreciation for the extent to which the integrated approach has been substantiated. An example is

the IJsselpoort River Climate Adaptation Park, a collaborative project by Natuurmonumenten nature organisation, five municipalities, Rijn en IJssel district water board, the Ministry of Infrastructure and Water Management, and the province of Gelderland, focused on spatial quality, flood risk management, nature, the economy, and leisure facilities. The evaluation¹⁸ of the Delta Act in 2016 showed that the parties involved tend to make better use of opportunities for linkage with issues beyond the Delta Programme (such as leisure facilities, shipping, and nature) over opportunities for linkage with one of the other three Delta Programme themes. In response, the regions will be paying additional attention to “internal” linkage. With respect to freshwater supply and spatial adaptation, such links are already regularly achieved at the regional level.

In many cases, an integrated approach takes time, e.g., for capitalising on opportunities for co-funding. That is why the Flood Protection Programme is drawing up a tentative schedule with effect from 2019: a long-term schedule of flood risk management projects to be carried out in the six years ahead (the official schedule) and the next six years (see Delta Plan on Flood Risk Management, paragraph 3.2.1, [Table 5](#)). This will give interested parties an early warning of dyke improvement projects and enable them to contact the water authorities at an early stage to discuss an integrated approach. The tentative schedule will be adjusted annually for the twelve years ahead (“ongoing”). It will be completed as the [assessment](#) of the primary flood defence systems progresses.

Integrated approach to each theme

The Flood Protection Programme and the regions feature many examples of an integrated approach. Examples are the exploratory study into the combination of dyke improvement, river widening, and area development in the Meandering Meuse project along the Dyked River Meuse and the More Meuse, More Venlo project. River-widening measures may also contribute to the achievement of ecological goals (water quality and nature) and enhance spatial quality.

An integrated approach is the common working method in freshwater supply measures. An example is the Innovative Freshwater-Saltwater Separation System (IZZS) in the Krammer locks. This system not only reduces the salt influx in the Volkerak-Zoommeer lake but also enhances fish migration options, shortens passage times for the shipping sector, cuts down energy consumption, and provides opportunities for generation and storage of sustainable energy.

Under the Delta Strategy regarding water quality and freshwater supply, over 30 parties¹⁹ have agreed to give impetus to the Delta Plan on Agricultural Water Management (DAW), that focuses on water quality and water quantity issues (including water shortages) and economic incentives in the agriculture sector. In 2018, farmers and district water boards will collectively set down the regional (water) taskings for the agriculture and water sectors. The water taskings involve water quantity and water quality. By 2020, the measures to be implemented must be specified in implementation programmes for each region and in operational plans for soil and water. Linkage of freshwater supply measures with the Delta Plan on Spatial Adaptation ([see 4.1.1](#)) is resulting in an integrated approach to the freshwater supply and spatial adaptation taskings.

Spatial adaptation has ground in common with other major taskings in both urban and rural areas, such as the energy transition and the circular economy, “future-proof living”, “towards a vital countryside”, and “regional economy as a catalyst”. In the period ahead, the governments involved will be mapping out the connections under the Inter-Ministerial Programme. This programme encourages governments to enter into a dialogue on the opportunities and bottlenecks of such connections, wherever necessary, and to set up effective collaborations. An example of the connection between the urban development tasking and climate adaptation is the development of a new, climate-proof residential area on the island of Marken ([Marken Above Water](#)). Climate buffers are examples of the connection between the nature tasking²⁰ and climate adaptation. One such climate buffer is the Onlanden nature reserve near the city of Groningen. By offering room for natural processes, the nature reserve doubles as a water storage area in order to prevent waterlogging in the city, while the project contributes to the realisation of the nature tasking of the Netherlands.

Interface with environmental policy

The Delta Programme goals overlap environmental policy, urban development policy, and building regulations to a significant extent. It is essential for environmental policy, which includes the comprehensive urban development tasking, to factor in the changing climate. New and restructured developments must not only be energy-neutral (climate mitigation) but also climate-adaptive,

¹⁸ [Parliamentary Document 34 513 no. 1](#).

¹⁹ Among which the Ministry of Infrastructure and Water Management, the Association of Dutch Regional Water Authorities, the Association of Provincial Authorities, and the Dutch Federation of Agriculture and Horticulture. [The parties have signed the declaration of intent regarding the Delta Strategy for Water Quality and Freshwater Supply](#).

²⁰ Rijksnatuurvisie 2014 ‘Natuurlijk verder’ [National Nature Vision 2014 “The Natural Way Forward”].

Atelier X

The Delta Programme taskings can be connected to other major spatial taskings, such as the energy transition, the transition to a circular economy, Netherlands Nature Network, and the quality of the living environment. Spatial design is an important tool for establishing such connections and can facilitate collaboration between parties.

In 2018, the Delta Programme partners and Atelier X employed spatial design for a range of areas, such as the Rhine tributaries ([River Design Lab Work Book](#)), the Meuse (Meuse Atelier Series), Spatial Adaptation (Climate Adaptation storyline), the IJsselmeer Region ([Regional agenda for the IJsselmeer Region](#)), and the coast ([Coastal Pact](#)).

At the end of 2017, Atelier X, set up within the context of [the Spatial Design Action Agenda 2017-2020](#), was transferred from the Ministry of Infrastructure and the Environment to the Ministry of the Interior and Kingdom Relations. The results of employing design for climate and water issues were discussed at the annual Climate and Water Platform meeting in December 2017 and published in early 2018 via a [new website](#).

from the very start, in terms of both the location selected for new developments and the building methods.

The provinces and municipalities are embedding spatial adaptation in their Environmental Visions; the central government is doing likewise in the National Environmental Vision.

Participation

The preparation of measures calls for participation by various governments, knowledge organisations, interest groups, businesses, and residents in order to develop widely supported and high-quality designs and innovative solutions, even though full consensus among all those involved will not always be achieved. As more and more components of the Delta Programme are entering the implementation phase, the importance of organising participation is increasing. Across the board, regional partners hold positive opinions regarding participation; however, they are also observing opportunities for further improvement. Broad-based participation at the overall strategy level remains a particular challenge.

Participation in dyke improvements

Stakeholders are involved in dyke improvements from the very start and to the maximum extent possible.

With respect to the Grebbe dyke improvement, local residents, entrepreneurs, institutions, and organisations have actively provided input regarding the ambitions for the area around this dyke and the solution strategies. In 2018, these so-called “[Dijkdenkers](#)” [Dyke Thinkers] drew up [recommendations](#) regarding the dyke improvement, such as “invest in the city’s relation with the flood plains” and “capitalise on the available values rather than focus on new initiatives”. The dyke thinkers will remain closely involved in the follow-up process.

Another example is the Marken dyke improvement that will commence in 2020. From the very start, Rijkswaterstaat has closely involved the residents of Marken via the Island Council. In the design process, the Island Council has provided input regarding the solution, which generated an outward dyke improvement at the Zuidkade. All those involved were satisfied with the participation by the Island Council and the collaboration will be continued in the plan elaboration. With respect to the Zwolle-Olst dyke improvement, the district water board is examining which measures are needed in the area, in consultation with local residents, and how they can best be fitted in. To this end, a group of “dyke thinkers” was formed, comprising some 45 interested IJsseldijk residents, who are eager to actively weigh in on the dyke improvements in their living environment.

At some locations, participation turned out less well. For example, the extensive citizen participation process for the Markermeer dyke improvement did not generate similar insights for all the dyke sections. For several sub-sections (Uitdam, Durgerdam), therefore, the authorities decided in 2017 to allow more time for a high-quality completion of the participation process.

In some cases, the quality of environmental management and participation is open to further improvement. To this end, Rijkswaterstaat and the district water boards are setting up training courses within the Flood Protection Programme.

Participation in freshwater supply measures

(Local) stakeholders are also participating in actual measures from the Delta Plan on Freshwater Supply. For example, the pilot projects for the Water Availability process involved collaboration with freshwater consumers in the agriculture, horticulture, nature, and drinking water sectors. As a result of the Water Availability process and the connection with the Delta Plan on Spatial Adaptation, more and more municipalities are embracing the Delta Plan on Freshwater Supply.

The implementation process for Delta Plan on Freshwater Supply measures and the elaboration of the Water Availability process have been designed in a manner that allows all the relevant consumers in an area to contribute. Their involvement has been organised at both the national and the regional level. Once a year, the authorities meet with the group of consumers to survey specific requirements and determine whether these can be met. This meeting has been set up because consumers have indicated their difficulty in determining which consultative meetings to attend.

Participation in spatial adaptation

Active and broad-based societal involvement is of paramount importance with regard to spatial adaptation, if only because private premises account for a large proportion of our cities, villages, and rural areas. In most cases, therefore, district water boards, municipalities, and provinces involve

companies, residents, NGOs, terrain managers, knowledge institutes, and educational establishments in spatial adaptation processes. Furthermore, several social parties are launching individual initiatives aimed at water-resilient and climate-proof planning. A good example is the *Handboek voor de watervriendelijke tuin* [Manual for water-friendly gardens], an initiative of the Association of Municipalities for Sustainable Development and the Dutch Garden Sector. The Overijssel Spatial Adaptation Living Lab has compiled a booklet²¹ in collaboration with other partners, explaining how to collectively substantiate climate measures in residential areas. In 2018, several sector organisations and interest groups actively involved their rank and file by focusing attention on spatial adaptation during gatherings, e.g., the RIONED day, and during development agenda meetings of the Dutch Green Building Council.

²¹ Publication: *Climate Adaptation and Environment Act*.

2.2 The Delta Programme governance

Since the launch of the Delta Programme, the central government, district water boards, provinces, and municipalities have been engaging in innovative forms of collaboration, with input from knowledge institutes, NGOs, businesses, and residents. The collaboration is substantiated at both the national and regional levels, and focuses on flood risk management, freshwater supply, and spatial adaptation.

Governance relating to Spatial Adaptation

With effect from 2017, the Delta Programme has featured a Delta Plan on Spatial Adaptation. The ambitions, agreements, and actions set out in this Delta Plan call for close collaboration between all the governments. The partners have agreed to base their collaboration – particularly in terms of implementation – on a nationwide division into working regions (see [Delta Plan on Spatial Adaptation](#)). In each working region, the governments involved will collectively map out the vulnerabilities to waterlogging, heat, drought, and urban flooding. Together with residents, businesses, and NGOs they will set down ambitions to reduce such vulnerability and implement measures to this end. The working regions will monitor progress for the benefit of their own local and regional administrations. On the basis of this information, seven existing regional consultative bodies (see [Delta Plan on Spatial Adaptation](#)) will report on the progress made with respect to spatial adaptation in the purview of the annual progress report by the Delta Programme Commissioner. The regional consultative bodies will foster interconnectivity with the other Delta Programme taskings (flood risk management and freshwater supply). In consultation with, inter alia, the Infrastructure and the Environment Consultative Body (OIM), further agreements will be made on the involvement

of NGOs in efforts aimed at rendering our country climate-proof and water-resilient.

Increasing interconnectivity, reducing administrative pressure

The governance of the other Delta Programme components also requires attention. Now that more and more elements of the Delta Programme are entering the implementation stage, a better picture of the interconnections between the three taskings (flood risk management, freshwater supply, and spatial adaptation) would be helpful. For that reason, the Delta Programme partners are checking whether the regional administrative consultations regarding these three taskings can be combined and liaised with the Delta Strategy for Water Quality. In addition to reinforcing interconnectivity in terms of content and the integrated approach, such combination is also intended to reduce the administrative burden.

Currently, each Delta Programme tasking features its own logical regional division, each with an appropriate administrative agenda. The Delta Programme Commissioner has called on the Delta Programme partners to table the simplification of the consultative structure and reinforcement of the substantive interconnectivity in their own regional consultation committee meetings. A good example is the southern region, in which the meetings of the Regional Consultation Committee on the Meuse / Elevated Sandy Soils South address the topics of water quality, freshwater supply, and spatial adaptation, immediately followed (“back to back”) by a meeting with the Delta Programme Steering Group for the Meuse, which covers flood risk management. This example is copied in other areas, in particular

Delta Plan on Spatial Adaptation

Spatial Adaptation:
regional consultative bodies and working regions*



This map indicates the situation in the working regions as of 1 July 2018. The design is still under development. [Click here](#) for the current status.

Working regions

- | | | | | |
|--|---|---|---|---|
| 01 Fries Bestuursakkoord Waterketen | 10 Northern Vechtstromen | 18 De Meierij Efficient Water Management working unit | 26 Maas & Mergelland cooperative | 33 Spatial Planning - Housing - Economy administrative platform - Central-Holland region |
| 02 Groningen and North Drenthe water chain collaboration | 11 East Veluwe water collaboration (SWOV) | 19 A50+ water collaboration cooperative | 27 Zeeland regional cooperative | 34 Amstel, Gooi & Vecht region cooperative |
| 03 De Liemers cooperative | 12 Veluwe edge cooperative | 20 Climate-proof Land van Cuijk | 28 Goeree-Overflakkee Spatial Planning - Housing - Economy administrative platform | 35 Spatial Planning - Housing - Economy administrative platform - Holland Rijnland region |
| 04 Achterhoek+ region cooperative | 13 Alblasserwaard-Vijtheerenland regional council | 21 Southeast Brabant water portal | 29 Amsterdam climate adaptation strategy | 36 Utrecht Spatial Adaptation Coalition |
| 05 North Veluwe water collaboration | 14 RAS Rijk van Maas & Waal cooperative | 22 Brabantse Peel cooperative | 30 Spatial Planning - Housing - Economy administrative platform - Drechtsteden region | 37 Flevoland climate adaptation |
| 06 Twente water grid | 15 Rivierenland spatial adaptation (NWR) | 23 Water Panel North cooperative | 31 Spatial Planning - Housing - Economy administrative platform - Hoeksche Waard region | 38 Noorderkwartier water chain collaboration |
| 07 West Overijssel DP Spatial Adaptation | 16 West Brabant region | 24 Western mining region cooperative | 32 Spatial Planning - Housing - Economy administrative platform - Rotterdam - The Hague metropolis region | 39 South Kennemerland South |
| 08 Fluvius | 17 Hart van Brabant working unit | | | 40 Climate-proof Haarlemmermeer |
| 09 Vallei & Eem Water Platform | | | | Developments are under way here, but official working regions have not yet been established |

Regional consultative bodies

- Regional Consultation Committee North
- IJsselmeer Region Administrative Platform
- Eastern Elevated Sandy Soils Freshwater Supply Region
- West-Netherlands Freshwater Supply Region, in collaboration with Rhine Estuary-Drechtsteden Regional Consultative Body
- Major Rivers Freshwater Supply Region
- Southwest Delta Regional Consultative Body
- Meuse Regional Consultation Committee / Southern Elevated Sandy Soils Freshwater Supply Region

Basic map

- Freshwater
- Saltwater / brackish water
- Area outside the dykes
- Urban area
- Docks
- Border

the north, east, southwest, and around the IJsselmeer lake. In the western part of the Netherlands, the debate still continues.

In concert with the administrative partners, appropriate forms of governance will be explored for the overarching issue of flood risk management.

Interconnectivity at the national level

The Ministry of the Interior and Kingdom Relations has joined the national Delta Programme Steering Group in order to give maximum substance to the connection between water and spatial planning. On account of the close relations with nature and agriculture, the Ministry of Agriculture, Nature, and Food Quality has also joined the Delta Programme Steering Group. The latter Ministry also represents the Ministry of Economic Affairs and Climate Policy in this steering group.

Soil subsidence

Soil subsidence is a factor to be reckoned within the Delta Programme. Some low-lying parts of the Netherlands are experiencing an annual local soil subsidence of up to 2 cm. This is mainly caused by the combination of peat degradation, increasing loads on weak soils, and (increasingly) lower groundwater levels. In addition, gas extraction, salt extraction, and river erosion are causing other forms of soil subsidence.

Subsidence of peat soils is resulting in CO₂ emissions and water quality issues. The Netherlands Environmental Assessment Agency (PBL) has [calculated](#) that up to 2050, the social cost of soil subsidence in peat soils will amount to 22 billion euros. In urban areas, the damage to infrastructure and foundations may run to 5.2 billion and 16 billion euros, respectively. In rural areas, the damage to (water) infrastructure and buildings may run to approx. 1 billion euros; water management costs are estimated at some 0.2 billion euros.

Soil subsidence is adding to the Delta Programme tasks. The subsiding soil could aggravate flood risks, especially considering that the sea level is rising and river discharge volumes are increasing. In addition, the gravity-driven drainage of excess water into the sea or polder outlets is going to require larger pumps. Locations at which differences in soil structure and soil load are causing uneven soil subsidence may suffer visible and invisible damage to the foundations of buildings, engineering structures, roads, and dykes, as well as to underground infrastructure such as cables, pipes, and sewer systems. Moreover, soil subsidence increases the risk of waterlogging and fosters seepage, which could result in the salinisation of groundwater and surface water in polders and the coastal strip. Measures aimed at reducing soil subsidence, such as adapted weir management, may cause (ground) waterlogging and have a negative impact on the availability of fresh water.

The importance of subsidence to the Delta Programme goals dictates a further analysis of its causes and effects. In the [Inter-Ministerial Programme](#) (February 2018), therefore, the parties working on the Delta Programme have set down their commitment to taking account of soil subsidence in the stress tests and risk dialogues that they are conducting within the framework of the Delta Plan on Spatial Adaptation. Such stress tests will thus provide insight into the impact of subsidence on waterlogging, heat, drought, and urban flooding at the local and regional levels. Administrators will discuss the results of the stress tests in (risk) dialogues. The insights into the effect of soil subsidence will be taken into consideration in the scheduling of measures under the Delta Plan on Spatial Adaptation but also in the Delta Plan on Flood Risk Management (impact on urban flooding) and the Delta Plan on Freshwater Supply (impact on availability of water). All parties involved bear specific responsibilities in this; the schedules of measures can be set down by mutual agreement.

The Ministry of Infrastructure and Water Management is making the existing information and know-how on soil subsidence processes available in the purview of the stress tests and is developing, in concert with the regional authorities, a plan of approach for improving information provision and the knowledge infrastructure pertaining to soil subsidence. Furthermore, the Delta Programme is seeking active collaboration with the [National Soil Subsidence Knowledge Programme](#) (formerly: Climate, Water, and Soil Subsidence Knowledge Programme), in which the central government, provinces, district water boards, municipalities, and knowledge institutes have collectively developed and shared subsidence expertise since 2016.

In the Inter-Ministerial Programme, several Ministries (among which Infrastructure and Water Management, Economic Affairs and Climate Policy, Agriculture, Nature, and Food Quality, and the Interior and Kingdom

Relations), provinces, district water boards, and municipalities have also agreed to join forces on developing peat soil visions. The sector platform on Agriculture and Land Use, which has been set up in preparation of the Climate and Energy Agreement, features a separate platform for the development of agreements on different forms of land usage in peaty areas to reduce CO₂ emissions. The peat soil visions will be translated into strategies for counteracting soil subsidence and its impact in urban and rural areas. Strategies aimed at rural areas include, e.g., water saturation through raising water levels or infiltration via drains but also transitions to wetter cultures, an energy landscape or natural solutions. The sequestration of greenhouse gases in expanding peat areas in nature reserves can be highly effective; cf. the soil strategy drawn up by the Minister of Agriculture, Nature, and Food Quality²². In built up areas, certain requirements are enforced with respect to land clearance, e.g., the use of lightweight materials in order to reduce future management costs ensuing from subsidence and the implementation of mitigating interventions in existing urban areas. The goals and measures will be embedded in the municipal and provincial Environmental Visions and in the National Environmental Vision (the project brief for the National Environmental Vision dated February 2017 identifies dealing with

²² Parliamentary Document 30 015 no. 54.

soil subsidence as one of the taskings in both urban and rural areas). Measures such as different forms of land use or adapted water level management call for coordination with a range of other social taskings, such as house building, sustainabilisation of agriculture, landscape management, and CO₂ reduction.

In several regions, parties have already joined forces to tackle soil subsidence, for example, in [the Weak Soil Platform](#). Collaboration is also under way in the Green Heart of Holland; local partners have drawn up a so-called perspective [memorandum](#) featuring an integrated strategy for the taskings in the fields of soil subsidence, agriculture, landscape, energy, and mobility. In February 2018, the municipalities of Alphen aan den Rijn, Gouda, and Woerden; the Rijnland and Stichtse Rijnlanden district water control boards; and the provinces of Utrecht and Zuid-Holland agreed with the central government to collectively explore ways to combat soil subsidence in this region. The province of Fryslân set down a peat grassland vision in 2015 and is now adopting the goals in the provincial Environmental Vision. The associated implementation programme is being carried out in concert by the Wetterskip Fryslân water board, the Frisian municipalities, the province of Fryslân, agriculture organisations, nature and environmental organisations, and the leisure sector.

2.3 Knowledge on new developments

Information on studies focused on specific issues or regions is provided in Chapters 3, 4, 5, and 7.

Delta Scenarios and Paris climate agreements

The Delta Scenarios²³ have been updated. The new socio-economic forecasts published by the Netherlands Bureau for Economic Policy Analysis (CPB) and the Netherlands Environmental Assessment Agency (PBL) at the end of 2015 (WLO scenarios) have now been incorporated into the Delta Scenarios. The scenarios are based on more realistic assessments of the trends in irrigation and the ensuing water requirements. The PBL and Deltares research institute have developed an additional variant for the PRESSURE scenario:

²³ Delta Scenarios are plausible scenarios for future climate and socio-economic developments. These scenarios constitute the basis for the measures set out in the Delta Plans and Preferential Strategies. The four Delta Scenarios are: STEAM, PRESSURE, WARM, and REST.

PRESSURE-PARIS. This variant reflects the transition required to comply with the Paris climate agreements and its impact on the water taskings. Among other principles, the PRESSURE-PARIS variant is based on a wetter management of peat grasslands, more forest to be used for CO₂ sequestration, a reduced need for cooling water, and an increased focus on densification in urban developments. The Delta Programme is using the updated Delta Scenarios and the PRESSURE-PARIS variant to update the [bottleneck analysis](#) for the freshwater supply. Furthermore, along with the other scenarios, the variant serves as input for the stress tests being conducted in the purview of spatial adaptation. The adjusted Delta Scenarios will be incorporated into the National Water Model²⁴.

²⁴ [The National Water Model](#) is a computer model that calculates water movements and provides insight into flood protection, the freshwater distribution, and water quality in the Netherlands.

New insights into the potential acceleration in [sea level rise](#) have not yet been incorporated in this interim update (see [paragraph 2.1](#)). An overall update of the Delta Scenarios is scheduled for 2019-2020. At that time, the most recent insights into climate change and the rising sea level will be taken into account, geared to the climate scenarios to be published by the Royal Netherlands Meteorological Institute KNMI.

National Water and Climate Knowledge and Innovation Programme

Knowledge issues that call for collaboration between knowledge institutes, governments, and the business community have been accommodated in the National Water and Climate Knowledge and Innovation Programme (NKWK)²⁵, which is closely linked to the Delta Programme. Collaboration programmes have already been rolled out for fourteen topics. In the autumn of 2018, the Netherlands Organisation for Scientific Research (NWO) will launch a new call for “Living Labs in the Delta”, aimed at gaining expertise and experience with new “building with nature” concepts. The Ministry of Agriculture, Nature, and Food Quality has also been involved in the NKWK with effect from 2018. The annual NKWK knowledge conference was held on 17 April 2018; its theme was “[From paper to practice](#)”.

²⁵ Delta Programme Commissioner, the Ministry of Infrastructure and Water Management, including Rijkswaterstaat, the Foundation for Applied Water Research STOWA, district water boards, the Netherlands Organisation for Scientific Research NWO, the Top Sector Water, Deltares, Wageningen UR, TNO, KNMI, and the business community.

In the coalition agreement of the new Cabinet (2017), additional funds have been set aside for fundamental and applied research. In his capacity as chairman of the NKWK Supervisory Board, the Delta Programme Commissioner has reiterated the importance of additional investments in water- and climate-related research, and the institutes conducting such research, to the Ministers of Education, Culture and Science (OCW) and of Economic Affairs and Climate Policy (EZK). Along with other relevant Ministries, the Ministry of Infrastructure and Water Management is consulting with the Ministries of OCW and EZK regarding the utilisation of the additional funds. The “Blue Route” in the [National Science Agenda](#) is relevant to this end; the NKWK can gear its strategy to this roadmap.

Early warning

[Recent developments](#) in weather and seasonal forecasts enable a more exact assessment of the probability of extreme weather and of long-term summer droughts. This new form of early warning enables various parties to better anticipate events and prevent or reduce damage (and possibly also casualties). For example, water managers can raise water levels when drought is expected and lower them (pre-pumping) in the event of expected extreme precipitation. Farmers can gear their irrigation or time of harvesting to the expectations. Flood defence system managers can give an early alert in the event of extreme water levels and relief workers can alert the public on time. The further development of this form of *early warning* by the KNMI is, therefore, important for the Delta Programme, supplementary to preventative measures.

2.4 Private sector, innovation, and international collaboration

2.4.1 Private sector and innovation

For all three Delta Programme themes, innovations constitute an important, essential condition for the realisation of the ambitious taskings by 2050. That is why a productive collaboration with the Top Sector Water has been initiated. The Delta Programme is creating conditions that are conducive to innovations. One such example are the [general explorations](#) in the Delta Plan on Flood Risk Management that provide opportunities for harnessing the creativity and innovative capacity of the private sector. The Delta Plan on [Freshwater Supply](#) comprises a range of climate adaptation pilots featuring innovative measures. In the field of spatial adaptation, innovative solutions are being developed at many locations. For example, in May 2018, the [WaterStreet](#) was opened in the Green Village testing ground in Delft, a testing facility for experiments, studies, and products aimed at coping with severe downpours, drought, and heat in the city. Entrepreneurs have centralised their innovative solutions here.

Tender procedures and competitions are particularly efficient methods for the government to focus on [innovation](#). Several ways are of interest to the Delta Programme. For example, tender procedures may explicitly stipulate “innovation-oriented purchasing”. This form of control, which is endorsed by economist Mazzucato²⁶, features in the current market visions of Rijkswaterstaat²⁷ and the Association of Dutch Regional Water Authorities²⁸. Another option is Small Business Innovation Research (SBIR). This form of tendering is conducive to finding innovative solutions to social challenges involving the public good. In the coalition agreement *Confidence in the future*, the government

²⁶ Mariana Mazzucato, 2013. The entrepreneurial state. Debunking public vs private sector myths.

²⁷ See [marktvisie.nu](#).

²⁸ [Market vision De waterschapsmarkt van de toekomst](#) – Bouwstenen voor vernieuwing [The regional water authority market of the future – Building blocks for innovation]

WaterStreet Workshop

Upon the opening of the WaterStreet in [The Green Village](#) at the Delft University of Technology campus, the Delfland district water control board and VPdelta organised a workshop on innovative solutions to urban water issues. They presented the action items generated by this workshop to the Chair of the Delfland board and to the Delta Programme Commissioner. The actions range from involving local residents to inviting municipalities to visit the WaterStreet, providing increased insight into the costs and benefits of innovative solutions, and using visual aids to visualise the effect of innovations and raise awareness of innovations among the public.

parties have stated that Rijkswaterstaat will be boosting innovation by assuming the role of launching customer and making greater use of this form of tendering.

Innovations can also be encouraged in other ways. An example is [the Heritage and Spatial Planning design programme](#) developed by the Creative Industries Incentive Fund at the behest of the Ministry of Infrastructure and Water Management and the Ministry of Education, Culture, and Science. Its aim is to involve designers in current social issues that directly impact the spatial structure of the Dutch cultural landscape and our daily living environment, such as climate change. Capitalising on design power and connecting the climate adaptation issue with cultural-historical heritage structures could generate surprising new insights and lines of thought. Grants to this end have been awarded to eight projects. Four of these pertain to “Urban development for extremes” (adapting cities to cope with extreme rainfall).

2.4.2 International collaboration

The expertise that the Netherlands is acquiring within the Delta Programme makes an interesting export product and offers opportunities for liaising with the many global actors in the water world. The Delta Programme Commissioner and the Special Envoys for International Water Affairs and International Climate Affairs for the Kingdom of the Netherlands are working closely together in this respect. The Delta Programme is supporting other nations with expertise and experience gained in the Netherlands, such as Vietnam, Bangladesh, Myanmar, the Philippines, and Indonesia. Many countries are faced with an increased risk of flooding, waterlogging, drought, and hurricanes. For complex and urgent water issues, they frequently turn to the Netherlands and the Delta Programme. For example, in 2018, the Myanmar government adopted a strategy for the sustainable development of the Ayeyarwadi delta,

Bangladesh Delta Plan

The Delta Programme has contributed to the development of the Bangladesh Delta Plan 2100. This plan comprises regional adaptation strategies, an investment agenda, and a proposal for an institutional framework featuring, inter alia, a commissioner, a fund, and an Act. The Bangladesh government adopted the Delta Plan in September 2018. The Dutch government and the Delta Programme are also providing support in the implementation of the delta plan.

while the Bangladesh government set down a delta plan for the Bramaputra delta in September 2018; both plans were developed using expertise from the Delta Programme. Furthermore, the Delta Programme is actively contributing to a delta plan for Vietnam (Mekong) and the Manila Bay Masterplan in the Philippines. Of note is the fact that European countries such as the United Kingdom but also the United States, are seeking advice from the Delta Programme partners and the Delta Programme Commissioner increasingly frequently.

In the Netherlands, the International Water Ambition (2016-2021) constitutes the framework for efforts expended abroad in the fields of water and climate adaptation taskings. The goal is to enhance flood protection and water security in the world. The Delta Programme is contributing the most recent expertise and innovations. In March 2018, the Ministry of Foreign Affairs, the Ministry of Infrastructure and Water Management, and the Association of Dutch Regional Water Authorities signed a [Blue Deal](#). In this agreement, the parties have formally set down their intention to collaborate on the realisation of the International Water Ambition (IWA) and the Sustainable Development Goals (SDGs).

In 2018, [the Global Centre of Excellence on Climate Adaptation](#) was launched. This network of some 50 international institutes focuses on the development of knowledge on effective climate adaptation methods. The Delta Programme is contributing its expertise and experience in the fields of flood risk management, freshwater supply, and spatial adaptation, and its innovative administrative approach. Through the Global Centre, such expertise and experience are made available in the purview of the activities of the Delta Alliance (a cooperative of Delft University of Technology, WUR/Wageningen Environmental Research, UNESCO-IHE, and Deltares) and the Delta Coalition (an international coalition that turns the spotlight onto the interests of the twelve most vulnerable delta countries). The activities of both the Delta Alliance and the Delta Coalition are connected to the activities of the Global Centre.

CHAPTER 3

Flood risk management: progress and measures



This chapter addresses the implementation of the Delta Decision on Flood Risk Management (paragraph 3.1) and the progress made with respect to the measures from the Delta Plan on Flood Risk Management (paragraph 3.2).

3.1 Delta Decision on Flood Risk Management

Flood risk management policy is aimed at ensuring that by no later than 2050, the probability of fatality due to flooding will be reduced to 1 in 100,000 per annum (.001%) or less for every resident living behind the dykes, as proposed in the Delta Decision on [Flood Risk Management](#). Additional protection is needed in areas prone to potentially large groups of victims, major economic damage, or serious damage due to failure of vital and vulnerable infrastructure of national significance. For that reason, new flood protection standards are in force for the dykes, dunes, and dams (layer 1). The risks are reduced even further by adaptations in spatial planning (layer 2) and disaster control systems (layer 3).

The work on the Delta Decision on Flood Risk Management is proceeding according to schedule. Approx. 15% of the primary flood defence systems have been assessed on the basis of the new standards, and approx. 10% of the dyke improvement projects carried out under the Flood Protection Programme are based on the new standards. The completed and scheduled improvements will reduce flood risk by some 50%²⁹ (layer 1).

The flood defence system managers have adopted a new method, provided by the central government, for the assessment of flood defence systems, while the dyke sections that pose the highest risks will be given priority in the Flood Protection Programme improvement projects. Measures to reduce the impact of urban flooding through spatial planning (layer 2) will be given special attention through the working group on Impact Reduction set up by the Delta Programme Steering Group. Studies have mapped out promising locations for smart combinations³⁰. Four Security Regions have completed their impact analyses; the other analyses must be completed in 2018 (layer 3). This will generate a sound basis for the implementation of the Preferential Strategies for flood risk management in the Delta Programme regions (see [Chapter 7](#)).

Solid statutory and financial basis

The Administrative Agreement on Water, the Water Act, and the Flood Protection Grants Scheme 2014 set out the statutory and financial frameworks for the Flood Protection Programme. The new standards that came into effect in 2017 have resulted in amendments to the Water Act and the grants scheme. In 2019, the central government and

the district water boards will assess the efficiency and effects of the grants scheme on the basis of the experience gained in actual practice. By 2023, the ongoing assessment of the flood defence systems will provide greater clarity regarding the scope of the flood risk management tasking. Subsequently, the funding agreements set down in the Administrative Agreement on Water will be reviewed.

Assessment:

on the road to the first picture of national security

Since the commencement of the First Primary Flood Defence Systems Assessment Round (in early 2017), sixteen assessments have been completed (mid-2018), i.e., some 15% of the primary flood defences. High-risk dykes have been assessed first. Some other dykes have also been assessed at an early stage in order to have their improvement tie in with other dyke improvement projects or other initiatives. For example, to this end, an interim assessment has been conducted for a dyke section near Salmsteke bij de Lek.

The aim of having a first national picture of the security tasking completed by 2023 is ambitious. As yet, the assessments are on schedule and are being accomplished at a steady rate, according to plan. However, the planning and quality are slightly under pressure as a result of the new assessment strategy and the additional effort that the tools require on the part of the flood defence system managers. The managers have entered into discussion with the Ministry of Infrastructure and Water Management in order to resolve bottlenecks in a timely and adequate manner. Expectations are that a first picture of the security tasking by 2023 will remain feasible, taking into account the intended improvements in the assessment tools that will enhance operational efficiency. The collaboration between the district water boards and the Ministry of Infrastructure and Water Management (including Rijkswaterstaat) is proceeding well: the organisations are exchanging expertise and

²⁹ Source: memorandum on monitoring of flood risk management target attainment, Deltares, June 2018.

³⁰ In specific situations, e.g., dyke improvements that entail extremely high costs or have a profound impact on society, “smart combinations” with spatial planning and/or disaster contingency plans may help to attain protection levels.

are collectively gaining experience with the flood probability approach. [The public Flood Risk Management portal](#) is showing the progress made in the assessment round in a map. At the end of 2018, a visualisation of the security assessment will be added, as will a link to the dyke improvements of the Flood Protection Programme.

Instruments for the assessment and design of flood defence systems

The assessment instruments for flood defence systems were amended in 2017. The first half of 2018 focused on gaining experience with the instruments. [The Helpdesk](#) offers practical lessons in the form of [factsheets](#) and best practices. In the spring of 2018, the Expertise and Know-how Platform organised a project week for managers to work collectively on assessments. During this project week, the managers were supported by Deltares and Rijkswaterstaat experts. The project week has facilitated collaboration on complex issues and enhanced synergy in the assessments.

In the years ahead, the design and assessment instruments will be integrated. In consultation with the district water boards and experts in the field, the Ministry of Infrastructure and Water Management is going to supplement and amend the instruments based on the experience gained by the managers and on the expertise that has been developed hitherto. In 2018, a basis will be created for the further development of the instruments. Together with managers and the private sector, the Ministry is working on a vision to determine the direction in which the instruments will be developed. Efforts are also under way with respect to roadmaps for the piping and macrostability failure mechanisms, hydraulic loads, and software for the determination of the development frameworks.

In the purview of the design process, the flood defence system managers will be provided with new software to facilitate the calculation of hydraulic loads for various climate scenarios and focus years. Furthermore, in 2018 an overview will be made available of manuals, guidelines, and software for the design of flood defence systems. A new system will be introduced in 2018 for the consultation of the technical guidelines and reports. This will facilitate the retrieval, management, and updating of expertise. The new manual for designing with flood probabilities (OI2014 version 5) will be completed by early 2019. With respect to the application of the new standards and the design instruments in Flood Protection Programme projects, the manual ties in with the practical experience and recommendations of the Risk-based Approach Knowledge Platform.

In 2017, the Flood Risk Management Expertise Network (ENW) published an advisory report on tailored [assessment](#). Following this report and an exchange of expertise with the United States and the United Kingdom, the Ministry

of Infrastructure and Water Management is developing, in consultation with the district water boards, a methodology for capitalising on the experience of experts in a transparent and substantiated manner in tailored assessments.

Long-term Ambition for the Rivers: Integrated River Management programme

Flood risk management is a key and urgent tasking in the area around the major rivers: flood risk management is a prerequisite for future developments, which necessitate preparation for increasing river discharges on account of climate change. The Rhine and Meuse Preferential Strategy for flood risk management, as set down in earlier Delta Programmes, involves a combination of dyke improvement and river widening. Dyke improvement is being tackled energetically in the Flood Protection Programme. River widening is given new impetus.

In addition to flood risk management, the rivers Rhine and Meuse feature other interconnected national and regional taskings. All the national taskings are more or less binding and essential in nature; they bear on the fields of shipping, water quality, nature conservation, freshwater supply, and river bed management. Regional taskings pertain to, inter alia, nature development, leisure/the economy, and an attractive residential and business climate. They also relate to spatial adaptation.

The governments involved agree that the aforementioned taskings call for an integrated approach to the river as a system, in which achieving the statutory flood protection is a precondition, and that the targeted implementation of river widening measures offers opportunities for synergy with other interests.

The Minister of Infrastructure and Water Management has expressed her intention to set up an Integrated River Management programme for the area around the major rivers, in collaboration with the stakeholders involved (governments, the business community, and NGOs). To this end, she has set aside a sum of 375 million euros in the Delta Fund. Together with the Delta Programme partners, the Minister is developing an evaluation framework for the selection of measures. One of the connecting measures in the programme is river widening. River widening serves many purposes. Targeted investment in river widening at specific locations will help to attain the flood risk management goals (to reduce vulnerability, to obviate the need for raising dykes, to improve the long-term resilience of the river system). Furthermore, such investment will contribute to other national (management) taskings such as shipping, to area development, and to other regional taskings. Differentiation between the river tributaries in terms of elaboration and (rate of) implementation is an option. The Rhine and Meuse managers have expressed their intention

to collectively formulate the river widening ambition for the period up to 2050, and to concretise and implement such an ambition in six-year rounds. Regional administrators have also expressed their willingness to co-fund. The ambition and the rounds will be translated into a common flood level line to be taken into account in dyke improvement efforts. The water level line set out in the ambition holds a commitment to take action; the water level lines associated with each round hold a commitment to produce results.

In 2020, the Integrated River Management programme will be incorporated into a policy framework, probably by way of an interim amendment to the National Water Plan 2016-2021, which with respect to spatial aspects also constitutes a framework vision by virtue of the Spatial Planning Act. River widening projects are scheduled and implemented in coordination with the Flood Protection Programme, a component of the Delta Plan on Flood Risk Management. The assessment framework will serve as the basis for further agreements between the central and regional governments on the funding of measures scheduled in an upcoming round, which may also involve an apportionment formula. The elaboration of the assessment framework and the framework vision, and eventually the initiation of river-widening studies and explorations calls for an appropriate working organisation and governance structure. Such a structure will be set up in the period ahead, in collaboration with the parties involved. Its development can be geared to the experience with and the organisation of central and regional governments within the Delta Programme. Participation of NGOs and the business community will also be factored in.

Smart combinations

In specific situations, e.g. dyke improvements that would entail extremely high costs or would encroach deeply on society, “smart combinations” with spatial planning and/or contingency measures would be an option to achieve the required protection level. The Ministry of Infrastructure and Water Management has elaborated, in collaboration with an advisory group³¹, the dyke sections at which a smart combination would be technically promising³². In this respect, technically promising entails that the benefits (savings on dyke improvement) outweigh the costs of the layer 2 and layer 3 measures. Whether a smart combination holds potential from a technical perspective appears to depend on the predominant contributing component of the standard: Local Individual Risk or the social cost-benefit analysis³³. A smart combination will not be promising from a technical

perspective in situations in which the standard is determined by a social cost-benefit analysis, because in this case, the standard already dictates a dyke design in which costs and benefits are balanced. A smart combination would not produce any savings in dyke design: at such locations, the spatial measures required for a smart combination would lead to higher costs. Smart combinations are found to be technically promising at the 58 dyke stretches for which the standard is governed by Local Individual Risk. These would be open to a smart combination with measures aimed at improving disaster control. A prerequisite, however, is that such a dyke stretch must be in need of improvement, which is not always the case. Furthermore, a more detailed exploration may show that a smart combination would not hold potential after all. Consequently, expectations are that several dozens of smart combinations will actually have potential.

A smart combination must be initiated by or in consultation with the region. Whether a smart combination will actually be substantiated at technically promising stretches will depend on local circumstances. Exploration of a smart combination must be prompted by an actual reason, such as insufficient room for improvement of the primary dyke, disproportionately high costs of dyke improvement or other weighty social interests. In addition, the parties involved must be confident that such a smart combination will enable maintenance of the required protection level. Consequently, as yet, no indication can be given as to whether a smart combination may be realised at a particular and technically promising dyke stretch. Smart combinations qualify for funding earmarked for the Flood Protection Programme if regular dyke improvement would be extremely costly or invasive.

Reducing the impact of urban flooding through appropriate spatial planning (layer 2)

Even if the flood defence systems are up to standard, flooding remains a risk. One of the Delta Programme taskings is to develop spatial designs that will reduce the impact of flooding. This will shorten the recovery time after a flood and could eventually limit, defer or prevent the need for dyke improvements. In addition, such designs will improve the Netherlands’ resilience to climate change. The Delta Programme Steering Group has concluded that impact reduction through spatial planning calls for additional targeted efforts. In the working group on Impact Reduction, which was recently set up, the parties involved in the [Delta Plan on Flood Risk Management](#) and [the Delta Plan on Spatial Adaptation](#) are collectively expediting the initiation of such efforts. In 2018, the working group will draw up a proposal for the required actions and specify the parties that are responsible for incorporating impact reduction into their policies.

³¹ The advisory group comprises representatives from provinces, district water boards, Association of Netherlands River Municipalities, and Security Regions.

³² [Rapport analyse slimme combinaties](#).

³³ In accordance with the amended Water Act.

Disaster control (layer 3)

The Security Regions are working on impact analyses and strategies for action perspectives. Meanwhile, 23 Security Regions have embarked on an impact analysis; the others will commence later in 2018. Four Security Regions have already completed their impact analyses. The Water and [Evacuation project was completed in 2017](#). The programme has generated tools that the Security Regions are currently implementing into their evacuation plans through the collective Water Crises Control in Security Regions (WAVE2020) implementation programme. The WAVE2020 programme is centralising the results of the impact analyses and the strategies for action perspectives into a single national picture, to provide a basis for a collective flood disaster control plan of all the governments. The programme also addresses supra-regional (preventative) evacuation. Rijkswaterstaat is taking responsibility for supra-regional traffic management during evacuations. In addition, the programme is publishing new guidelines pertaining to, inter alia, societal continuation and recovery. In 2019, the guideline on transportation of residents, animals, and goods will be available as a basis for regional and national evacuation plans. Finally, the programme is fleshing out information exchange between the responsible organisations, in order to ensure that all will have the same information during a crisis and in the preparation stage. The Water Crises and Floods Management Steering Group (SMWO) has commissioned the WAVE2020 programme, that involves collaboration between the Security Regions, district water boards, Rijkswaterstaat, and the relevant Ministries. In 2018, the National Crisis Plan Evacuation (NCP-E) will be completed. This sets out the procedure for the administrative decision-making process of the national government in the event of extremely comprehensive evacuations. The plan is of a generic nature and applicable to multiple types of disasters. The NCP-E does not replace the existing national and regional plans; it ties in with the regional plans that are currently being developed.

The results of the impact analyses and strategies can also be used for the assessment of layer 2 measures, the substantiation of the Flood Risks Directive, and the climate stress tests being conducted by the municipalities. Working on flood disaster control remains important for the Security Regions; after all, the effect of evacuations (the evacuation fractions³⁴) has been incorporated into the protection standard.

September 2017 saw a large-scale flood exercise, entitled *Deining & Doorbraak* [Upheaval & Collapse]. The drill has generated a wide range of insights, experience, and lessons to be learnt. Across the board, working with the National Crisis Management System (LCMS) was perceived as positive; some

³⁴ e percentage of residents that can leave the threatened area on time through preventative evacuation.

aspects appear to call for increased uniformity. In addition, the drill endorsed the importance of well-coordinated crisis communication. (Cf. [the box in paragraph 7.4.1](#).)

In 2017, Rijkswaterstaat assessed the feasibility of *reverse laning* as an evacuation measure. *Reverse laning* is a traffic measure involving temporarily changing the direction of traffic in the opposite lane, in order to be able to use this lane for outgoing traffic during an evacuation. The feasibility study has shown that in the Netherlands, reverse laning will hardly, if at all, speed up evacuation processes, whereas the measure requires an extensive preparation period. For that reason, Rijkswaterstaat recommends reticence in the use of reverse laning. In the period ahead, policy commitments will be set down in more detail. In the threat phase, the emphasis is on preventative evacuation by road. It is not possible to adapt the main infrastructure to such an extent as to ensure its continued full availability in flooded areas. Outside flooded areas, continued availability of the infrastructure for all modes of transport is indicated. A study will be conducted in the period ahead to examine whether the existing traffic management and evacuation strategies will suffice or whether supplementary strategies are required, and what costs this will involve. The N3 motorway near Dordrecht is being considered as a potential reverse laning pilot location. A *reverse laning* field test will be conducted in consultation with the Security Regions, based on an assessment framework yet to be developed.

Expertise and innovation

A proper and timely substantiation of the flood risk management tasking calls for research and innovations specifically tailored to this issue, supplementary to the Delta Programme-wide development of knowledge (see [paragraph 2.3](#)). This theme-specific expertise is mainly gathered through the knowledge programmes scheduled by the Ministry of Infrastructure and Water Management and [the general explorations](#) being conducted under the Flood Protection Programme.

New knowledge programmes

Since 1 January 2018, the Ministry of Infrastructure and Water Management has been working on the implementation of the Flood Risk Management knowledge programme. The programme focuses on three issues: Technology, System, and Living Environment. The Technology issue covers topics such as hydraulic loads and geotechnology. The System issue covers studies into the coast and the rivers. The new issue of Living Environment encompasses topics that touch on flood risk management, such as waterlogging. The knowledge programme is updated annually.

The Ministry and the district water boards have compiled an overview of all the flood risk management research studies already commissioned. Thus, the organisations

know who is researching what; the overview also provides insight into opportunities for collaboration. An example is the All Risk study³⁵ being conducted by five universities (headed by Delft University of Technology), in which the Flood Protection Programme, the Ministry of Infrastructure and Water Management, and the district water boards are actively involved. Another example is the collaboration on the Rivers and Coastal Genesis 2.0 focus areas within the National Water and [Climate Knowledge and Innovation Programme \(NKWK\)](#). In the autumn of 2017, Dutch, American, and British experts compared their methods for the assessment of flood defence systems in an intensive workshop.

Macrostability general exploration: Eemdijk pilot

In the Macrostability general exploration, private sector parties, knowledge institutes, and governments are seeking more efficient, faster, and cheaper methods for dyke improvement. In four clusters, they are looking for innovative solutions to the macrostability failure mechanism. The solutions are tested immediately and if possible, implemented in projects as a pilot solution. The Rivierenland district water board bears responsibility for this general exploration. In early 2018, the exploration involved the Eemdijk pilot. The researchers had two test dykes collapse, one with and the other without a sheet pile wall, and they monitored their distortion and strength. The Vallei & Veluwe district water board, Deltares research institute, and several private sector parties collaborated on the sheet pile wall test. PhD students enrolled in the All Risk programme are analysing the data.

Although costly, dyke improvement using sheet pile walls is implemented regularly at locations featuring little room for dyke improvement due, for example, to buildings along the dyke. The test is expected to generate options for optimising the design and assessment methods. In the future, lighter sheet pile walls could perhaps be used. Cutting down on steel means that lighter fixtures could possibly be used to attach the wall, which would cause less hindrance to the environment. This could also yield cost savings.

Forelands general exploration

Some dykes in the Netherlands feature forelands: areas outside the dykes, between the dyke and river or shallow water beds in front of the dyke toe. Forelands can reduce the hydraulic load on a dyke and enhance its strength. As yet, this is not taken into consideration in dyke assessments. Factoring in forelands will save costs and reduce nuisance on account of dyke improvement projects. The Forelands general exploration was launched in early 2017. Its aim is to draw up a Forelands Guideline enabling all primary flood defence system managers, with effect from 2019, to take

optimum and uniform account of the effect of forelands in their assessments and in Flood Protection Programme projects.

[The interim version](#) of the Guideline was completed in December 2017. This version has been discussed with several stakeholders, among whom flood defence system managers, consultants, researchers, and the Flood Protection Programme. A next version is expected sometime in the summer of 2018. The final version will be completed by the end of 2018; it will be available as from 2019.

Cables and Pipes general exploration

The dykes accommodate a range of water and gas pipes as well as power and data communication cables. Across the board, such cables and pipes are managed by grid managers. In dyke improvement projects, the security of the dyke is paramount to the dyke manager, whereas the grid manager focuses on supply security for residents. Timely coordination between these two parties will shorten the lead times of dyke improvement projects and considerably reduce the costs involved. The risk files compiled for all Flood Protection Programme projects show that cables and pipes pose a major project risk, especially the cables and pipes that have not yet been mapped out. Cables and pipes thus also constitute a significant risk to the overall programme. For that reason, the Cables and Pipes general exploration pursues the following goals:

- liaising the worlds of dyke managers, grid managers, and other stakeholders;
- optimising and keeping a better grip on security risks (to the dyke and to cables and pipes);
- optimising and keeping a better grip on implementation risks (time, money, content, and process).

Valuation of adaptivity and flexibility

Within the context of a doctoral study³⁶, Deltares has explored the extent to which river-widening measures from the Preferential Strategy for the IJssel offer additional flexibility for future adaptations of the strategy, and options for putting a money value on such flexibility through a social cost-benefit analysis. The study was co-commissioned by the Delta Programme. The researchers have employed the innovative so-called “real option theory” to conduct the analysis.

A key conclusion is that flexibility holds demonstrable value and that the output of adaptively scheduled measures will increase if the uncertainty in future river discharges is factored in. The study can help dyke managers to come to substantiated choices in the design of flood defence systems.

³⁵ For more information: [Background Document D, WV-3](#).

³⁶ Kind, Jarl M., Jorn H. Baayen and Wouter J. Botzen, Benefits and limitations of real options analysis for the practice of river flood risk management (accepted for publication in Water Resources Research).

3.2 Delta Plan on Flood Risk Management: measures to protect the Netherlands from flooding

The Delta Plan on Flood Risk Management comprises all the Delta Programme studies, measures and provisions, scheduled or to be scheduled, pertaining to flood risk management. The measures are funded from the Delta Fund, and, in some cases, from the Ministry of Infrastructure and Water Management budget. Where appropriate, the Delta Plan on Flood Risk Management also features regional measures not subsidised by the central government.

Every year, the Delta Programme Commissioner submits a proposal for the Delta Programme, which includes the Delta Plans. The Delta Plans comprise studies, measures, and provisions in the fields of flood risk management, spatial adaptation, and freshwater supply in the Netherlands. The proposal contains a detailed schedule for the first six years and an indicative schedule for the subsequent twelve years. It looks ahead to 2050 (in accordance with Art. 4.9 paragraph 5 of the Water Act).

The Delta Plan on Flood Risk Management, as outlined below, features diagrams and tables reflecting the progress, scheduling, planning, and phasing of the flood risk management projects.

3.2.1 Implementation programmes

Flood Protection Programme

The Flood Protection Programme is an ongoing programme; the measures are scheduled for a period of six years, with a tentative schedule for the next six years. The programme is aimed at having all flood defence systems meet the new standards by 2050. This will ensure a minimum protection level of 10⁻⁵ per annum for every resident of the Netherlands living behind a primary dyke or dam by no later than 2050. The Flood Protection Programme is drawn up collectively by the implementation alliance of the district water boards and Rijkswaterstaat. Dyke improvements are carried out by the manager of the dyke sections concerned, to which end a grant is provided from the Flood Protection Programme covering 90% of the cost, based on an efficient, plain and simple design. Every year, the alliance will propose a new schedule, that builds on the preceding year's schedule (evolving programme). The Minister of Infrastructure and Water Management sets down the programme once a year within the context of the Delta Plan on Flood Risk Management.

The implementation of the Flood Protection Programme is in full swing and proceeding as scheduled. The first target, the improvement of 100 kilometres of dykes by 2020, is expected to be attained. The completion of the first round of assessments in 2023 will yield a good picture of the overall new dyke improvement tasking. The dyke improvements featured in the programme have been prioritised by urgency. The most urgent sections have already been incor-

porated into the programme and for most of these sections, explorations or plan elaborations have commenced. A statutory element³⁷ of the programme adoption is an annual consultation based on a draft schedule. The consultation³⁸ regarding the 2019-2024 draft schedule took place in early 2018. Points for attention in the schedule were the influx of new projects, increasing the stability of the programme, and fitting the Flood Protection Programme into the Delta Fund dykes funding arrangement. The adoption of the new flood protection standards in the elaboration of projects could generate new insights and taskings. These will affect the scope and cost of a project, and consequently impact the overall programme through the sum of all projects. The proposed adjustments have been processed as best as possible within the principles of the programme.

Regional and local area processes are vitally important in the implementation of dyke improvement projects. Dyke improvements may impact the living environment, which is why relevant stakeholders are involved at the earliest possible stage. Local and regional governments play a formal role in this respect. For example, municipalities play a role on account of their responsibility for local spatial planning (zoning plan). Provinces play an important role in dyke improvement projects on account of their responsibility for the living environment, regional area developments, and nature. Furthermore, the provinces set down the Water Act Project Plan, an essential link in the development of dyke improvement projects. In addition, it is incumbent upon municipalities and provinces to identify and capitalise on opportunities for linkage with other taskings and ambitions in an area. To this end, the district water boards submit the draft Flood Protection Programme schedule during the annual Delta Programme regional consultation committee meetings.

New projects in the programme

The schedule for 2019-2024 features the first new projects ensuing from the first (partial) [assessment](#) of flood defence systems according to the new standards: a total of four new projects. These projects have been accommodated in the programme on an urgency basis. Up until mid-2020, the

³⁷ Water Act, Article 7.23.

³⁸ This consultation enables stakeholders to identify linkage opportunities at an early stage.

Dyke improvement forecast

Situation as of 31 March 2018

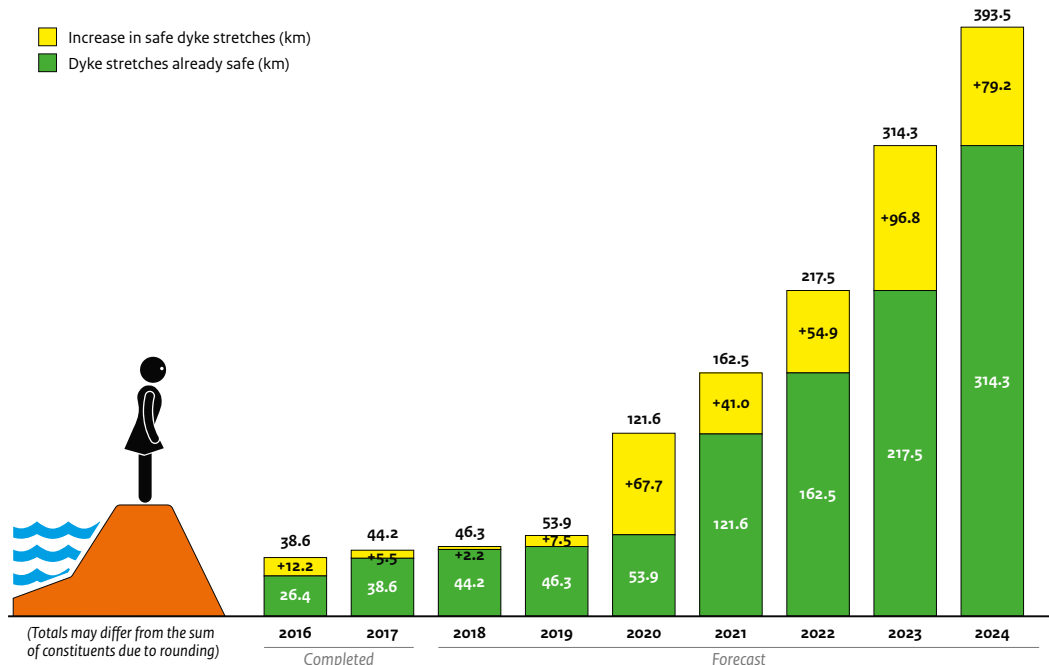


Figure 2 Forecast for dyke improvements implemented under the Flood Protection Programme, in kilometres. Data pertaining to the period 2016-2023 is based on projects completed in 2017. Data for the year 2024 is based on the proposed schedule for 2019-2024.

schedule features both dyke improvements ensuing from the (extended) third round of assessments under the old standards (largely in progress) and (increasingly more) dyke improvements based on the first round of assessments involving the new standards. The dyke improvements ensuing from an assessment under the old standards will be designed in accordance with the new standards.

Dyke improvement in kilometres per annum

By 2050, all flood defence systems must meet the flood protection standard. The Flood Protection Programme covers the improvement of 943 kilometres of dykes and 468 engineering structures. In the years ahead, the programme will be substantiated in more detail on the basis of the outcomes of the [assessments](#).

Figures 2 and 3 provide a prognosis regarding the improvement of dykes and engineering structures. Both figures show that the number of completed improvement projects is increasing considerably after the initial years. The Flood Protection Programme is gaining momentum. The Flood Protection Programme alliance partners are working on smart and broadly supported solutions. The aim is to shorten the lead time of dyke improvement projects and reduce the price per kilometre.

Need for knowledge development and innovation

(Technological) innovations and the [development of knowledge](#) among managers constitute an important driving force for the attainment of the Flood Protection Programme goal. The programme is boosting such innovations and knowledge development through Communities of Practice and General Explorations.

Dijkwerkers Community

Communities are regarded as the pre-eminent means to encourage collaboration and knowledge exchange between alliance partners. [The Dijkwerkers \(Dyke Workers\) community](#) has served as the umbrella organisation since 2017. This online platform encompasses more than 30 communities with a total of over 700 members (dyke workers). Eight of these communities are Communities of Practice (CoPs), each focused on a specific group of dyke workers (such as project managers, environmental managers, concern controllers). The CoPs organise 15 to 20 meetings annually to exchange knowledge. Every year, the Dijkwerkers community conducts several surveys within the community regarding new developments and more efficient ways of collaboration.

Forecast for engineering structures to be improved

Situation as of 31 March 2017

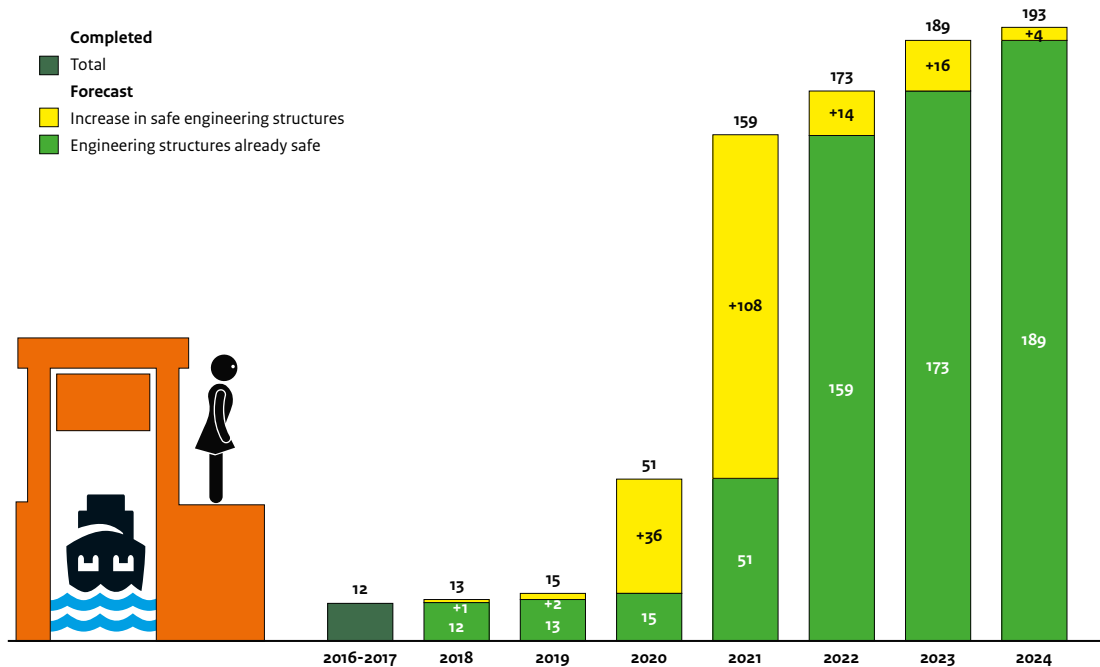


Figure 3 Forecast for improvements to engineering structures implemented under the Flood Protection Programme. Data pertaining to the period 2016-2023 is based on projects completed in 2017. Data for the year 2024 is based on the proposed schedule for 2019-2024.

General Explorations

General Explorations are aimed at developing new expertise and innovative solutions that are applicable in multiple projects. Thus, General Explorations are important for the entire Flood Protection Programme in order to arrive at a more efficient implementation and smarter, well-supported, and cheaper solutions. Table 1 provides an overview and a schedule of ongoing General Explorations. The scheduled Explorations are diverse in nature. Some focus on gaining more in-depth technical expertise (such as the Piping and Macro-stability explorations), others address coping with risks (such as the Cables and Pipes exploration) or dealing with specific circumstances (such as the Forelands exploration). See [paragraph 3.1](#) for details on the results achieved.

Innovations are also realised within individual projects. In 2017, one project involving an innovative element was completed: the mobile dam in Spakenburg. The general explorations and the innovative elements in projects are conducive to the aim of carrying out the projects more rapidly and more cheaply.

Table 1: Schedule of General Explorations in progress

Flood Protection Programme - General Exploration and innovations		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
No. on the map	Name												
321	Piping GE												
322	Wadden Sea GE		■										
322	Clay and grass cladding (Wadden Sea GE)												
322	Dyke with forelands (Wadden Sea GE)		■	■	■	■	■						
322	Kerkhoven Polder – Germany pilot (Wadden Sea GE)												
*	Macro-stability GE												
*	JLD earth anchor (Macro-stability GE)												
*	Cables and pipes GE												
323	Vecht flood perspective system elaboration												
*	Forelands GE												
*	GE regarding dyke improvement using local soil												
*	Innovation reserves							■	■	■	■	■	■

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

* These General Explorations do not pertain to any specific location and are, therefore, not reflected on the map.

Table 2: Delta Plan on Flood Risk Management – schedule of measures

Flood Protection Programme			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Programme budget series 2019-2030			178	276	451	392	460	607						
No. on the map	Project no.	Project name												
201	22AR	Fort Everdingen-Ameide Sluis												
202	22W	Vianen												
203	25Q	Grebbedijk												
204	22D	Neder-Betuwe												
205	24AG, 4AL, 24AM	Zuid-Beveland West, Hansweert S1												
206	05C	Gouda IJssel dyke (phase 2)												
207	05D	Gouda IJssel dyke improvement (VIJG) track 1												
208	05E	Gouda IJssel dyke improvement (VIJG) track 2												
209	06D	Capelle/Zuidplas												
210	02B	Waaier sluisce, Gouda												
211	22AI	Wolferen-Sprok												
212	22AW	Sprok-Sterreschans												
213	22K	City of Tiel												
214	22X (incl. intermediate sections 22BA)	Gorinchem-Waardenburg (GoWa)												

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

Flood Protection Programme			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Programme budget series 2019-2030			178	276	451	392	460	607						
No. on the map	Project no.	Project name												
215	22Y (incl. intermediate sections 22BC)	Tiel-Waardenburg (TiWa)												
216	16M	Geervliet-Hekelingen 20-3												
217	16E	V3T flow slide												
218	22AQ	Ameide-Streefkerk												
219	02D	Strong Lek dyke Wijk bij Duurstede-Amerongen												
220	02F	Strong Lek dyke Culemborg ferry – Beatrix lock												
221	02I	Strong Lek dyke Irene locks – Culemborg ferry												
222	22AU	Sterreschans-Heteren												
223	13N	Ravenstein-Lith												
224	24AH + 24AN	Zuid-Beveland West, Westerschelde S2												
225	24AO	Zuid-Beveland West, Westerschelde S3												
226	06K (incl. intermediate sections)	Strong IJssel dykes Krimpenerwaard (KIJK)												
227	80K	SVK Hollandsche IJssel storm surge barrier (gate)												
228	06F	Remainder of Hollandsche IJssel tasking												
229	13K	Cuijk-Ravenstein												
230	02E	Strong Lek dyke – Salmsteke												
231	34U	Zwolle-Olst												
232	34M	Zwolle												
233	34R	Zwolle floodgate												
234	34AP	Vecht Dalfsen west												
235	34AK	Vecht Stenendijk Hasselt												
236	34AN	Vecht-Zwolle												
237	22E	Gameren												
238	80F	Ijmuiden												
239	34O	Mastenbroek IJssel												
240	24AE	Zuid-Beveland Oost, Oosterschelde												
241	24AQ	Kanaal Zuid Beveland												
242	24R	Zuid-Beveland Oost, Westerschelde												
243	34P	Mastenbroek Zwarte Meer												
244	34L	Genemuiden-Hasselt												
245	34Q	Mastenbroek Zwarte Water												

Key: Study Exploration Plan elaboration Realisation

Flood Protection Programme			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Programme budget series 2019-2030			178	276	451	392	460	607						
No. on the map	Project no.	Project name												
246	18A	Eemshaven-Delfzijl												
247	28F + 28H	Koehool-Lauwersmeer												
250	18D	Lauwersmeer/Vierhuizen												
251	27D	Zuidermeer dyke – MSNF												
252	25K	IJssel dyke Apeldoorns Canal												
253	34K	Around Kampen												
254	03O	Wieringermeer storm surge barrier / Balgzand dyke / Amsteldiep dyke												
255	80G	Vlieland												
256	03V	Engineering structures												
257	80L	Marken												
258	25L	Northern Randmeer dyke												
259	80B	Drongelens Canal (P52)												
260	02C	Improvement of former category C dyke HDSR												
261		Improvement of former category C dyke Rijnland												
262		Improvement of former category C dyke RWS												
263	03I	North Sea Canal (D31 - D37)												
264	03E	Wieringermeer storm surge barrier												
265	80A	Boscherveld lock												

Key: Study Exploration Plan elaboration Realisation

Table 3: Measures set out in the Administrative Agreement on the Meuse

Administrative Agreement on the Meuse *3		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
No. on the map	Project Name												
331	Round 1												
331	Round 2												
331	Round 3												
332	Baarlo												
333	Venlo-Velden and Groot Boller												
	Re-calculation of Meuse Agreement (pre-financing)												€

Key: Study Exploration Plan elaboration Realisation

* 3 The essence of expediting the projects being implemented under the Administrative Agreement on the Meuse involves the combined implementation of the exploration, plan elaboration, and realisation stages of the dyke improvements. With the exception of the dyke improvements near Blerick, the old foundry (19C), and Steyl-Maashoek (19D), all the projects are now combined into and elaborated in a single integrated exploration. Separate schedules and estimates will be drawn up for the realisation of each individual project.

Round 1 involves the following dyke stretches: 19N Nieuw Bergen, 19Q Belfeld, 19R Beesel, and 19I Heel. The realisation phase has been divided over 2019 and 2020, as chances are that the application for the decision on one of the dyke stretches cannot be submitted until 2020.

Round 2 involves the following dyke stretches: 23C Alexanderhaven (full decisions on 23A and B have already been made), 19D Steyl-Maashoek, and 19O Buggenum (the amount stated for Alexanderhaven plan elaboration comprises both the exploration and the plan elaboration).

Round 3 involves the following dyke stretches: 19K Well, 19J Arcen, and 19H Thorn. The realisation phase schedule has factored in the fact that the application for a decision on one of the dyke stretches will be submitted in 2020; applications for a decision on the other two will be submitted in 2021. As the realisation phase of the remaining two requires a budget in excess of 40 million euros, the amount has been divided over 2021 and 2022.

The Venlo-Velden and Groot Boller projects involve the dyke stretches of 19L Venlo-Velden and 19S Blerick Groot Boller. These will be integrated into the MIRT Exploration for the More Meuse, More Venlo project.

Kessel has been included as a separate dyke stretch. The preferential alternative for this dyke stretch involves the removal of 19R from the Water Act. The application for a decision to this effect will be submitted in 2018. Funding agreements will be made in consultation with the Flood Protection Programme. A decision on the implementation of the preferential variant is still pending. If the preferential variant is rejected, an application for a decision on the plan elaboration and realisation phase of this dyke stretch will, as yet, be submitted at a later stage.

Table 4: Reserve for pre-financing

Reserve for pre-financing			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
No. on the map	Project no.	Project Name												
373	36-2	Sasse pumping station	€											
350	24AK, 24AJ, 24AR	Sint Annaland/Kop van Ossensisse				€		€						
352	14A	Geertruidenberg/Amertak				€			€	€				
355	28J *	Lemsterhoek												
359	28H	Lauwersmeerdijk								€				
356	04A	Spuihaven Schiedam			€									
357	21A	Rijnkade				€				€				
360	21H	Havenstraat												
361	21I	Ijsselpaviljoen				€								
362	21K	Vispoorthaven												
358	21F	Twente Canal – regular section				€								
368	03R	Gouwzee & Buiten IJ			€				€		€		€	€
372	03Y	Durgerdam dyke connection			€									
369	03S	Markermeer dyke connection			€									
366	21E	Gruthoek industrial estate			€									
370	06H	Stolwijk lock			€									
*		Meuse Agreement							€					

* Decision has been granted and advance has been paid, but projects have not yet been reported as “dyke safe” and/or the decision regarding the realisation phase has not yet been set down. The project is not formally completed yet.

** This pre-financing is not tied to any specific location and, therefore, is not indicated on the map.

See [paragraph 2.1](#) under “Integrated Approach” for an explanation of the tentative schedule.

Table 5: Tentative schedule for 2025-2030

Tentative schedule for 2025-2030			2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
No. on the map	Project no.	Project name												
601	02H	Strong Lek dyke: Klaphek – Jaarsveld												
602	02J	Strong Lek dyke: Vreeswijk – Klaphek												
603	02G	Strong Lek dyke: Salmsteke – Schoonhoven												
604	27E	IJsselmeerdijk												
605	17D	Kerkhovenpolder-Duitsland												
606	27F	IJmeerdijk-Almere Poort												
607	27C	Kunstwerken Noordoostpolder												
608	13S	's Hertogenbosch-Heusden												
609	21AI	Spijk-Westervoort												
610	22BJ	Everdingen-Ravenswaaij												
611	22BK	Heerewaardense Afsluitdijk												
612	22BI	Gorinchem-Sliedrecht												
613	22AT	Gameren												
614	22BL	Sliedrecht-Kinderdijk												
615	13H	Boxmeer – Cuijk (section)												
616		Meuse boulevard, Cuijk												
617	03L	Den Helder sea wall												
618	03Q	Markermeer dyke section (D22) Schardam												
619	03P	Dijkvak Markermeer (D18)												
620	34AL + 34AM	Vecht North Zwartewaterland												
621	34AR + 34AS	Vecht East												

Key: ■ Exploration ■ Plan elaboration ■ Realisation ■ * ■ * ■ *

* The projects indicated in yellow, blue and orange have been transferred to the “tentative schedule” for the programme as reservations, because they still need to pass an assessment that meets all the statutory aspects. A grey colour indicates that the Human Environment and Transport Inspectorate (ILT) has not yet provided a conclusion regarding the project; the project has nonetheless been included in the ILT planning. As yet, such projects cannot be scheduled, as confirmation of their failure to pass the ILT assessment is a precondition for inclusion into the Flood Protection Programme. The projects can be regarded as promising and, as such, have been included as reservations.

Table 6: Second Flood Protection Programme

Second Flood Protection Programme		2019	2020	2021	2022	2023	>
Budget: a total of 2663 million euros, of which 872 million euros will be available with effect from 2019.							
501	Den Oever flood defence						
502	Houtrib dyke						
503	Markermeer dyke Hoorn-Edam-Amsterdam						
504	Texel Wadden Sea dyke						

Key: ■ Exploration ■ Plan elaboration ■ Realisation

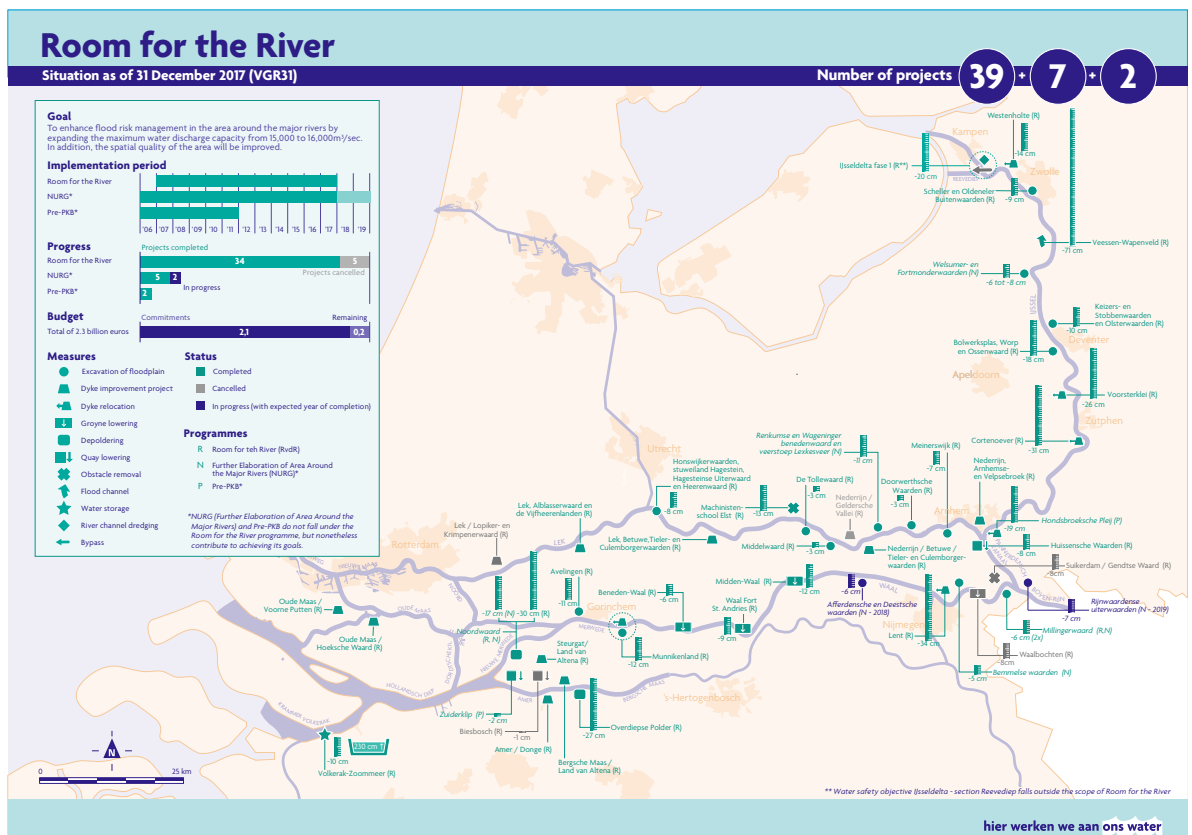


Figure 4 Room for the River programme - situation as of 31 December 2017

Second Flood Protection Programme

The Second Flood Protection Programme mainly comprises measures ensuing from the first and second assessments of the primary flood defence systems. The last projects under this programme are under way. The improvement of the Markermeer dykes is expected to commence in early 2019. More information is provided in the 13th progress report on the Second Flood Protection Programme ³⁹.

Room for the River

In 1993, the water of the major rivers rose to an alarming level and in 1995, the risk of flooding increased to such an extent that the authorities decided, for security reasons, to evacuate 250,000 residents and a livestock of one million animals. These events prompted the Room for the River programme. Its aim was to achieve the required protection level along the Rhine tributaries and the downstream section of the Meuse by the end of 2015, whilst enhancing the associated spatial quality. In 2001, the Room for the River programme was designated as a Major Project.

Meanwhile, [the final evaluation](#) has been submitted to the Lower House. The evaluation shows that the programme has achieved its goals under the allocated budget and largely within the pre-scheduled timeframe. The budget still

available is sufficient for the final completion of payments and coverage of the remaining risks. The programme has rendered the area around the major rivers safer and stronger from an economic, ecological, and landscape perspective, whilst added value has been created for residents, leisure facilities, the business community, and nature.

The Room for the River programme comprised 34 measures: flood plain excavations, dyke relocations, lowering of groynes and embankments, dyke improvements, removal of obstacles, depoldering, and the construction of a flood channel. An independent assessment by Deltares shows that these measures enable the rivers to discharge the required volumes. The independent Q team chaired by the National Landscape and Water Consultant has concluded that the projects have enhanced spatial quality and in many cases, to a considerable degree.

The evaluation has identified the following noteworthy elements:

- the Key Planning Decision, which provided structure and scope;
- the dual goal (flood risk management and spatial quality), which produced a sense of urgency and garnered support;
- the option of converting to measures carrying wider regional support;

³⁹ Parliamentary Document 32 698 no. 38.

- the emphasis on collaboration at all levels and strong regional commitment;
- the implementation of innovative solutions, inter alia, in order to prevent demolition of houses and buildings;
- strict focus on planning, in addition to the focus on money;
- sound financial basis with room for citizen participation, unforeseen issues, and communication.

Meuse Projects

The high water levels of 1993 and 1995 not only prompted the Room for the River project but also the Zandmaas/Grensmaas interventions under the Meuse Projects. The aim of the Zandmaas/Grensmaas project is threefold: flood protection, nature development, and sand and gravel extraction. The Zandmaas measures involve, inter alia, the construction and raising of embankments, widening of the River Meuse, the construction of a retention area and flood channels, and the creation of areas for nature development. The Grensmaas measures involve river widening, the construction of embankments, dredging gravel pits, and excavating secondary channels, and nature development. The measures are combined with commercial sand and gravel extraction. Meanwhile, the [final evaluation](#) has been submitted to the Lower House.

The Zandmaas high water target was already achieved in 2015. With respect to Grensmaas, the high water target

was safeguarded in 2017. An extraordinary element of the Zandmaas/Grensmaas projects is the self-realisation⁴⁰ by sand and gravel companies. This method has been adopted for a large proportion of the Grensmaas project and in two components of the Zandmaas project. This enabled the government to maintain budget neutrality for a significant proportion of the project (estimated at two-thirds): the costs bearing on the national budget amount to some 550 million euros, whereas the project costs total an estimated 1.5 billion euros. The Zandmaas/Grensmaas projects have a major spatial impact, with the development of more than 1500 hectares of nature and an earth movement of some 150 million m³. Many projects have also fostered the goals of the European Water Framework Directive. In the years ahead, the nature and gravel extraction targets will be fully attained. The deadline for the nature target in the Grensmaas project is 31 December 2018. Gravel extraction in the Grensmaas will continue up to and including 2024 in order to enable the self-realiser to tie in with market conditions. For more information, see the 33rd Progress Report on the Zandmaas and Grensmaas⁴¹.

⁴⁰ If a land owner can make a reasonable case for his/her willingness and ability to realise the new purpose as indicated by the government, the land cannot, in principle, be expropriated. The self-realisers are carrying out their projects at their own expense and risk; the projects are funded from the proceeds of the extraction of their own sand and gravel.

⁴¹ [Parliamentary Document 18 106 no. 243](#).

Table 7: Meuse Projects measures

Meuse Projects		2019	2020	2021	2022	2023	>
Grensmaas budget: a total of 153 million euros, of which 72 million euros will be available with effect from 2019							
Zandmaas budget: a total of 400 million euros, of which 78 million euros available with effect from 2019.							
806	Grensmaas project, 11 locations						2024
807	Final element embankments, Limburg district water board						
808	Final element embankments, Limburg district water board						

WaalWeelde

The WaalWeelde project involves collaboration between regional parties, the central government, the business community, and residents to render the river Waal safe, natural, and economically strong. Two of the nine projects in the WaalWeelde implementation programme will continue in 2019: the Loenensche Buitenpolder and the restructuring of the Heesselt floodplains. For more information: see waalweelde.gelderland.nl.

Table 8: WaalWeelde measures

Waalweelde		2019	2020	2021	2022	2023	>
Budget: 31 million euros from the central government (under NURG and National Waters Improvement Programme), 30 million euros from the province of Gelderland.							
Central government projects							
431	Heesselt floodplains						
Province of Gelderland projects							
435	Loenensche Buitenpolder						

IJsselmeer Closure Dam

The IJsselmeer Closure Dam (Afsluitdijk) project comprises dyke improvements and provisions for the expansion of the discharge capacity. For more information: see www.theafsluitdijk.com and [paragraph 7.2.1](#).

Table 9: IJsselmeer Closure Dam measures

IJsselmeer Closure Dam		2019	2020	2021	2022	2023	>
Budget: 1578 million euros for improvement of the IJsselmeer Closure Dam and expansion of the discharge capacity, 20 million euros for the realisation of the ambitions.							
421	IJsselmeer Closure Dam						

Repair of Oosterschelde and Westerschelde stone claddings, and foreshore deposits in Zeeland

The Repair of Oosterschelde and Westerschelde Stone Claddings / Foreshore Deposits in Zeeland project involves the improvement of the stone cladding of dykes along the Oosterschelde and Westerschelde. Further research has shown no need for measures near Borsele.

Table 10: Schedule of measures pertaining to repair of Oosterschelde and Westerschelde stone claddings and foreshore deposits in Zeeland

Repair of Oosterschelde and Westerschelde stone claddings and Zeeland foreshore deposits		2019	2020	2021	2022	2023	2024	>
Budget: a total of 812 million euros, of which 44 million euros will be available with effect from 2019								
Foreshore deposits								
912	Breskens-C							
913	Breskens							
915	Zierikzee							
916	Burghsluis							
917	Schelphoek							
918	Ellewoutsdijk							
919	Nieuw-Neuzenpolder							
920	Margarethapolder							
921	Kleine Huissenspolder							
922	Eendragtspolder							
923	Molenpolder							
924	Waarde- en Westveerpolder							
925	Vlissingen							
926	Oost-Bevelandpolder							
927	Wemeldinge-West							
928	Wemeldinge-Oost							
929	Hoedekenskerke							

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

3.2.2 River widening in interconnection with dyke improvement

In order to see river widening off to a meaningful start the central government has set aside 200 million euros from the Delta Fund as its share in the additional cost of river widening measures. Based on regional proposals for the Rhine and Meuse, the Minister of Infrastructure and Water Management has agreed to the MIRT explorations listed in Table 12.

With respect to the river Meuse, the MIRT explorations and studies listed in Tables 11 and 12 will be supplemented by explorations of five system restoration measures. The explorations, to be conducted under the Flood Protection Programme, pertain to dyke relocations and dyke improvement in accordance with the Administrative Agreement on the Meuse (Table 3).

The Delta Programme is going to use the expertise and experience gained in the Room for the River and Meuse Project programmes in the administrative agreements regarding the Integrated [River Management programme](#) in which the central and regional governments are collectively implementing the Preferential Strategy for the rivers (powerful interaction of dyke improvement and river widening).

In February 2018, the Varik-Heesselt Steering Group decided, albeit not unanimously, to deposit the preliminary preferential alternative of dyke improvement with nature and water compensation in the flood plains (VKA1) for inspection. In June 2018, the Delta Programme Commissioner [advised](#) the Minister of Infrastructure and Water Management on the matter.

Table 11: MIRT Studies into river widening

MIRT Studies	2019	2020	2021	2022	2023	2024	>
Meuse							
701 Southern Meuse valley (formerly Maastricht)							
702 Lob van Gennep							
703 Meuse bank park 's-Hertogenbosch-Maasdriel							
Rhine							
704 IJsselkop							

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

Table 12: MIRT Explorations into river widening

MIRT Explorations	2019	2020	2021	2022	2023	2024	>
Rhine							
711 Varik-Heesselt							
712 IJsselpoort river climate adaptation park							
Meuse							
721 Meandering Meuse (formerly Ravenstein-Lith)							
722 Oeffelt-Vortum							
723 More Meuse More Venlo (formerly Venlo)							

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

Table 13: Realisation of river widening

Realisation	2019	2020	2021	2022	2023	2024	>
Rhine							
732 IJssel delta phase 2							
733 Pannerdensch Canal groyne lowering							
Meuse							
731 Ooijen-Wanssum area development							

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

3.2.3 Studies ensuing from knowledge agenda and in regions

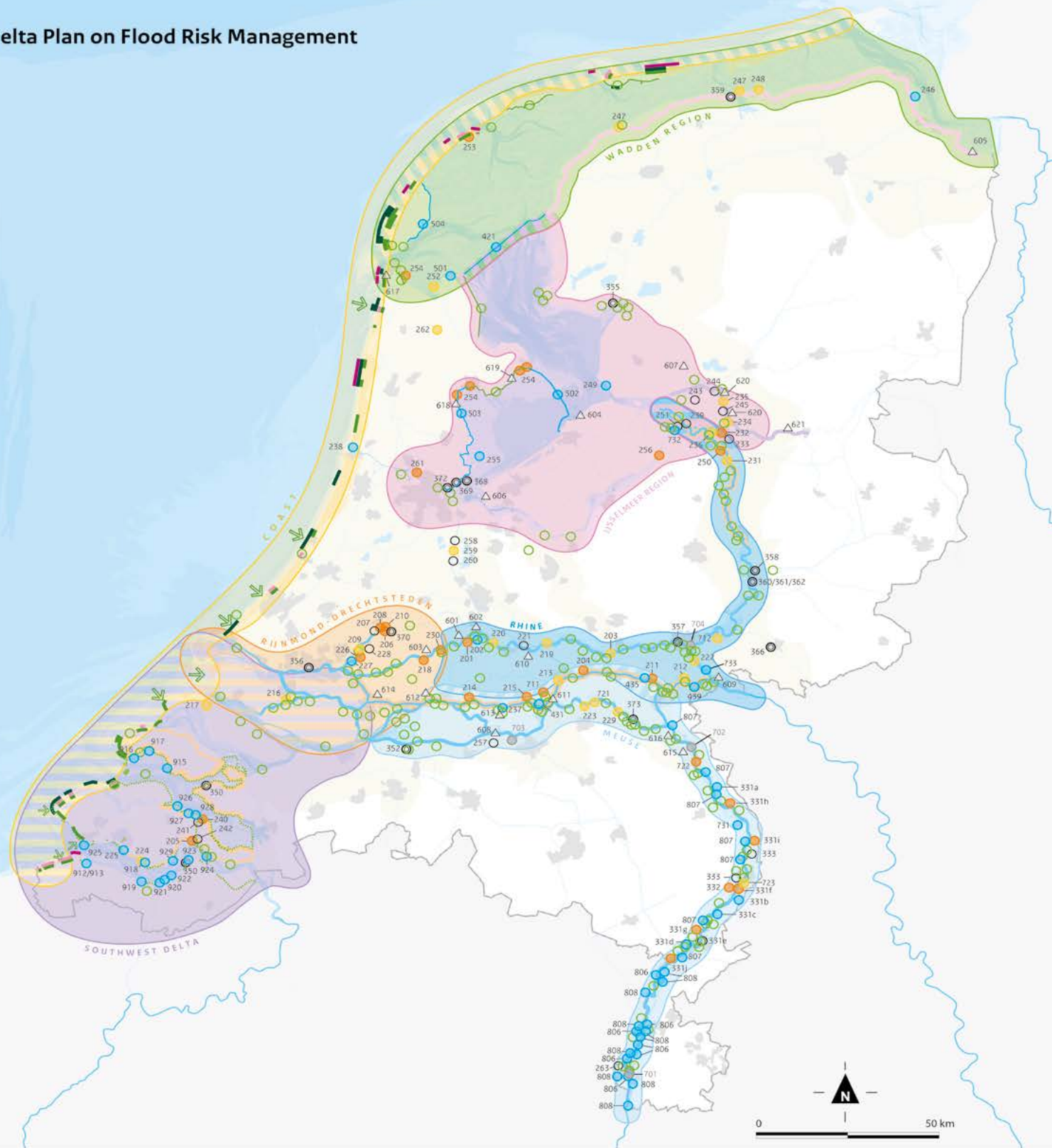
Several follow-up studies have been scheduled to elaborate Delta Decisions, Preferential Strategies, and measures and provisions contained in the Delta Programme.

Table 14: Schedule of studies into flood risk management and spatial adaptation

Studies into flood risk management and spatial adaptation	2019	2020	2021	2022	2023	2024	>
Flood risk management							
<i>Tools and instruments</i>							
Supplementary support instruments for assessments (WBI2023)							
Development of knowledge regarding Flood Risk Management							
<i>Optimisation issues</i>							
IJsselmeer Region system study							
<i>Fundamental research</i>							
Additional monitoring, research, and pilots regarding sand system (under Coastal Genesis 2.0)							
Morphological behaviour of river systems and stability of bifurcation points							
Spatial adaptation							
Spatial Adaptation Incentive Programme (2018-2022) cf. Delta Plan on Spatial Adaptation							

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation

Delta Plan on Flood Risk Management



Projects and implementation programmes Project numbering refers to measures scheduled in the Delta Programme. Colour, if any, indicates plan phase.

Flood Protection Programme 2019-2024

- 200/300 Project number
- Dyke improvement project
- General explorations:
 - Piping (321)
 - Wadden Sea dykes (322)
 - Vecht flood perspective system elaboration (323)
- Meuse agreement project
- ⊙ Pre-financed dyke improvement project

Second Flood Protection Programme (HWBP-2) (MIRT) River widening projects

- 500 Project number
- Improvement to dyke, dune, dam, or engineering structure
- Dyke section
- ⇒ Weak Links on the Coast project
- Flood Protection Programme tentative schedule 2025-2030**
- 600 Project number
- △ Project location

Meuse projects: Grensmaas and Zandmaas

- 800 Project number
- Project location
- Other projects**
- 400 Project number
- Project location

Repairs of stone cladding in Oosterschelde and Westerschelde, Zeeland shore face deposits

- 900 Project number
- Stone cladding
- Deposit location
- Sand replenishment locations 2012-2019**
- Beach replenishment scheduled
- Beach replenishment completed
- Shore face replenishment scheduled
- Shore face replenishment completed

Status per project: Plan phase as of 2019

- Scheduled
- Study
- Exploration
- Plan elaboration
- Realisation
- Completed

*Status does not apply for Flood Protection Programme tentative schedule 2025-2030.

Basic map

- Freshwater
- Saltwater / brackish water
- Flood-prone area
- Area outside the dykes
- Urban area
- Docks
- Border

CHAPTER 4

Freshwater supply: progress and measures



This Chapter addresses the implementation of the Delta Decision on Freshwater supply (paragraph 4.1) and the progress in the measures set out in the Delta Plan on Freshwater Supply (paragraph 4.2).

4.1 Delta Decision on Freshwater Supply

The Delta Decision on [Freshwater Supply](#) and the associated Delta Plan on [Freshwater Supply](#) are intended to secure a sufficient supply of fresh water during drier periods, now and in the future, to enhance the living environment, and to boost the economic position of the Netherlands. All across the nation, measures aimed at the efficient use, retention, storage, and supply of fresh water are being implemented. A new programme of measures is being prepared for the period 2022-2027. By substantiating the Water Availability process, the freshwater supply regions and the central government are creating transparency with respect to their responsibilities⁴². Consultations are under way with the major water consumers regarding more efficient water usage. The water managers are collectively working on Smart Water Management with a view to, inter alia, a more efficient distribution of water during water shortages. The [annual progress report](#) provides a comprehensive overview of the progress made.

The Delta Decision on Freshwater Supply is being implemented along three tracks: the Delta Plan on Freshwater Supply, the Water Availability process, and the Knowledge Track. Several key elements are explained below.

Developments in the Delta Plan on Freshwater Supply

The implementation of the measures set out in the Delta Plan on Freshwater Supply is proceeding largely according to schedule (see [paragraph 4.2](#)). All the freshwater supply regions and the central government (Rijkswaterstaat and the Ministry of Infrastructure and Water Management) are working on the measures agreed upon. The drinking water sector is also making investments to secure the future drinking water supply. Two important measures for a climate-proof freshwater supply are well on schedule: flexible water level management in the IJsselmeer Region and the Central Netherlands Climate-proof Water Supply. Increasingly more measures are entering the plan elaboration and realisation phases, such as the replacement of the station that pumps water from the Pannerdensch Canal to the river Linge (plan elaboration) and the construction of a 1475-hectare storage area in the Koningsdiep stream valley in Fryslân (realisation). Several measures are delayed, among which the optimisation of the freshwater supply via the Brielse Meer and some integrated measures at the Elevated Sandy Soils; in most cases, more time is needed for research or coordination. More information on the progress of the measures in each region, in the regional system, and in the main water system is provided in [Chapter 7](#).

In 2018, a proposal will be available regarding potential measures in the second phase of the Delta Plan on Freshwater Supply (2022-2027), based on the national bottleneck analysis for the long-term freshwater supply. This proposal will also review the need for adapting the Preferential Strategy for the freshwater supply and the associated adaptation pathways.

In 2017, the link between the Delta Plan on Freshwater Supply, the Delta Plan on Spatial Adaptation, and environmental policy was reinforced. The steps being undertaken by governments with respect to spatial adaptation (Analysis, Ambition, Action) are similar to the processes in place in the freshwater supply regions. For example, the municipal stress tests (Analysis) compare to the freshwater supply bottleneck analyses, whilst the risk dialogue on spatial adaptation corresponds to the Water Availability process. Linkage of the two Delta Plans opens up the opportunity to enhance municipal commitment to the freshwater supply tasking. The programmes also seek to link up with respect to the topic of soil subsidence. The Delta Plan on Freshwater Supply is encouraging provinces and municipalities to set out, in their Environmental Visions, how they are linking the availability of water and groundwater (level) management to spatial considerations. To this end, the governments must collectively map out any limitations in the availability of water, the risks of water shortages, and how water requirements are affected by spatial usage and spatial ambitions.

Water availability

The Freshwater Administrative Platform has set down semi-annual water availability benchmark dates in order to be able to monitor and adjust progress in the elaboration of the Water Availability instrument. The fourth review (May 2018) shows that all the freshwater supply regions

⁴² The Water Availability instrument reflects the availability of fresh water and the probability of water shortages in a specific area, in both normal and dry situations.

and Rijkswaterstaat have mapped out the bottlenecks in the availability of fresh water by way of a (regional) bottleneck analysis (similar to the spatial adaptation stress test). Throughout the Netherlands, more than 150 regional processes and analyses are being conducted or have been completed. The area elaborations (dialogue with consumers) that have been launched cover a surface area of some 15% of the Netherlands plus the main water system. This raises water awareness. The elaborations are increasingly integrated: wherever possible, the parties involved are tying in with other water taskings or regional processes. The elaboration methods differ on account of differences in scale level, urgency, administrative considerations, water systems, consumer requirements, and linkage with other regional processes. This has also prompted a transition towards a different type of water management, in which the availability of fresh water is no longer regarded as a matter of course but rather as a collective responsibility of governments and consumers. Such a transition takes time.

As announced in Delta Programme 2015, the Water Availability process, its rules, the instruments available for the administrative embedding of agreements, and its ambition level were subjected to an interim evaluation in 2018. This evaluation and the fourth review both show that all the freshwater supply regions have embarked on the elaboration of water availability. Paragraph 4.2 addresses the progress of the Water Availability process in each freshwater supply region ([phase 2 measures](#)).

One of the goals of the Delta Decision on Freshwater Supply is to have water availability agreements for all the regions and the main water system in place by 2021. According to the Freshwater Administrative Platform meeting of 17 May, this goal calls for an intensification of the efforts being expended by the governments involved; however, it is still feasible. The focus is on urgent areas, in order to be able to factor in the relevant findings in the decisions made on measures to be taken in the second phase of the Delta Plan on Freshwater Supply. The freshwater supply regions are substantiating their reasons for regarding specific areas as urgent on the basis of the bottleneck analyses and the relevant dialogue with consumers; this also with a view to climate change (step 1, transparency). Delta Programme 2020 will provide an overview of the urgent areas for which water availability will be mapped out anyhow. In addition, Delta Programme 2020 will list the areas that are found to have a sufficient supply of fresh water and therefore do not, for the time being, require any agreements. By 2021, the stakeholders in the urgent areas will have conducted a dialogue on potential measures (step 2, optimisation); wherever possible and necessary, they have made agreements on actions and measures (step 3). The parties may submit substantiated measures ensuing from the Water Availability process or the regional processes to

the administrative decision-making process regarding the second phase of the Delta Plan on Freshwater Supply. In the less urgent areas, the regional processes will continue after 2021, i.e., after the decision-making on the second phase of the Delta Plan on Freshwater Supply.

The interim evaluation has generated four points for attention and lessons to be learned. These pertain to the incorporation of the Water Availability instrument in environmental policy, linkage with spatial adaptation, the actual scheduling of measures for urgent areas, and the manner in which the optimisation and efficiency of current water management are discussed and set down. These points for attention will be elaborated for the regional and national levels; they are regularly discussed in the Freshwater Administrative Platform.

Monitoring of target attainment

The Delta Programme Commissioner is keeping tabs on the attainment of targets by having several indicators monitored. Up until 2021, the Delta Programme indicators for freshwater supply are focused on the Water Availability process. The indicators are expressed in the following process elements: creating transparency, discussing optimisation, and setting down agreements. For each freshwater supply region, the status of the process elements is reflected on the map of the Netherlands, supplementary to the benchmark dates of the Water Availability process. Towards 2021, the Delta Programme Commissioner will draw up recommendations, at the proposal of the Freshwater Administrative Platform, regarding freshwater supply aspects that require additional quantitative indicators in order to verify whether the implementation of the Delta Decision on Freshwater Supply is on the right track. Such aspects could perhaps be incorporated into a reviewed “Delta Decision” regarding freshwater supply (upon the first six-year [review](#)). Such quantitative indicators will be underpinned by, inter alia, the bottleneck analyses and the model calculations. (See [Background Document A](#) (in Dutch) for the state of affairs. The first results will be presented in Delta Programme 2020.)

Knowledge and innovation

The Freshwater Supply knowledge track is focused on new expertise regarding the water system, more efficient model instruments, insight into the effectiveness of (hydrological and economic) measures, and information to underpin the review of the freshwater supply strategy. The studies are on schedule.

In 2017, investment efforts were expended on the Bottleneck Analysis⁴³, the Freshwater Supply Strategy 2.0, and the adjustment of the instruments used to calculate the

⁴³ The bottleneck analysis maps out current and future bottlenecks in the supply of and demand for fresh water.

socio-economic impact of water shortages. With respect to the agriculture and nature aspects, the efforts were coordinated with the Agriculture and [Nature Water Guides](#). The bottleneck analysis constitutes the basis for the measures scheduled in phase 2 of the Delta Plan on Freshwater Supply (see [paragraph 4.2](#)).

In 2017, a set of instruments was developed to determine the impact of measures when upscaled to the regional level. The instruments provide insight into the contribution of local agriculture measures to the regional water tasking, and into the costs and benefits of such measures. The instruments are focused on the freshwater supply tasking, but also address side effects such as the impact in terms of surface water pollution by fertiliser runoff.

4.2 Delta Plan on Freshwater Supply: measures to secure the availability of fresh water in the Netherlands

The Delta Plan on Freshwater Supply comprises all the measures, studies, and knowledge issues relating to a sustainable freshwater supply that have been scheduled and agendised, and that are funded – in whole or in part – from the Delta Fund.

Phase 1 measures

The regions, the central government, and consumers are going full steam ahead with the implementation of the measures set out in the Delta Plan on Freshwater Supply. In the period up to 2021, the overall expenditure scheduled for the freshwater supply measures contained in the Delta Plan total more than 400 million euros, of which a sum of 159 million euros⁴⁴ will be funded from the Delta Fund. The progress reports on the projects show that a larger proportion of the expenditure will be carried out ahead of schedule in the second half of the implementation period (2019-2021). In most cases, this is because the plan elaboration phase is taking longer than expected, because more research is required, or because coordination is taking more time. This entails risks in terms of the allocation of the budget available for the first phase. An interim evaluation in 2018 has revealed how the depletion of the funds is working out, and has identified the financial windfalls and setbacks. The Freshwater Administrative Platform has agreed to keep a finger on the pulse and to review, in November 2018, whether there is a budget deficit or whether the budget allows the launch of additional freshwater supply projects.

Table 15 presents an overview of scheduled and agendised studies and measures to substantiate the Delta Decision and the Preferential Strategies for the freshwater supply. These studies and measures ensue from the Freshwater Supply Investment Programme 2015-2021, as contained in Delta Programme 2015. The investment programme has been compiled on the basis of a national investment agenda, the regional implementation programmes of the freshwater supply regions, and a number of implementation programmes of the user functions. The progress of the

projects under way in the Elevated Sandy Soils South and East regions is also reflected on their websites.

The central government and the regions have set down financial arrangements regarding the Freshwater Supply Investment Programme in the Administrative Agreements on Freshwater Supply . Table 16 specifies the Delta Fund – regional funding ratio for each measure.

Smart Water Management

The Smart Water Management (SWM) measure set out in the Delta Plan focuses on efficient operational water management using IT, across management boundaries. Generic and regional annual plans have been drawn up featuring activities such as the development of collective information screens and lines of reasoning. Furthermore, a serious game with regional variants has been developed. By playing this game, the water managers involved will get to know one another better, and gain insight into one another's systems and into the impact of acting on a larger scale level. Several organisations played this game in 2017 at Smart Water Management meetings, such as the annual days of the Rhine Meuse Estuary and Amsterdam-Rijn Canal-North Sea Canal regions, and the collective annual day of the Elevated Sandy Soils East and IJsselmeer Regions. Furthermore, the development of shared dashboards for water managers continued in 2017.

Phase 2 measures

On 14 September 2017, the Freshwater Administrative Platform adopted the [Roadmap](#) for the development of measures to be implemented in phase 2 of the Delta Plan on Freshwater Supply, featuring milestones for the decision-making process (see Figure 5). The measures are founded on the updated Bottleneck Analysis. This nationwide analysis zooms in on seven “hotspots” requiring

⁴⁴ This involves 150 million euros for the first round of government measures plus 9 million euros for the Noordervaart.

supra-regional policy choices. This information will enable administrators to make well-founded choices regarding the next phase. In the purview of a thorough assessment, the regions are mapping out their (regional) ambitions, bottlenecks, and potential measures in various ways, such as the Water Availability track. In 2018, this process will lead to a proposal for the potential measures in phase 2. For the period ahead, 2022-2027, a sum of 150 million euros has been set aside in the Delta Fund for the implementation of these measures.

The Water Availability process comprises three steps: step 1: transparency, step 2: optimisation, and step 3: agreements⁴⁵. All three steps are realised in consultation with consumers. The progress varies from one freshwater supply region to the next. The paragraphs below outline the status for each region.

In the West Netherlands freshwater supply region, some twenty regional processes have been launched to map out the demand for and supply of fresh water (step 1). The processes have been initiated by either the province or the district water board; consumers – in particular, farmers and drinking water companies – and municipalities are involved in all the regional processes. Optimisation (step 2) is being discussed in seven regional processes, among which the Noordelijke Vechtplassen and Westland. In the Boskoop and Haarlemmermeer regional processes, parties have set down agreements on efforts to promote water-saving measures (step 3).

In the IJsselmeer freshwater supply region, the district water boards have initiated several pilots and supporting studies in the purview of the Water Availability process. Other relevant parties are involved as well. Some ten (area) processes and pilots in the Water Availability context are under way. Four have completed step 1 (transparency), in four others optimisation (step 2) has been discussed with consumers, and two regional processes will complete all the Water Availability steps in 2018. For example, the Hollands Noorderkwartier district water control board has mapped out the areas that will still have water during dry periods and the areas facing water shortages, using the priorities set down in the Prioritisation Scheme (step 1). For the time being, the Hunze en Aa's district water board in the coastal area has ceased flushing and is gauging its impact on salinity (step 3).

The essence of the Water Availability strategy at the Elevated Sandy Soils is an area-specific approach and addressing water availability in interconnection with other interests and spatial issues, with an action perspective for all the parties concerned. More than 100 regional processes are

under way in this freshwater supply region; some have already been completed. In 2021, the Elevated Sandy Soils freshwater supply region will present an area-wide picture of water availability. With respect to step 1 (transparency), the parties will provide clear insight into the volume of water available and the scope of the water demand. A map of bottlenecks will show the main bottlenecks. A model-based analysis of the bottlenecks is scheduled for 2018. Step 2 (optimisation) shows where measures aimed at improving water availability have been taken or are foreseen for the period ahead. The exact substantiation of the local measures will ensue from the regional processes.

In the Southwest Delta freshwater supply region, the province of Zeeland has discussed the current freshwater supply situation with consumers in various ways, including in regional meetings (step 1); opportunities for optimisation are being explored (step 2). The Brabantse Delta district water board has set down Water Availability Frameworks for its management area. These Frameworks provide a clear action perspective for freshwater consumers in the major part of the area. Additional agreements are advisable for some regions. On the island of Goeree-Overflakkee, the Water & Spatial Planning regional platform substantiated the Water Availability process in 2013. Since then, no further area elaborations have been undertaken.

In the freshwater supply region of the major rivers, three projects have mapped out the freshwater supply and demand (step 1). The water requirements of the area around the major rivers has been determined on the basis of a Deltares model. In the Overbetuwe, a Water Availability pilot is under way. Consumers are also involved in the above projects and pilot. In collaboration with the Southern Agriculture and Horticulture Organization (ZLTO) and other consumers, the Rivierenland district water board has been working on an incentive scheme. Across the board, consumers are aware of the taskings in the field of water availability.

With respect to the main water system, step 1 (transparency) has been completed. From the very start of the Main Water System Water Availability process, the central government has been consulting closely with freshwater supply regions and consumers withdrawing water from the main water system. The dialogue is being fleshed out via regional meetings and pilots. Six pilots have embarked on step 2; this involves a continuous process. With effect from January 2018, the www.wabes.nl website provides information on the availability of fresh water at 150 locations in the main water system. The data is based on calculations of probability and pertains to, inter alia, capacity, water level, chloride content, and temperature.

⁴⁵ Each step is accomplished in consultation with the consumers.

Delta Plan on Freshwater Supply – Roadmap to Phase 2 | products and milestones

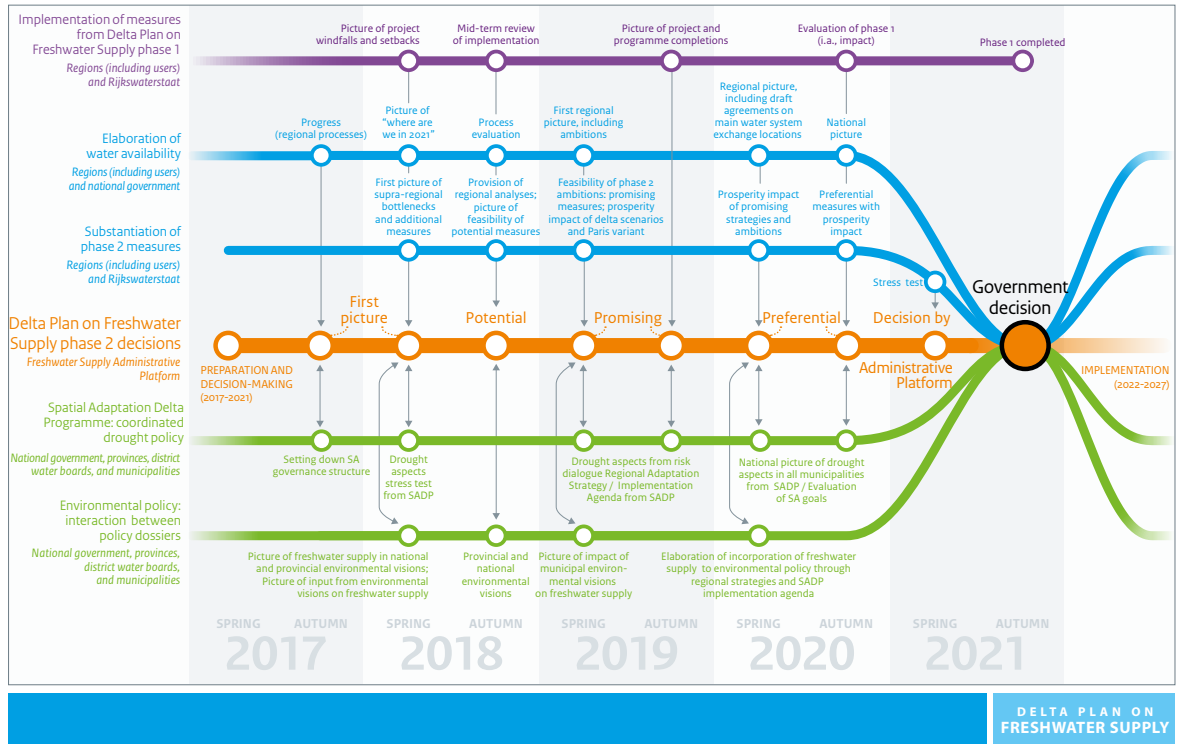


Figure 5 Freshwater Supply Roadmap

Table 15: Schedule of measures set out in the Delta Plan on Freshwater Supply

Delta Plan on Freshwater Supply 2019-2022		2019	2020	2021	>
IJsselmeer Region					
171	Flexibilisation of IJsselmeer lake water level, involving:				
171a	MWS : new IJsselmeer lake water level ordinance (2017)				
171b	MWS: operationalisation of flexible water level management				
171c	MWS: measures pertaining to Frisian IJsselmeer lake shores				
171d	MWS: robust and natural shores in IJsselmeer Region, phase 1				
171e	Implementation of water level ordinance				
172	Northern region elevated grounds project programme, involving:				
172a	Natural design of Dwarsdiep area				
172b	Climate-proofing Drentse Aa basin				
172c	Optimisation of farmland inlets, Northern Netherlands elevated (sandy) soils				
172d	De Dulf-Mersken and vicinity area development				
173	IJsselmeer Region testing ground, involving:				
173a	Spaarwater				
173b	Gouden gronden				
173c	Hunze en Aa's testing ground				

Key: Study (grey) Exploration (yellow) Plan elaboration (orange) Realisation (blue) Completed (green)
 Climate adaptation pilots (purple) Policy development (dark green)

Delta Plan on Freshwater Supply 2019-2022		2019	2020	2021	>
173d	Wetterskip Fryslân testing ground				
Elevated Sandy Soils					
174	Implementation programme for Elevated Sandy Soils Delta Plan, Southern Region				
175	Implementation programme for Elevated Sandy Soils freshwater supply, Eastern Region				
176	Innovative climate adaptation pilot South: sub-irrigation				
177	Innovative climate adaptation pilot East 1: effluent sub-infiltration				
178	Innovative climate adaptation pilot East 2: smart weir				
179	Innovative climate adaptation pilot East 3: Zutphen water distribution				
West-Netherlands					
180	MWS: Irene locks (KWA+ in MWS)				
181	Small-scale water supply (KWA) capacity expansion step 1				
182	Optimisation of Brielse Meer lake water supply, step 1				
183	Innovative climate adaptation pilot De Groote Lucht freshwater plant				
Southwest Delta					
184	Roode Vaart transfer to West-Brabant and Zeeland				
185	Climate adaptation pilot Zeeland freshwater supply testing ground, involving:				
185a	E1 – Mapping and Monitoring (FRESHM)				
185b	E2 – Water preservation in the soil (GO-FRESH)				
185c	E4 - Reprocessing				
185d	E6 – Adaptation of crops to raise salt tolerance				
185e	E7 – DeltaDrip				
185f	E8 - More fruit with less water				
185g	E9 - Walcheren Waterhouderij project				
185h	E10 – Area Freshmaker				
Area around the major rivers					
186	MWS: study into longitudinal control dams				
187	Launch of measures in area south of the major rivers				
188	Innovative climate adaptation pilot regarding sustainable use of shallow groundwater				
Main water system					
189	Water availability in the Main Water System (MWS)				
190	Smart Water Management (SWM)				
191	Noordervaart				

Key: ■ Study ■ Exploration ■ Plan elaboration ■ Realisation ■ Completed
■ Climate adaptation pilots ■ Policy development

Table 16: List of water availability pilots

No. on the map	Pilots	No. on the map	Pilots
IJsselmeer Region		Southwest Delta	
501	Northern sandy grounds	542	Westeramstel
502	Oostpolder	543	Eiland van Schalkwijk
503	Groot Limmerpolder freshwater valley	544	Northern Vechtplassen
504	Optimisation of Zeven Blokken inlets	545	Inlaagpolder
505	Water level ordinance regarding first ring of Electra storage basin	546	Haarlemmermeerpolder
506	Oldambt	547	Westland greenhouse culture
507	Flood circuits in peaty grasslands in Friesland	548	Groot Wilnis - Vinkeveen
508	Salinisation-prone areas of Frisian Wadden Sea coast	549	Holland Sticht Voorburg Oost
509	Sandy soils of Friesland	550	Northern Vechtstreek
510	Northern sandy grounds	551	IJburg (Zeeburgereiland)
Elevated Sandy Soils East		552	Heintjesrakpolder and Broekerpolder
520	Oude Diep	553	Goose Zomerkade
521	De Berkel	554	Naardermeer lake and vicinity
522	Wageningen city canal	Area around the major rivers	
523	Hammerflief	560	Zeeuws-Vlaanderen
525	Graafschap	561	Zuid-Beveland (minus Reigersbergsche polder)
Elevated Sandy Soils South		562	Walcheren, Noord-Beveland, and Schouwen-Duiveland
530	Gebiedsuitwerking Noord-Brabant	563	Tholen, Sint Philipsland, and Reigersbergsche polder
531	Weerterland	564	Rietkreek, West-Brabant
532	Parkstad	565	Goeree Overflakkee
West-Netherlands		Main water system	
540	Boskoop	580	Kop van de Betuwe
541	Plaspolder, Schaapsweipolder, Hoekpolder, Oud- Wateringsveldschepolder, Nieuw-Wateringsveldschepolder, and Noordpolder	590	Hollandsch Diep
		591	Meuse
		592	Rivierenland

Table 17: Freshwater supply investment programme 2019 - 2021 (in millions of euros)

Delta Plan on Freshwater Supply 2019-2022		Delta Fund 2019-2021	Regions* 2019-2021	Total 2019- 2021	Total contribution from Delta Fund 2015-2021
IJsselmeer Region					
171	<i>Flexibilisation of IJsselmeer lake water level, involving:</i>				
171a	MWS: new IJsselmeer lake water level ordinance (2017)	0,0	0,0	0,0	1,3
171b	MWS: operationalisation of flexible water level management	0,3	0,0	0,3	0,9
171c	MWS: measures pertaining to Frisian IJsselmeer lake shores	11,9	0,0	11,9	12,0
171d	MWS: robust and natural shores in IJsselmeer Region, phase 1	0,4	0,0	0,4	2,5
171e	Implementation of water level ordinance	2,4	0,0	2,4	3,4
Northern region elevated grounds project programme, involving:					
172					
172a	Natural design of Dwardsdiep area	0,4	0,0	0,4	0,6
172b	Climate-proofing Drentse Aa basin	0,2	2,7	2,9	0,2

* The aggregate contributions from sources other than the Delta Fund. Arrangements regarding, inter alia, funding have been set down in Administrative Agreements on Freshwater Supply.

Delta Plan on Freshwater Supply 2019-2022		Delta Fund 2019-2021	Regions* 2019-2021	Total 2019- 2021	Total contribution from Delta Fund 2015-2021
172c	Optimisation of farmland inlets, Northern Netherlands elevated (sandy) soils	0,0	0,0	0,0	0,0
172d	De Dulf-Mersken and vicinity area development	0,1	0,2	0,2	0,2
173	<i>IJsselmeer Region testing ground, involving:</i>				
173a	Spaarwater	0,0	0,0	0,0	0,7
173b	Gouden gronden	0,0	0,9	1,0	0,1
173c	Hunze en Aa's testing ground	0,2	0,2	0,3	0,2
173d	Wetterskip Fryslân testing ground	0,1	0,1	0,2	0,2
Elevated Sandy Soils					
174	Implementation programme for Elevated Sandy Soils Delta Plan, Southern Region	19,7	63,8	83,5	32,9
175	Implementation programme for Elevated Sandy Soils freshwater supply, Eastern Region	16,2	54,0	70,2	27,1
176	Climate adaptation pilot South: sub-irrigation	0,0	0,1	0,1	0,1
177	Climate adaptation pilot East 1: effluent sub-infiltration	0,0	0,0	0,0	0,0
178	Climate adaptation pilot East 2: smart weir	0,0	0,0	0,0	0,0
179	Climate adaptation pilot East 3: water distribution	0,0	0,0	0,0	0,0
West- Netherlands					
180	MWS: Irene locks (KWA+ in MWS)	0,5	0,0	0,5	0,8
181	Small-scale water supply (KWA) capacity expansion step 1	35,8	0,0	35,8	40,0
182	Optimisation of Brielse Meer lake water supply, step 1	1,4	0,5	1,8	1,5
183	Climate adaptation pilot De Groote Lucht freshwater plant	0,0	0,0	0,0	0,5
	Other measures involving the regional water system	0,0	11,0	11,0	0,0
Southwest Delta					
184	Roode Vaart transfer to West-Brabant and Zeeland	12,2	12,2	24,4	12,5
185	<i>Climate adaptation pilot Zeeland freshwater supply testing ground, involving:</i>				
185a	E1 - Mapping and Monitoring (FRESHEM)	0,0	0,0	0,0	0,7
185b	E2 - Water preservation in the soil (GO-FRESH)	0,0	0,0	0,0	0,2
185c	E4 - Mild desalination	0,0	0,0	0,0	0,0
185d	E5 - DeltaDrip	0,1	0,3	0,4	0,1
185e	E6 - Adaptation of crops to raise salt tolerance	0,0	0,0	0,0	0,1
185f	E7 - More fruit with less water	0,1	0,1	0,2	0,1
185g	E10 - Area Freshmaker	0,0	0,0	0,0	0,1
185h	E10 - Walcheren Waterhouderij project	0,0	0,4	0,5	0,1
185i	Other	0,1	-	0,1	0,1
Area around the major rivers					
186	MWS: study into longitudinal control dams	0,0	0,0	0,0	0,1
187	Launch of measures in area south of the major rivers	0,3	0,7	0,9	0,5
188	Climate adaptation pilot regarding sustainable use of shallow groundwater	0,1	0,2	0,3	0,1
HMain water system (cf. measures outlined for each region)					
189	Water availability in the Main Water System (MWS)	0,3	0,0	0,3	1,2
190	Smart Water Management (SWM)	2,7	0,0	2,7	4,9
191	Noordervaart	9,0	0,0	9,0	9,0
Totaal				155,2	

* The aggregate contributions from sources other than the Delta Fund. Arrangements regarding, inter alia, funding have been set down in Administrative Agreements on Freshwater Supply.

Delta Plan on Freshwater Supply



Projects and implementation programmes Project numbering refers to measures scheduled in the Delta Plan on Freshwater Supply. Symbol colour, if any, indicates plan phase.

Delta Plan on Freshwater

Delta Plan on Freshwater Supply measures (corresponds with table 15 DP2019)

- Freshwater supply project / implementation programme
- Climate adaptation pilot innovation
- Development of policy on availability of water from main water system
- slim watermanagement

Pilot or measure number (corresponds with table 16 DP2019)

181 Smart water management (corresponds with table 15 and 16 DP2019)

Status per measure: plan phase as of 2018

- Not yet entered plan phase
- Study
- Exploration
- Plan elaboration
- Realisation
- Completed

Basic map

- Administrative region border
- Freshwater
- Saltwater / brackish water
- No supply of freshwater
- Main water system
- Limited supply of freshwater
- Area outside the dykes
- Urban area
- Docks
- Border



0 50 km

CHAPTER 5

Spatial adaptation: progress and measures



This chapter addresses the implementation of the Delta Decision on Spatial Adaptation (paragraph 5.1) and the progress of the measures set out in the Delta Plan on Spatial Adaptation (paragraph 5.2).

5.1 Delta Decision on Spatial Adaptation

The Delta Decision on Spatial Adaptation is aimed at securing a climate-proof and water-resilient spatial design in the Netherlands by 2050. This requires climate-proof and water-resilient actions on the part of the central government, the provinces, the municipalities, and the district water boards with effect from 2020. Last year, the governments agreed to expedite and intensify their efforts; the activities to this effect were set down in the Delta Plan on Spatial Adaptation. The acceleration has now been carried out on a wide scale. Most governments have embarked on stress tests and are accommodating climate adaptation in their plans and regulations. Soil subsidence has been found to add to the spatial adaptation tasking. For that reason, the governments decided in 2018, in the context of the Inter-Ministerial Programme⁴⁶, to factor in soil subsidence in the stress tests and risk dialogues being conducted within the framework of the Delta Plan on Spatial Adaptation. This generates insight into the impact of soil subsidence on waterlogging, drought, heat, and the consequences of urban flooding. Upon the presentation of Delta Programme 2018, the Delta Programme Commissioner called on all governments to set aside substantial additional resources for spatial adaptation in order to be able to realise the ambitions and agreements. Supplementary to the ongoing Incentive Programme, the national government is setting aside a total of 20 million euros of additional resources. This reservation is intended for, in particular, knowledge development and sharing, pilot studies, and support to be provided to regional and local governments for, inter alia, conducting stress tests and risk dialogues in 2019 and 2020. Furthermore, the national government is preparing an amendment to the Water Act in order to create a legal basis for the allocation of Delta Fund grants to regional measures aimed at combating waterlogging. In addition, within the framework of the Administrative Agreement on Climate Adaptation, as announced in the Coalition Agreement, the governments have engaged in consultations regarding the financial tasking involved in spatial adaptation.

⁴⁶ Under the Inter-Ministerial Programme, the central government, municipalities, district water boards, and provinces will optimise their collaboration on societal taskings, including climate adaptation.

Concrete steps on spatial adaptation

The Delta Plan on [Spatial Adaptation](#) contains seven ambitions with concrete interim goals. The Delta Plan sets out that by no later than 2019, municipalities, district water boards, provinces, and the central government will map out, in collaboration with local stakeholders, the vulnerabilities to the four issues⁴⁷ in their domain, in both urban and rural areas. The municipalities, district water boards, provinces, and the central government will conclude regional agreements regarding their cooperation in these analyses.

The [working regions](#) will be monitoring progress in their area. Their findings will constitute the basis for the seven existing [Regional Consultative Bodies](#) to report on the progress made with respect to spatial adaptation in the purview of the annual progress report by the Delta Programme Commissioner. By the spring of 2018, information was available on 357 of the 380 municipalities, which generated a first picture. The majority of the governments have embarked on mapping out the vulnerabilities to

⁴⁷ Waterlogging, heat, drought, and the impact of urban flooding.

extreme weather; however, many of them have not yet covered all four issues, nor their entire territory. A minor proportion of the municipalities have reported that they have not yet conducted a stress test; an even smaller proportion of municipalities have not provided any information in this respect. One-quarter of the municipalities that have conducted a stress test have also launched a risk dialogue. In the second half of 2018, standards will become available for the stress tests, which will improve the inter-comparability of the outcomes. Twenty municipalities, most of which are situated in the Elevated Sandy Soils – South region, have a spatial adaptation implementation programme in place. Fourteen municipalities, many of which are situated in the Elevated Sandy Soils – East region, report having incorporated spatial adaptation into their Environmental Visions.

In the Climate-proof Networks project, Rijkswaterstaat is gathering knowledge on the vulnerability of infrastructure to climate change. Several years ago, Rijkswaterstaat already conducted a waterlogging stress test for the main road system; in 2019, stress tests will be completed for all four issues.

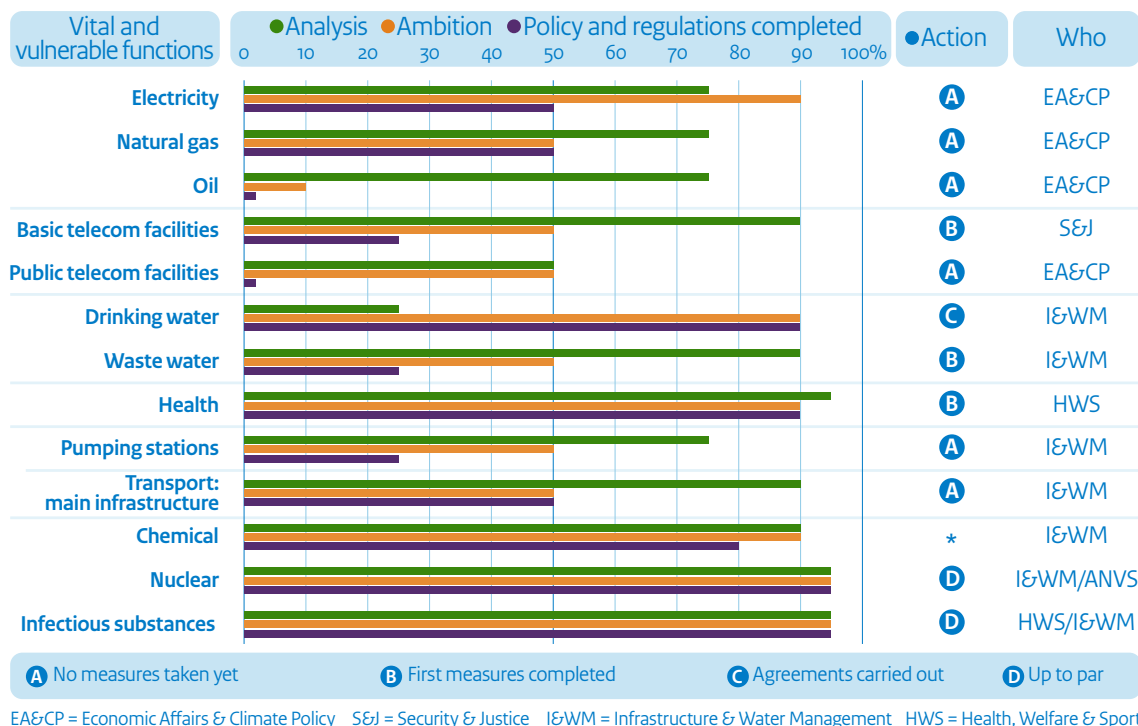


Figure 6 Summary of progress among vital and vulnerable functions with respect to “Analysis – Ambition – Action” steps.

* No insight yet into progress with respect to “Action” step. RIVM will draw up a summary based on the individual analyses conducted by businesses (chemical sector), that have been submitted to the competent authorities.

In 2017, the [connection](#) between the Delta Plan on Freshwater Supply and the Delta Plan on Spatial Adaptation was enhanced. Linkage of the two Delta Plans increases the options for an integrated approach to the two issues. The programmes also seek to link up in the field of soil subsidence.

The Delta Programme Steering Group has concluded that impact reduction through spatial planning requires targeted additional efforts. In the Impact Reduction working group which was recently [set up](#), the parties engaged in the Delta Plan on [Flood Risk Management](#) and the Delta Plan on [Spatial Adaptation](#) are collectively seeking to expedite the efforts.

National Vital and Vulnerable Functions

The Fourth Progress Report regarding the approach to national vital and vulnerable functions is contained in [Background Document F \(in Dutch\)](#).

In 2017, the Ministries responsible set down (preliminary) ambition levels⁴⁸ for the continued operation or rapid recovery of vital and vulnerable functions in flooded areas. These ambitions constitute the points of departure for the regional vulnerability analyses. With respect to a majority of the functions, the “Analysis” step has largely

⁴⁸ These ambitions are outlined in the [Third Progress Report \(in Dutch\)](#) regarding the approach to national vital and vulnerable functions.

been substantiated by now. In the past year, the drinking water, waste water, and chemical functions made great strides to this end. Several other functions saw less progress. As for the “Ambition” step, progress varies widely. Before 2020, policy and supervision must have been set down in order to safeguard the ambition levels agreed upon. An exploratory study is being conducted into measures and policy commitments required for the main infrastructure function. For several other functions, the existing legislation, regulations, and policy suffice. For the remaining functions, this still needs to be explored. With respect to a number of functions (drinking water, nuclear, infectious substances/genetically modified organisms) the substantiation of the “Action” step in terms of measures, if any, has already been visualised.

In addition to the national strategy for the thirteen vital and vulnerable functions, four regional Vital and [Vulnerable pilots](#) have been launched in recent years: Botlek, Westpoort, IJssel-Vecht delta, and Zeeland.

Monitoring of target attainment

The outcomes of the stress tests and the subsequent risk dialogues enable a more exact visualisation of the spatial adaptation tasking and formulation of goals. In anticipation of such outcomes, a consistent set of criteria and indicators is being developed to gauge target attainment ([see Background Document A for the state of affairs](#)). The first results will be presented in Delta Programme 2020.

National Climate Adaptation Strategy implementation programme

In March 2018, the Cabinet ratified the implementation programme for the National Climate Adaptation Strategy. This sets out the climate adaptation actions involving issues that are supplementary to the Delta Plan on Spatial Adaptation. Spearheads are heat stress, agriculture, nature, infrastructure, the built-up environment, and collaboration on provincial and regional strategies and visions. Any common ground is addressed in close collaboration between the parties involved in the National Climate Adaptation Strategy and the Delta Plan on Spatial Adaptation; this avoids duplication of efforts.

Expertise and innovation

Developing and sharing knowledge

Knowledge is developed in various ways, among which the Climate-proof City focus area of the National Water and Climate Knowledge and [Innovation Programme \(NKWK\)](#). The consortium of research agencies – among which STOWA, Deltares, TNO, and research universities – focuses on areas such as green-blue infrastructure, health, costs and benefits, and funding. In addition, the Delta Plan on Spatial Adaptation is conducting specific studies in collaboration with a wide range of research institutes and consumers, for example, regarding the further development of standards for stress tests. Alliance is sought with the knowledge programmes of, inter alia, the Delta Plan on Freshwater Supply. [The Climate-proof Together Platform](#) is concretising the knowledge requirements of local and regional governments and is referring professionals throughout the country to practical experience and applicable knowledge. Efforts in the field of [soil subsidence](#) are undertaken in collaboration with the National Soil Subsidence Knowledge programme. Regional governments are also engaged in knowledge development.

The Universities of Technology of Delft, Eindhoven and Twente, and Wageningen University and Research Centre have set up the 4TU Centre for [Resilience Engineering](#) to bundle technological and socio-economic expertise relating to resilience. Resilience is the capacity of systems to adapt to external developments and extreme conditions, such as climate change. The universities have submitted a proposal for a large-scale research programme: DeSIRE. This proposal has been accepted. The goal is to train a new generation of engineers and experts to successfully incorporate resilience engineering into the design, construction, and integration of vital infrastructure.

Studies and pilot projects

Throughout the country, pilots and studies are being conducted in the purview of developing concrete climate adaptation measures. For example, the InnovA58 project

initiated by Rijkswaterstaat has explored the options for climate adaptation on a motorway. The study has shown that climate adaptation is one of the pre-eminent regional taskings for which Rijkswaterstaat, district water boards, municipalities, and nature organisations can jointly explore solutions, such as more efficient road drainage in areas faced with waterlogging issues. According to a study conducted in Rheden, waterlogging and sewer overflow issues can be resolved by vertical drainpipes that allow rainwater to infiltrate deep into the soil. In the Cooling and Utilising Heat project, the district water board and municipalities in the Utrecht area have drawn up a map of opportunities for using thermal energy from surface water. Studies conducted in the Merwede canal zone in Utrecht and the Mossen neighbourhood in Houten have shown that such options can be promising and financially attractive.

Smart Roof 2.0

At the former Navy grounds in Amsterdam, businesses, governments, and stakeholders are collectively engaged in the innovative [Smart Roof 2.0 project](#). They have converted the black asphalt roof covering building 002 to a blue-green oasis with plants, and installed a large number of sensors. The project is aimed at gaining more insight into the cooling effect of blue-green roofs in cities. Rainwater is collected in a drainage layer and is used for the natural irrigation of the vegetation. The roof thus yields a wide range of benefits: it reduces the volume of rainwater ending up in the sewer system during severe downpours; on hot days, the roof temperature drops considerably; it introduces more greenery in the city; and it looks attractive. The study is supervised by the KWR Watercycle Institute knowledge institute.

Heat Stress conference

The central government, provinces, municipalities and district water boards are relatively unfamiliar with the impact of heat – one of the four Spatial Adaptation themes. Within the context of the National Climate Adaptation Strategy (NAS), a Heat Stress conference was organised in June 2018, together with a range of parties, among which the Delta Programme. The conference focused on the question of how the Netherlands is dealing with a warmer climate: what do we know about heat stress; how does heat affect our health; will there be more pollen and insects; what does heat entail for agriculture and horticulture; does heat offer opportunities as well; how are we dealing with new plant and animal species; how can cities address the housing tasking, the energy transition, and climate adaptation in an integrated manner; and what can we learn

from southern European countries? The conference was attended by a broad-based audience of 500 delegates and highly appreciated. Under the National Climate Adaptation Strategy implementation programme, a heat agenda will be drawn up, underpinned by the outcomes of the conference. Its implementation will commence in the autumn of 2018.

5.2 Delta Plan on Spatial Adaptation: the measures to render the Netherlands climate-proof and water-resilient

The Delta Plan on Spatial Adaptation comprises the measures aimed at rendering the Netherlands climate-proof and water-resilient, with a focus on seven ambitions.

5.2.1 Mapping out vulnerability

Stress test

Insight into the vulnerability to weather extremes constitutes the basis for spatial adaptation. That is why the municipalities, provinces, district water boards, and the central government have agreed, in the Delta Plan on Spatial Adaptation, to conduct stress tests in order to map out the vulnerabilities in their areas by no later than 2019. A majority of the governments have initiated such stress tests; however, many have not yet addressed all four issues or covered their entire territory. Many municipalities are mapping out their vulnerabilities together with the district water boards and provincial bodies.

In 2018, standards will be developed for the stress tests in order to improve the inter-comparability of the outcomes. Standardisation means that everyone will use the same input and parameters for the stress test, such as a standard downpour or a standard period of heat or drought. A tailored approach is feasible, and parties are free to select their own calculation models. In February 2018, the central government, in collaboration with the other governments and knowledge institutes, published the [Handreiking gestandaardiseerde stresstest licht](#) (Guidelines to the standardised stress test light), a tool for obtaining a first picture of the vulnerabilities of an area. The stress test will be elaborated further in 2018, in close consultation with the users and experts, among which the Foundation for Applied Water Research Stowa and the RIONED Foundation [umbrella organisation in the field of urban water management and sewer systems]. The stress tests will also reveal the impact of soil subsidence on the vulnerability of the [area](#). Soil subsidence can be caused by peat oxidation, loading on soft soils or lower ground water levels but also by gas or salt extraction and river bed erosion.

Standard precipitation events followed by waterlogging, and heat variables

The problems caused by different types of downpours may differ from one area to the next. For that reason, experts have compiled a set of downpours to be used as input for the stress tests. They have opted for return frequencies of 1/100 per annum, 1/250 per annum, and 1/1000 per annum, in combination with short downpours (1 to 2 hours) and long downpours (48 hours). The computations may be supplemented with less extreme downpours, for example, to explore measures in a risk dialogue. In order to be prepared for the climate tasking and on account of the lifespan of investments, the precipitation statistics as expected for 2050 were used as the point of departure. In view of the rapidly developing insights, the National Spatial Adaptation Team will adjust these standards, if need be, in the years ahead.

Table 18: Three standard return frequencies result in six different precipitation events at the local and regional levels

Scale	Return frequency	Duration	Volume [mm] – 2050 climate
Local	100	1 hour	70
	250	1 hour	90
	1000	2 hours	160
Regional	100	48 hour	120
	250	48 hours	130
	1000	48 hours	160

Volumes may change as a result of advancing insights; see stress test on www.ruimtelijkeadaptatie.nl.

Heat stress can be expressed in various variables that are connected with different forms of heat stress. As the standard variables, knowledge parties have opted for two variables that are closely linked to spatial planning: 1) the perceived daytime temperature as an indicator of “daytime outdoor comfort” and 2) the number of tropical nights as an indicator of “comfort in buildings”. The latter variable also touches on building owners’ and building occupants’ own responsibility. At any rate, both variables will be considered in the stress tests.

In the province of Zuid-Holland, the provincial authorities and the district water boards have developed a set of digital stress test maps for all the municipalities, reflecting the vulnerabilities up to the building or street levels. The municipalities can use these maps when conducting their stress tests. Currently, the maps only cover the built-up environment. Together with the municipalities, the atlas will be upgraded to include, for example, rural areas and to reflect the impact of soil subsidence. The maps can be consulted via www.zuid-holland.klimaatas.net. The Hollands Noorderkwartier district water control board has drawn up similar maps for the municipalities in the province of Noord-Holland. These can be viewed at hnk.klimaatas.net.

Outcomes of Amsterdam Rainproof stress test

In Amsterdam, a waterlogging stress test has been conducted, validated, and analysed over the past few years by the partners collaborating on the Rainproof project. [Areas](#) prone to serious damage to buildings or vital infrastructure on account of extreme rainfall, or to disruption of their accessibility, have been marked in red. These bottlenecks have to be resolved within five years. Cases in point are, e.g., the Rivierenbuurt, De Baarsjes, and a number of hospitals, which are already working hard on solutions. Other bottlenecks, such as those in De Pijp, De Banne, Betondorp, sections of the harbour, and Buitenveldert must be resolved within ten and fifteen years. Wherever possible, the measures will tie in with work that has already been scheduled.

For their stress tests, the governments can also use the impact analyses conducted by the Security Regions, reports on the vulnerability of national vital and vulnerable functions, and expertise gained in the [four regional pilots](#) to reduce the vulnerability of such functions.

Vulnerability and historic heritage

Locations featuring moveable heritage and valuable historic interiors can also be vulnerable to climate change. Such locations are, for example, museums, archives institutes, and buildings with historic interiors such as churches, country houses, government buildings, farms, and private residences. In order to make municipalities aware of the fact that such heritage is vulnerable to, e.g., waterlogging, the Cultural

Heritage Agency of the Netherlands has published a water dossier on the website www.veilig-erfgoed.nl.

In response to this dossier, the Prevention Network of The Hague (HPN) – a cooperative comprising, inter alia, the museums in The Hague, the National Archives, the City Archives, the Royal Library, the Security Region, the fire department, and the police – has conducted the Water Project The Hague. For several institutions, analyses have been conducted, with the assistance of engineering firms and the Cultural Heritage Agency, to calculate the potential water level near their buildings and to check whether the water could enter. The organisations concerned subsequently explored measures to keep their heritage dry. Furthermore, they have collectively drawn up an [action plan](#). The network has contacted the municipal authorities in order to raise awareness of the danger that an excess of water poses to the municipal heritage in The Hague.

Vital and Vulnerable pilots

The four regional Vital and Vulnerable pilots involve Amsterdam Westpoort, Botlek, IJssel-Vecht delta, and Zeeland. The Amsterdam Westpoort district accommodates a range of vital and vulnerable functions. Local urban flooding would cause major economic damage and social disruption, not just here but elsewhere in and around Amsterdam as well. Infrastructure that is not on the list of national vital and vulnerable objects, such as heat grids, is also regarded as crucial in terms of impact reduction. In the Botlek pilot, the Port of Rotterdam and the municipality have analysed the current flood protection level in this area outside the dykes. Flooding would mainly cause economic damage here; environmental pollution would be minor, and the risk of casualties would be negligible. The province of Zeeland is primarily focusing on improving the water resilience of its electric power supply, which is essential to virtually all its other vital and vulnerable functions. The chemical sector constitutes another point for attention. In the IJssel-Vecht delta, the focus is on raising awareness and urgency among the managers of the various functions. This has resulted in a clear substantiation of threshold values. The province is working on conditions for grid managers in new developments.

A connecting thread in all the regional pilots is that the regions need more clarity regarding the roles and division of tasks: what will be the responsibility of the central government and the regional parties, what choices need to be made, who will coordinate the efforts? Despite the vulnerabilities that have been identified, it is difficult for the regional governments, chain partners, and the business

community to swing into action. That is why the Delta Programme is going to explore, together with the regions, what it takes to proceed from awareness to action. In the period ahead, a number of cases will be tackled in collaboration with (government) partners from the regions, chain partners, the Ministries responsible, and the business community. Preparations will commence in the summer of 2018. The (inter-Ministerial) guidelines of the central government and the Delta Programme will also be reviewed and, if so required, adjusted in this new phase (from Analysis and Ambition to Action). The Spatial Adaptation Steering Group will coordinate the regional implementation of the Delta Decision on Spatial Adaptation, in order to improve the flood protection of the vital and vulnerable functions by no later than 2050. The efforts will tie in more closely with the Delta Plan on Spatial Adaptation approach (stress tests, risk dialogues, et cetera). The central government will remain responsible for the amendment in 2020 of policies and regulations, if so required. This manner of coordination provides greater clarity regarding what needs to be addressed at the national level and what can be substantiated at the regional level.

5.2.2 Conducting risk dialogues and drawing up strategies

A risk dialogue serves two purposes: raising awareness of the vulnerability to climate extremes at the local or regional levels and discussing local and regional ambitions to reduce such vulnerabilities and the specific measures that could be taken to this end. The action plan of the Delta Plan on Spatial Adaptation comprises the drafting of guidelines for risk dialogues. According to the progress report, several front runners have already proceeded from stress test to risk dialogue. Experience shows that the risk dialogue calls for a tailored and area-specific approach rather than standard guidelines. In 2018, the National Spatial Adaptation Team will explore how they can best support local parties in their efforts in order to ensure that all the risk dialogues have been completed by 2020, in accordance with the agreements.

Drechtsteden risk dialogue

In the Drechtsteden area, the risk dialogue is focused on the housing development locations, as prompted by the stress test maps for the area. In a pre-analysis, the municipalities are mapping out the taskings and linkage opportunities of sewer plans and re-pavement plans.

5.2.3 Drawing up implementation agendas

The aim of the Delta Plan on Spatial Adaptation is for the governments to draw up implementation and investment agendas for their regions by no later than 2020.

Regional adaptation strategy for Rijk van Maas en Waal

The collaboration on the regional adaptation strategy for the Rijk van Maas en Waal area showcases the development of a widely supported spatial adaptation strategy. In the past few years, the Rivierenland district water board, seven municipalities in the Land van Maas en Waal and Rijk van Nijmegen areas, and the province of Gelderland have mapped out the vulnerabilities to climate effects and the opportunities; on this basis, they have conducted a risk dialogue with regional parties. The process is expected to result in a widely supported regional adaptation strategy by the end of 2018. In 2019, the governments will draw up an implementation agenda and local implementation plans.

5.2.4 Capitalising on linkage opportunities

In the years ahead, cities and villages need to take measures in the purview of the energy transition and to enhance the liveability of neighbourhoods. This opens up opportunities for combinations with climate adaptation measures, for example, with respect to cultural history, nature, biodiversity, and housing developments. In the [Inter-Ministerial Programme](#), the governments have agreed to capitalise on cross-overs with climate adaptation in their elaboration of the issues of “future-proof living”, “towards a vital countryside”, and “the regional economy as a catalyst”. At all scale levels, the maintenance, development, and management agendas offer opportunities for linking up with spatial adaptation. This extends to both public and private measures.

Linkage examples

In the city of Deventer, climate adaptation constitutes a structural component of the multi-year public space maintenance programme. This enables the municipality to capitalise on climate adaptation opportunities in each project. Examples are the Hanzeweg, where the municipality has combined major maintenance work with the tackling of waterlogging. In the [Klimaat Klaor pilot](#), local residents, entrepreneurs, and organisations in the area around Lichtenvoorde, Vragender, and Lielvelde are creating a resilient area that is capable of coping with extreme conditions. The pilot has been initiated by the Rijn en IJssel district water board, the municipality of Oost Gelre, the province of Gelderland, and the Dutch Federation of Agriculture

Jacob van Deventer Atlas

In the sixteenth century, the King of Spain commissioned Dutch cartographer Jacob van Deventer to draw maps of more than 200 cities in the “low countries”. The 200 maps were recently compiled into the Jacob van Deventer Stedenatlas [City Atlas]. The detailed maps provide insight into the old water infrastructures, a significant part of which still remain. The maps can be used to analyse how people dealt with water throughout the centuries. This may help to find solutions to current taskings relating to waterlogging and drought. The maps also clarify why problems arise at specific locations. For example, in the past, urban expansion frequently involved the closing off or diversion of old waterways, without a proper view of the consequences. The Cultural Heritage Agency of the Netherlands has developed a theme [dossier](#) regarding the role of cultural heritage in stress tests and risk dialogues.

and Horticulture LTO North, Oost-Achterhoek section. It is aimed at collectively giving impetus to regional plans that have ground in common with greenery, the soil, water, and the climate.

5.2.5 Promotion and facilitation

In 2018 and 2019, the Delta Programme will be employing a range of instruments to promote and facilitate spatial adaptation.

Additional funding and amendment to the Water Act

The new Incentive Programme 2018-2022 was launched in 2018. A total of 5 million euros from the Delta Fund had already been set aside for this period.

Supplementary to the ongoing Incentive Programme 2018-2022, the national government is setting aside a total of 20 million euros of additional resources. The intention is to use these funds in 2019 and 2020 in particular for knowledge development and sharing, pilot studies, and support to be provided to regional and local governments for, inter alia, conducting stress tests and risk dialogues. Furthermore, the national government is preparing an amendment to the Water Act in order to create a legal basis for the allocation of Delta Fund grants to regional measures aimed at combating waterlogging, in the purview of a future temporary incentive scheme to expedite regional spatial adaptation efforts. The national government will substantiate the temporary incentive scheme in consultation with the regional governments.

Incentive Programme

The new Incentive Programme 2018-2022 was launched in 2018. In this phase, the Incentive Programme is focused on supporting the regions. In 2018, an incentive scheme will be developed to enable transparent and effective allocation of the available budget to the facilitation of the regions. In the first half of 2018, within the context of the Incentive Programme, the Climate Adaptation Advisory Team conducted interviews with twelve regions to address any questions that have arisen regarding the implementation of the Delta Plan on Spatial Adaptation. Each region subsequently received a customised recommendation regarding its most urgent question. A summary of the questions submitted by the regions and the connecting thread in the customised recommendations is available at the [Knowledge Portal](#). The questions mainly pertain to collaboration and governance: how do we involve administrators and managers, what do we tackle locally and what needs to be tackled at the regional level, how do we involve other parties and organisational units in the process and the risk dialogue? The recommendations by the Climate Adaptation Advisory Team were used to further substantiate the Incentive Programme; the recommendations provide a good picture of the questions at issue in the regions. The Incentive Programme is going to respond to these questions.

Within the context of the Incentive Programme, the fourth round of Impact Projects was launched in March 2018. This round focuses in particular on projects related to Ambition no. 2 of the Delta Plan: conducting risk dialogues and drawing up strategies. Eight projects have been [selected](#):

- Design Thinking and Spatial Adaptation (inter alia, province of Noord-Brabant and province of Limburg);
- Risk dialogue for climate-proofing a subsiding historical city (Gouda, Rijnland district water control board, province of Zuid-Holland);
- Climate-proof and Sustainable Development instrument (Municipality of Gooise Meren);
- Neighbourhood climate and greenery monitor, and augmented reality application (Groningen);
- Risk dialogue based on individual heat measurements (Amersfoort);
- Collaboration (Urban Agenda) and consultation regarding climate-smart urbanisation (Urban Agenda/Heijmans, Watertorenberaad/Urbancore, Amsterdam University of Applied Sciences, Staatsbosbeheer, Tilburg, Zwolle, province of Noord-Brabant);
- Assessment system for water risks in the spatial domain (Rotterdam, Dordrecht, Amsterdam/Waternet, Zwolle, province of Overijssel and other parties);
- Nieuwdorp Climate Street (municipality of Borsele).

In 2017, the Incentive Programme supported Impact Projects and *living labs*. In early 2018, the results of the third round of Impact Projects were disseminated through the Spatial Adaptation newsletter and the Knowledge Portal. The Share my [City project](#) has generated tools for several cities, among which Dordrecht and Breda, that local residents can use to identify appropriate climate adaptive measures for their postal district. The heat tool for villages and cities in the province of Zeeland provides insight into heat stress issues in rural regions. The Climate-resilient Development project in [Noordwijk](#) has generated a practical step-by-step plan for climate-proofing new neighbourhoods. The Cooling and [Utilising Heat project](#) features two business cases for the generation of thermal energy from surface water, with combating heat stress as a side effect. The Impact Project relating to the disconnection of downspouts and the greening of [schoolyards](#) was already completed in 2017.

Climate-proof Together Platform

In 2018, the [Climate-proof Together Platform](#) was set up. In order to expedite spatial adaptation efforts, it is imperative that the available knowledge, tools, and experience be shared wherever possible; this obviates the need for re-inventing the wheel. The platform consists of a core team of community managers and networkers who are actively coordinating supply and demand in various regions, sectors, and existing networks. In 2018 and 2019, the platform will be focusing on the upscaling of best practices and on the accessibility of (practical) expertise to the regions and municipalities that are taking no or limited account of climate adaptation in their policy development.

Action perspective for non-insurable damage

In 2018, the National Spatial Adaptation Team embarked on the development of an action perspective for private citizens and businesses suffering non-insurable damage as a result of waterlogging. The aim is to paint a clear picture of governmental damage prevention, the action perspectives for private individuals and private parties, and the coverage of residual risks by insurance companies and emergency funds. In 2018, the Delta Programme will explore the information made available via the National Climate Adaptation Strategy, the Ministry of Agriculture, Nature and Food Quality, and the Dutch Association of Insurers which is investigating the possibility of expanding the current coverage by water damage caused by “horizontal water”⁴⁹. On 9 August 2018, the Dutch Association of Insurers issued a (positive) recommendation to its members regarding this issue.

Knowledge Portal

⁴⁹ Damage caused by rain falling directly (vertically) on an object is insurable; damage caused by water falling elsewhere and subsequently flowing to an object usually is not.

The Knowledge Portal (www.ruimtelijkeadaptatie.nl/english/) is the central climate adaptation website at which various groups of users can find expertise, tools, up-to-date information, and model projects. The Guidelines to the standardised stress test light and the Climate Impact Atlas are consulted particularly frequently. Since 2017, the Knowledge Portal provides additional information on the National Adaptation Strategy aimed at a range of sectors. The Climate-proof Together Platform can now also be contacted via the Knowledge Portal. Parties that wish to embark on climate adaptation have received customised expertise and advice through the Knowledge Portal. In May 2018, a provincial knowledge portal was launched for the province of [Noord-Brabant](#).

Financial incentives for climate adaptation at private premises

Early 2018 saw the completion of a [study](#) into the financial incentives that municipalities and district water boards can use to encourage residents and entrepreneurs to climate-proof their buildings or gardens. The study shows that several financial incentives hold potential. One such example is the differentiation of taxes levied by district water boards and municipalities. According to the study, a mix of measures, among which communication and linkage with other sustainability issues, will produce the greatest effect. This has prompted the National Spatial Adaptation Team to set several follow-up actions in motion, among which the support of pilot projects and the development of sustainable bye-laws for sewage charges. In addition, a leaflet has been drafted to inform municipalities, district water boards, and provinces of their options in terms of financial incentives for climate adaptation. Shortly after the municipal executive elections, this leaflet was forwarded to all the municipalities, district water boards, and [provinces](#) in order to be taken into account in the establishment of local coalition agreements.

Regional incentive initiatives

Supplementary to the Incentive Programme of the Delta Plan on Spatial Adaptation, several regions have initiated incentive programmes of their own. For example, the province of Noord-Brabant introduced two grant schemes in 2018 aimed at encouraging municipalities to green schoolyards and to conduct stress tests and risk dialogues.

5.2.6 Regulating and embedding

The Environment Act is expected to come into force on 1 January 2021. By that time, the governments must have completed their Environmental Visions. One of the agreements set out in the Delta Plan on Spatial Adaptation is for the governments to set down their goals and ambitions with respect to spatial adaptation in these Visions. Fourteen municipalities have reported that they have already done so. In January 2018, several frontrunners shared their experience at a networking event. The KANS network,

Hart van Holland Environmental Vision

In the Hart van Holland area, ten municipalities are working on a collective agenda for the Environmental Visions by reviewing the various taskings in an integrated manner. Climate adaptation and linkage opportunities are important topics, as are the taskings in the fields of urbanisation, mobility, the energy transition, and the natural living environment (greenery, water, biodiversity, soil subsidence, climate adaptation). The municipalities will be using the results as input for their municipal Environmental Visions.

a cooperative of municipalities in the field of climate adaptation, is developing a selection model featuring tools for incorporating spatial adaptation in Environmental Visions.

The governments may also embed their spatial adaptation goals and ambitions in other plans, programmes, and regulations, such as plans relating to greenery, the public space, the energy transition, circular construction, sustainability, vitality of rural areas, or sewers, and in municipal bye-laws. Several governments have also taken steps to this end. The municipality of Amsterdam has developed an instrument to encourage, gauge, and reward circular construction and innovation: the Amsterdam Roadmap for Circular Allocation of Land. The instrument can be used in land allocation tender procedures but also in transformation, renovation, and demolition projects. The 32 criteria set out in the roadmap do not solely pertain to materials but also to adaptive and future-proof designs and to sustainability ambitions in the fields of energy, water, biodiversity, and ecosystems. Criteria can be selected and assessed in terms of interconnectivity, depending on the tender procedure, the specific area characteristics (such as the infrastructure in place), and the ambition. Each tender procedure can thus be focused on integrated and structural sustainability. At the end of 2017, the teams engaged in the Delta Plan on Spatial Adaptation and the National Climate Adaptation Strategy launched an exploratory study into how governments can embed the responsibility of individuals for spatial adaptation via performance guidelines and marks of distinction. In this context, representatives of the Delta Plan on Spatial Adaptation, the National Climate Adaptation Strategy, NEN Standardisation Institute, and the CROW⁵⁰ and SBRCURnet⁵¹ expertise networks organised a meeting in October 2017 on the development of standards for climate adaptation. The meeting was aimed at informing the private

⁵⁰ Knowledge platform of governments, contractors, and consultancies.

⁵¹ Knowledge institute of the construction sector.

sector, gauging the need, and enhancing collaboration between public and private parties and standardisation organisations. A joint working group has been initiated to explore which existing standards are relevant, to identify the adjustments required in the purview of climate-proofing, and to survey the need for new standards.

Building regulations and Housing Act

Expectations are that building regulations may help to remove obstacles and increase opportunities with respect to spatial adaptation. One of the actions set out in the Delta Plan on Spatial Adaptation is that the central government will explore, prior to 2020, whether additional (building) regulations can be conducive to climate-proof spatial planning, with sufficient scope for customisation. A team of representatives of the Delta Plan on Spatial Adaptation, the National Adaptation Strategy, and the Ministry of the Interior and Kingdom Relations is conducting the study. Initially, the team will explore the options for working on climate adaptation using the existing instruments, and why such options are still insufficiently exploited. The team will also take the Water Review into account. Input for the study

Climate adaptation in new developments

The municipality of Epe is factoring in climate adaptation in all its new development plans. For example, the green structures in the new Klaarbeek neighbourhood serve two purposes: water storage and reduction of heat stress. In addition, they enhance the biological diversity and serve as a park and playground for local residents.

may be provided by, inter alia, the Built-up Environment climate adaptation dialogue, as announced in the NAS Implementation Programme 2018-2019, and by research conducted by the district water boards. The district water boards have explored options for including regulations on water-resilient construction in their own district water board bye-laws, and whether there is a need for additional building regulations from other governments. The team is also examining whether it is feasible and advisable to set down quality requirements regarding the hydrological preparation of grounds for construction and habitation.

Within the context of the Delta Plan on Spatial Adaptation, the central government is exploring, under the direction of the Minister of the Interior and Kingdom Relations, how an amendment of the Housing Act will afford housing corporations greater scope for contributing to spatial adaptation in new developments and maintenance operations. The Ministry of the Interior and Kingdom Relations is taking the

lead in the national adaptation dialogue regarding the built-up environment; this topic ties in with its responsibilities.

5.2.7 Responding to calamities

Water-resilient and climate-proof spatial planning can significantly reduce damage and nuisance caused by extreme weather situations, but calamities can never be prevented entirely. In such cases, the prevention of chain effects is important. The Security Regions and local/regional governments are mapping out the vulnerabilities of the

(national) vital and vulnerable functions. The Security Regions are doing so within the framework of the impact analyses, the governments in the context of the stress tests. The parties will make regional arrangements for a collective and complete survey. The risk dialogues will determine how the interaction between the second and third layers of multi-layer flood risk management will be translated into the regional Adaptation Strategy. Delta Programme 2020 will report on the progress made.

CHAPTER 6

Delta Fund



This chapter provides insight into the financial security of the Delta Programme, by comparing the resources available in the Delta Fund to the expected financial scope of the Delta Programme taskings.

The Delta Programme features measures that are funded entirely or partially from the Delta Fund: the measures pertaining to flood risk management and freshwater supply for which the central government bears (partial) responsibility. In addition, the Delta Programme comprises measures for which the central government does not bear responsibility, such as measures involving the regional water system and measures to combat waterlogging. Such measures are not funded from the Delta Fund.

The paragraphs below successively outline the developments in the Delta Fund, the resources contributed by the other Delta Programme partners, and the financial taskings of the Delta Programme up to 2050. This is followed by the Delta Programme Commissioner's conclusion regarding the degree to which the funding of the Delta Programme is safeguarded.

6.1 Developments in the Delta Fund

The Delta Fund contains financial resources which the central government has earmarked to fund investments in flood risk management, freshwater supply, and water quality, and the associated management and maintenance by the central government. The Delta Fund can also provide grants for measures in the fields of flood risk management, freshwater supply, and water quality implemented by other governments (see Article 7.22d, second paragraph, of the Water Act). Water quality only comes to the fore in this analysis in interconnection with the Delta Programme taskings (flood risk management and freshwater supply). The Delta Plan on [Flood Risk Management](#), the [Delta Plan on Freshwater Supply](#) and the Delta Plan on [Spatial Adaptation](#) contain an overview of all the studies conducted and the concrete measures scheduled under the Delta Programme, including the budget allocated.

Reflection of recommendations of the Delta Programme Commissioner in Delta Programme 2018

In the cover letter to DP2018, the Delta Programme Commissioner recommended adding a substantial sum to the Delta Fund for the implementation of the Delta Plan on Spatial Adaptation, and setting aside Delta Fund resources for river widening projects and the second round of freshwater supply measures.

The Coalition Agreement has not earmarked additional resources for climate adaptation. Supplementary to the ongoing Incentive Programme 2018-2022, the national government is setting aside a total of 20 million euros of additional resources. This reservation is intended for, in particular, knowledge development and sharing, pilot studies, and support to be provided to regional and local governments for, inter alia, conducting stress tests and risk dialogues in 2019 and 2020. Furthermore, following the

request from the House of Representatives set down in the Geurts motion⁵², the national government is preparing an amendment to the Water Act in order to create a legal basis for the allocation of Delta Fund grants to regional measures aimed at combating waterlogging. In addition, within the framework of the Administrative Agreement on Climate Adaptation, as announced in the Coalition Agreement, the governments have engaged in consultations regarding the financial tasking involved in spatial adaptation.

A sum of 375 million euros will be set aside for the Integrated River Management programme. This programme addresses the national river taskings, among which flood risk management, shipping, ecological water quality, water availability, river bed situation, and vegetation management, in interconnection in order to achieve synergy in the scheduling and implementation of measures. On the basis of urgency and willingness to invest, regional taskings such as nature and room for living, working, and leisure may also be accommodated in the programme. Within the framework of the Integrated River Management programme, the national and regional governments are also substantiating the Preferential Strategy for river flood risk management (through a combination of river widening and dyke improvement), as set down in the National Water Plan 2016-2021. In the years ahead, the programme will be elaborated and set down in a policy framework that will serve as a framework vision for the spatial aspects of the programme (Spatial Planning Act); this will create a policy basis and a legal basis for the ensuing individual projects.

The major drought during the summer of 2018 and the expectation that such droughts may occur more frequently

⁵² [Parliamentary Document 27 625 no. 437](#).

in the future constitute reason to press ahead with the measures set out in the Delta Plan on Freshwater Supply. Following the Phase 1 Freshwater Supply Measures, a sum of 150 million euros will be set aside within the Delta Fund for the subsequent phase, 2022-2027. This next phase involves the implementation of further measures to contain damage caused by drought and salinisation.

The funds for the Integrated River Management programme and for the second round of Freshwater Supply measures,

for which an Initial Decision is still pending, have been included under Article 5 of the Delta Fund as a reservation. Consequently, they are not reflected separately in Figure 7.

Delta Fund budgets

In the period 2019-2032, a sum of approx. 17.5 billion euros will be available in the Delta Fund, which brings the average annual budget to nearly 1.3 billion euros. This is visualised in Table 19, which reflects the itemised and overall Delta Fund budgets for the budget year 2019 and the period

Table 19: Delta Fund budgets in 2019 and totals, based on the 2019 draft Budget (in millions of euros)

		2019	total (2019-2032)
Item 1	Flood risk management investments	407,2	6.669,6
Item 2	Freshwater supply investments	25,2	129,7
Item 3	Management, maintenance and replacement	180,3	2.883,4
Item 4	Experiments	32,5	892,0
Item 5	Network-related expenses and other expenditure <i>of which Investment scope</i>	302,3 11,0	5.009,4 1.123,7
Item 6	Contribution from other national budgets	-	-
Item 7	Water quality investments	84,4	805,0
Total expenditure under Delta Fund		1.042,9	17.512,9

Delta Fund budgets

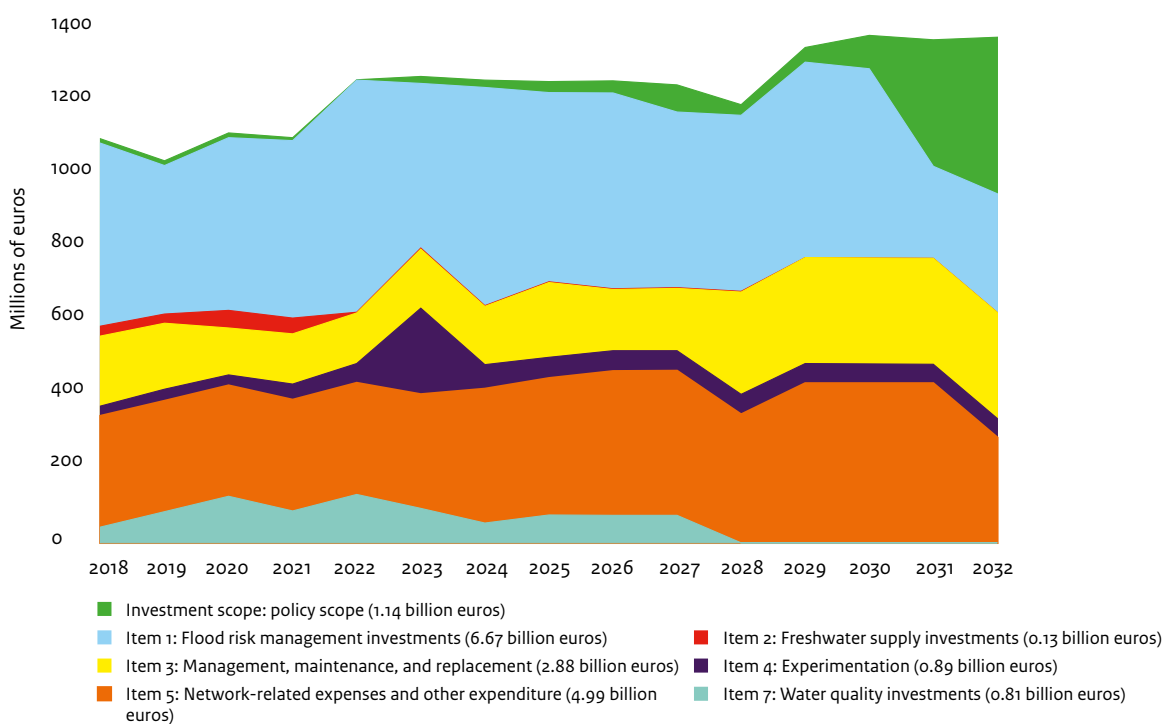


Figure 7 Delta Fund budgets, per item and totals, based on 2019 draft Budget.

2019-2032. Figure 7 reflects the itemised budget trends up to and including 2032.

Non-allocated budget available for investment

In this budget, the Delta Fund is extended by another year up to and including 2032, in accordance with the system. After subtraction of ongoing commitments (management, maintenance, replacement, Rijkswaterstaat overheads, and the government contribution to the Flood Protection Programme), this yields additional scope for investment. In 2032, this involves a sum of 423 million euros that will become available for priority policy taskings in the field of water.

The implementation of the Delta Programme is in full swing. Under the ongoing efforts, such as the dyke assessments based on the new flood protection standards, the Integrated River Management programme, the Delta Plan on Freshwater Supply, and the Water Quality and Freshwater Supply Delta Approach, these investment funds will be allocated in an adaptive manner in the years ahead. The overall

non-allocated budget available for investment – 1,124 million euros (2019 - 2032) – comprises a total of approx. 339 million euros in risk reservations.

Reservations

In the past, the non-allocated budget available for investment used to comprise reservations to cover risks and to accommodate new policy intentions. In order to provide more insight into the nature of the reservations, a new item has been created in the Delta Fund, viz. 5.04 "Reservations". This covers estimated expenditure for future taskings for which an Initial Decision is still pending. Currently, the reservations concern the following items in particular: Regional flood defences managed by the central government (198 million euros); Integrated River Management (375 million euros); second round of freshwater supply investments (150 million euros); Water Quality of the Major Waters (200 million euros); Spatial Adaptation (20 million euros); and a research reservation from 2022 onward (20 million euros).

6.2 Resources from other partners

District water boards

Investments

The district water boards and the central government share responsibility for the management of some 3400 kilometres of primary flood defence systems in our country. Any (sections of) such flood defence systems that fail to meet the standards call for dyke improvements to be scheduled under the Delta Plan on Flood Risk Management. Such projects are prioritised and funded under the [Flood Protection Programme](#). With effect from 2011, the district water boards and the central government have collectively funded the improvement of flood defence systems managed by district water boards. From 2011 up to and including 2013, the district water boards have contributed annual sums of 81 million euros to the Flood Protection Programme and the Second Flood Protection Programme. With effect from 2014, the district water boards and the central governments have contributed equal amounts. Since 2016, these amounts have been subject to annual indexation within the framework of the National Budget indexations. In 2018, the district water boards and the central government will each contribute 188 million euros⁵³. District water boards improving a primary flood defence system receive a reimbursement from the Delta Programme that covers 90 per cent of their expenditure; funding of the remaining 10 per cent is up to them.

In addition to investments in flood risk management, the district water boards also invest in all the other components of their tasks. In our country, water management infrastructure requires continuous adaptation to changing weather conditions, a rising sea level, soil subsidence, urbanisation, salinisation, and tighter (European) environmental standards. This not only applies to the approximately 3200 kilometres of primary flood defence systems managed by the district water boards, but also to the more than 14,500 kilometres of regional and other flood defence systems, 230,000 kilometres of watercourses, 6500 pumping stations, 330 waste water purification plants, and tens of thousands of minor hydraulic structures⁵⁴. Consequently, the investment agendas of the 21 district water boards are considerable. Overall, the district water boards will be investing an annual average of 1.4 billion euros in the period 2018-2021. The figures below reflect the distribution of this sum by task, at the national level (Figure 8) and by district water board (Figure 9).

⁵³ Sum based on 2017 price level, to be indexed later on in 2018.

⁵⁴ Five district water boards in the western part of the country have the ancillary task of managing 7500 kilometres of roads.

Average investment

Annual investment in the period 2018-2021

- Flood defence systems, 620 million euros
- Water system management, 335 million euros
- Purification management, 365 million euros
- Other, 85 million euros

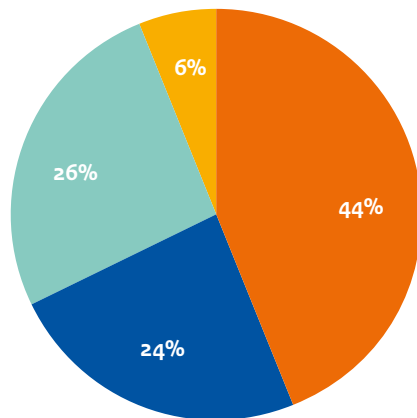


Figure 8 Average annual investment expenditure by the district water boards in the period 2018-2021, by task

Source: Waterschapsbelastingen 2018 - Het hoe en waarom [Land drainage rates 2018 - How and why], Association of Dutch Regional Water Authorities, May 2018.

Taxation and expenditure

Investment ensures that the infrastructure section concerned will see many years of operation again. Such investments are funded by local residents and businesses through the water drainage taxes. Rather than lump-sum internalisation into the taxes, the investments are spread over several years. The investments are part of the overall operating costs of the district water boards, which will account for 2.75 billion euros in 2018. Figure 10 reflects the distribution of this sum across the policy fields of the district water boards.

The operation of waste water purification plants accounts for the largest share in the expenditure (39%), followed by water system activities (29%). The construction and management of flood defence systems has been accounting for an increasing proportion of the expenditure since 2011: 5% in 2010 versus 14% in 2018. This increase can mainly be attributed to the fact that the district water boards have been participating in the Flood Protection Programme since 2011.

Total operating costs

Of the district water boards in 2018

- Construction/maintenance of flood defence systems, 377 million euros
- Design/maintenance of water systems, 773 million euros
- Construction/operation of waste water purification plants, 1068 million euros
- Construction/management of roads, waterways, and ports, 49 million euros
- Permit applications and enforcement, 108 million euros
- Taxation and tax collection, 112 million euros
- Other activities, 262 million euros

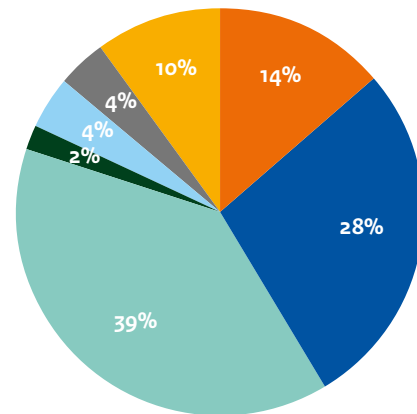


Figure 9 Total operating costs of the district water boards in 2018, by policy field

Source: Waterschapsbelastingen 2018 - Het hoe en waarom [Land drainage rates 2018 - How and why], Association of Dutch Regional Water Authorities, May 2018.

Provinces

The provinces are contributing to the Delta Programme in various ways: by allocating staff to the various programme teams or within their own organisations, by co-funding sub-programmes, or by contributing to research or the implementation of measures. The provincial efforts are mainly focused on linking the various regional (social, economic, nature, landscape) taskings to the Delta Programme taskings.

In the dyke improvement project between Eemshaven and Delfzijl, the province of Groningen bears the bulk of the costs involved in the restructuring of the area between the double dyke to accommodate saline agriculture, sedimentation, and the construction of a bicycle track. In the improvement of the Markermeer dykes, the province of Noord-Holland is contributing some 50 million euros to the integrated development of the area. The province of Gelderland has set aside 50 million to 70 million euros to co-fund river-widening projects in the period 2020 to 2030. The money has been earmarked for investments in linkage opportunities and area developments in flood protection measures that enhance the spatial development and spatial

Long-term investments 2018-2021

Gross expenses

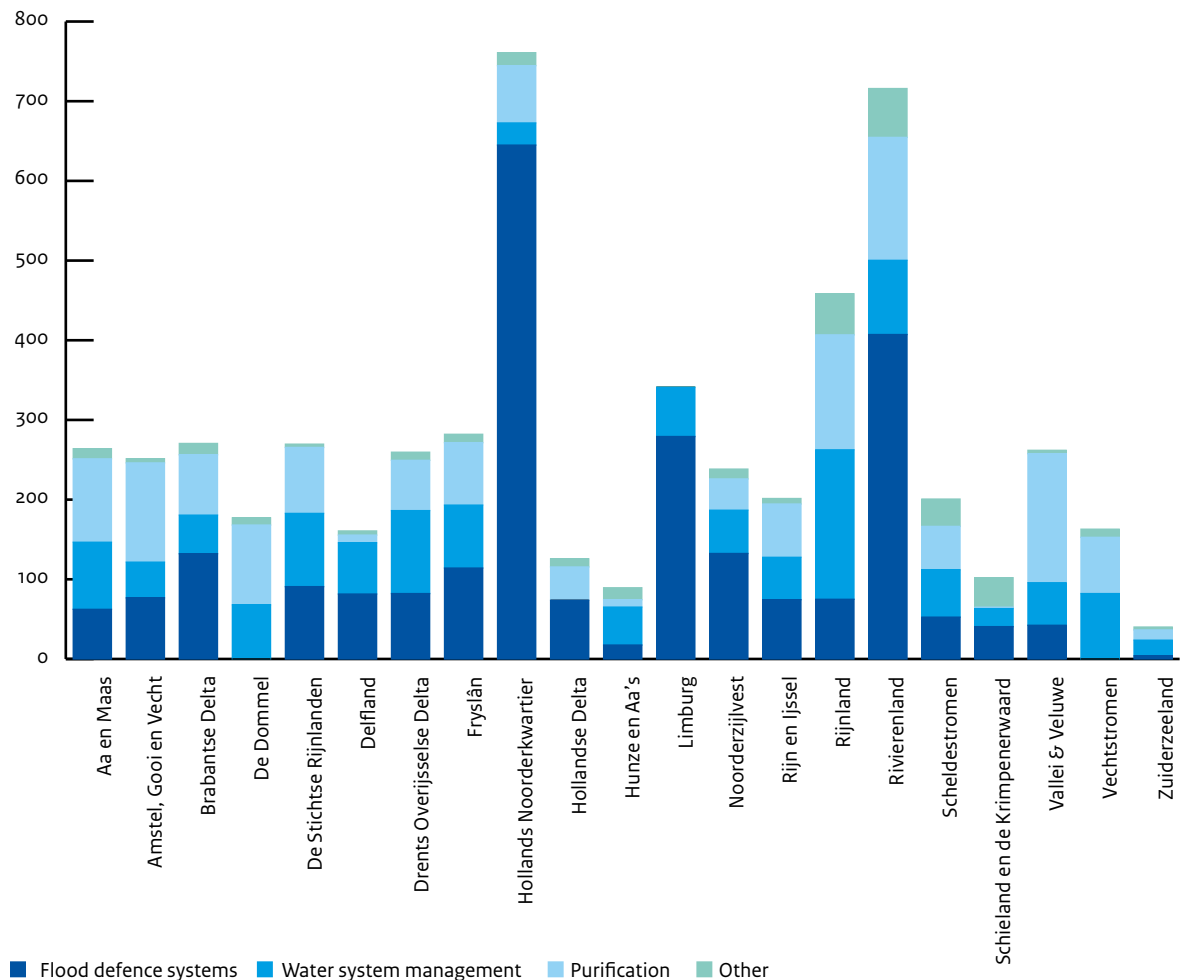


Figure 10 Total investment expenditure by the district water boards in the period 2018-2021, by task (amounts in millions of euros)

Source: *Waterschapsbelastingen 2018 - Het hoe en waarom* [Land drainage rates 2018 – How and why], Association of Dutch Regional Water Authorities, May 2018.

quality of the area concerned. The province of Noord-Brabant is co-funding flood risk management projects along the Meuse, such as the Ravenstein-Lith pioneering project, featuring both river widening and dyke improvement.

The provinces play a coordinating role in the Water Availability process. The province of Zuid-Holland chairs the National Water Availability Working Group and has initiated several water availability pilot projects. The province of Limburg has joined forces with the Limburg district water board, terrain managers, and municipalities in a wide range of projects related to water retention and infiltration. Attention is also being paid to water quality and waterlogging in order to ensure water resilience. Examples are the resilient planning of stream valleys, the realisation of wet gems of nature, the water saturation of headwater areas, and the construction of climate buffers. The province

of Noord-Brabant has set up a grant scheme for projects aimed at water saving or water retention. Businesses, citizen initiatives, municipalities and NGOs may submit applications for such grants. The province is also investing in a resilient, climate-proof freshwater supply in West-Brabant, in combination with the restoration of estuary dynamics in lake Volkerak-Zoommeer.

The provinces have also embraced spatial adaptation. For example, the province of Zuid-Holland has invested, together with the district water boards, in a digital atlas featuring [stress test maps](#) for all its municipalities and activities to assist municipalities in engaging in stress tests and risk dialogues. Zuid-Holland has invested in strategic explorations regarding climate adaptation, provincial stress tests, and risk/opportunities dialogues relating to provincial infrastructure, drinking water, nature, greenery, and inner-

city densification. In addition, Zuid-Holland has invested in research into soil subsidence, supplementary to its ongoing knowledge programme. The province of Utrecht is contributing staff and funding to several innovative projects, such as the green schoolyards atelier, the Zwanenkamp natural playground, greenery vouchers, climate lectures for a healthy living environment, and the digital climate portal featuring story maps.

Municipalities

In 2017, the municipalities spent 1.578 billion euros on urban water management. Approximately one third of this amount is spent on interest and repayment of loans for provisions constructed earlier. Slightly less than half is spent

on the management of sewerage systems and other waste water, groundwater, and rainwater facilities. With a view to the potential damage, the municipalities are already raising their investments in order to limit waterlogging (from 200 million euros in 2014 to 225 million euros in 2015 and beyond). This is in addition to the municipal investments in, e.g., sewerage (some 650 million euros per annum) and combating waterlogging due to rising groundwater levels. The municipalities will continue and expand these additional investments in the years ahead. The implementation will factor in the synergy between the investments in the regional water system, the built-up environment, and the provincial investments in nature.

6.3 The financial taskings and security of the Delta Programme

The Delta Fund constitutes the financial foundation of the Delta Programme. It provides resources to ensure the future flood protection of our country and to secure a sufficient supply of fresh water. In the period 2033-2050, assuming an annual extrapolation of the Delta Fund by 1.4 billion euros, an indicative sum of 13,5 billion euros will be available for the implementation of the Delta Programme.

Tentative extrapolation of Delta Fund

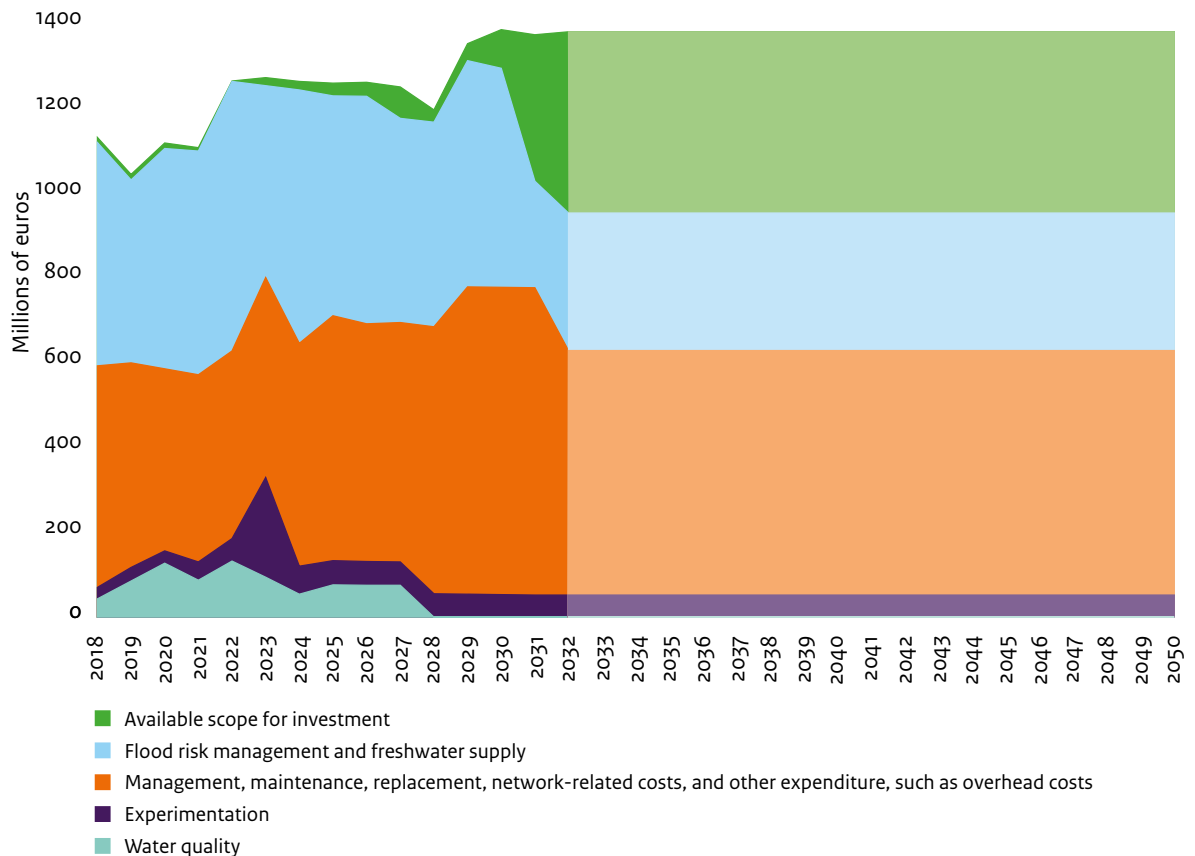


Figure 11 Tentative extrapolation of Delta Fund

The tentative extrapolation in Figure 11 is based on the year 2032. In accordance with the agreements between the central government and the district water boards, as anchored in the Water Act, the Delta Programme Commissioner has assumed that the district water boards will continue the series earmarked for new flood protection measures after 2032. The extrapolation shows that out of the approx. 1.4 billion euros going around annually in the Delta Fund, an annual sum of approx. 0.6 billion euros will be needed for management, maintenance and replacement (item 3) and network-related and other expenses (item 5). In terms of investment budget (items 1 and 2, the series available / earmarked for new flood protection measures by the district water boards and the reservations relevant to the Delta Programme under Article 5), an annual sum of approx. 0.8 billion euros will be available in the period 2033-2050. The investment budget available in the period 2033-2050 would thus amount to more than 13.5 billion euros. This means that, from now on up to and including 2050, a total sum of some 24 billion euros would be available for the flood risk management and freshwater supply taskings of national importance. Added to this sum will be the funds that Delta Programme partners other than the central government and the district water boards, such as the provinces, are expected to provide.

For the implementation of the Delta Programme in the period up to and including 2050, Delta Programme 2016 sets out an estimated budget of 26 billion euros, at a bandwidth of +/- 50% (as is realistic for such a long term). This estimate will be reviewed following any new and concrete insights into, e.g., the costs of dyke improvements and river widenings. Until such and other new insights have been processed, the estimate set out by Delta Programme 2016 will serve as the basis for assessing whether the Delta Fund budget will be adequate.

For now, the Delta Programme Commissioner has drawn the conclusion that, based on the tentative extrapolation of the Delta Fund up to and including 2050, the taskings and the available resources are reasonably balanced. The long-term financial security of the Delta Programme is currently up to par. If, in the future, spatial adaptation measures will (temporarily) need to be funded from the Delta Fund, we will need to monitor closely whether all the existing taskings can be covered in the longer run. The Delta Programme Commissioner will report on this issue in the annual Delta Programme.

PART II

Regions

CHAPTER 7

Progress per region



7.1 Introduction

The Delta Programme is aimed at rendering the Netherlands climate-proof and water-resilient. Step by step, the regional partners are realising this goal by implementing measures in accordance with the Preferential Strategies set out in Delta Programme 2015. This chapter reflects the progress made in 2017-2018 with respect to flood risk management, freshwater supply, and spatial adaptation in the regions. It translates the progress made on the national themes (Part I) into the regional elaboration (Part II). Part II is underpinned by input from the Delta Programme regional steering groups and regional consultative bodies. The overall aim is to adopt an integrated approach, wherever possible, and foster participation by governments, NGOs, businesses, and local residents. This is generating increasingly more successful examples.

7.2 IJsselmeer Region / IJsselmeer Region Freshwater Supply Region

7.2.1 Progress in implementation of Preferential Strategies

Flood risk management

The implementation of the Delta Decision and the Preferential Strategy for the IJsselmeer Region is on schedule. The essence involves the realisation of operational preconditions enabling maintenance of the average winter water level up to 2050. In early 2018, the work on the IJsselmeer Closure Dam (Afsluitdijk) was contracted out to a consortium of contractors. The commission comprises the placement of pumps to generate the required additional discharge capacity by 2022. From that moment on, Rijkswaterstaat will have another operational measure at its disposal – in addition to gravity-driven drainage – for maintaining average winter water levels at NAP [Normal Amsterdam Water Level] -25 cm.

The dyke improvement tasking for the IJsselmeer Region is also proceeding as scheduled. Work on the Houtrib dyke improvement commenced in mid-2017 and is expected to be completed by 2020, as scheduled. Work on the improvement of the Markermeer dykes is expected to commence in early 2019; the Provincial Executive of Noord-Holland is expected to decide on the endorsement of the Water Act project plan in the fourth quarter of 2018. The plan elaboration regarding the dyke section around the island of Marken is under way; the project is expected to enter the realisation phase in 2020.

The computation instruments for the Integrated Study into Flood Risk Management and Water Level Management were completed in 2017 and used to analyse long-term water level management strategies. The analyses provide insight into hydraulic effects, the cost involved in the improvement of flood defence systems, and the cost involved in water

discharge⁵⁵. Other factors also play a role in the comparative assessment of the strategies. For that reason, the impact on, e.g., regional water management and nature has been surveyed in terms of quality, based on literature research⁵⁶. In 2018, the Ministry of Infrastructure and Water Management, including Rijkswaterstaat, and the district water boards will discuss the results and the ensuing policy considerations. This may prompt some limited additional analyses.

Freshwater supply

IJsselmeer Region

The introduction of flexible water level management is on schedule. On 14 June 2018, the new IJsselmeer Region Water Level Ordinance was adopted. The permit required under the Nature Conservation Act was granted in 2017. Upon its adoption, the water level ordinance was published on 18 June; subsequently, it was open to public inspection for six weeks. Rijkswaterstaat and the district water boards have tested a first version of the new information and decision systems. The protocols for operational water level management in the main water system and the regional water systems will be ready in early 2019.

In its advisory report (June 2017), the Environmental Impact Assessment Committee concluded that raised water level management will have a positive impact on the availability of fresh water. Furthermore, the adoption of a bandwidth will enable a more flexible response to weather and discharge conditions. Raising the water level in spring and an advanced drop in late summer will foster a more natural water level behaviour and have a positive impact on local

⁵⁵ [Report on Phase 1.](#)

⁵⁶ [Report on Phase 2.](#)

natural values. The introduction of the new water level ordinance is prompting the implementation of a mitigating measure: the expansion of the water intake capacity of the Steenen Beer dam near Muiden. In addition, the central government has pledged funding to regional parties to help implement measures aimed at promoting leisure sailing in the IJsselmeer Region. Such measures pertain, e.g., to the dredging of access channels and marinas. A maximum of 13.4 million euros (including VAT) will be set aside for both measures. Furthermore, the central government has set aside 12 million euros from the Delta Fund for improving the resilience of the Frisian coast. The province of Fryslân, the municipalities of Súdwest-Fryslân and De Fryske Marren, Wetterskip Fryslân, It Fryske Gea, and the central government are collaborating on a plan for the optimum use of these resources. Under the heading of Frisian IJsselmeer Coast Linkage Opportunities, the central government and the region are collectively exploring how the restoration efforts can be combined with improvements in the fields of leisure activities, nature, cultural history, and fisheries.

The IJsselmeer Region Robust and Natural Shores project comprises measures aimed at adapting shores to changing water levels, for example, using solutions based on the *building with nature* concept. The improvement of the shores near the Hoeckelingsdam appears to be particularly effective. The measures foster a more resilient freshwater supply system in lake Markermeer; furthermore, they are conducive to flood risk management and the attainment of the Natura 2000 targets.

Regional waters

All the district water boards in the area are taking measures in the purview of the freshwater supply. For example, the Fryslân and Hunze en Aa's district water boards are working on brook restoration. Remeandering and the construction of inundation and nature areas promote water preservation and surface water infiltration to groundwater. The province of Flevoland has initiated several projects aimed at improving the soil structure and thus the water storage capacity of the soil.

Under the Northern Elevated Soils Project Programme, the province of Groningen and the Noorderzijlvest district water board organised regional meetings in the Dwardiep area. The participants reviewed which measures hold most potential for longer water retention and thus contain damage due to drought. The programme is also working on simulation models for the impact of such measures on, e.g., crop yield and rootage depth. The first results have been discussed with stakeholders. In the Drentse Aa catchment area, the province of Drenthe and the Hunze en Aa's district water board have used a groundwater model to visualise the impact of climate change on the wet nature in the stream valleys of the Drentse Aa Natura 2000 area. They

have also selected the most effective mitigating measures. In addition, areas have been selected that qualify for groundwater irrigation. The main stakeholders (nature or agriculture organisations and the drinking water company) have participated in the process via stakeholders' meetings. The end results will be presented to the administrators by mid-2018, whereupon the implementation phase will be substantiated further. The implementation of the area development project in and around Dulf-Merksen has been delayed, because the terrain could not be acquired. The aim is now to complete the project by no later than 2021.

The Hunze en Aa's coastal area sees virtually no irrigation, on account of brown rot and grain cultivation on clay grounds. That is why the district water board has ceased flushing for the time being. In the period 2016-2018, the district water board will gauge the salt content in the Oldambtboezem storage basin. In 2019, its conclusions will be discussed with the stakeholders. Subsequently, the district water board will decide on whether or not the Oldambtboezem basin will be flushed.

The Spaarwater [Water Saving] programme focuses on measures to combat salinisation and to ensure a sufficient supply of clean fresh water for the agriculture sector. Spaarwater 2 revolves around the economic analysis and regional upscaling of the Spaarwater measures. For the entire Wadden Region, Spaarwater 2 is mapping out where the various measures hold potential. In addition, their impact on the regional water system is examined and quantified. The study visualises the economic effect of the measures for farmers, and outlines the costs and benefits for water managers, in combination with mapping out their impact on the overall water system. Detailed studies are being conducted for three pilot polders along the Wadden Sea in Noord-Holland, Friesland, and Groningen, in collaboration with farmers and water managers. Spaarwater 2 will be completed by mid-2018. In Flevoland, Spaarwater 2016-2019 focuses on parcel hydrology and soil subsidence. The aim is to save water and keep clayey-peaty soils as wet as possible in order to combat soil subsidence. The supplementary Spaarwater Flevoland-Soil and Water Natural Capital project will run from 2017 to 2020. This project is aimed at developing a viable, affordable variant of system-oriented drainage that can also be used in other areas. Additional attention will be paid to water quality aspects.

Freshwater Supply Regions

The freshwater supply regions zoning was amended in 2018. The provinces of Fryslân and Groningen, and the northern part of Drenthe now fall under the Regional Consultation Committee North Freshwater Supply Region. The IJsselmeer Region Freshwater Supply Region now comprises the province of Noord-Holland north of the Noordzee Canal (excluding Amsterdam-Noord) and the province of Flevoland.

Spatial adaptation

Several concrete spatial adaptation efforts have already been accomplished in this region. In the area north of the North Sea Canal, the Hollands Noorderkwartier district water board is working on climate adaptation together with municipalities. It has drawn up a [Climate Atlas](#) for the municipalities and set up the Noorderkwartier Climate Network in the purview of sharing knowledge. Furthermore, the district water board is conducting regional dialogues with several municipalities in order to put climate adaptation on the agenda. Climate adaptation also features on the agenda of the supra-regional area programme in the Kop van Noord-Holland area.

The city of Alkmaar reconstructed the De Hoef neighbourhood two years ago and removed the locks: the area has no drainage sinkholes; rainwater drains into the soil via infiltration. The new situation has passed the first severe precipitation (approx. 45 mm/hr) without any problems.

7.2.2 Integrated approach

Flood risk management projects also see the substantiation of other goals, in many cases, based on administrative agreements. This has resulted in a high degree of integrality. For example, the Afsluitdijk Wadden Centre, leisure facilities in the Trintelhaven port, and area developments on the island of Marken are realised within the framework of flood risk management projects. The design for the Markermeer dyke improvements is geared to the eco system restoration taskings.

The sheltering measures near the Hoornse Hop bay have been revoked and will be replaced by ecological measures. Such interventions will involve both the Houtrib dyke (west side, between Enkhuizen and Trintelhaven) and the Markermeer coast of Noord-Holland, at both locations in combination with ongoing dyke improvement projects. Near the Houtrib dyke, a swamp area will be constructed with land-water transitional zones. Near the Markermeer dykes, the measures primarily involve physical connections between the areas inside and outside the dykes. Here, the measures are developed in interconnection with the Spatial Quality programme pursued by the province of Noord-Holland.

Freshwater supply measures in the area are also being substantiated in an integrated manner. Efforts expended in 2017 included the remeandering of the Koningsdiep (Friesland) and the construction of a 1.5-hectare storage area in the stream valley. The integrated project also produced nature-friendly shores and new nature.

On 17 May 2018, the central government, provinces, district water boards, municipalities, NGOs, area managers, interest groups, and the business community collectively endorsed

the [IJsselmeer Region Agenda 2050](#). This regional agenda, established on the basis of regional dialogues, is aimed at fostering the spatial interconnectivity between opportunities and taskings relating to, e.g. climate adaptation, the energy transition, economic functions, and nature enhancement. In the field of climate adaptation, many efforts are already being expended along the Delta Programme implementation track. The regional agenda comprises a guiding perspective for the period up to 2050; in 2018, it will lead to an associated knowledge and innovation agenda and an implementation agenda. The underlying idea is that an integrated approach to tackling ambitions, taskings, and projects can yield great gains. The parties working on the regional agenda also intend to incorporate the results of the integrated system study. Their goal is the optimum utilisation of pumps and sluices at the IJsselmeer Closure Dam, and optimum dyke improvement after 2050. The IJsselmeer Region Agenda ties in with the flood risk management and freshwater supply frameworks set out in the Delta Programme.

In early 2018, the IJsselmeer Region Administrative Platform and the National-Regional Steering Group of the IJsselmeer Region Agenda 2050 concluded that they perceive opportunities for uniting the Regional Agenda and the Delta Programme governance processes. In 2018, they will plot an appropriate development track.

7.2.3 Participation

The annual consultations regarding the Flood Protection Programme afford governments, businesses, and NGOs the opportunity to input linkage opportunities for dyke improvements in the IJsselmeer Region. In 2018, meetings were held in various parts of the region on account of the diversity of the issues and of the stakeholders. Projects involve broad-based participation by, in particular, government bodies, NGOs, and local residents.

Separate participation processes have been set up for the dyke improvements near Uitdam and Durgerdam. With respect to Uitdam, the Delta Programme Commissioner has issued an [advisory report](#) regarding a solution that is supported by local residents, the municipality, and the province: a breakwater bank on the lake side of the dyke and structural reinforcement of the inner bank where needed, for example, with sheet piles. The Durgerdam process is expected to result in a broadly supported dyke improvement variant by the autumn of 2018.

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7.3 Rhine Estuary-Drechtsteden / West-Netherlands Freshwater Supply Region

7.3.1 Progress in implementation of Preferential Strategies

Flood risk management

The preferential strategy for flood risk management in the [Rhine Estuary-Drechtsteden area](#) is based on prevention through dykes, storm surge barriers, and river widening. The region aims to combine the measures with spatial developments wherever possible. In addition, the region is exploring how spatial measures in the areas outside and inside the dykes can raise the safety level. Another item on the agenda is bringing disaster management up to par. A final aim is to improve the flood protection of the areas outside the dykes and of vital and vulnerable objects. Virtually all the measures on the implementation agenda of the Rhine Estuary-Drechtsteden area are proceeding as scheduled. The paragraphs below reflect the progress made with respect to several measures.

The results of the study into the reduction of the probability of failure and into the partial closure of the Maeslant storm surge barrier will be incorporated into the region's flood risk management. The options for partial operation of the Maeslant storm surge barrier, such as closing one of the two sector doors, will serve as a back-up measure to stem a maximum of water when extreme weather necessitates closure of the barrier. The outcomes have prompted Rijkswaterstaat to further explore, within the Delta Programme, which measures can be implemented in interconnection with the dyke security tasking.

Rijkswaterstaat and the Schieland en de Krimpenerwaard district water control board have embarked on a study into options for the further improvement of the Hollandsche IJssel storm surge barrier and their impact on the Hollandsche IJssel flood risk management tasking. Following the first substantive meetings in March 2018, an action plan (including planning) has been drawn up.

The dyke improvements scheduled for the Rhine Estuary-Drechtsteden area under the Flood Protection Programme are on track. The Kinderdijk-Schoonhovenseveer dyke improvement project is currently in progress and is expected to be completed in the summer of 2018. The Flow Slide V3T project will enter the elaboration phase in 2018, as scheduled. However, part of this project will already be implemented in 2018, as it is linked to the work Rijkswaterstaat is carrying out at the Spijkenisser bridge. The work involves filling several erosion pits in the Oude Maas river with sediment released in the excavation of the Nieuwe Waterweg, within the framework of a pilot study. The pilot study will provide insight into future sediment management.

The Forelands General Exploration comprises an initial analysis of the Hollandsche IJssel forelands. This analysis will visualise the potential of including forelands in the security assessment of the flood defence systems. The analysis focuses on twenty kilometres of dykes with elevated, wide forelands. The results pertaining to the first five kilometres are available: these dykes have been found to meet the standards, if the effect of the forelands is factored in. The results regarding the remaining fifteen kilometres will be available in 2018. Responsibility for the Forelands General Exploration is vested with the Schieland en de Krimpenerwaard district water control board. The analyses are conducted in collaboration with the Strong IJssel Dykes Krimpenerwaard (KIJK) project and the Rijnland district water control board.

The MIRT [Multi-Year Programme for Infrastructure, Spatial Planning and Transport] Study into the operationalisation of the strategy to enhance the coping capacity of [Eiland van Dordrecht](#) was completed in early 2018. According to the study, a smart combination would not be advisable here: the investment expenditure related to additional reinforcement of the regional dykes outweighs the expenditure involved in additional reinforcement of the primary dyke. This is because a smart combination requires comparatively large investments to render the regional flood defences sufficiently high and strong. The study has, however, identified other opportunities for multi-layer flood risk management. The parties involved will continue their collaboration on such opportunities. As a [follow-up to the MIRT Study](#) regarding the Alblasserwaard-Vijfheerenlanden area, the regional parties (province, municipalities, and district water board) are elaborating potential linkage opportunities with respect to the dyke improvements scheduled in this area up to 2050. The results of three exploratory studies – Traffic on the Dykes, Quality of the Dykes, and Multi-Layer Flood Risk Management – will serve as the basis for this process. The parties will present the results in the second half of 2018 in a collective perspective memorandum, to be used by the Regional Council to inform the (new) administrators of the partner organisations about the flood risk management tasking and the linkage opportunities, and to make a first move towards a joint agenda.

In the purview of the Water and Evacuation project, the Security Regions are mapping out the taskings related to disaster management. Dordrecht has already drawn up a flood risk management plan in the pilot phase of the Water and Evacuation project. The Zuid-Holland Security Region is working on a similar plan for the Alblasserwaard-Vijfheerenlanden area, together with other stakeholders. On the basis of the aforementioned study into multi-layer

flood risk management and the Water and Evacuation project, the Regional Council is going to examine the added value of, inter alia, shelters. The international EU FRAMES project is mapping out which (unexpected) partners could contribute to disaster management during and after a flood.

In 2017, the municipality of Rotterdam set up a strategic regional adaptation agenda for the areas outside the dykes, in collaboration with the stakeholders. One of the follow-up actions is the development of area-based flood risk management strategies for all the areas in the region that are situated outside the dykes. A pilot study has already produced such a strategy for the Botlek area. The Rotterdam Port Authority and the municipality are currently working on a flood risk management strategy for the Waal-Eemhaven and Merwe-Vierhavens areas outside the dykes.

Freshwater supply

The implementation of measures in the West-Netherlands region is largely on track. The parties involved are working on a wide range of projects aimed at improving the water resilience of the water system.

The plan elaboration of the Expansion of the Central Netherlands Climate-proof Water Supply measure is in full swing. The Leidsche Rijn/Oude Rijn, Enkele Wiericke, and Gekanaliseerde Hollandse IJssel (GHII) sections have entered the plan elaboration phase. The extended exploration regarding the Lopikerwaard route has generated a preferential variant, in coordination with a feedback group. The preferential variant is expected to garner sufficient public support in the area. The plan elaboration phase will commence in 2018, following administrative endorsement.

The preferential alternative to the modification of the Prinses Irene locks was completed in 2017. The sober alternative is regarded as the preferred alternative: there will be no bypass, but the capacity of the water inlet system will be expanded. This will ensure a sufficient supply of fresh water in dry periods and keep waiting times for the shipping sector within limits. The report on the preferential alternative is ready and has been discussed with the stakeholders. The exploration has been conducted under budget. The preferential decision will be taken in mid-2018.

Earlier capacity issues have delayed the implementation of the Optimisation of Lake Brielse Meer System measure. In 2017, however, impetus was given to the preparation of this measure. The elaboration phase will commence in 2018. The realisation is scheduled to be completed by 2021. This planning is not at risk.

At the end of 2017, a follow-up study was launched into the costs and benefits of future supply routes to the western part of the Netherlands, among which a Permanent Eastern Supply Route. This study will produce an important building block for the decisions to be made regarding the next steps.

In the COASTAR project⁵⁷, several district water boards and the province of Zuid-Holland are exploring, inter alia, the options for brackish water extraction in deep polders in the purview of drinking water production. Other initiatives are mapping out alternative sources for drinking water production. For example, Waternet is exploring, in collaboration with the Amstel, Gooi en Vecht and Rijnland district water control boards, and the drinking water companies, whether the capture of brackish seepage can be combined with the production of drinking water.

The selection process for the technology to be used in the De Groote Lucht freshwater supply plant pilot will be finalised in 2018; subsequently, decisions will be made regarding the installation. The aim is to realise a freshwater supply plant featuring a water harmonica system, and to use the purified effluent to flush the Krabbeplas (swimming water) lake. This will help to prevent the development of blue-green algae and concurrently create a new source of fresh water for the drainage pools and polders.

Spatial adaptation

Three quarters of the municipalities in the western part of the Netherlands have conducted some form of stress test; one third of these municipalities have taken all four spatial adaptation themes into consideration in these tests. Seven municipalities have already conducted risk dialogues and drawn up strategies. Three municipalities have an implementation programme in place.

Municipalities and district water boards in the province of Zuid-Holland are conducting stress tests for the existing built-up environment. To this end, the district water boards and the province have developed stress test maps reflecting vulnerabilities at the building and street levels. In addition, the province of Zuid-Holland is conducting its own stress tests for the entire area. One of the first actions involved the review of its own infrastructure. On the basis of a stress test, the province has first mapped out the vulnerabilities of each road section, moving bridge, and waterway. Subsequently, the bottlenecks, risks, and opportunities (e.g., for innovative applications) have been explored in consultation with the provincial infrastructure managers and project leaders. The province is going to involve external partners, such as the Security Regions, in the next phase.

⁵⁷ COASTAR stands for COastal Aquifer Storage And Recovery; the project has been initiated by the Water Technology Top Consortium for Knowledge and Innovation.

In 2018, the province of Zuid-Holland conducted a climate stress test for provincial roads and waterways, which was followed by a risk and opportunities dialogue. Rijkswaterstaat will complete the stress tests involving the main road network by 2019. Rijkswaterstaat and the province of Zuid-Holland have agreed to pool the results and together look for integrated solutions.

In collaboration with Atelier X⁵⁸, the city of Dordrecht has elaborated seven climate adaptation pilot projects. The municipalities of Barendrecht and Papendrecht are capitalising on urban developments in the purview of climate adaptation. In Barendrecht, a new square will climate-proof the city. Trees on and around the square create a pleasant atmosphere on hot days. A water storage facility underneath the square will prevent waterlogging. Papendrecht has harnessed the reconstruction of the Vincent van Goghlaan to engage in climate-adaptive planning of the public space. The investment costs turned out to equal the regular investment costs; expectations are that such planning will require a slightly higher management budget.

The Amsterdam Metropolitan Area (MRA) has drawn up an [implementation agenda](#) for climate adaptation. The MRA is collaborating with provinces, municipalities, and district water boards on supra-regional taskings, such as flood impact containment. In addition, the parties are drawing up climate-proof frameworks for the construction tasking. The Amsterdam working region is tackling climate adaptation on a wide scale: the existing Rainproof, Water-proof Westpoort, and Future-proof Assets programmes are also going to focus on heat and drought. In the Amstel, Gooi en Vecht (BOWA) working region, the municipalities and the district water board have collectively conducted a stress test; this will constitute the basis for the risk dialogue to commence in 2018. The Rijnland district water control board has joined forces with the municipalities in the Noord-Holland section to set up active working regions. To this end, the parties around Haarlem will link up with the existing sustainability platform. Around the Haarlemmermeer polder, the obvious combination would be to link up with the collaborative efforts regarding the water chain.

October 2017 saw the publication of the report on the adaptation strategy for water-proofing the [Westpoort area](#), initiated by the municipality of Amsterdam, the Amstel, Gooi en Vecht district water board, the Amsterdam Port Authority, the province of Noord-Holland, and the Ministry of Infrastructure and Water Management. Under this adaptation strategy, the region intends to take specific further steps to improve the water resilience of the vital and vulnerable

functions in the Westpoort area. Westpoort is one of [the four regional](#) Vital and Vulnerable pilots.

[Smart Water Management](#) has produced a concrete success in actual practice in Noord-Holland. At the end of 2017 and in early 2018, the Amsterdam region was affected by heavy precipitation, but this caused hardly any waterlogging. The water managing authorities (Hollands Noorderkwartier district water control board, Amstel, Gooi en Vecht district water board, Rijnland district water control board, and Rijkswaterstaat) managed to prevent waterlogging through smart collaboration.

In 2018, fourteen municipalities in the Utrecht West region conducted climate stress tests for all four climate issues, including soil subsidence, in collaboration with the Security Region, De Stichtse Rijnlanden district water control board, and the province of Utrecht. Eight pioneering governments in this region have joined forces in the Spatial Adaptation Coalition and are collectively working on a regional agenda. In recent years, each individual government has already carried out several projects.

In 2017, the municipality of Nieuwegein drew up a climate vision based on a risk dialogue. The vision, that is reflected in its own working processes and activities, sets an example for other municipalities in the region. The municipality of Woerden has drawn up a Climate Adaptation Action Plan featuring a long-term strategy and a concrete action plan. In the municipality of Utrecht, De Stichtse Rijnlanden district water control board, the province of Utrecht, and the municipality of Utrecht are collectively going to climate-proof the zone along the Merwede Canal. The Climate-adaptive [Merwede Canal Zone study](#) has generated designs for various (types of) water plazas, wadis, and green roofs.

7.3.2 Integrated approach

In the Rhine Estuary-Drechtsteden area, governments, NGOs, and the business community are exchanging expertise on water and spatial planning, climate change, and combining solutions with other spatial taskings. The exchange is achieved in various ways, such as through the Climate Adaptation City Deal platform, in which national pioneers in the field of climate adaptation are jointly developing new insights and tools.

Supplementary to the considerations of the [Signal Group](#), the Rhine Estuary-Drechtsteden region set up a regional hackathon on the impact of a potential acceleration of the rise in sea level on the Preferential Strategy.

The Regional Perspective for the northern rim of the island of Vorne-Putten (Geuzenlinie) addresses, inter alia, water-resilient planning. In 2017, the municipalities

⁵⁸ Atelier X (set up by the Ministry of the Interior and Kingdom Relations) adopts a designing approach to help resolve urgent societal issues.

on Voorne-Putten decided to refrain, for the time being, from drawing up a regional programme as set out in the Environment Act, but rather to continue their collaboration in the area through the existing Voorne-Putten cooperative. In consultation with the Ministry of Infrastructure and Water Management, the municipalities are going to explore options for linking multi-layer flood risk management and the energy transition.

Many freshwater supply measures are additionally fostering the resilience of regional water systems and contributing to the resolution of taskings in the fields of water quality, waterlogging, soil subsidence, and regional area developments. Regional water availability processes are frequently linked to the updating of water level ordinances and other integrated regional processes. The information generated by the regional water availability processes and the regional freshwater supply bottleneck analysis serves as input to the drought issue in the spatial adaptation stress tests. The stress tests produce a more integrated picture of the water taskings in both rural and urban areas. Several research lines also combine taskings, such as the reduction of brackish seepage in the Horstermeer polder through drinking water production and the reduction of regional flushing.

In the Blokhoven polder, De Stichtse Rijnlanden district water control board has constructed a water storage facility in order to climate-proof the water system. The facility is designed as an inundation field that is flooded on a monthly basis. This brings the Nieuwe Hollandse Waterlinie heritage area to life. With the financial support of De Stichtse Rijnlanden district water control board, the municipality of Stichtse Vecht is tackling the public space at various locations, e.g., Kockengen, by de-paving, improving the water permeability of the subsoil, and converting playgrounds to water buffers with nature-friendly banks.

The work on deepening the Nieuwe Waterweg will commence in 2018. The Rotterdam Port Authority and the water managers are collectively working on the integrated monitoring programme.

7.3.3 Participation

Many projects are still in the research phase and focus on the long term. This hampers the participation of businesses and individual residents. Governmental participation is running smoothly. In the Rotterdam port area, the Port Authority, the municipality, other governments, and the local business community are collaborating on flood risk management adaptation strategies for each section of the port. The parties are collectively mapping out the impact of potential damage and opportunities for solutions. On the basis of an assessment framework specifically developed for the port area outside the dykes, they are drawing up a

strategy and developing measures. In 2018, an analysis and strategy development process will commence for the inhabited areas outside the dykes in Rotterdam. This also raises awareness in the area. This project shows that participation is feasible and generates added value if the issue is sufficiently concrete.

In the West-Netherlands Freshwater Supply Region, the agriculture, nature, and drinking water sectors are involved in the administrative consultations, as is the Rotterdam Port Authority. Local sections of the Dutch Federation of Agriculture and Horticulture are participating in many regional water availability processes, as are individual farmers. Nature organisations are actively involved in the joint fact-finding process regarding water supply routes in the western part of the Netherlands and in the feedback group.

Strategic agenda for the Krimpenerwaard

In 2017, urban development expert Riek Bakker presented a long-term vision for the Krimpenerwaard area, together with a community of more than 100 participants. Political mediator Sybilla Dekker and area developer Peter van Rooy are working on the next step: a strategic agenda featuring long-term and short-term actions for the Krimpenerwaard. In the Exploration Platform, representatives of the various groups are collectively drawing up the Strategic Agenda and setting down agreements regarding its implementation. The agenda will be incorporated into the Krimpenerwaard Panorama, which is scheduled to be completed by the end of 2018. Groups of residents, entrepreneurs, farmers, nature organisations, young people, and administrators of the province, municipalities, and district water board are involved in these activities. The governments provide financial support and staffing. Responsibility for the initiative is borne by the Waard Committee, which is chaired by the Royal Commissioner; the Delta Programme Commissioner also sits on this committee.

7.4 Rhine / Area around the major rivers freshwater supply region

7.4.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for flood risk management along the Rhine focuses in particular on the prevention of flooding and containment of consequential damage. The tasking is comprehensive and urgent. The core of the strategy is a powerful interaction of dyke improvement and river widening. Collaboration between the governments involved and regional stakeholders is crucial in order to capitalise on a maximum of opportunities in the economic and spatial domains. This will render the area around the Rhine safe, climate-proof, and attractive. The paragraphs below outline the state of affairs regarding the short-term and long-term measures and studies. Important long-term issues are the proposal by the Delta Programme Commissioner to further substantiate river widening in interconnection with dyke improvement (see [Paragraph 3.1, Long-term Ambition for the Rivers: Integrated River Management programme](#)) and the long-term approach to the discharge [distribution](#).

An interactive map of [measures](#) provides immediate insight into the work that is being carried out to enhance the safety, climate resilience, and appeal of the Rhine area.

Dyke improvements

For the 2018-2023 period, the Flood Protection Programme has scheduled a large number of dyke improvement projects along the rivers Waal, Nederrijn-Lek, and IJssel. Once the projects are completed, these dykes will meet the new standards for flood defence systems that came into force in 2017. Two projects along the river IJssel are in progress: Pannerden-Loo and the quay improvement near Zutphen (a component of the River in the City project). The implementation of the Twente canals dyke improvement project will commence in 2018. A preferential alternative has been set down for the IJssel dyke - Apeldoorns Canal project; the plan elaboration has commenced. The IJssel dyke Zwolle-Olst project is in the exploration phase and will generate a preferential alternative in 2019. Three projects along the river Waal are expected to complete their exploration phases and set down preferential alternatives in 2018: Gorinchem-Waardenburg, Tiel-Waardenburg, and Wolferen-Sprok. In the Gameren project, preparations for the realisation of the dyke improvement will commence in 2018. Two dyke improvement projects along the Nederrijn-Lek – Vianen en Salmsteke – will also complete their exploration phases with a preferential alternative in 2018. The Amerongen-Wijk bij Duurstede and Arnhem Rhine quay sub-projects have entered the exploration phase. For the Culemborg ferry-Beatrix lock sub-project, the exploration phase will commence in 2018. The Grebbe dyke exploration will generate a preferential alternative by no later than 2020.

The water managers are discussing the scheduled dyke improvements with all the regional partners along the river Rhine, on the one hand, in order to identify linkage opportunities at an early stage, and on the other, to discuss options for tying in with river-widening efforts. For example, the exploration regarding the Wolferen-Sprok dyke section (river Waal) also addresses the interconnectivity with the Oosterhout dyke relocation set out in the Preferential Strategy. In the exploration regarding the IJssel dyke Zwolle-Olst project, the collaborating governments will examine, in 2018, whether linkage with various leisure and ecological taskings is feasible. A 1.2 km stretch of the Rhine quay in Arnhem needs to be improved. The Rijn en IJssel district water board is responsible for the flood risk management of the high Rhine quay and has initiated a project, in collaboration with the municipality of Arnhem, the province of Gelderland, Rijkswaterstaat, and local stakeholders, to gain clarity regarding the interests and functions at stake in terms of flood risk management and the Rhine quay as a living environment.

Upheaval & Collapse

In September 2017, the Crisis Control Platform of the Central Netherlands district water boards initiated a large-scale flood exercise under the heading of *Deining & Doorbraak* (Upheaval & Collapse). For an entire week, the district water boards, Security Regions, Rijkswaterstaat, and the Ministry of Defence engaged in a serious flood scenario drill. The crisis partners intended to gauge the efficiency of their collaboration at the various levels and field-test their crisis strategies. Working with a shared crisis management system also featured high on the agenda.

The comprehensive and complex drill has yielded a wealth of insights, lessons to be learnt, and useful experience. Considerable progress has been made regarding information management. Across the board, working with the National Crisis Management System (LCMS) was perceived as positive. Some elements appear to call for increased uniformity. The drill has once more highlighted the importance of well-coordinated crisis communication. This calls for efforts on the part of many, which the parties involved need to harness. In conclusion, the drill caused some upheaval in the media: it has attracted tremendous interest. A fine way to inform residents about working on flood risk management and the need to do so in close cooperation.

River widening

Varik-Heesselt

The integrated MIRT Exploration regarding the Tiel-Waardenburg dyke improvement and the Varik-Heesselt river widening projects has ultimately generated two variants as a potential preferential alternative: dyke improvement with nature and water compensation in the floodplains (VKA1) and dyke improvement with a flood channel (VKA2). In February 2018, the Varik-Heesselt steering group expressed its preference for the provisional preferential alternative of dyke improvement with nature and water compensation in the floodplains (VKA1). The Gelderland Provincial Executive deposited the provisional preferential alternative for public consultation, also on behalf of the Ministry of Infrastructure and Water Management, the executive board of the Rivierenland water authorities, and the Mayor and Aldermen of the municipality of Neerijnen; the documents were available for perusal from 15 March until 26 April 2018. During this period, everyone had the opportunity to present their views.

Some 85 responses have been submitted. Approx. 65 responses supported the provisional preferential alternative of the steering group; approx. 50 of these were virtually identical responses submitted by Varik residents. Some 20 responses expressed a preference for another provisional preferential alternative, among which were 7 responses from municipalities along the river Waal. These municipalities point out that the provisional preferential alternative will impact the entire catchment area of the river Waal. They request that this impact be mapped out and that they be consulted regarding the results prior to the final decision. Three nature organisations have also responded and requested a reconsideration of the preferential alternative. The steering group will take the response into account when drawing up its final recommendation to the Minister. On 12 June 2018, the Delta Programme Commissioner presented an [advisory report](#) to the Minister of Infrastructure and Water Management regarding the long-term preservation of the spatial reserve for the flood channel in the General Spatial Planning Regulations Decree for the period beyond 2050, if the VKA1 variant is selected. The Minister has decided to opt for the VKA1 alternative, to not amend the General Spatial Planning Regulations Decree, and to maintain the area reservation for the flood channel⁵⁹.

IJsselpoort and Reevediep River Climate Adaptation Park

The MIRT Exploration regarding the IJsselpoort River Climate Adaptation Park is expected to be completed by the end of 2019. The province of Gelderland is responsible for this exploration. Meanwhile, the municipalities of Arnhem, Duiven, Rheden, Westervoort, and Zevenaar have set down

the Scope and Level of Detail Memorandum regarding the IJsselpoort River Climate Adaptation Park. This memorandum sets out what this project involves, and which studies are being conducted to map out the environmental impact of the draft designs. The Environmental Impact Assessment procedure will commence in 2018. Delta Programme 2018 already reported that the exploration phase has been extended by a year. This opens up the opportunity to elaborate this tasking on a sufficiently wide scale, together with all the [partners](#). The decision regarding the preferential alternative is foreseen for 2019. The measures pertaining to the Reevediep, the new water connection between the river IJssel and lake Drontermeer, are on schedule. Expectations are that all the measures will be completed by 2022. The final delivery is scheduled for 2023.

Updating of Preferential Strategy

The Administrative Platform on the Rhine Delta Programme has agreed to update the Preferential Strategy. The goal is to develop a realistic and feasible set of river-widening measures in interconnection with long-term dyke improvements. In March 2018, the results of the various studies and analyses conducted over the past eighteen months were compiled into a synthesis document for the Rhine tributaries. This will serve as the basis for the “provisional administrative preference” to be set down in 2018, regarding a programme running up to 2050 and looking ahead to the period beyond.

In the Preferential Strategy, retention in the Rijnstrangen is an option for the period beyond 2050. In 2017, a study was conducted into the optimum use and an optimum design of this retention area under the new flood protection standards. The study has mapped out several options for an effective usage scenario with the associated costs and benefits. These show that retention in the Rijnstrangen could be effective under the new standards, if the use of this area is based on discharge forecasts featuring inlet control. The study has provided input for the updating of the Preferential Strategy.

In 2015-2017, Rijkswaterstaat conducted a study into the options for river widening in the bifurcation points area (vicinity of Pannerdensche Kop and IJsselpoort). The study has shown that the IJsselpoort River Climate Adaptation Park project may impact the discharge distribution across the Rhine tributaries. For that reason, the province of Gelderland examined, in 2017, the feasibility of river-widening measures along the Nederrijn and the Pannerdensche Canal, mapping out the aggregate impact of measures involving the Huissensche Waarden, Meinerswijk-City Blocks, and the IJsselpoort River Climate Adaptation Park. The province, Rijkswaterstaat, Rivierenland district water board, the municipalities of Arnhem and Lingewaard,

⁵⁹ Parliamentary Document 27 625 no. 434.

and the Ministry of Infrastructure and Water Management have reviewed how the measures can best be incorporated into the updated Preferential Strategy, to ensure that the required area developments will be accomplished and that the discharge distribution remains balanced. The study has shown that the proposed measures are viable and can be linked to other initiatives and sources of funding, in both the short and the long term. Maintenance of the discharge distribution at the IJsselkop bifurcation area and realisation of a 25 cm water level reduction requires measures in Meinerswijk-Stadsblokken and Huissensche Waarden. Consequently, the MIRT Consultation Committee decided, at the end of 2017, to launch a MIRT Study regarding the IJsselkop in order to further map out the options for realisation and funding of the measures involving Meinerswijk-Stadsblokken and Huissensche Waarden.

The study has shown that, based on the current know-how and points of departure, changing the discharge distribution after 2050 would not appear cost-effective; however, it would make sense to keep the option open (cf. paragraph 2.1).

Along the Nederrijn-Lek, the provinces of Utrecht and Gelderland have commissioned an initial analysis to identify promising initiatives for a combination of the existing dyke improvement taskings and small-scale river widening. Short-term linkage opportunities and the interests of parties involved in the proposed strategy must also be indicated. The analysis will be completed by mid-September 2018.

Collaboration with North Rhine-Westphalia

The central government, the Rijn en IJssel and Rivierenland district water boards, and the province of Gelderland have joined forces with North Rhine-Westphalia in the field of flood risk management. The collaboration is aimed at exchanging expertise, coordinating policy, and conducting joint research. In this context, a joint study has been conducted into flood risks in the border area. This is relevant, because flooding in the Dutch section could lead to wet feet in the German section and vice versa. The study has mapped out the differences in flood risk management strategies pursued on either side of the border and has identified current and future flood risks for local residents. The study has been conducted in accordance with the Dutch method that has also been used in the National Flood Risk Analysis for the Netherlands study. The organisations have shared expertise on the impact of the climate on Rhine discharges. The joint study will be completed this year; the results will be presented at the next International Flood Conference.

Freshwater supply (Area around the major rivers freshwater supply region)

The implementation of the freshwater supply measures in the area around the major rivers is on track. At the end of 2017, the Rivierenland district water board and

the Southern Agriculture and Horticulture Organization (ZLTO) opened up the Water Savings and Water Efficiency incentive scheme to consumers. The preparations for the replacement of the pumping station that transfers water from the Pannerdensch Canal to the first section of the Linge have commenced. Arnhem is also preparing for the replacement of a pumping station. The models visualising the supply from the Betuwe surface water system are ready; the supply models for the Land van Maas en Waal and the Land van Heusden en Altena areas are being developed. The Rivierenland district water board, finally, is preparing a climate pilot entitled Sustainable Use of Shallow Groundwater, in collaboration with provinces and drinking water companies. The pilot will commence in 2019.

For information on the freshwater supply measures involving the eastern part of the Netherlands: see [Elevated Sandy Soils-East Freshwater Supply Region](#).

Spatial adaptation

Governments in the province of Gelderland have joined forces in bodies such as the Gelderland Spatial Adaptation Platform. In addition to the province, district water boards, and the major municipalities in Gelderland, the participants include the Association of Netherlands Municipalities VNG-Gelderland and Rijkswaterstaat.

Wherever possible, the division into working regions ties in with the existing water chain cooperative (see Map 1). The participating parties, the division of roles, and the collaborative format may differ from one working region to the next. In the Land van Maas en Waal and Rijk van Nijmegen areas, the district water boards and the municipalities have been collaborating since 2015. The other municipalities in the Gelderland section of the area around the major rivers are in touch with the district water boards and the province regarding collaboration.

In 2018, the parties involved in the Vallei en Eem Water Platform, Noord-Veluwe Region, and Oost-Veluwe Region signed a regional manifesto in which they assume responsibility for the implementation of the Delta Plan on Spatial Adaptation. The parties are working on the development and roll-out of a regional stress test for the entire area.

The Rijn en IJssel district water board is going to expand the existing cooperatives for the water chain to include water system, spatial planning, and living environment issues, in terms of both substantiation and administration. The Achterhoek Plus Administrative Consultation Committee is promoting the agendising and elaboration of spatial adaptation in the six (waste) water teams.

The province of Gelderland is working on embedding climate adaptation in all its policies and projects.

For example, climate adaptation has already been accommodated in the Neighbourhoods of the Future project (under the Energy Transition programme), in the management and maintenance of roads, and in its Nature Vision. Climate adaptation is an element of the sustainability focus issue in the further development of the provincial Environmental Vision in Gelderland and thus constitutes a key spearhead. Together with stakeholders (among which are municipalities and district water boards), the province is going to determine how to embed climate adaptation in its Environmental Vision.

For the progress regarding spatial adaptation in the eastern part of the Netherlands: [see Elevated Sandy Soils-East](#).

7.4.2 Integrated approach

The essence of the Preferential Strategy for the Rhine is an integrated approach, focused on a powerful interaction between dyke improvement and river widening. This approach is further substantiated by the updated Preferential Strategy, which also addresses spatial quality. Last summer, the Rhine Delta Programme, the provinces of Gelderland and Overijssel, and [Atelier X](#) launched the Rhine Tributaries Design Lab (in short, the Rhine Lab). The Rhine Lab is intended to assist in the integrated and regional elaboration of the flood risk management tasking for the Rhine tributaries by conducting design studies. The Rhine Lab has explored how the flood risk management measures along Rhine tributaries relate to the spatial taskings involved in the energy transition, the transition towards a circular economy, the Netherlands Nature Network, and the living environment in the area around the major rivers. Its aim was to achieve a balance between hydrological, economic, and ecological developments, and to capitalise on opportunities for area development. The Rhine Lab provides input for the Long-Term Ambition for the Rivers. In a series of workshops focused on the rivers Waal and IJssel, a growing group of experts has outlined the prospects for 2100. The outcomes have been compiled into the [manual entitled *Vizier op de Rivier \[River in Sight\]*](#).

In the IJsselpoort River Climate Adaptation Park project, nine national and local governments are working on solutions to high-water and low-water taskings and are exploring the spatial planning options for the floodplains. The IJssel water level impacts all the functional uses of the area. For that reason, stakeholders joined forces as early as in 2013, in order to collectively pursue an optimum spatial design for the area. The development vision drawn up at that time is now being elaborated in an integrated regional vision zooming in on four taskings:

- flood risk management: phreatic decline and dyke improvements;
- the economy: appropriate business activity, improvement of waterways, and sustainable energy generation;

- nature and water quality: connecting nature reserves and improving water quality;
- leisure: improving accessibility and enhancing perception of the area.

In addition to flood protection, the Reevediep project also generates new nature and new leisure facilities. Four hundred hectares of new wet delta nature will be created. With effect from mid-2019, residents of Kampen and tourists will have new cycle tracks and trails at their disposal. In addition, a leisure craft channel will be created in the Reevediep. This flood channel thus also fosters the local economy and the bustle of the city.

In the river Waal near Tiel, Rijkswaterstaat is conducting a pilot involving longitudinal erosion control dams in the navigation channel. As a result of the dams that have been constructed parallel to the banks, this section of the river now consists of two flow channels: a main navigation channel and a wide bank channel for other river functions such as nature. Several functions can thus co-exist without negatively impacting one another. The first results are positive. Many target fish species set out in the Water Framework Directive are increasing in population. High water levels are falling, because convex bank groynes have been removed altogether. River bed erosion in this section ceased in 2015; the river bed actually seems to be rising again. This also puts an end to the fall in low water levels ensuing from this river bed erosion. The conclusions of the pilot study will be available after 2019.

An integrated approach also holds potential with respect to the design of freshwater supply measures. For example, the new pumping station near Arnhem opens up the opportunity to combine freshwater supply with the generation of thermal energy in the purview of a local heating-cooling grid.

7.4.3 Participation

In the Rhine region, several best practices can be observed in terms of participation. For example, in the autumn of 2017, an intensive participation process was launched for the IJsselpoort River Climate Adaptation Park project in order to survey ambitions for this park. Open evenings, workshops, and kitchen table talks enabled local residents and users to input their ambitions and ideas for the area, and to join the discussion on the options for improving the area's functionality and for combining several functional uses. The focus was on the flood risk management tasking. In early 2018, the ambitions and ideas collected were accommodated in the draft memorandum *Kansrijke oplossingsrichting [Promising Solution Strategy]*, which constitutes the basis for the Environmental Impact Assessment and the cost-benefit analysis. In 2019, the preferential alternative will be incorporated into the inter-municipal spatial vision.

The provinces of Gelderland and Utrecht, the Vallei en Veluwe district water board, Staatsbosbeheer, Rijkswaterstaat, and the municipality of Wageningen are conducting a comprehensive exploratory study into the improvement of the Grebbe dyke along the Nederrijn. Via a unique and intensive participation process, local residents, visitors, entrepreneurs, and other parties are submitting ambitions and preferences to raise the appeal of the dyke. The process can serve as an example to other Delta Programme projects. In the three years ahead, the study will map out feasible ideas. The aim is for the final plan to

render the dyke both safe and attractive. Implementation of the project is expected to commence in 2023.

In 2018, the Rhine Delta Programme will organise comprehensive knowledge meetings on the updating of the Preferential Strategy, the progress in projects, and the results of studies, for both governments and NGOs in the area. The autumn of 2018 will see the Rivers Day: a major two-day regional conference aimed at informing the wide Rhine community.

7.5 Meuse

7.5.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the Meuse aims to render the Meuse safe and attractive through a powerful interaction of dyke improvements and river widening. The point of departure is the realisation of a sustainably safe river as the basis for an economically prospering region. The Meuse region is collaborating with the central government on short-term plans for dyke improvements and river widening. Since 2016, these parties have also been working on the Long-Term Ambition for the Rivers, in coordination with the Rhine region: the ambition for river widening along the Meuse up to 2050, in interconnection with the dyke improvements (see [paragraph 3.1](#)).

Short-term measures

Based on the Regional Proposal for the Meuse 2016, the central and regional governments have set down agreements on a first round of measures (eight explorations and three studies). The flood risk management required in this area is established through a combination of river widening, dyke improvement, and area developments. Several explorations comprise a combined elaboration of dyke improvement and river widening/dyke relocation. The Limburg en Aa and Maas district water boards, and the municipality of Venlo have adopted this integrated approach, which presents them with two separate funding frameworks, viz. those of the Flood Protection Programme (HWBP) and of the Multi-Year Programme for Infrastructure, Spatial Planning and Transport (MIRT). The initial obstacles that arose were overcome by process innovations.

The eight explorations are well on schedule:

- *More Meuse More Venlo* (initiated by municipality of Venlo)
In this combined MIRT/HWBP exploration, an integrated area development will constitute the basis for proposals – to be presented in 2019 – that will increase the safety and appeal of the city of Venlo, whilst enhancing the multi-

modal logistics hub of Venlo / Venlo Trade Port.

- *Meandering Meuse* (formerly: Ravenstein-Lith, initiated by Aa en Maas district water board)

This combined MIRT/HWBP exploration commenced in 2017. The aim is to combine river widening, dyke improvement, and area developments (in the purview of, inter alia, nature, leisure activities, and commercial shipping) into an integrated plan. The decision on the preferential alternative is envisaged for early 2020, as is the signing of the associated administrative agreement.

- *More room for the Meuse – Oeffelt bottleneck* (initiated by the province of Noord-Brabant)

The exploration is aimed at removing the bottleneck near the bridge over the Meuse between Oeffelt and Gennep. Two measures on the Brabant side offer good prospects: two openings in the bridge land abutment and flood-plain excavation. The plan elaboration is scheduled to commence in the autumn of 2019.

- *Five dyke relocations under the Flood Protection Programme* (initiated by Limburg district water board)

One of these dyke relocations (Venlo-Velden) has been accommodated in the More Meuse More Venlo project. The other four explorations are carried out within the framework of the integrated Flood Protection Programme exploration regarding a total of ten dyke sections. A vision and a spatial quality framework for these sections were set down in 2017. In addition, potential solution strategies have been explored and procedures have been launched.

The three MIRT Studies are also on track:

- *Meuse Bank Park* (initiated by municipality of 's-Hertogenbosch)

The ambition is to develop nature reserve along the Meuse in which future flood risk management measures and infrastructural structures reinforce one another. The study also covers river widening around Alem. This will expand the through-flow area and result in a substantial drop in water level. The regional governments intend to put the results of the MIRT Study on the agenda of the Delta Programme Steering Group for the Meuse and

submit them to the Consultation Committee – MIRT 2018 for a decision.

- *Southern Meuse valley (initiated by municipality of Maastricht)*
Flood protection is a major challenge for the city of Maastricht. Raising the existing dykes in urban areas by some 1.5 metres is undesirable on account of its impact on the identity of the city and thus on its social and economic appeal. The study focuses on river widening in combination with urban developments to preserve and enhance the identity of the city. The aim is to set down agreements between the central government and the region in the autumn of 2018, covering some of the river-widening options in and around Maastricht.
- *Lob van Gennep (initiated by the province of Limburg)*
The study has shown that solution strategies involving retention will foster water storage, flood protection, and spatial quality, both in the Lob van Gennep area and downstream. Opportunities will open up in the area for, inter alia, leisure activities and tourism. The protection deficit will decrease at the dyke sections on the Gelderland and Brabant side, where spatial quality is vulnerable. Opportunities will also open up for reinforcement of both wet and dry nature, and for a connection with the Maasheggen nature reserve. The region aims to set down agreements with the central government in the autumn of 2018 regarding the launch of a MIRT Exploration.

In Limburg, ten Flood Protection Programme dyke improvement projects have entered the exploration phase (in five areas, the projects also involve a dyke relocation variant; see above). The district water board is actively involving local stakeholders in the potential alternatives. For the Nieuw-Bergen, Belfeld, Beesel, and Heel projects, preferential alternatives were set down in early 2018; the projects have entered the plan elaboration phase. For the other sections, decisions regarding the preferential alternatives are expected by the end of 2018. The municipalities involved will incorporate the Venlo-Velden and Baarlo-Hout Blerick projects into an (inter)municipal spatial vision (administrative decision-making 2018/2019).

Long-term measures

The Meuse region intends to combine dyke improvement with both river widening and area developments, in order to create a sustainably safe and attractive Meuse. In the purview of a long-term ambition for the Meuse, the Preferential Strategy for the Meuse is being updated and elaborated in the Meuse Valley and Dyked Meuse regional processes (see [paragraph 3.1](#)). These processes involve collaboration between the central government, provinces, district water boards, and municipalities. In 2017, progress was made with the social cost-benefit analysis. The Meuse partners will set down the long-term points of departure for the entire Meuse in the Adaptive Implementation Strategy

Local material: sustainable basis for dyke improvement

Dyke improvement entails a great demand for raw materials. In many cases, the raw materials are transferred from other projects, some of which are situated at a great distance. This is costly and causes nuisance to local surroundings. In the Ooijen-Wanssum project, the contractors' consortium has opted for constructing the dykes from local material wherever possible. This is viable because the project comprises a combination of flood channels and dyke improvements: incorporation of the clayey material from the channels into the dykes closes the soil balance. This saves costs, reduces transport movements, and is, on balance, a sustainable solution. The Local Soil General Exploration which has been launched under the Flood Protection Programme uses the experience gained in Ooijen-Wanssum.

for the Meuse. To this end, they have drawn up the [Spatial Perspective](#) for the River Meuse. Policy embedment of the flood risk management frameworks is scheduled for 2020, as is the next round of river-widening measures. The point of departure is an integrated approach in interconnection with area developments.

Freshwater supply

For the implementation of the Preferential Strategy regarding freshwater supply in the area around the major rivers: see Area Around the [Major Rivers Freshwater Supply Region](#) and Elevated [Sandy Soils-South Freshwater Supply Region](#).

Spatial adaptation

For the progress made in spatial adaptation: see [Elevated Sandy Soils-South](#).

7.5.2 Integrated approach

Wherever possible, the partners in the Meuse region – the central and regional governments – are taking account of ambitions and goals relating to other policy fields. They pursue an integrated approach, in accordance with the Regional Proposal for the Meuse 2016. Studies and explorations are consistently identifying linkage opportunities; the aim is to develop integrated, widely supported regional projects. Good examples are the More Meuse More Venlo and Meandering Meuse projects. The perspective is a safe and attractive Meuse (in terms of ecology, the economy, and leisure activities). This means that spatial quality is a key criterion for future measures, in addition to the long-term manageability of the river.

The long-term ambition for the Meuse is being elaborated in regional processes at the Dyked Meuse and Meuse Valley level. Initiators are the provinces of Noord-Brabant and Limburg; all the Meuse municipalities are participating. The province of Gelderland is also involved in the Dyked Meuse project. The regional processes bring the synergy with other taskings and opportunities expressly to the fore. Along the Meuse, combinations with mineral extraction are also conceivable. The measures are assessed on the basis of a [Spatial Perspective for the River Meuse](#) that the parties have established in several workshop sessions, in collaboration with Atelier X of the Ministry of the Interior and Kingdom Relations. The framework elaborates the international position, the national significance, and the regional diversity in words and images.

Initial coordination between the Delta Programme Steering Group for the Meuse and the Security Regions along the Meuse has taken place.

7.5.3 Participation

Local governments, regional parties, and residents are participating in the ongoing explorations and studies. Depending on the nature and scope of the projects, stakeholders can obtain information on the results and, if possible, actively participate through workshops, information evenings, mailshots, flyers, and a website. For example, the Meandering Meuse project involves an innovative process with stakeholders aimed at the collective development of promising alternatives. In monthly workshops, the parties are developing building blocks for river widening, dyke improvement, and area developments (nature, leisure activities, and, e.g., access to the port of Oss for commercial vessels).

Administrative coordination is substantiated in the steering groups for the Meuse Valley and Dyked Meuse regional processes, and the steering groups governing the explorations and studies. At the Meuse-wide level, decisions are coordinated with the Meuse Consultative Group, in which interest groups are participating on a supra-regional level.

7.6 Southwest Delta

7.6.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the Southwest Delta is aimed at a climate-proof, safe, ecologically resilient, and economically vital delta. With respect to the coast and the Oosterschelde, the adagio is “flexible where possible, rigid where needed”. Wherever possible, measures are linked to environmental and other spatial ambitions. An integrated approach and participation are firmly embedded in the Southwest Delta.

For the time being, the dyke improvement projects being carried out under the Flood Protection Programme are on schedule. The dyke improvements on the island of Schouwen-Duiveland (2.4 kilometres) have been completed. Preparations for the Hansweert dyke improvement project (5.15 kilometres) are under way.

The beach nourishment programme for the coast and the Westerschelde, which is aimed at keeping the sandy system in sustainable balance with the rising sea level, is proceeding as scheduled. The Noord-Beveland beach is scheduled for replenishment in the autumn of 2018; replenishments at the Zeeuws-Vlaanderen beaches will commence at the end of 2018 and continue until the end of 2019. The Coastal Genesis 2.0 programme and the VNSC working group on coastal flood risk management in the Westerschelde estu-

ary are exploring the long-term development in the sand budget. In this context, the VNSC working group is examining the resilience of the existing Flemish and Dutch coastal protection strategies, and is surveying ambitions and opportunities for collective research into long-term flood risk management and collective pilot projects. The results of the VNSC working group will be available by the end of 2018; those of Coastal Genesis 2.0 in 2020. In the Oosterschelde, appeals to the Council of State have deferred sand replenishment to the Roggenplaat shoal by two years to the winter of 2019/2020. Sand replenishment is essential to combat the impact of sand deficit.

Within the Flemish-Dutch Scheldt Commission (VNSC), the Flemish Region and the Netherlands are working on an Agenda for the Future, aimed at the sustainable development of the Scheldt estuary. By the end of 2018, the VNSC and the stakeholders will jointly review the first research programme.

As a follow-up to the MIRT Study into Integrated Flood Risk Management in the Oosterschelde, a study was launched in 2018 to connect the outcomes of the MIRT Study to (the combat of) sand deficit in the Oosterschelde and functions such as nature, landscape, and fisheries. The parties are thus working towards a long-term perspective for the Oosterschelde: climate-proof, secure, and sustainably managed. The MIRT Study has shown that, depending on the pace at which the sea level is rising, the closing

frequency of the Oosterschelde storm surge barrier will increase: from the current average of once a year to ten times a year in the event of a 60 cm rise in sea level, or 100 times a year in the event of a 125 cm rise in sea level. Originally, the Oosterschelde storm surge barrier was designed to have a life span of 200 years, based on a 40 cm rise in sea level as then expected. If the sea level should rise by more than 50 cm, components of the Oosterschelde storm surge barrier will probably need adjustment. This will come up in the follow-up to the exploration of the potential effects of an accelerated and extreme rise in sea level for the Delta Programme⁶⁰. Delta Programme 2020 will report on the potential consequences and adjustments.

In collaboration with the district water board, Rijkswaterstaat, and the Security Region, the province of Zeeland is drawing up a provisional standard for the regional flood defence systems of Zeeland. Both the standardisation of regional flood defence systems and the impact analysis being conducted by the Security Region are proceeding as planned; both will be completed by the end of 2018.

Freshwater supply

The freshwater supply measures set out in the first phase of the Delta Plan on Freshwater Supply for the Southwest Delta are closely related to a decision on a saline Volkerak-Zoommeer lake in accordance with the draft National Framework Vision for Grevelingen and Volkerak-Zoommeer. In anticipation of such a decision, the implementation of the freshwater supply measures has incurred a considerable delay. The region is examining other measures that could potentially contribute to improving the freshwater supply in the area and that could be implemented in the period up to and including 2021. Such measures will be elaborated further in 2018. Decisions in this respect will be taken in interconnection with a roadmap for the decision-making process regarding the Volkerak-Zoommeer lake and the related alternative freshwater supply.

The work on the Roode Vaart in Zevenbergen was contracted out at the end of 2017 (no regret measure). An open water section and a long culvert will reconnect the Roode Vaart North and South here. The work commenced in the summer of 2018. According to schedule, transfer of water to West-Brabant via the Roode Vaart will be possible by the end of 2019.

The Brabantse Delta district water board has drawn up a framework for the elaboration of the Water Availability process. This framework has been adopted at the administrative level and offers a perspective for action covering a large

section of the area. Several areas require further elaboration. The results of two projects completed within the context of the Freshwater Testing Ground (Freshwater-Saltwater Mapping and Monitoring) are publicly available on the websites of the province of Zeeland and the Scheldestromen district water board. The Raising Crop Salt Tolerance project has generated an advisory map for potato farmers showing which parts of Zeeland are best suited to the cultivation of salt-tolerant potato species. Three projects applied for a grant under the Rural Development Programme in 2017: Walcheren Waterhouderij – innovative water management; More Fruit with Less Water – raising the moisture retention capacity of the soil; and DeltaDrip – Optimisation of irrigation. All three applications were turned down because of too great a focus on research. In 2018, the applicants will amend their applications in order then to qualify for a grant.

Spatial adaptation

The Southwest Delta region comprises the working regions of Zeeland and Goeree-Overflakkee. The Southwest Delta Regional Consultative Body reports on the progress made in these areas in terms of spatial adaptation. The provinces of Zeeland, Zuid-Holland, and West-Brabant are represented on the Southwest Delta Regional Consultative Body. The Elevated Sandy Soils-South Regional Consultative Body reports on progress in West-Brabant; the Rhine Estuary-Drechtsteden Regional Consultative Body reports on the Zuid-Holland areas outside the Southwest Delta.

In 2014, the municipalities of Zeeland, the Scheldestromen district water board, the Zeeland Security Region, Rijkswaterstaat, and the province of Zeeland embarked on the implementation of the Delta Decision on Spatial Adaptation in the region. In 2015, the provincial authorities of Zeeland set down an ambition document and an implementation plan. In 2017, several consultation committees were incorporated into the so-called Water Morning, now comprising administrative-level representatives of all the governments as well as the holders of the water and spatial planning portfolios. Spatial adaptation is a standard agenda item at Water Morning meetings.

In September 2017, the authorities decided, on the basis of a working paper, how the ambitions of the Delta Plan on Spatial Adaptation will be substantiated in Zeeland. Three studies have been scheduled for 2018 and 2019 to substantiate the “Analysis” component⁶¹: 1) identification and standardisation of regional flood defence systems (multi-layer flood risk management); 2) impact analyses to map out how flooding will impact society, including the impact on vital and vulnerable infrastructure; and 3) climate stress

⁶⁰ See [Background Document B](#) (in Dutch).

⁶¹ First step of the “Analysis-Ambition-Action” method.

tests. These studies will outline the results for the islands of Walcheren, Noord-Beveland, Zuid-Beveland, Schouwen, Tholen/St. Philipsland, and Zeeuws-Vlaanderen.

The analysis of the effects of flooding and serious waterlogging on the vital and vulnerable functions will be completed in 2018. Along with the other outcomes of the impact analysis conducted by the Security Region, the results will constitute the basis for strategies regarding action perspectives in flood-prone areas in Zeeland and spatial adaptation measures. The Standardisation of Regional Flood Defence Systems to be launched in 2019 by the province, district water board, Rijkswaterstaat, Security Region, municipalities, and stakeholders will explore ways to utilise the secondary dykes to contain the impact of flooding.

The climate stress tests only cover the municipalities. All the governments are providing expertise and experts to this end. The studies conducted in the context of the standardisation of regional flood defence systems and the impact analyses are used as input to the climate stress tests. Four out of the thirteen municipalities have already conducted a climate stress test accordingly: Borssele, Goes, Noord-Beveland, and Reimerswaal. Five municipalities will complete their stress tests at the end of 2018, the remaining municipalities will follow suit in 2019. The risk dialogue in Zeeland will commence in 2019; preparations are under way. The Nature and Environmental Education consultations will play an important role in this dialogue. Expectations are that separate dialogues will be conducted in each sub-region, once studies 1, 2, and 3 have been completed for the sub-region concerned (see above). In 2018, the municipalities of Zeeland have made funding available to extend the heat stress gauging pilot study by several years.

The province of Zeeland will accommodate climate adaptation policy in its Environmental Plan 2018. The aim is for the Provincial Council to adopt the Environmental Plan in September 2018.

7.6.2 Integrated approach

The strategy for the Southwest Delta revolves around an integrated approach. Throughout the delta, the point of departure is: ecological resilience, economic vitality, and climate-proof security. Linkage opportunities are identified at an early stage in the purview of the Delta Plan on Flood Risk Management. In 2018, the Hansweert dyke improvement exploration identified linkage opportunities for this project, such as an upgraded meeting house on the dyke, renovation of a beach section, or campsites for RVs on the dyke. The municipality of Borssele has requested attention for the permanent location of an existing restaurant with lodging facilities at the Baarland sea wall. With the municipality of Tholen, agreements have been made regarding the combination of dyke improvement with an urban develop-

ment tasking in St. Annaland. The municipality of Goes has requested attention for the lock in Goese Sas and the potential linkage with renovation work.

The Smart Sand Handling pilot on the island of Schouwen has produced, inter alia, a new dynamic and raised the ecological and landscape values of the dunes. Within the context of this pilot, a single replenishment at the Kop van Schouwen beach was partially skipped, without causing any safety risks.

The Water Morning meetings enable representatives of the provincial authorities, the district water board, Rijkswaterstaat, and the municipalities to exchange experience and to coordinate their efforts in the fields of spatial adaptation, water issues, and flood risk management. The municipalities of Brabant and Zuid-Holland involved in the Southwest Delta also participate in these meetings.

The Innovative Saltwater-Freshwater Separation system in the Krammer locks will mitigate the salt burden on the Volkerak-Zoommeer lake; it will improve fish migration options, reduce passage times for commercial shipping, cut down power consumption, and open up opportunities for the generation and storage of sustainable energy. In 2018, an integrated project brief was formulated for the Krammer Locks Renovation project, including maintenance, remote control, and the realisation of the saltwater-freshwater separation system. The renovation project will not be completed before 2024.

The central and regional governments intend to draw up a regional agenda for the Southwest Delta in 2018. The aim is a balanced development of natural and economic resources, within the preconditions of flood risk management. The regional agenda will be established through a co-creation process involving governments, terrain managers, port authorities, entrepreneurs in the leisure sector, shippers, the fishery sector, power plants, and other stakeholders. The central government will ultimately adopt the regional agenda. The Regional Agenda for the Southwest Delta will consist of three components:

- a collective directional perspective for the Southwest Delta up to 2050, integrated, and covering all the major waters with attention to current topics such as the energy transition, climate adaptation, and circularity;
- an agenda programme for “wet” measures and projects up to 2030;
- a knowledge and innovation agenda.

The regional agenda will integrate current topics (such as the energy transition, climate adaptation, and the circular economy) and recent developments (such as the Major Waters Ecology Programme and the Scheldt Estuary Agenda for the Future) into the Delta Programme Preferential Strategy for the Southwest Delta.

In 2017, the Ministry of Infrastructure and Water Management and the Ministry of Agriculture, Nature and Food Quality commissioned the Major Waters Exploration within the context of the Delta strategies regarding Water Quality and Freshwater Supply. This exploration has identified the measures that need to be taken to render the major waters ecologically healthy and future-proof. One conclusion was that the Grevelingen takes priority. In March 2018, the central government decided to allocate additional funds to the improvement of the Grevelingen water quality. This has finalised the co-funding arrangement with the region. The goal is to improve water quality by introducing a reduced tide of 0.5 m. This can be achieved with a sluice, which could potentially be combined with a tidal plant. Options for such a measure will be explored in 2018, along with the preparations for the plan elaboration. The improvement of water quality is a component of the Preferential Strategy for the Southwest Delta; the introduction of a reduced tide is an important step towards the realisation of the Preferential Strategy. The measure combines the aims in the fields of water quality, nature, and climate resilience. A sluice can accommodate the expected sea level rise in the next 30 years; adjustment of water level management will extend this period even further.

7.6.3 Participation

Participation is firmly embedded in the Southwest Delta and ranges from collective studies (Freshwater Programme) to collective implementation and co-funding.

Many parties are involved in the Public Vital Infrastructure in the Resilient Delta project. This project is aimed at developing new information on the cascading effects of failing vital infrastructure as a result of flooding, and on the potential measures in the pro-action, response, and recovery phases. Professionals can use the results to increase societal resilience. Research is conducted by a consortium involving a wide range of parties: the University of Applied Sciences HZ Vlissingen (secretary), the province of Zeeland,

the municipality of Reimerswaal, Zeeland Security Region, Rijkswaterstaat Sea & Delta, Scheldestromen district water board, and Deltares. The Netherlands Organisation for Scientific Research NWO is co-funding the research. The project will be completed by January 2019.

An example of a successful participation process is the establishment of the Zeeland Coastal Vision. This vision is the product of the collaboration between the coastal municipalities of Zeeland (Schouwen-Duiveland, Noord-Beveland, Veere, Vlissingen, and Sluis), Rijkswaterstaat, Scheldestromen district water board, Zeeuwse Milieufederatie, Het Zeeuws Landschap, Staatsbosbeheer, Natuurmonumenten, Toeristisch Ondernemend Zeeland (including the sector organisations Recron, HISWA, VEKABO, and Horeca Nederland), the Southern Agriculture and Horticulture Organization ZLTO, and the province of Zeeland. The coastal vision addresses taskings in the fields of nature and landscape, leisure accommodation, and flood risk management. Under the direction of the Zeeuwse Milieufederatie, Toeristisch Ondernemend Zeeland, and the district water board, the parties have compiled solutions to these taskings in an integrated strategy for the coastal zone. The focus is on the protection and enhancement of existing qualities and the development of new qualities in the coastal zone. In a covenant, the parties have agreed to embed the coastal vision in their policies and to implement the associated action programme. The coastal vision will thus foster the establishment of a future-proof coastal zone featuring a balanced development of the cornerstones of the Preferential Strategy for the Southwest Delta: flood risk management, the economy, and ecology.

With respect to the measures involving the Volkarak-Zoommeer lake, a regional process will be launched. The aim is to gain a better picture of the functioning of the water system, in collaboration with water consumers, inter alia through participatory monitoring.

7.7 The Coast

7.7.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the Coast is aimed at a safe, appealing, and economically viable coast by connecting the flood risk management tasking with spatial ambitions. The integrated tasking set out in the National Coastal Vision will remain the point of departure. The parties involved are jointly working on a zoning plan to regulate construction in the coastal zone, as set down in the Coastal Pact. The Coastal Genesis 2.0 research programme is substantiating

the Decision on Sand, which is focused on keeping the sand budget along the Dutch coast up to par by means of sand replenishment. The implementation of the Preferential Strategy for the Coast and the Decision on Sand is largely proceeding as planned.

In the period 2016-2019, maintenance of the ordnance coastline and ensuring that the coastal foundation keeps pace with the rising sea level will require less sand than the long-term annual average of 12 million m³. In 2017, sand replenishment involved nearly 10 million m³ of sand. On the one hand, the diminishing demand for sand is the result

of recent large-scale replenishments (such as for the Sand Engine and the seaward reinforcement of the Weak Links Along the Coast); on the other hand, it can be attributed to the fact that the sand deposited stays put longer than expected. Coastal measurements produce annual pictures of sand volumes. Deltares has explored how the [signs](#) regarding a potential acceleration in sea level rise may impact the Delta Programme. These signs are highly relevant to the coast and can be taken into account in the required scope of the annual sand replenishments. This issue is addressed in the policy recommendations presented by Coastal Genesis 2.0.

In early 2018, the Minister of Infrastructure and Water Management set down the revised situation of the ordnance coastline. The Water Act stipulates that the ordnance coastline situation must be evaluated and, if need be, adjusted every six years. The ordnance coastline has a signalling effect and constitutes the basis for scheduling the annual sand replenishments under the Coastline Maintenance programme. The ordnance coastline near the (former) “weak links” has expanded further seaward, because the beaches at these locations have been extended seaward. At several locations, the ordnance coastline situation no longer corresponded to the natural coastal situation, which counteracted the signalling effect of the ordnance coastline. At these locations, the situation has been optimised.

The three sub-studies of the Coastal Genesis 2.0 programme⁶² have been contracted out: Long-Term Coastal Research; Ameland Sea Gate Replenishment pilot; and Ecology. The National Water and Climate Knowledge and Innovation Programme (NKWK) is addressing the knowledge requirements relating to ecology, spatial planning, and the economy. The knowledge requirements regarding sand extraction have not yet been outsourced; a decision will be taken in 2018. All the sub-studies and know-how gathered in other projects will contribute to the substantiation of the policy recommendations that Coastal Genesis 2.0 will present in 2020.

Within the context of Coastal Genesis 2.0, research is being conducted into the operation of tidal inlets, the interaction between the North Sea and the Wadden Sea, and the long-term developments in the coastal system. In the spring of 2018, a pilot study was launched involving a 5 million m³ sand deposit in the Ameland Sea Gate. This replenishment in the outer delta between the islands of Terschelling and Ameland is expected to yield information on sustainable ways to have the Dutch coast keep pace with the rising sea level. In the autumn of 2017, the Ameland Inlet was subjected to a comprehensive measuring campaign,

⁶² Coastal Genesis 2.0 is a long-term research programme focused on sand transport along the Dutch coast (morphology) and future sand replenishment.

followed by limited measurements along the entire coast. After completion of the sand replenishment, the Ameland Inlet will continue to be monitored for several years. A new data management system provides the parties collaborating within Coastal Genesis 2.0 with access to all measurement data. The first results of the measuring campaign, the studies, and the Ameland Inlet Replenishment pilot will be available in the autumn of 2018.

The Flemish-Dutch Scheldt Commission (Coastal Safety & Westerschelde Estuary project group) has embarked on a survey of the resilience of existing Flemish and Dutch coastal protection strategies ([see paragraph 7.6.1](#)).

Under the Coastal Pact (21 February 2017), the provinces are working on a zoning plan to regulate new recreational construction in their coastal areas. By mid-2018, a national picture⁶³ will be presented of the zoning plans, based on the provincial zoning plans and an [advisory report](#) by the Government Advisory Council. The Council advocates reticence in new construction and recommends a focus on the preservation of existing values and on quality improvement. The aim is for provincial governments to embed the final zoning plan in policy and regulations by the end of 2018. In anticipation thereof, the parties are already gearing the preparation of any new spatial planning efforts to the intended zoning plans wherever possible. The zoning plans foster the envisaged character of the various coastal areas, featuring natural dynamics in combination with extensive or intensive leisure activities. This serves to substantiate the preferential strategy: a safe, attractive, and economically viable coast.

7.7.2 Integrated approach

Regional parties can submit wishes regarding beach replenishment during the annual consultations on the Coastline Care programme. Where possible, Rijkswaterstaat will incorporate such wishes into this programme, in order to ensure that the replenishments tie in with leisure activities, nature, and other developments in the area. Such wishes may pertain to, e.g., local reticence regarding beach nourishment in the purview of dynamic coastal management, such as has been exercised at the [Kop van Schouwen](#). Parties are also submitting wishes regarding beach width and implementation periods, with a view to leisure activities. The latter wishes, that largely entail higher costs, require separate assessment and cannot always be granted.

⁶³ Parliamentary Document 29 383 nr. 303.

Coastal Pearls are locations featuring potential for development and governance power for the realisation of ambitions. The goal is an integrated approach. A good example is Cadzand-Bad, where reinforcement of the Weak Link has been combined with the construction of a marina. The Smart Sand Handling pilot project at the island of Schouwen was officially completed on 8 February 2018. The municipality of The Hague is currently realising plans for the revitalisation of the coastal zone north of the Kurhaus hotel (such as Legoland). Some coastal developments have been substantiated in a highly integrated manner, such as those near the National Park Hollandse Duinen and the Hondsbossche Duinen. Options for flood-proof and climate-adaptative house construction in the Velsen port area are currently being explored. For most of the Pearls, developments are lagging behind the agreement set down in Delta Programme 2015: regional collaboration to develop an integrated coastal strategy for each Pearl, by linking the flood risk management tasking to ambitions regarding economic and ecological developments, knowing that the development ambitions will rise ahead of the flood risk management tasking. Indeed, linkage with flood risk management is currently not an option, because the reinforcement of the Weak Links has rendered the coast up to par, whilst the ambitions regarding housing and leisure activities along the coast are, apparently, not strong enough to bring about the intended integrated development.

The Wadden Sea features on the UNESCO World Heritage List, including the intertidal areas with channels, the shoals, and the mud flats of the islands' Wadden Sea coast. The policy pursued by the regional and central governments is focused on the protection and preservation of the functions in this unique part of the Netherlands.

This means safeguarding and preserving the appeal of, in particular, small-scale leisure facilities and tourism, nature, cultural history, landscapes, and spatial quality. In addition to knowledge about the Wadden Sea itself, this calls for knowledge of the interaction between the North Sea and the Wadden Sea. Such efforts are closely linked to the aforementioned Ameland Inlet Replenishment pilot and the Preferential Strategy for the Wadden Region.

7.7.3 Participation

The activities undertaken in the various regions to achieve the desired construction zoning plans in the coastal zone have enhanced commitment to the coast. The provinces are drawing up the zoning plans in collaboration with, e.g., district water boards, municipalities, nature organisations, and the leisure sector. This process will continue until the Coastal Pact goals have been attained (2019).

Coastal zone taskings primarily pertain to the local levels in the regions, rather than the national level. The Coastal Pact covers the spatial domain and is characterised by regional elaboration. After all, coastal protection is currently up to par. Given the signals regarding a potential acceleration in [sea level rise](#), this may change. At the national level, increasing attention will be focused on research into the rising sea level, the climate scenarios, and their impact on coastal flood risk management. The regional coastal processes boast broad-based commitment. The annual consultations regarding the national Coastline Maintenance programme also foster participation. Parties in the Wadden Region are being involved in and informed about the Ameland Inlet Replenishment pilot in various ways, including through free local papers on the islands.

7.8 Wadden Region / Freshwater Supply Region North

7.8.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the [Wadden Region](#) focuses on the preservation of the buffering function of islands, outer deltas, and intertidal areas. Sand replenishment and dynamic dune management ensure a sustainable balance between the sand system of the island coast and the rising sea level. Wherever possible, dyke improvements foster nature and sustainable forms of human use. The strategic action perspectives that have been drawn up for the Wadden islands to substantiate the third layer of multi-layer flood risk management, will be elaborated into tactical and operational measures for each island. All the measures set out in the Preferential Strategy for the Wadden Region are on schedule.

The Coastal Genesis 2.0 research programme generates knowledge regarding future coastal management (cf. [paragraph 7.7.1](#), The Coast). With respect to the Wadden Region, knowledge development is focused on the safety of the Wadden islands and the preservation of the intertidal area. This requires particular information on the operation of the tidal inlets between the islands, as this is closely intertwined with coastal development on the heads and tails of the islands, and with sand transport to the Wadden Sea. To be able to make the right and timely choices, it is important to know how the sea gates will respond to an accelerated rise in sea level ([cf. Ameland Inlet Replenishment pilot](#)).

Regular coastal management with sand replenishment is proceeding as planned. Ameland saw channel margin replenishment in 2017; a similar replenishment off the island of Vlieland is under way. Monitoring will need to

show how effective such replenishment is in terms of coastal protection.

The dyke improvement efforts set out in the Flood Protection Programme are also on schedule. The Eemshaven-Delfzijl dyke improvement is in progress and will be completed by the end of 2019. Potential solutions to the Vlieland dyke improvement are being explored. The General Exploration regarding the Wadden Sea Dykes, which is mapping out whether new dyke improvement solution strategies bear application along the Wadden Sea, will mainly focus on administrative support and knowledge sharing in 2018 and 2019. The spring of 2019 will see a final conference to disseminate the results on a wide scale; the Wadden Sea Dykes General Exploration will be completed by the end of 2019. The results are already finding concrete application in dyke improvement projects along the Wadden coast.

In the purview of “disaster management up to par”, the Fryslân Security Region has drawn up strategic action perspectives for the response to (imminent) flooding and waterlogging. It has also embarked on tactical and operational elaboration, using an integrated measures control matrix⁶⁴. Fryslân Security Region aims to make optimum use of its existing disaster organisation, to embed the basic requirements for disaster control (such as multi-disciplinary collaboration, regular drills, updated plans), and to utilise the coping capacity and resilience of society. The point of focus is the impact on survival and liveability. Measures will be incorporated into the regular skills programmes for the Security Regions’ disaster staff. The Flood and Evacuation working group of the Fryslân Security Region, in which various parties⁶⁵ involved in the Wadden Region Delta Programme are participating, coordinates the elaboration and implementation of the measures. The activities tie in with the Environmental Vision and the activities relating to climate adaptation, such as the [Frisian Administrative Water Chain Agreement](#). In 2018, the Fryslân Security Region will embark on the development of a standard evacuation process focused on coping capacities, which can also be used in the event of (imminent) flooding and waterlogging.

Freshwater supply

The zoning into freshwater supply regions changed in 2018. The provinces of Fryslân and Groningen and the northern part of Drenthe now constitute the Freshwater Supply Region North. This year, the IJsselmeer Region Freshwater Supply Region still reported on the progress in the Freshwater Supply Region North ([cf. paragraph 7.2.1 IJsselmeer Region/ IJsselmeer Region Freshwater Supply Region](#)).

⁶⁴ An overview of measures and their interconnectivity.

⁶⁵ Wetterskip Fryslân, RWS-NN, province of Fryslân, Fryslân fire brigade, representatives of the Wadden islands, and the municipality of Harlingen.

Spatial adaptation

The Regional Consultation Committee North, Northern Rhine/Nedereems catchment area is the administrative contact with respect to the implementation of the Delta Plan on Spatial Adaptation in the northern part of the Netherlands. The Regional Consultation Committee is going to promote and give impetus to the efforts, whilst leaving control in the hands of the working regions that are substantiating spatial adaptation in actual practice. Represented on the Regional Consultation Committee are the three northern provinces, the Water Company, the Hunze en Aa’s and Noorderzijlvest district water boards, Wetterskip Fryslân, the municipalities, and the central government (the Ministry of Infrastructure and Water Management, including Rijkswaterstaat, and the Ministry of Agriculture, Nature and Food Quality). The working regions are addressing the impact of flooding, waterlogging, drought, and heat on the basis of the “Analysis – Ambition – Action” system.

The Water Chain Control Group is going to supervise the implementation of measures in the province of Groningen and the northern part of Drenthe. Represented on this group are the municipalities in Groningen and Drenthe, the Noorderzijlvest and Hunze en Aa’s district water boards, Groningen Water Company, and Drenthe Waterworks. The provinces of Groningen and Drenthe are joining the debate on this topic. In 2018, the parties will set down working agreements on how the supervision by the Water Chain Control Group will be fleshed out. Several municipalities in Groningen and Drenthe have already embarked on stress tests. The province of Groningen and the district water boards have been actively involved from the very start.

In the Fryslân working region (province of Fryslân), the Frisian Administrative Water Chain Agreement 2016-2020 constitutes the basis for collaboration on spatial adaptation and water awareness. All the Frisian municipalities, the province of Fryslân, Wetterskip Fryslân, and Vitens water company are involved. In 2017, this working region embarked on climate stress tests for all the municipalities in the province, including the Wadden islands. The stress tests will map out the vulnerability to waterlogging and heat in continuous built-up areas. The stress tests will be completed by mid-2018.

The first phase of Waddenlei, the study into multi-layer flood risk management on the Wadden islands, has been completed (impact project). Together with the Fryslân Security Region, the island municipalities are drawing up an action plan aimed at formulating a multi-layer flood risk management strategy for each island in the second phase. The island residents are actively involved in the process, as are bodies such as Rijkswaterstaat and Wetterskip Fryslân. The municipalities are utilising the flood risk maps gener-

ated by the impact analyses, which reflect the interconnectivity between the second and third layers. The strategies are focused on resilient spatial planning to contain the impact of flooding and to enable continued operation of the vital functions (second layer of multi-layer flood risk management), and on action perspectives and aid via the facilities available on the islands (third layer of multi-layer flood risk management). The main determinative factors for the second layer are the economic strength of the island municipalities and nature legislation. In some cases, measures may need to be taken to ensure the continued operation of ferry services and other infrastructure outside the dykes. The resilience of an area determines the focus and the action perspective in the third layer. Third layer measures are particularly important on the islands, because in times of emergency, the islands are left to their own devices, more so than other areas, whereas the capacities of emergency services and governments are limited, and the islands may be crowded with tourists. The security situation differs from one island to the next. In 2019, the strategies will be linked to other ongoing processes, such as the stress tests being conducted on the Wadden islands (under the Frisian Administrative Water Chain Agreement) and the pursuit of self-reliance in the field of water (in the context of the Streekwurk Waddeneilanden project).

In collaboration with the province of Fryslân, Wetterskip Fryslân, and It Fryske Gea, the municipality of Weststellingwerf has constructed a nature reserve south of Wolvega, featuring water storage facilities and room for the collection of rainwater from Wolvega.

7.8.2 Integrated approach

Sand replenishment and dynamic dune management are not just effective in terms of flood risk management, but also in terms of leisure facilities, nature, and the economy. [The Ameland Inlet Replenishment pilot](#), which was launched in March 2018, can contribute to the nature tasking. The innovative dyke concepts being studied in the Wadden Sea Dykes General Exploration are another fine example of an integrated approach. In 2018, work commenced on the excavation of the Klutenplas on the mud flats to extract clay for the Wide Green Dyke. The work is carried out in close collaboration with nature managers. Within the Eemshaven-Delfzijl dyke improvement project, three pilot studies from the Wadden Sea Dykes General Exploration are being implemented (Double Dyke, Rich Dyke, and Overtopping Dyke). In addition, opportunities are being created for linkage with nature, leisure facilities, and the regional economy. This dyke, including the associated projects, will be completed by the end of 2019.

Eems estuary sludge issue

The Delta Programme flood risk management tasking has ground in common with the Economy and [Ecology in](#)

Wide Green Dyke and Clay Maturation Plant

The Dollard dyke in the northeast of Groningen is substandard. The Hunze en Aa's district water board is implementing an innovative dyke improvement method here: the Wide Green Dyke. The dyke will be wider, with a more gentle slope covered in a thick layer of clay on which grass will grow. The Wide Green Dyke is a demonstration project of the Wadden Sea Dykes General Exploration, which is being carried out under the Flood Protection Programme. In this exploration, new dyke improvement concepts are being developed. The study is co-funded by the Waddenfonds.

This innovative improvement method requires large volumes of clay (approx. 1.7 million m³). The district water board aims to use local clay to this end. A clay pit dug on the mud-flat in front of the dyke will generate sufficient clay. Sludge will settle in the pit, which in time will generate a new supply of clay (the "clay engine"). Moreover, this will have a turbidity-reducing effect on the water in the Eems-Dollard, which will boost ecological development. In the clay well, an island will be created as a breeding ground for the avocet, a wading bird that is having a hard time in the Dollard area. The aim is to gradually roll out mud-flat clay extraction all along the coast, improving each dyke section in turn. An added bonus of the Wide Green Dyke is that improvement is relatively simple, if such is needed, for example, on account of the rising sea level.

The demonstration project is intertwined with the Clay Maturation pilot. In this study, Rijkswaterstaat, the province of Groningen, Groningen Seaports, Hunze en Aa's district water board, Het Groninger Landschap, and EcoShape are examining various methods for converting saline or brackish sediment to clay. To this end they use, e.g., sediment from the Breebaart brackish nature polder and dredging sludge from the port of Delfzijl. In field tests, EcoShape researchers assess which "maturation" method works best. Other estuaries are also faced with turbidity and flood risk management issues. This opens up opportunities for the Netherlands to implement this new form of *building with nature* elsewhere in the Netherlands (for example, in the Westerschelde) and abroad.

[Balance programme](#) initiated by the parties around the Eems estuary. The Eems estuary occupies a special position within the Wadden system: it is the last open estuary in which fresh river water mixes with saline sea water and meets the tide. Governments and private parties seek to significantly reduce turbidity in the estuary and restore the transitional zones typical of estuaries. In part, the solutions can be combined with the dyke improvement tasking set out in the Delta Programme. For example, the construction of new mud flats to capture sludge will foster flood protection, because the mud flats will reduce wave action on the dykes. In addition, the new mud flats will provide new habitats for wildlife species. Sludge extraction from the estuary can also be achieved through solutions implemented behind the dykes, by employing the “double dyke” system. After a maturing process in so-called clay maturation plants, the sludge will find useful applications, such as in dyke improvement projects along the Wadden coast.

Regional agenda

In 2017, governments, fisheries organisations, Wadden ports, and nature organisations embarked on the collective development of long-term ambitions for a range of issues in the Wadden Region, such as nature, landscape, ports, the economy, sustainable energy, fisheries, employment, accessibility, and security. These ambitions will underpin the Regional Agenda for the Wadden Region 2050 that these governments and private parties intend to set down by the end of 2018 / in early 2019, featuring well-supported policy intentions and measures. The participating parties will incorporate the agreements into their own policy documents; the central government will do so in the National Environmental Vision. A key question in the Regional Agenda is how the Delta Programme taskings can be

Declaration of Leeuwarden

At the end of a trilateral Wadden Conference in May 2018, the Netherlands, Germany, and Denmark signed the Declaration of Leeuwarden, containing agreements regarding collaboration on several major challenges for the Wadden Region. The agreements pertain to, inter alia, a joint knowledge agenda, research into bird and fish populations, tackling microplastics, sustainability, and the rising sea level. The Declaration will be updated every four years and serves as a guideline for collaboration at the international level.

combined with the other taskings in the Wadden Region, and what needs to be done to this end.

7.8.3 Participation

Various regional and national stakeholders are actively involved in the Wadden Sea Dykes General Exploration. As the efforts to be expended in 2018 and 2019 will focus on knowledge sharing and administrative support, the study is expressly seeking collaboration with the community in this period. In the exploration phases of regular dyke improvement projects from the Flood Protection Programme, stakeholders and interested parties will not just be informed; they are also invited to actively weigh in. Many are seizing this opportunity. Representatives of various interest groups sit on the feedback groups for the dykes and the sandy coast. Island residents are closely involved in the development of integrated flood risk management strategies for the Wadden islands.

7.9 Elevated Sandy Soils East and South Freshwater Supply Regions

7.9.1 Progress in implementation of Preferential Strategies

Freshwater supply

Unlike in most other regions, a substantial supply of water from the main water system is largely impossible at the Elevated Sandy Soils. The sandy soils predominantly rely on the availability of groundwater. Retention, storage, and infiltration of rainwater are thus important instruments for safeguarding the availability of water for the various functions. As the Elevated Sandy Soils functions are highly intertwined with the developments in the area, an integrated approach is imperative. By no later than 2021, the governments must have communicated with the entire region on such an approach, providing transparency regarding the availability of fresh water. In the period up to 2030, the required measures

and agreements will be set down, giving priority to the most urgent measures.

In March 2018, the southern section mapped out the measures that have been realised up to now and drew up a schedule for the remaining part of the planning period. Implementation in the southern section is on schedule and expectations are that the parties will meet the agreements set down in the administrative agreement on the regional supply. The main pillars for the freshwater supply measures to be taken by district water boards are the resilient planning of stream valleys, the Desired Ground and Surface Water Regime (GGOR), wet gems of nature, and optimisation of the water supply. Examples of projects in which the Water Availability process plays a key part are the restructuring of the Tungelroyse Beek, Meersen-Oirsbeek, and Kwistbeek stream valleys; level-driven drainage in

Midden-Limburg and Noord-Limburg; and sub-irrigation in Mariapeel. Growing attention is being paid to the role of soil quality in water management. The provinces of Limburg and Noord-Brabant are launching a joint study into the options for large-scale subsoil water storage.

The Newcomers Scheme in the southern section is a great success. The budget did not permit the granting of all the applications submitted; the requests that scored best in the tender procedure have received a grant. Several municipalities, the agriculture sector, and terrain managing organisations in Noord-Brabant and Limburg are using their grants to carry out projects aimed at combating dehydration. Examples are: large-scale disconnection of downspouts in residential areas, introduction of level-driven drainage, and the restructuring of (wet) nature reserves to expand buffer capacities.

In the first quarter of 2018, Rijkswaterstaat contracted out the engineering services for the expansion of the water supply via the Noordervaart. The goal is to expand water supply to the Peel region to 5.4 m³/s by 2021. Regarding the re-profiling of engineering structures in the Noordervaart, consultations are under way with stakeholders such as the municipality, the district water board, and the province.

The eastern section has also given impetus to the implementation of measures. The municipalities and district water boards are on track. Expectations are that they will meet their commitments for the implementation period of 2016-2021. Several projects were launched in 2017, such as the Lunterse Beek Soil and Water Pilot, Twello Water System Optimisation, water retention in nature reserves (Havikerwaard, Hallerlaak, Osink-Bemersbeek projects), stream valley restructuring (Winterswijk, Zoddebeek, and Buurserbeek), and water storage near small town centres (Baakse Beek headwater area). Furthermore, the Vallei en Veluwe district water board equipped several schoolyards in Amersfoort in 2017 under the Amersfoort Blue Deal.

In the spring of 2018, agricultural parties and terrain managers drew up a schedule of specific measures; they are currently preparing the implementation of the measures.

In the southern section, 20% of the total budget is available for parties that are not associated with the administrative agreement. Thirty projects have received grants and 24 projects have been rolled out. The eastern section has adopted the Realisation Strategy for East-Netherlands Freshwater Supply Measures. This sets out agreements to expedite and streamline the implementation of measures.

Spatial adaptation in Elevated Sandy Soils-East

The East-Netherlands Freshwater Supply Region comprises 78 municipalities, 4 district water boards, and 4 provinces.

Many of these parties have already conducted stress tests in their management areas. The stress tests all identify the area's vulnerability to waterlogging and, in some cases, also its vulnerability to heat.

Only a few governments have conducted a risk dialogue; however, most have already scheduled such dialogues. A minor proportion have drawn up a strategy and embedded this in their Environmental Visions. However, many parties have already implemented measures, such as in [Deventer](#), [Almelo](#), and the area around [Lichtenvoorde](#), [Vragender](#), and [Lievelede](#). Several parties are working on an implementation programme.

Collaboration within the regional consultative bodies and the working regions is still in the initial phase. In the working regions, collaboration on spatial adaptation is largely accomplished through the existing water chain consultations. Municipalities and district water boards have already been working together for a while within the framework of the water chain; the parties are seeking an efficient way to have provinces and "spatial planning" join in.

East-Netherlands is giving priority to stress tests to identify vulnerabilities and bottlenecks, and to risk dialogues in order to gain a clear picture of the taskings in the years ahead.

Spatial adaptation - Regional Consultation Committee for the Meuse/Elevated Sandy Soils-South

In the South-Netherlands region, the provinces of Noord-Brabant and Limburg, the five district water boards, and the municipalities are collaborating on climate adaptation. Regional consultations are held within the Regional Consultation Committee for the Meuse, whose agenda also features coordination regarding the Preferential Strategy for Freshwater Supply to the Elevated Sandy Soils-South and the measures to be implemented in the purview of the Framework Directive on Water. Twelve working regions operate under the Regional Consultation Committee. In 2018/2019, a quartermaster will be professionalising the collaboration. Furthermore, a South-Netherlands Implementation Agenda will be drawn up, as will a South-Netherlands administrative agreement on climate adaptation, as agreed in the MIRT [Multi-Year Programme for Infrastructure, Spatial Planning and Transport] South.

A large number of municipalities in South-Netherlands is working on climate stress tests, many of them in collaboration with the region or neighbouring municipalities. Several municipalities have already completed their climate stress tests and the first climate dialogues have commenced. The Limburg district water board is expected to embark on risk dialogues with the municipalities by mid-2018. In 2018/2019, the regional explorations will be supplemented

with analyses and strategies at the municipal level. Several district water boards, municipalities, and individual residents are already engaged in climate adaptation, in anticipation of the steps set out in the Delta Programme. For example, Parkstad Limburg is implementing measures to combat heat stress and retain water in the urban area.

In the hills of southern Limburg, climate change is causing increasing erosion and waterlogging. In the most vulnerable areas, measures are urgently required. For that reason, in early 2018, the municipality of Meerssen signed a declaration of [intent](#) setting out agreements with the district water board, the agriculture and horticulture sector (LLTB), and terrain managers; the parties intend to enter into a concrete collaboration agreement later on in 2018. The aim is for the most urgent measures to be implemented in 2019 and 2020.

7.9.2 Integrated approach

The Elevated Sandy Soils feature several examples of an integrated approach. The municipality of Oldebroek is addressing waterlogging in collaboration with the business community, which also yields benefits in terms of the environment, sustainability, and education. The Celavita and Plukon business premises will be disconnected from the sewer system (a total of some 8 hectares). Ownership of the required infiltration facilities – crates and a wadi – will be vested with these companies. The wadi will also serve as an educational location for schoolchildren. The warm water discharged by Celavita will be used to heat the municipal swimming pool. The Eiland van Weert is combining water buffering with the enhancement of urban nature, optimisation of agricultural developments, and improvement of green-blue structures. The restructuring of the Geleen stream valley (Zitterd Waterproof) not only serves to contain waterlogging and dehydration, but is also conducive to nature and the living environment. In Sittard city centre, fish passages and pools will be created.

7.9.3 Participation

Participation is being substantiated in concrete projects. A good case in point is Almelo. This municipality has conducted a climate scan of the Nieuwstraat and is going to climate-proof this shopping street from shop front to shop front. The new street design will be developed together with its residents. The aim is to capitalise on opportunities for greenery wherever possible, for example, with green facades and additional greenery between the shops. The street profile will be adapted to have rainwater flow in the opposite direction, as a result of which excess water will end up in the surface water. This will reduce waterlogging during extreme downpours occurring with a probability of 1/100 per annum.

Design Thinking

Fourteen government organisations in South-Netherlands are employing the Design Thinking method to explore ways to raise awareness of the topic of climate adaptation and to encourage people to take action. By adopting different mindsets and fathoming what spurs people on, new solutions come into view. The method is focused on perception, emotion, and behaviour, supplementary to the engineering mindset and the politico-administrative manner of policy making. This has generated five scenarios to better involve residents in the changes in their living environment resulting from climate change. In 2018, designers will elaborate the scenarios into solution prototypes that will subsequently be field-tested locally. In the autumn of 2018, the strategy will be presented at the Dutch Design Week in Eindhoven.

Hills of southern Limburg

During severe downpours, large volumes of water flow downhill at high speed in the hills of southern Limburg. In a similar area in Belgium, such conditions caused a fatality in 2016. That is why measures are urgently required in the most vulnerable areas. One such area is Meerssen. A downpour occurring with a probability of 1/100 per annum will present the village with one and a half metres of fast-running water.

Everyone has a task in containing the impact. The district water board is constructing retention buffers; farmers take measures on their fields; municipalities address the public space. Individual residents, finally, protect their homes with slabs. All these parties have committed to the strategy.

Meerssen is the first of a total of 39 bottleneck areas in southern Limburg that will be tackled. The overall costs are expected to come down to more than 150 million euros just for the retention measures in the water system. The local standard for regional system waterlogging in built-up areas is 1 in 25 years or even less.



ALL FIVE STORM SURGE BARRIERS CLOSED ON 3 JANUARY 2018

Ramspol inflatable rubber dam



Maeslant storm surge barriers



Hartel storm surge barrier



Hollandsche IJssel storm surge barrier



Oosterschelde storm surge barrier

Appendix Indicators of the Delta Programme Signal Group

1. Indicators of the Signal Group

In 2017, under the auspices of the Delta Programme Commissioner's staff, a number of experts from Delta's research institute, Royal Netherlands Meteorological Institute KNMI, the Netherlands Environmental Assessment Agency, Rijkswaterstaat, and Wageningen University (the Signal Group) embarked on the development of a method to timely and reliably identify signals that would prompt an adjustment of the Preferential Strategies. The first such signals pertained to the potential acceleration in sea level rise and the increasing frequency of peak downpours, as already reported in Delta Programme 2018.

For this signalling method, the experts are looking for indicators to timely identify developments that could jeopardise target attainment: "What do we want to know?" Such indicators concern, for example, the assumptions and choices in the Preferential Strategies and Delta Decisions regarding sea level rise, the use of space, or salinisation. Subsequently, they start looking for variables: "How can we measure this?" Variables can pertain to "driving forces" of the water tasks and the "impact of changes" on water systems or functional uses. Variables relating to the driving forces (driver variables) produce early signals, yet in many cases, the exact impact on the water tasks is still unclear. Driving forces can be, for example, sea level rise, river discharges at Lobith, the population living within a dyke ring, the use of land, and the like. The advantage of impact variables is that they indicate the consequences of a particular change, which usually constitutes a stronger incentive to take action. The downside is that in many cases, such an impact can only be observed once the underlying processes have gone through a long track of changes, without any action having been taken. That is why the Signal Group is looking for an efficient combination of driver and impact variables.

The question is whether and how information can be gathered on such indicators that would bring signals into view sufficiently in time and with a sufficient degree of reliability. To this end, the Signal Group has drawn up an ex ante estimate. A signal constitutes the point of departure for a policy debate on the meaning of the signal. Separation of the signal and the subsequent discussion is important. A signal can lead to targeted attention in further research, scheduled evaluations and monitoring, an analysis of the consequences, and – through policy amendment, if need be – to the ultimate adaptation of projects. To properly complete this process, it is important that signals are identified in time, but also that signals are reliable and stable. Sufficiently timely means: factoring in the time required for plan preparation, design, and construction. For major projects, this involves a timeframe in the order of ten years.

Sufficiently reliable means: a significant trend or warning signal from an observation series that often features a great deal of noise from annual fluctuations⁶⁶.

Table 18 reflects the aggregate indicators to be adopted by the Signal Group: indicators for flood risk management, freshwater supply, and spatial adaptation. On account of the focus on Delta Programme-wide developments, the Signal Group will also keep in touch with the Ministry of Infrastructure and Water Management / Knowledge, Innovation and Strategy Department (KIS) and the Early Warning programme set up by Rijkswaterstaat, that periodically retrieves signals for all the policy fields of the Ministry, such as developments in European transport, inland shipping, and the circular economy.

2. The communication process between the Signal Group and the Delta Programme

The Signal Group and the Delta Programme meet at least twice a year within the Delta Programme Knowledge Network:

- in January of year X, to discuss which of the developments identified could constitute reason for adapting the Preferential Strategies. The Signal Group puts forward the Delta Programme-wide developments (such as an accelerated rise in sea level); the themes and regions put forward the theme- and region-specific developments (such as changes in the demand for water from lake IJsselmeer). The conclusions are submitted to the Programme Consultation Committee meeting in March. The Consultation Committee determines which developments bear elaboration. The developments to be elaborated are reported in the Delta Programme drawn up in year X (= DP 200X+1). Managers and knowledge institutes subsequently analyse data regarding such developments and map out where adaptations could be required (in which themes or regions). This analysis period roughly runs from March up to and including August (or, if more knowledge needs to be developed, until August of the next year or the year after that).
- in September of year X, to discuss the topics (now elaborated in detail) that could require adaptation in the current strategies and to advise whether such an adaptation already needs to be implemented that year or whether it can wait until the systematic six-year review. The conclusions are submitted to the Programme Consultation Committee meeting in September and subsequently, if need be, to the Delta Programme Steering Group to determine which elements of which strategies need to be adapted. The adaptations are implemented

⁶⁶ The signification can be used to classify signals as weak, moderate or strong.

by the programme offices operating within the Delta Programme. The debate and the decision-making regarding adaptations roughly run from September X up to and including February X+1. The adaptations are reported in the Delta Programme drawn up in year X+1 (DP 200X+2).

The annual process relating to the progress report in the annual Delta Programme has been outlined above. A signal generally sets a multi-year process in motion, involving (adaptation of) monitoring and policy evaluation that could result in decisions to adapt policy and strategies, which adaptations subsequently constitute the basis for the corresponding measures.

Table 20 Indicators of the Delta Programme Signal Group.

Additional information is gathered to gain a better understanding of changes and consequences.

Indicator	Variable	Why	Additional info	Who
Sea level rise	Expected rise in sea level along the Dutch coast by 2050, 2100, and 2200, including bandwidth	Assumption in Delta Scenarios, determinative for flood risk management	Measurement series regarding average global rise in sea level; noise-signal ratio is more conducive to a sufficiently timely identification of the acceleration in the trend.	KNMI
	Volume/year of beach replenishments	Impact indicator for sea level rise with potential impact on Preferential Strategy	Surface area of intertidal area in Wadden Sea, Oosterschelde, Westerschelde	Rijkswaterstaat
	Closure frequency of storm surge barriers: Maeslant, Hollandsche IJssel, Oosterschelde	Impact indicator for sea level rise with potential impact on Preferential Strategy for Rhine Estuary-Drechtsteden	Alarm frequency (more observations)	Rijkswaterstaat
	Storm surge frequency at NW > 8 Bft	Impact indicator for sea level rise with potential impact on Preferential Strategy for IJsselmeer Region	Correction for storm surge and IJssel discharge (RWS)	Rijkswaterstaat
Extreme river discharges by Rhine and Meuse	Expected extremely high (1/100) and low (National Coordination Committee for Water Distribution meeting) river discharges by 2050 and 2100	Assumption in Delta Scenarios, determinative for flood risk management, freshwater supply, and Preferential Strategy for the Rivers	<ul style="list-style-type: none"> • Combined measurement series covering 10 rivers in NW Europe: more observations, enabling earlier inference of trend • Average Rhine/Meuse discharge in 6 summer months • Spatial developments upstream • Rhine tributaries discharge distribution 	Rijkswaterstaat in collaboration with Deltares, International Commission for the Protection of the Rhine. (ICBR), International Commission for the Protection of the Meuse (ICBM)
Land use and population	Forecast regarding land use, economic value, and population figures by 2050 by COROP region	Assumption in Delta Scenarios, determinative for protection level, water demand, and Delta Plan on Spatial Adaptation.	Flood risk management will detail this according to current values of the dyke rings with a view to periodic evaluation of protection levels	Netherlands Environmental Assessment Agency (PBL) in collaboration with Statistics Netherlands (CBS)

Indicator	Variable	Why	Additional info	Who
Climatological drought	Precipitation shortage (calculated)	Assumption in Delta Scenarios, with potential impact on freshwater supply strategies	<ul style="list-style-type: none"> • Loss of revenue / crop/ hectare • Differing Desired Ground and Surface Water Regime (GGOR) in growing season • Demand for water from main water system • Increase in irrigation • Failure to meet IJsselmeer target level (days) 	KNMI, Wageningen University & Research Centre (WUR), and CBS
Salinisation	Inlet intake stops (frequency and duration)	Impact indicator for salinisation with potential impact on Preferential Strategy	Maximum salt concentration at inlets	Rijkswaterstaat, in collaboration with district water boards and drinking water companies
Waterlogging	Measured and expected extreme precipitation per hour and per 2 days	Peak precipitation in urban areas (hour) or rural areas (2 days) causing waterlogging	Damage functions generate scope of damage (SA, NAS)	KNMI, PBL
Heat stress	Measured and expected (2050, 2085) heat waves and number of tropical days (>30°C) and nights (>20°C) in De Bilt and Eindhoven	Heatwaves affect health (mortality)	Fatality functions generate scope of damage (NAS)	KNMI
DP-wide new knowledge, insights, innovations relating to damage and casualty functions, cost functions		With a view to assumptions in measure design, with a potential impact on Preferential Strategy		KNMI, Rijkswaterstaat, PBL, WUR, CBS, and Deltares

Background documents and downloads



List of background documents

Background Document A (in Dutch)

[Analysis – Ambition – Action System –strategy outlines for first six-year review](#)

Background Document B (in Dutch)

[Deltares report: exploration of potential impact of accelerated and extreme sea level rise on the Delta Programme](#)

Background Document C (in Dutch)

[Advisory report of the Infrastructure and the Environment Consultative Body and response by the Delta Programme Commissioner](#)

Background Document D (in English)

[Updated Delta Programme Knowledge Agenda](#)

Background Document E (in Dutch)

[Progress report on freshwater supply in the delta: working on freshwater supply in the delta, looking back on 2017 and looking ahead to 2018](#)

Background Document F (in Dutch)

[Fourth progress report regarding Approach to national vital and vulnerable functions](#)

The maps of DP2019 are available for download in English

[Map 1 Delta Plan on Spatial Adaptation](#)

[Map 2 Delta Plan on Flood Risk Management](#)

[Map 3 Freshwater supply measures](#)

Colophon



Delta Programme 2019 is a publication of the Ministry of Infrastructure and Water Management, the Ministry of Agriculture, Nature, and Food Quality, and the Ministry of the Interior and Kingdom Relations.

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Photos

- High water, Nieuwe Waterweg, November 2017: Tineke Dijkstra Fotografie
- Drought: field of sugar beets, Groesbeek, July 2018: Flip Franssen
- Waterlogging and rain in urban area, May 2018: Tineke Dijkstra Fotografie
- Eemdijk sheet pile pilot, March 2018: provided via Macrostability General Exploration
- Drought, summer 2018: Ooijpolder, Nijmegen: Flip Franssen
- Groene Mient climate-adaptive courtyard, The Hague, May 2018: Tineke Dijkstra Fotografie
- Houtribdijk dyke improvement, Lelystad, June 2018: Tineke Dijkstra Fotografie
- High water in Biesbosche polder De Noordwaard, Werkendam, January 2017: Rob Poelenjee
- Vital and vulnerable: Westpoort oil transshipment, Amsterdam, 2018: Flip Franssen
- Dyke improvement, Prins Hendrik Zanddijk, Texel, July 2018: Tineke Dijkstra Fotografie
- Heavy storm, during which all five Dutch storm surge barriers closed simultaneously, 3 January 2018:
 - Ramspol inflatable rubber dam: Hollandse Hoogte, Martijn de Jonge
 - Maeslant storm surge barriers: Hollandse Hoogte, Peter Hilz
 - Oosterschelde storm surge barrier: Dirk-Jan Gjeltema
 - Hartel storm surge barrier: provided by Rijkswaterstaat, Driton Binaku
 - Hollandsche IJssel storm surge barrier: Pieter van Dieren

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Delta Programme

The Delta Programme is a national programme involving an innovative collaboration between the central government, the provinces, municipalities and district water boards, with input from NGOs, knowledge institutes, residents, and the business community. The aim is to protect the current and future generations of the Netherlands against flooding, to ensure a sufficient supply of fresh water, and to render our country climate-proof and water-resilient in order to prevent major damage. The collaboration is founded on the issues of Flood Risk Management, Freshwater Supply, and Spatial Adaptation and involves close interaction with the regions in which these themes are being elaborated in concrete terms.

The Delta Programme Commissioner submits an annual proposal for the Delta Programme to the Minister of Infrastructure and Water Management, fosters the implementation of the Delta Programme, and monitors its progress. The proposal also comprises three Delta Plans featuring all the measures and provisions scheduled: a Delta Plan on Flood Risk Management, a Delta Plan on Freshwater Supply, and a Delta Plan on Spatial Adaptation. Every year, the Delta Programme is presented to the States General on Prinsjesdag, the official opening of Parliament in September.

www.rijksoverheid.nl/deltaprogramma
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