Delta Programme 2018

Continuing the work on a sustainable and safe delta

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Including:
Delta Plan on Flood Risk Management
Measures to protect the Netherlands from flooding

Delta Plan on Freshwater Supply
Measures to ensure the availability of freshwater in the Netherlands

Delta Plan on Spatial Adaptation
Measures to render the Netherlands climate-proof and water-resilient

The Delta Programme is published through an online tool. The PDF before you has been generated from this online publication. After 19 September 2017, the publication is available at www.deltacommissaris.nl.

Coverphoto: Urban flooding, May 2016, Cuijk

Contents

Translation of the original cover letter from the Delta Programme Commissioner to the State Secretary for Infrastructure and the Environment.

M.H. Schultz van Haegen – Maas Geesteranus
State Secretary for Infrastructure and the Environment
P.O. Box 20901
2500 EX The Hague

Date: 22 June 2017
Re: Delta Programme 2018 cover letter

Your Excellency,

It is my pleasure to present to you the Delta Programme 2018 (DP2018). In order to be able to continue to make sufficient headway with the Delta Programme, I would like to draw your attention to three proposals contained in this letter, supplementary to the proposal and the recommendations that form part of the DP2018 main text, relating to the funding of the flood risk management, freshwater supply, and climate-proofing taskings.

Recent insights into climate change render the timely implementation of the Delta Programme even more urgent, and call for additional efforts in several areas. For this reason, in addition to the measures set out in the Delta Plan on Flood Risk Management, aimed at protecting the Netherlands against flooding, and the measures pertaining to water availability as set out in the Delta Plan on Freshwater Supply, this Delta Programme 2018 is the first to comprise a Delta Plan on Spatial Adaptation. The Delta Plan on Spatial Adaptation comprises a strategy and measures for climate-proofing and improving the water resilience of the Netherlands, thus enabling the country to cope with extreme weather conditions.

The Delta Plans contain detailed schedules of measures and provisions for the first six years and indicative schedules for the subsequent twelve years, looking ahead to 2050 (in accordance with Article 4.9, paragraph 5 of the Water Act). Under Article 3.6b of the Water Act, it is my duty as Delta Programme Commissioner to monitor the progress in the implementation of the Delta Programme, to report on such progress, and to issue relevant advice. With a view to safeguarding its continued progress, the financial embedding of the Delta Programme gives rise to three recommendations.

1. I recommend that, in line with the investment agenda[1] of the regional government umbrella organisations (Association of Netherlands Municipalities VNG, Association of Provincial Authorities IPO, Association of Dutch Regional Water Authorities UvW), which requests an annual sum of 230 million euros for the implementation of the Delta Plan on Spatial Adaptation, a substantial additional sum[2] be added to the Delta Fund in the purview of the implementation of the Delta Plan on Spatial Adaptation. If a new Cabinet should decide to allocate such a sum, it would be conceivable that these additional resources would be used for a limited period of time, e.g., for six years, to foster local and regional plans to combat waterlogging and heat stress. In my capacity as Delta Programme Commissioner I will provide further advice on this matter in due time.

2. I recommend that the central government and other Delta Programme partners set aside a substantial sum for river widening projects; the central government may do so in the Delta Fund. Within the Delta Fund, a sum of 200 million euros has already been earmarked for the short-term implementation of the "river widening and dyke improvement" strategy. Meanwhile, several MIRT Explorations have been launched, in collaboration with regional partners, to substantiate this strategy. My advice to the parties concerned is to continue to contribute, based on an allocation ratio (central – regional governments) yet to be determined, with due regard for the experience gained in recent years. This would make it possible to pursue the success of the Room for the River programme, and continue to work on a robust river system. To this end, the Delta Programme parties are currently developing a long-term ambition for river widening projects along the Meuse and the Rhine tributaries, supplementary to the short-term river widening measures. This is generating high-quality area developments along these rivers, rendering the area around the major rivers not only resilient and structurally safer, but also increasing its appeal and "perceptibility".

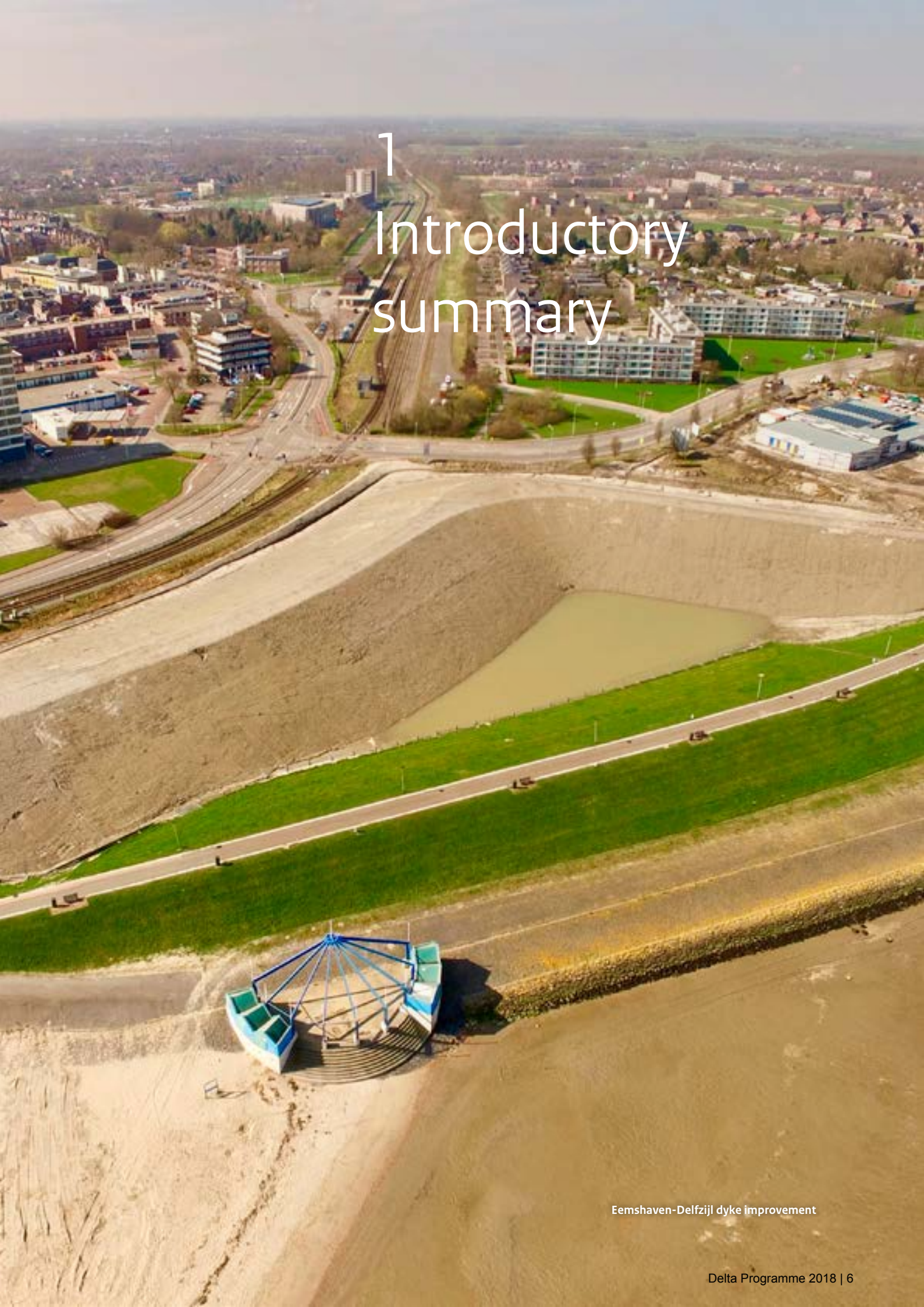
3. I recommend that, in the period of 2022 to 2027 inclusive, a total of 150 million euros be set aside in the Delta Fund for the second round of freshwater supply measures. Like flood risk management, the availability of sufficient freshwater is vitally important to the liveability of our country. This is particularly significant in terms of the economy: some 17% of the Dutch economy depend on freshwater. For the first round of freshwater supply measures, a sum of 150 million euros has been set aside in the Delta Fund up to and including 2021. The Delta Programme 2015 already indicated that investments continue to be needed in the period beyond in order to improve the resilience of the water system and attain the water availability goals by 2050.

Finally, I would like to call your attention to an issue pointed out by local authorities. A sustainable approach to our delta requires the commitment of and close collaboration between (and among) all the parties concerned: not just governments, but also residents and businesses. This applies to all the taskings addressed by the Delta Programme: flood risk management, freshwater supply, and climate-proofing the Netherlands. In this regard, the Association of Dutch Regional Water Authorities UvW, the Association of Netherlands Municipalities VNG, and the Association of Provincial Authorities IPO note that any cutbacks affecting the local authorities will be at loggerheads with the realisation of the urgent Delta Programme taskings.

W.J. Kuijken
Government Commissioner for the Delta Programme

1 IPO, UvW, and VNG investment agenda, "Naar een duurzaam Nederland – energieneutraal, klimaatbestendig en circulair" [Towards a sustainable country – energy neutral, climate-proof, and circular]: https://www.uvw.nl/wp-content/uploads/2017/03/Investeringsagenda-voor-Kabinetsformatie-2017-Naar-een-duurzaam-Nederland-2017.pdf
2 See p. 27 of the investment agenda.

1 Introductory summary



Eemshaven-Delfzijl dyke improvement

1.1 Continuing the work on a sustainable and safe delta

A safe and sustainable delta is not a matter of course. Sixty per cent of our country is prone to flooding; flooding from the sea or one of the major rivers ranks among the top five of the most disruptive disasters to our society.* Seventeen per cent of our economy is dependent on fresh water. The sea level is rising, the soil is subsiding, and weather extremes are increasing. We want to continue to protect the population and the economic values, that have risen substantially over recent decades. This poses major taskings for the Netherlands in the fields of flood risk management, freshwater availability, and climate-proofing. The relevant measures set down in the Delta Programme are well on schedule. However, additional efforts are required to render the spatial design of the Netherlands climate-proof and water-resilient in time. This is where the new Delta Plan on Spatial Adaptation comes in: this Delta Plan generates additional measures to speed up the process as necessitated by the urgency of this tasking.

*** top five of the most disruptive disasters to our society.**
RIVM, 2016: Nationaal Veiligheidsprofiel 2016 [National Safety Profile 2016], an all-hazard overview of potential disasters and threats that could disrupt our society.

Preface: the Delta Programme up until now

In 2010, the Netherlands embarked on a unique approach to these taskings, under the supervision of the Delta Programme Commissioner: a national strategy with ample scope for and involvement of regional parties (governments, the business community, NGOs, and residents). In 2014, on Prinsjesdag – the state opening of Parliament in September – the Cabinet presented proposals for Delta Decisions and preferential strategies to the House of Representatives: structuring decisions regarding the work on the delta in the decades ahead. By the end of 2014, the central government set the proposals down as policy in the National Water Plan. The umbrella organisations of the provinces, district water boards, and municipalities underscored their commitment to the chosen approach by signing the Administrative Agreement on the Delta Programme, and agreeing to encourage their members to adopt the Delta Decisions and preferential strategies in their own plans. This affords the Netherlands the frameworks and the compass to take timely measures.

An essential element of the Delta Programme is the adaptive delta management concept: 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. This enables us to continue to make progress, while acknowledging the uncertainties regarding climate change and socio-economic trends. An important factor in this respect is the "Monitoring, Analysing, Acting" system developed within the context of the Delta Programme. The adaptive approach underpins both the Delta Decisions and the preferential strategies for the IJsselmeer Region, Rhine Estuary-Drechtsteden, the Rhine and Meuse rivers, the Southwest Delta, the Coast, the Wadden Region, and the Elevated Sandy Soils.

In accordance with the Water Act, which has been amended under the Delta Act, the Delta Programme Commissioner annually draws up a proposal for the Delta Programme. This comprises a proposal for the schedule of measures to be implemented* under the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater Supply. The Delta Programme 2018 (DP2018) is the first to comprise a proposal for the new Delta Plan on Spatial Adaptation, which is focused on climate-proof and water-resilient spatial planning in our country.

*** proposal for the schedule of measures to be implemented**
Detailed schedule for the first six years, outline schedule for the subsequent twelve years, looking ahead to 2050.

Progress of the work on the delta

A safe and sustainable delta is of fundamental importance to the Netherlands and requires continuous efforts. In recent years, the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater Supply have ensured a sound basis for the improvement of flood protection and the availability of fresh water. The parties operating within the Delta Programme are staying on track and keeping up the pace in the implementation of the agreed measures in order to tackle the taskings. Even though the horizon is 2050, making headway is urgent: we need to keep up our ability to cope with rising water levels and design the Netherlands in a manner that enables us to make optimum use of valuable freshwater flows, to combat unacceptable waterlogging, and to minimise heat stress in built-up areas. In this respect, it is vital that we look for solutions that serve multiple interests and connect taskings in order to develop feasible and efficient measures. In addition to posing a technological challenge for the Netherlands, this entails a range of social issues that extend into the very heart of our cities.

Under the adaptive approach, the Delta Programme closely monitors external developments – for example, relating to the climate or socio-economic conditions – that may affect the pace or the direction of the preferential strategies as set down. This enables us to verify whether the Delta Programme is "on track", or whether there is reason for a change of course by reconsidering targets or measures. Currently, the Delta Programme is well on track. However, new scientific insights provided by the Royal Netherlands Meteorological Institute KNMI show that the expected rise in sea level and increased precipitation during peak downpours (frequency and intensity) could occur more rapidly than has been assumed in the Delta Scenarios up until now.* The heavy precipitation resulting from clusters of downpours in the south-eastern part of the country during the summer of 2016 ties in with this image. This adds to the urgency of the Delta Plan on Spatial Adaptation. Next year, Delta Programme 2019 will map out the potential impact of a more rapidly rising sea level in more concrete terms, in anticipation of the publication of the new KNMI scenarios in 2021. The potential increase in severe downpours will also be examined further.

*** the expected rise in sea level and increased precipitation during peak downpours (frequency and intensity) could occur more rapidly than has been assumed in the Delta Scenarios up until now.**
See Background Document B: Report and findings of the Delta Programme 2018 Signal Group including fact sheets and references.

The Delta Programme 2018 before you shows that the implementation of the Delta Plans is well "on schedule". The measures envisaged are largely accomplished within the time frame and budget agreed upon. Since 1 January 2017, the new flood risk management standards and the associated instruments have been embedded in law: an important milestone and a precondition for boosting flood protection according to the new standards in the decades ahead. The Netherlands will be safer.

Since the commencement of the Delta Programme, district water boards, municipalities, provinces, and the central government have worked together in an innovative manner, with input from knowledge institutes, NGOs, the business community, and residents. The independent committee that evaluated the Delta Act in 2016 concluded that by adopting this method of working, the Delta Programme is performing "very well, and in large measure in accordance with the high expectations and ambitions of the legislator". The evaluation committee has identified various points of attention for the period ahead, such as intensifying the integral nature of the measures and the participation of all relevant parties. For that reason, Delta Programme 2018 now also reflects the progress made with respect to these two aspects.

Delta Plan on Spatial Adaptation

Waterlogging following severe downpours is a more frequent sight in the Netherlands. The future will see even more frequent extreme precipitation*: up to five times more in 2050, and up to ten times more in 2085 (based on the KNMI '14 climate scenarios). Practical experience has already revealed that such downpours can cause major economic damage. In our country, the so-called *supercell* (rain, gusts of wind, and hail) in and around Someren caused hundreds of millions of euros of damage in 2016. Heat and drought also cause bigger problems and more damage in the Netherlands. If we refrain from taking steps, damage due to waterlogging, heat, drought, and urban flooding could rise to some 70 billion euros in the period up to 2050.* The interim evaluation of the Delta Decision on Spatial Adaptation shows that implementation got off to a good start, yet the current approach fails to sufficiently encourage the parties involved to adopt spatial adaptation as an inseparable component of their policies and implementation efforts with effect from 2020. This prevents us from attaining the goals set down earlier. The evaluation of the Delta Act (Op peil [Up to standard], 1 July 2016) has already demonstrated that as yet, spatial adaptation is largely perceived as noncommittal, while regions and municipalities differ widely in terms of both awareness, and analysis and approach.

*** The future will see even more frequent extreme precipitation**
STOWA, 2015. Nieuwe neerslagstatistieken voor waterbeheer: extreme neerslaggebeurtenissen nemen toe en komen vaker voor. [New precipitation statistics for water management: extreme precipitations are increasing and occuring more frequently.]

*** the period up to 2050.**
Deltares report 1205463-000: Schades door watertekorten en -overschotten in stedelijk gebied [Damage caused by water shortages and excess water in urban areas] (see https://ruimtelijkeadaptatie.nl/resultaten-dpnh/resultaten-dpnh/).

These developments have induced us to draw up a Delta Plan on Spatial Adaptation this year, within the context of the Delta Programme. This Delta Plan is aimed at rendering the Netherlands resilient against extreme weather conditions by minimising the impact of drought, heat, waterlogging, and urban flooding. The Delta Plan on Spatial Adaptation features a systematic approach with a view to developing climate-proofing measures at the local and regional levels.

In December 2016, the Council of Ministers endorsed the National Climate Adaptation Strategy (NAS) 2016. The NAS covers the full scope of climate adaptation. It is interconnected with the Delta Programme in the sense that a large section of the adaptation tasking – the taskings that ensue from heat, drought, waterlogging, and urban flooding – is substantiated under the Delta Programme. In addition to the adaptation to climate change (climate adaptation), combating climate change (climate mitigation) is of vital importance in order to avoid "fighting a running battle". Mitigation and adaptation are, in part, communicating vessels. However, even if mitigation proves successful, the effects of climate change will continue to lag for a long time, which is why adaptation remains imperative.

Cyber security and a safe delta

The importance of cyber security must not be underestimated (cf. the advisory report Herna Verhagen prepared at the behest of the Cyber Security Council: "Nederland digitaal droge voeten" [The Netherlands keeping its digital feet dry]). The Netherlands is dependent on many IT systems that control vital processes, including in the fields of flood risk management and freshwater supply. A cyber attack on these systems could result in, e.g., failure of a pumping station, sluice, lock, or storm surge barrier, with potentially serious consequences. For that reason, safeguarding the reliability of such IT and data systems is of crucial importance. The Delta Programme Commissioner has brought this topic to the notice of the water managers, recommending that they press ahead with the protection of their crucial IT systems against cyber-related threats, and raise the protection level of such systems. Many efforts are already under way. However, cyber security is a battle that requires continuous shifting, awareness, and alertness, as illustrated by the worldwide issues arising after the Wannacry hostage software attack in May 2017.

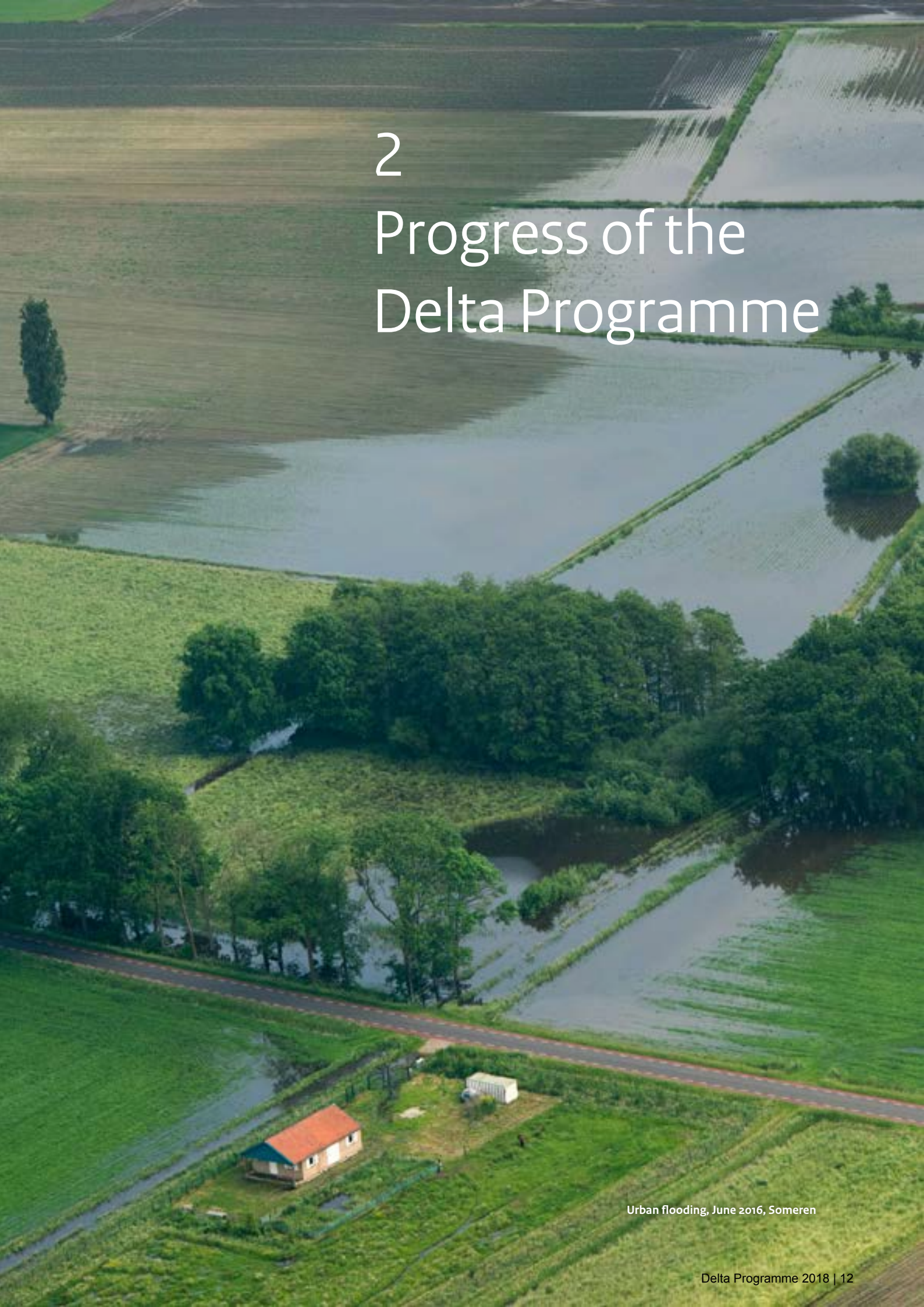
Continuing the work on a safe and sustainable delta

Recent insights into climate change are rendering timely implementation of the Delta Programme even more urgent, and require additional efforts in some areas. The expected weather changes appear to manifest themselves more rapidly than was originally assumed. This calls for persistent alertness to new developments, the thorough development and exchange of knowledge, and a reliable and sound financial basis to keep the implementation on schedule. A sustainable use of our delta requires efforts on the part of and close collaboration between (and within) all the parties concerned. Not just on the part of governments, but also on the part of residents and businesses. This extends to all the taskings covered by the Delta Programme: flood risk management, freshwater supply, and climate-proofing the Netherlands.

Smart measures and smart connections are needed to be prepared in good time for future taskings, using the budget available. For that reason, the Delta Programme continues to encourage innovations, e.g., through the Top Sector Water, and expand expertise through the National Water and Climate Knowledge and Innovation Programme (NKWK). Furthermore, the taskings covered by the Delta Programme will need to be linked to the other major challenges and ambitions facing the Netherlands, such as the energy transition and the transition to a circular economy. Thus we keep working on a safe and sustainable delta, in an efficient manner. From an international perspective, the Netherlands is a pioneer in this field.

Part I
National level

2 Progress of the Delta Programme



Urban flooding, June 2016, Someren

This year's Delta Programme provides a new way of insight into the progress made. The "Monitoring, Analysing, Acting" system, the engine of adaptive delta management, generates administratively relevant information on the progress of the Delta Programme. By addressing four key questions, a consistent picture is painted of the state of affairs and the need, if any, for strategy adjustments. The Delta Programme thus ties in to the evaluation of the Delta Act and the Cabinet's response to it.

2.1 Progress based on Monitoring, Analysing, Acting

In recent years, the Delta Programme has developed a monitoring and evaluation system: the "Monitoring, Analysing, Acting" system. Its aim is threefold:

- keeping a finger on the pulse in order to timely change course: essential to the adaptive approach used in the Delta Programme;
- encouraging a collective learning process: sharing lessons and successes;
- giving account regarding the progress made.

The DP2018 before you is the first to provide a progress overview based on this new system.

This Delta Programme provides insight into the progress made by reference to four key questions:

1. On schedule: are we implementing the measures within the time frame and budget agreed upon? The central point of focus here is the progress made on implementation (output).
2. On track: are we on track or do external developments constitute a reason for reconsideration of goals or measures? The central point of focus here is attainment of the goals (outcome).
3. Integrated approach: are we addressing the taskings in an integrated manner?
4. Participation: are governments, businesses, NGO's, and residents involved on a wide scale, where such is called for?

Community of Practice and Signal Group

Several times a year, representatives of the themes and the regions meet in Communities of Practice to exchange experience with the implementation of preferential strategies and Delta Plans (the so-called blue line in Figure 1). The community focuses on key questions 1, 3, and 4 in particular. A Signal Group, composed of experts in the field from various backgrounds, has analysed which external developments – such as the pace of climate change – could constitute a reason for the reconsideration of preferential strategies and Delta Plans (the green line in Figure 1). The developments identified and their potential impact are elaborated. The analyses are focused on the question whether and when the preferential strategies and Delta Plans need adjusting. This generates the answers to question no. 2.

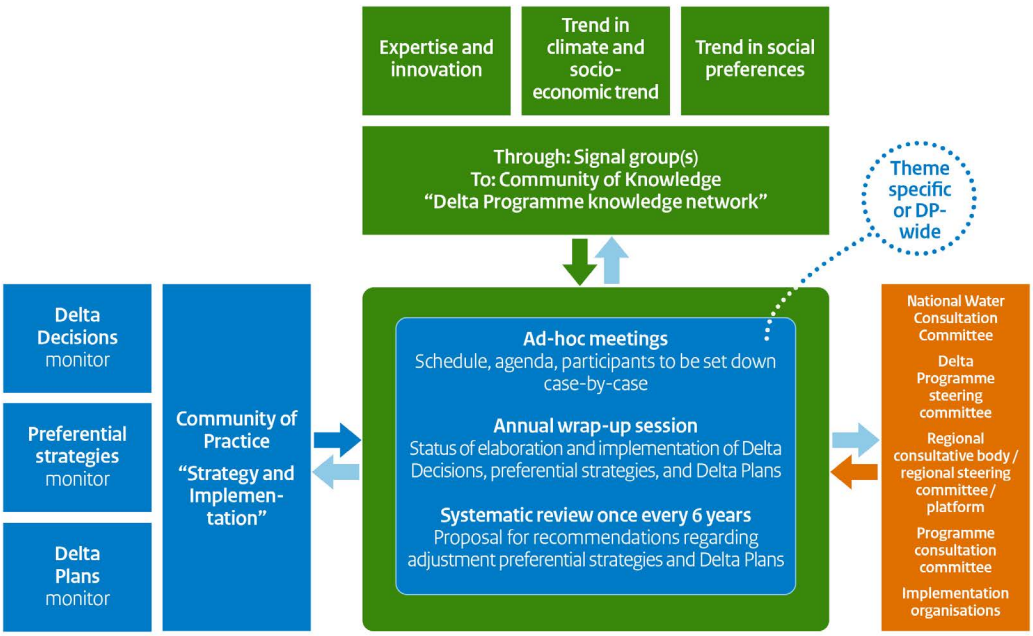


Figure 1

Periodical coordination between output and outcome (blue line) and external developments (green line)

These four questions have changed the substantiation of the progress information. Progress is reviewed at the level of the Delta Decisions and preferential strategies, targeting administrative questions. This is done consistently for the overall Delta Programme (Paragraph 2.2), the themes (Paragraphs 2.3 - 2.5), and the regions (Part II). The Delta Programme only outlines the progress made with respect to the individual projects at a general level; a more detailed picture is presented in the underlying progress reports, such as the Projectenboek HWBP [Flood Protection Programme Project Book] and Werken aan zoet water in de Delta [Working on freshwater supply in the Delta].

2.2 General picture of the progress

A general picture of the progress of the Delta Programme is presented below, based on the “on schedule”, “on track”, “integrated approach” and “participation” questions. This is followed by a paragraph on the effectiveness of the regions in terms of the implementation of the Delta Programme.

Continue reading

» 2.2.1 On schedule

» 2.2.2 On track

» 2.2.3 Integrated approach

» 2.2.4 Participation

» 2.2.5 Effectiveness of the regions

2.2.1 On schedule

Flood risk management

The implementation of the new flood risk management policy is proceeding as planned. Major steps have been taken over the past year. The amendment to the Water Act, comprising the new standards, came into effect on 1 January 2017. The regulation pertaining to the assessment of primary flood defence systems has also been effective since 1 January 2017 and the first set of instruments is available. These are important conditions to ensure that the flood defence systems meet the new standards by no later than 2050. The assessment of the flood defence systems in accordance with the new standards has commenced; in 2023, it will yield an initial picture of the condition of the flood defence systems and the required dyke improvements. Meanwhile, preparations have started for the urgent improvement of dykes whose safety falls considerably short of the new standards. At several locations, e.g., in the Wadden Region, parties are exploring innovative dyke improvement methods. In the area around the major rivers, the governments concerned are collectively working on an ambition for the combined river widening and dyke improvement efforts up to 2050, in order to set down the points of departure for both types of measures in terms of water management. In the IJsselmeer Region, two significant milestones have been accomplished with respect to flood risk management: the construction of pumps in the IJsselmeer Closure Dams has been put out to tender, and the new IJsselmeer water level ordinance is expected to come into effect in early 2018. The study into reduction of the failure probability and the partial operation of the Maeslant storm surge barrier was completed in early 2017. Within the Rhine Estuary-Drechtsteden Delta Programme, Rijkswaterstaat is exploring which measures can be implemented by 2028 in interconnection with the safety tasking concerning the dykes (cf. Paragraph 4.2).

Spatial adaptation

The interim evaluation of the Delta Decision on Spatial Adaptation shows that public commitment to spatial adaptation is expanding considerably, yet the parties still fail to take sufficient initiative. At the same time, the urgency is increasing. This warrants the conclusion that additional effort is required in order to be able to attain the goal set for 2050. The new Delta Plan on Spatial Adaptation, which has been incorporated into this year's Delta Programme as a first, is aimed at ensuring this momentum. Central government efforts to improve the flood protection of national vital and vulnerable functions are on schedule. The regional governments are also improving the resilience of their vital and vulnerable functions; some are still in the "analysis" phase (e.g., conducting stress tests), others have entered the "ambition" stage (e.g., drawing up adaptation strategies), and some have embarked on the "action" stage (among which Amsterdam Rainproof, Dordrecht, Rotterdam).

Freshwater supply

All across the country, measures pertaining to the implementation of the Delta Decision on Freshwater Supply are being prepared and in progress. Increasingly more regional parties are opting for an integrated approach to freshwater supply, waterlogging, and water quality issues. In some cases, such an approach takes more time to prepare, but ultimately it will prove more efficient. All the measures set out in the Delta Plan on Freshwater Supply are expected to be completed by 2021 as planned. All the freshwater supply regions (and Rijkswaterstaat with respect to the main water system) have embarked on the water availability issue. The majority of the regions are seeking to tie in with other taskings and area-based processes. Particularly in relation to the major freshwater stocks, the parties involved tend to regard the water availability strategy as not always sufficiently urgent, which in some cases is causing delays. The May 2017 benchmark further shows that implementation is on schedule, and that the first results are becoming manifest. The governments concerned are preparing a roadmap to provide insight as regards the interconnectivity of the agreements on water availability, the updating of the bottleneck analysis, and the national freshwater supply targets, in preparation for the second phase of the Delta Plan on Freshwater Supply (2022-2028). It is important for water availability to be embedded in environmental policy at all levels. This will be a point of focus in the period ahead.

2.2.2 On track

The Delta Programme is on track. The vast majority of the measures agreed upon are being implemented as planned, and as yet, no delays have been encountered that could jeopardise the attainment of the goals. The parties are regularly examining whether external developments necessitate an adjustment of the course. The analyses initiated by the Signal Group will provide more insight into this in the years ahead. The Signal Group is composed of experts from Rijkswaterstaat (the executive branch of the Ministry of Infrastructure and the Environment), the Netherlands Environmental Assessment Agency, the Royal Netherlands Meteorological Institute KNMI, Deltares research institute, and Wageningen University. It is led by the Staff of the Delta Programme Commissioner. The Delta Programme is working out the preferential strategies in more concrete terms and identifying interim goals or benchmarks for the period from 2020 to 2050 in order to be able to determine whether the preferential strategies need to be adjusted in the light of external developments. The proposals for such adjustment, based on the more concrete elaboration of the strategies, will be incorporated into Delta Programme 2019.

Signal Group meetings held in the spring of 2017 have yielded an initial overview of external developments. Prior to the meetings, the Staff of the Delta Programme Commissioner had asked a group of experts from outside the water domain for their views on relevant developments using the Delphi method (see box), in order to encourage the Signal Group members to adopt a broad perspective. The initial overview drawn up by the Signal Group shows two potentially important developments:*

- potential acceleration in sea level rise;
- increasingly more severe downpours, causing damage due to precipitation, hail, and gusts of wind (*supercells*).

*** important developments:**
See Background Document B: Report and findings of the Delta Programme 2018 Signal Group including fact sheets and references.

Measurements and new research indicate that the sea level is rising more rapidly than has been assumed in the delta scenarios. This still needs scientific confirmation by the IPCC. In 2021, the KNMI will need to translate this into new forecasts for the Dutch coast. In anticipation, the Signal Group is exploring and mapping out the potential consequences for the Delta Programme. The results will be presented in Delta Programme 2019. The increase in severe downpours is already manifest in measurements and forecasts for the future, and bears physical explanation. This development constitutes one of the justifications for the Delta Plan on Spatial Adaptation, and will be accommodated in the Climate-proof City focus area. The Delta Programme Commissioner has entered into dialogue with expert weather presenters on climate change, its impact in terms of weather extremes, the potential consequences for the Netherlands, and communication on this topic.

Delphi: top five external developments

The organisations participating in the Signal Group specialise in the physical domain (such as climate change and water management); this is where the main Delta Programme taskings lie. In its identification of relevant developments, the Signal Group will logically also focus on developments in the physical domain. To ensure that other types of developments, such as societal trends, are factored in as well, and to provide the Signal Group with a broad basis from which to start its activities, the Delta Programme has enlisted the assistance of twenty experts from outside the world of water.

These external experts from government circles, the science sector, and NGOs have used the so-called Delphi method to weigh in on external developments that could have a large impact on the preferential strategies of the Delta Programme. Under this method, the experts answer several rounds of questionnaires. The anonymised answers are given in a personal capacity on the basis of ready knowledge and personal experience. The following five developments have come up most frequently:

1. Accelerated climate change

Accelerated climate change impacts all the Delta Programme themes, among other ways because of the decrease in drainage options, hindrance to inland water transport (more frequent excessively low and high water levels), and longer periods of freshwater shortage than currently being reckoned with.

2. IT developments

On the one hand, new technological advances open up opportunities for the Delta Programme, for example, by enabling new types of measures, more efficient monitoring, and new communication methods. On the other hand, the water system may become more vulnerable to power and IT failures, hacking, and terrorist attacks.

The importance of cyber security must not be underestimated. The Netherlands is dependent on many IT systems that control vital processes, including in the fields of flood risk management and freshwater supply. A cyber attack on these systems could result in, e.g., failure of a pumping station, sluice, lock, or storm surge barrier, with potentially serious consequences. The Delta Programme Commissioner has brought this topic to the notice of the water managers, recommending that they press ahead with the protection of their crucial IT systems against cyber-related threats, and raise the protection level of such systems.

3. Energy transition

The Delphi respondents call attention to the opportunities for expanding the water management contribution to the energy transition. The water managers acknowledge the ways in which water management can contribute to the energy transition, and are joining forces to further expand this. The contributions pertain to energy generation, energy storage, and the reduction of energy consumption. This ties in with the ambition pursued by the Ministry of Infrastructure and the Environment, viz. to ensure full energy-neutrality in the infrastructure managed by Rijkswaterstaat (roads, waterways, flood defence systems, sluices, locks, bridges) by 2030. At the end of 2016, Rijkswaterstaat and the district water boards entered into an energy coalition – in addition to the ongoing Green Deal – to give impetus to the realisation of the energy goals. In the decades ahead, the energy transition will leave its mark on spatial developments, along with climate adaptation. This is also manifest in the investment agenda* that the municipalities, provinces, and district water boards have drawn up in the purview of the formation of a new Cabinet. In addition, the energy transition is producing a different range of vital and vulnerable infrastructure because of the switch from fossil fuels to greener and more locally generated energy.

4. Energetic society

With the advent of the energetic society, the Delta Programme taskings will tend to be addressed through private initiatives by residents, businesses, and farmers rather than through an official administrative process. The Delphi respondents foresee that insurance companies and pension funds will play a part in this, through social co-acting and investments.

5. Circular economy

In a circular economy, water can be regarded as an economically scarce commodity and a bearer of economic prosperity. This calls for increased attention in the freshwater supply strategies to loop closure and to the distribution of water across the Netherlands.

The Signal Group has taken these developments into consideration in its inventory. On the basis of the criteria adopted (the development has been observed in measurements, forecasts indicate that the development will continue in the future, and there is a causal explanation for the occurrence of the development), the Signal Group has established that only the first of these five developments compels a reconsideration and possibly an adjustment of the preferential strategies. The Delta Programme will,

however, have the other four developments elaborated further in order to check whether the Delta Programme forgoes opportunities for combining the preferential strategies with these developments.

*** investment agenda**
Investment agenda of the Association of Provincial Authorities IPO, the Association of Dutch Regional Water Authorities UvW, and the Association of Netherlands Municipalities VNG, Naar een duurzaam Nederland – energieneutraal, klimaatbestendig en circulair [Towards a sustainable Netherlands – energy-neutral, climate-proof, and circular].

2.2.3 Integrated approach

The Delta Programme will affect the lay-out of the Netherlands: nearly all the measures entail a spatial impact. With a view to the importance of spatial quality and of linking up with other ambitions and taskings, proper coordination between "water" and "spatial planning" is essential. Spatial design constitutes a key tool in this respect. Ensuring the quality of decisions and plans calls for attention to be paid to the interconnectivity between regional and main water systems, within the themes as well. Furthermore, within the main water system, interconnectivity at the national scale is relevant too: choices made in the area around the major rivers could have an impact on the IJsselmeer Region and the Rhine Estuary-Drechtsteden area; what happens in the Nieuwe Waterweg is of relevance to the Southwest Delta.

One of the points for attention emerging from the evaluation of the Delta Act involves the reinforcement of integration with other spatial taskings in the period ahead. The Cabinet and the administrative partners have requested the Delta Programme Commissioner to monitor, using the "Monitoring, Analysing, Acting" system, whether the focus on the statutory flood risk management and freshwater supply taskings is in balance with the pursuit of an integrated approach.

In the pursuit of integrality within the Delta Programme, the primary focus is on connecting the flood risk management and freshwater supply taskings with ambitions in other fields, such as shipping, nature, recreation, and regional economic development. To supplement this focus, the Delta Programme will step up its efforts to explore opportunities for better inter-linkage between the taskings related to flood risk management, freshwater supply, and spatial adaptation. This will be substantiated mainly at the regional and local levels. The progress reports that the regions and the themes have submitted to the Delta Programme Commissioner reflect various good examples of an integrated approach. Particularly with respect to the spatial adaptation and freshwater supply taskings, an integrated stance is common practice. With respect to the flood risk management taskings, linkage opportunities are provided and encouraged at all levels. In order to enable further substantiation of the integrated approach, it is important to create sufficient time; this will also be conducive to the opportunities for (co)financing.

In line with the investment agendas of the Association of Provincial Authorities, the Association of Dutch Regional Water Authorities, and the Association of Netherlands Municipalities, it is imperative for the provinces, district water boards, and municipalities to incorporate sustainability goals (energy-neutral, climate-proof, and circular design) when elaborating measures ensuing from the Delta Programme.

Since 2016, the Delta Programme has been placing projects that connect water and spatial planning on a map in order to encourage the exchange of expertise and experience.

Spatial design

The independent committee that evaluated the Delta Act in 2016 expressed a highly positive opinion, and pointed out that the Delta Programme taskings could be interlinked with other spatial taskings to an even greater extent. In its response, the Cabinet indicated its intention to focus considerable attention on such efforts in the years ahead.

Spatial design is a key tool for establishing connections: between interests; between local, regional, and national developments; and between long-term strategies and implementation projects. Spatial design can facilitate collaboration between parties.

In 2017, the Delta Programme partners will be joining forces with Atelier X to employ design as an instrument for the Rhine tributaries, spatial adaptation, and the Delta Plan on Flood Risk Management. Atelier X will also contribute to the Regional Agenda for the IJsselmeer Region, with design at the interface of spatial planning, climate, and water.

Atelier X has been set up as a component of the Spatial Design Action Agenda 2017-2020, and follows up on the spatial design efforts that have been expended over recent years through the Delta Design Platform. Atelier X employs design for strategic agendas and complex area developments, encourages knowledge development, and acts as a liaison between the parties involved. The results of the design efforts expended in 2016 (through the Delta Design Platform) have been made available in an online magazine.

2.2.4 Participation

Participation is essential in the Delta Programme: capitalising on the expertise, ideas, experience, and creativity of all those involved often produces better solutions. For that reason, the Delta Programme encourages governments initiating activities in the fields of flood risk management, freshwater supply, and spatial adaptation to organise joint fact finding processes, inviting other (potentially) interested parties to weigh in at an early stage, to explore taskings and solutions area by area, and provide room for new solutions (befitting the tasking and the project stage).

Coordinating role for Delta Programme Commissioner in Markermeerdijken-Uitdam dyke improvement

Joint fact finding and the timely involvement of potentially interested parties constitute an important basis for developing widely supported decisions. To accomplish this, the Delta Programme Commissioner plays an active role in special situations. For example, in March 2017 the Delta Programme Commissioner took on the role of independent process coordinator for the Uitdam dyke improvement project, at the behest of the governments concerned and local residents. The Uitdam dyke improvement is an element of the Markermeerdijken improvement tasking, a project that has been running for more than ten years. By way of a joint fact finding process, the Uitdam stakeholders have equivocally elaborated a soil variant and a constructive variant. On the basis of the results, the Delta Programme Commissioner has drawn up an independent and directive advisory report regarding the improvement method to be employed at Uitdam, which he presented to the Hollands Noorderkwartier district water control board on 27 June 2017.

A point for attention presented by the Delta Act evaluation committee is that the elaboration and implementation phases entail a wider and more complex circle of stakeholders (the delta community), which raises the requirements for involving the outside world.

This year, for the first time, the Delta Programme provides explicit insight into the extent of participation in the implementation of the Delta Decisions and preferential strategies. The general picture is that across the board, governments and NGOs are widely involved at the various levels (policy development, elaboration, and implementation). In some cases, involving municipalities in the regional Delta Programme taskings requires additional attention, and on occasion, involving businesses and residents appears difficult. A complicating factor is that many projects are still in the research phase. As requested by the Cabinet and administrative partners, in the comprehensive Cabinet response to the evaluation of the Delta Act, the Delta Programme Commissioner will continue to encourage collaboration with NGOs and the business community. At the national level, the Infrastructure and the Environment Consultative Body provides advice to the Delta Programme Steering Group.* NGOs also remain involved in the regions (see overview). Participation in the regions is achieved through, e.g., consultative groups and regional consultative bodies, with annual stakeholders meetings. The Flood Protection Programme supports and fosters participation in various ways, including by setting up environment managers communities and publishing guidelines. At the project level, district water boards, municipalities, and Rijkswaterstaat involve residents, the business community, and NGOs from the very start of the process; with respect to MIRT projects, such involvement is effected in accordance with the Code Maatschappelijke Participatie [Social Participation Code].

*** Delta Programme Steering Group.**
Cf. the advisory report by the Infrastructure and the Environment Consultative Body regarding Delta Programme 2018 and the Delta Programme Commissioner's response in Background Document C.

The Delta Programme projects are highly diverse in nature. They range from research into new policy instruments to the implementation of dyke improvements. Furthermore, the projects differ as to the stage they are in (exploration, plan elaboration, realisation). In the Delta Programme, initiators are requested, prior to a study or project, to provide systematic clarity regarding the scope available for input from NGOs, businesses, and residents, and to provide insight during the process into how the questions and ideas submitted have been used. Such an ex ante outline of the process clearly demonstrates – to both initiators and participants – what input, expertise, and time investment are needed and feasible to actually substantiate the participation. This provides a basis for the parties involved to enter into a dialogue about an appropriate and practicable form of participation.

Strategic Vision for Krimpenerwaard

Impelled by the driving force of initiator and resident Riek Bakker, a community of more than one hundred participants presented a long-term vision for the Krimpenerwaard area in early 2017. The community was composed of residents, entrepreneurs, and young farmers. Supported by independent experts, the participation groups have drawn up advisory reports that were unanimously adopted by the community and that form an integral part of the vision document. People could also submit ideas during the two-weekly consultation hour held by the initiator; some twenty people have utilised this opportunity. The vision document is a fine example of an adaptive approach: the taskings to be tackled in the next 30 years have been linked to decisions to be taken in the short term. The vision document also indicates which taskings can be connected, such as flood risk management and infrastructure, soil subsidence and underwater drainage, local manufacturing industry and energy transition. The province, the Krimpenerwaard municipalities, and local business organisations have supported the vision document with a financial contribution. The "Waardcommissie", chaired by the (provincial) Royal Commissioner and with the participation of the Delta Programme Commissioner, acted as "keeper" of the initiative. The subsequent step will be a concrete implementation agenda to be drawn up by an Explorer, in parallel to the decision-making process in the municipal councils and the Provincial Council of Representatives.

2.2.5 Effectiveness of the regions

Since the adoption of the Delta Decisions*, the regions have been given ever increasing directive and coordinating roles. The committee that evaluated the Delta Act in 2016 has pointed out that this entails a risk in terms of effectiveness: in the years ahead, the regions will be required to put in substantial efforts in the fields of direction and coordination, whereas the capacity – and thus the effectiveness – of the regional project organisations has fallen rather than risen following the Delta Decisions. In the Cabinet response to the evaluation of the Delta Act, the Cabinet and the Delta Programme partners have acknowledged this risk. They have indicated that in the first half of 2017, the partners will collectively map out what is needed to preclude this risk, and commit to expend the required efforts.

*** Delta Decisions**
The adoption of policy ensuing from the proposals for Delta Decisions, as set down in Delta Programme 2015.

In his letter dated 23 December 2016, the Delta Programme Commissioner brought the importance of boosting regional effectiveness to the attention of the administrators of the regional programmes, and requested them to develop and implement proposals aimed at increasing the effectiveness. The overall picture emerging from the administrative responses received is that regional effectiveness has their attention, but it is not (yet) up to par. The Delta Programme Steering Group has noticed that the regions are now giving impetus to their efforts to raise regional effectiveness, yet it will be important to actually substantiate the reinforcement of this effectiveness. The Delta Programme Commissioner will keep a finger on the pulse in the Delta Programme Steering Group and take stock in November 2017.

Increasing effectiveness - IJsselmeer Region

In early 2017, the IJsselmeer Region Administrative Platform decided to boost the effectiveness of the regional programme, and to allocate additional capacity to knowledge exchange and communication. Thus, the Platform aims to ensure that the coordination team will be properly equipped.

The above decision was prompted by a pilot project revolving around the “Power of collaboration”. Administrative stakeholders in the area pointed out the need for increased interconnectivity between the many projects set up to elaborate the preferential strategy. The administrators set store by continuously sharing the story of the Delta Programme in order to keep the importance of a safe and resilient region in mind, and provide a framework for all the individual projects.

In 2016, the IJsselmeer Region Administrative Platform commissioned a study under the “Power of collaboration” pilot to map out the efficiency of the collaboration between the 40 signatories of the IJsselmeer Region Pact. The methodology adopted has been perceived as useful, and the outcomes have resulted in, inter alia, the above decision to further raise regional effectiveness. The methodology has been simplified to expand the scope of the pilot, and made available to all the regional consultative bodies in early 2017.

2.3 Progress in flood risk management

Flood risk management policy has been updated under the Delta Decision on Flood Risk Management.* This policy aims to ensure 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 individual in the Netherlands. Additional protection will be provided 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. In order to attain these goals new flood protection standards have come into force on 1 January 2017.

*** Delta Decision on Flood Risk Management.**
See DP2015, Delta Decision on Flood Risk Management.

On schedule

For the schedule of studies, measures, and provisions relating to flood risk management, refer to the Delta Plan on Flood Risk Management (Part III). The various components of the Delta Decision on Flood Risk Management are all on schedule. That is important: they constitute a precondition for the timely implementation of the preferential strategies in the various regions.

Statutory and financial basis

Entirely as planned, the new flood risk management policy, incorporating the new standards, has been embedded in law. This is a major step forward. The amended Water Act has come into force on 1 January 2017; both the House of Representatives and the Senate have adopted the amendment unanimously. The Act also regulates how measures required under the new standards will be funded from the existing State grants and the contributions of the district water boards to the Flood Protection Programme. The Delta Fund provides a solid and long-term basis for the funding of flood risk management efforts.

The new ministerial regulation for the assessment of primary flood defence systems has also come into effect in good time. The regulation and the underlying instruments enable flood defence system managers to embark on their assessment of the primary flood defence systems. The instruments will be developed in more detail over the next two years. The Flood Protection Grants Scheme 2014 has been adapted to the new standards.

Upon the introduction of the new standards, several so-called Category C dykes have lost their function in the primary system and now serve as regional flood defence systems. Appendix VI to the Water Decree lists the category C dykes qualifying for a once-only grant for the implementation of measures to meet the provincial standards.

Assessment: first picture of national security

The First Primary Flood Defence Systems Assessment Round commenced in early 2017, as scheduled. District water boards and the Ministry of Infrastructure and the Environment, including Rijkswaterstaat and the Human Environment and Transport Inspectorate, have published a scenario with process agreements on the Water Helpdesk website. The aim is to have a first national picture of the flood risk situation by 2023. In the years ahead, the parties will learn to work with the new system, and flood defence systems urgently in need of improvement will be tackled. Reports on the subsequent assessment rounds, that are scheduled every twelve years, will be available in 2035 and 2047. The 2035 report is intended to provide a more detailed picture of the flood risk situation; the goal is for a majority of the primary flood defence systems to meet the standards by 2047. This schedule brings the target of having all the primary flood defence systems meet the new standards by 2050 within reach.

All the district water boards have set down an action plan for the assessment which will be regularly refined and adjusted on the basis of their first experience with the new assessment system and tools. The district water boards and Rijkswaterstaat have placed the assessment high on their agendas, the required resources and capacities have been budgeted, and the managers have agreed to join forces and share their expertise and know-how. By now, six assessments have been completed (mid-2017).

Design

The new Design Instruments have become available in January 2017 (OI 2014v4): they are included in a manual for designing primary flood defence systems according to the flood probability approach, incorporating the guidelines and technical reports currently available. This manual ties in with the instruments used for the assessment of flood defence systems (WBI2017). In 2017, a new system will be available for technical guidelines and reports, facilitating the retrieval, management, and updating of expertise.

Flood Protection Programme

The dyke improvements set out in the Flood Protection Programme have been prioritised by urgency. The most urgent projects have been incorporated into the programme and for the majority of these projects explorations are under way. The Flood Protection Programme is on schedule; its progress is reflected in the Delta Plan on Flood Risk Management (Part III). In the spring of 2017, consultative meetings were conducted regarding the draft Flood Protection Programme 2018-2023, in accordance with the Water Act (Article 7.23). The water managers have endorsed the draft programme, save some minor adjustments. Every effort has been made to accommodate the adjustments within the underlying principles of the programme. The water managers have also endorsed the General Exploration regarding dyke improvements using local soil.*

*** General Exploration regarding dyke improvements using local soil.**
See Delta Plan on Flood Risk Management, Flood Protection Programme, General Explorations.

Dyke improvements and river widening

The provinces, district water boards, and Ministry of Infrastructure and the Environment are protecting the area around the major rivers against flooding with a powerful combination of dyke improvements and river widening. Several ongoing studies exploring the options for river widening along the Meuse and the Rhine provide short-term clarity regarding the interaction with scheduled and future dyke improvements under the Flood Protection Programme. For the period beyond 2030, the long-term ambition must provide such clarity (cf. Rhine and Meuse). It is important for this ambition to be completed in good time and embedded in policy in order for it to be taken into account in short-term dyke improvements. The Delta Programme Commissioner regularly confers with the administrators concerned on this topic.

Risk-based approach in other procedures

The district water boards have started to incorporate the new standards into all their procedures in order to safeguard the proper and timely implementation of flood risk management policy. They have conducted impact analyses to map out how the new standards will impact management and maintenance, licensing procedures, and disaster control. The district water boards are using the new expertise and insights when drawing up and carrying out maintenance plans, assessing permit applications, and updating dyke boundaries.

In the spring of 2017, the *Informatiehuis Water** produced the Flood Risk Management portal: a facility enabling the exchange of information on the assessment and improvement of primary flood defence systems between managers, the Ministry (including the Human Environment and Transport Inspectorate), and the Flood Protection Programme.

*** Informatiehuis Water**
The Informatiehuis Water is a collaborative of water managers, focused on the provision of uniform, accessible, and useful information about water.

In collaboration with Rijkswaterstaat, the district water boards and provinces are exploring whether elements and insights from the new safety system for primary flood defence systems can also be applied to regional flood defence systems. In 2016, the district water boards and provinces, under the auspices of the Foundation for Applied Water Research STOWA and with support from the central government, compiled the Visie op de regional waterkeringen 2016. Verder bouwen op een goed fundament [Vision of the regional flood defence systems 2016. Continuing to build on a solid foundation]. In the years ahead, they will implement a collective policy and knowledge agenda. In addition, the provinces and district water boards are examining the necessity of developing a provincial standard for former primary flood defence systems.

Smart combinations

In specific situations, for example, involving locations at which dyke improvement will be extremely expensive or encroach deeply on social life, "smart combinations" with spatial planning and/or disaster management may be made to reduce the dyke improvement effort and nonetheless attain the protection level. In such "smart combinations", agreements are made on a case-by-case basis. Such "smart combinations" may hold promise for ten to twenty sections of primary flood defence systems. These are sections at which the standard is dictated by the Local Individual Risk (LIR). Specific local circumstances, such as the presence of regional flood defence systems, may also open up opportunities for "smart combinations". The Ministry of Infrastructure and the Environment will be exploring, in collaboration with the regions, how smart combinations can be employed for these promising sections, and whether all the potentially promising sections have been identified.

Reducing the impact of a flood (layer 2)

Another important consideration in spatial developments, in addition to smart combinations, is reducing the impact of a flood. The challenge is to develop a spatial design that minimises both the impact of flooding and the residual risk*. This could limit, defer, or obviate the need for future dyke improvements, and render the Netherlands more resilient to climate change. The Delta Plan on Flood Risk Management is substantiating this, along with the new Delta Plan on Spatial Adaptation.

*** residual risk**
The risk that remains once the flood defence systems are up to par.

Disaster management (layer 3)

In the years ahead, the Security Regions, in collaboration with water and road managers, the Ministry of Infrastructure and the Environment, the Ministry of Security and Justice, and other stakeholders, will map out the effects of a water crisis (coastal flooding, river flooding, or serious waterlogging). This is the outcome of the Water and Evacuation project, one of the three strategic agenda projects of the *Veiligheidsberaad* (administrative platform of 25 Security Region chairs) and the Ministry of Security and Justice. In 2018, each Security Region must have completed an impact analysis; these will serve as the basis for the adoption of an Action Perspectives Strategy in 2020, aimed at, e.g., evacuation and rescue operations. The results of the impact analysis also constitute an important basis for identifying the most effective impact-reducing measures. Thirteen out of the 25 Security Regions are conducting or have completed an impact analysis (mid-2017). The "Eiland van Dordrecht" impact analysis was the first to be completed.

Another result of the Water and Evacuation project is the guideline for increasing the collective coping capacity (i.e., residents helping one another) in a water crisis. This guideline features communication tools that Security Regions and other stakeholders may use. The Guide to Information Exchange comprises agreements on the exchange of information in the event of a water crisis and how to prepare: how, what, when, by whom, and with whom? The Water Management Centre of the Netherlands operates the National Water and Floods Information System (LIWO), that plays an important part in this respect. In the years ahead, the Security Regions will continue to work on the implementation of the results of the project, on crisis plans for each catchment area, and on national evacuation strategies. The Delta Programme Steering Group seeks to have the Security Regions tie in with the regional consultative bodies of the Delta Programme. This bears a tailored approach.

Rijkswaterstaat is exploring how the evacuation function can be accommodated in its working processes, and examining the options for a reversed laning pilot (temporarily changing the direction of traffic, in order to expedite evacuation).

On track

Following the completion of the First Primary Flood Defence Systems Assessment Round, the Delta Programme will indicate annually whether the dyke improvements are proceeding at a pace that enables attainment of the goal set for 2050.

The new standards represent a major change. In the years ahead, flood defence system managers, supervisory bodies, and private parties will be gaining experience with the new approach to flood risk management in accordance with the amended regulations. Together with the planned evaluations of the new instruments*, the progress of measures, and expertise amassed in the General Explorations, such experience will reveal whether the course set for flood risk management needs adjusting. The evaluations of the standards, the first of which is scheduled for 2024 and which will subsequently be conducted once every twelve years, will also address the developments in layer 2 (impact reduction) and layer 3 (disaster control).

*** evaluations of the new instruments**
The interim evaluations of the assessment process (2019 and 2021) and the final evaluation (2023, concurrently with the National Assessment of Flood Probabilities), the evaluation of the Flood Protection Grants Scheme (2019), and the evaluation of the co-funding of primary flood defence system improvements (2023).

Integrated approach

Several developments foster the integrated approach to dyke improvements. For example, the amended Flood Protection Grants Scheme now allows grants for so-called pre-explorations (also referred to as early explorations) as an optional component of the exploration phase of a dyke improvement project. This opens up possibilities for using grants at an earlier stage of sections of the exploration featuring a long lead time, for example, mapping out, in collaboration with regional parties, the opportunities for linkage with other taskings in the vicinity of the dyke section to be improved. The Flood Protection Programme supports an integrated approach to dyke improvements with the Handreiking landschappelijke inpassing en ruimteijke kwaliteit in waterveiligheidsopgaven [Guidelines for landscaping and spatial quality in flood risk management taskings]. Any costs saved on dyke improvements can be factored in when selecting river-widening measures or smart combinations.

The Flood Protection Programme and the sub-areas feature many integrated approach showcases: the link between the Tiel-Waardenburg dyke improvement and the Varik-Heesselt bypass along the Rhine, the Strong Lek Dyke project, the link between the Eemshaven-Delfzijl dyke improvement and the regional tasking, the comprehensive Grebbedijk exploration, the double dyke concept along the Wadden Sea, and the exploration of a dyke improvement, river widening, and area development combination near Ravenstein-Lith along the Dyked River Meuse and in the Northern Meuse Valley in Limburg. In some cases, river widening measures can help to attain water quality targets; take, for example, the longitudinal groynes in the river Waal, and the secondary channel in the Hemelrijkse Waard.

In the Rhine Estuary-Drechtsteden area, the IJsselmeer Region, and the Wadden Region, the studies into multi-layer flood risk management are good examples of an integrated approach.

Participation

The procedure for dyke improvement projects that are carried out within the context of the Flood Protection Programme is based on the MIRT [Multi-Year Programme for Infrastructure, Spatial Planning and Transport] system. This entails that managers substantiate participation in explorations for dyke improvements through active stakeholder management. The guidelines for explorations and plan elaborations provided by the Flood Protection Programme indicate how such participation can be fleshed out. Bodies with a direct interest are involved from the outset. Rijkswaterstaat and the district water boards are organising education and training activities in order further to improve the quality of stakeholder management and participation.

Flood defence system managers, private parties, and knowledge institutes are closely involved in General Explorations and the assessment of primary flood defence systems. The new approach to flood risk management calls for the active development and transfer of knowledge. The Risk-based Approach Knowledge Platform (design) and the Expertise and Know-how Platform (assessment) play a pivotal role in this respect. An active helpdesk supports flood defence system managers in the first assessment round.

The provinces play a key part in the adoption of the project plans for dyke improvements. In 2016, a training course on the introduction of the new standards was set up for provincial staff in order to enable them properly to participate in flood risk management projects. In addition, the provinces can be actively involved in terms of spatial quality and – with a view to the Environment Act – environmental quality. Such involvement is already manifest in, e.g., the Strong Lek Dykes project and the Ravenstein-Lith project.

Collaboration with experts, universities, and private parties is vitally important in the pursuit of flood risk management. In December 2016, the Flood Risk Management Expertise Network (ENW) published the Grondslagen voor hoogwaterbescherming [Foundations for flood protection]. In that same month, the Applied and Technological Sciences domain of the Netherlands Organisation for Scientific Research NWO-TTW accepted the All Risk research proposal submitted by five universities (led by Delft University of Technology), which is aimed at furthering expertise on flood risk management. The Flood Protection Programme, the Ministry of Infrastructure and the Environment, and the district water boards are actively involved in this research.

2.4 Progress in spatial adaptation

The Delta Decision on Spatial Adaptation* revolves around a transition to a climate-proof and water-resilient spatial design by 2050. An interim goal is for the central government, provinces, municipalities, and district water boards to embed climate-proof and water-resilient action in their policies by 2020. The governments have set down their collective commitment in the Administrative Agreement on the Delta Programme. The new Delta Plan on Spatial Adaptation, to be included in the Delta Programme with effect from this year, sets out ambitions and agreements jointly to expedite and intensify the efforts. This first Plan is focused on combating waterlogging, urban flooding, and heat stress. Governments and other parties have already initiated many efforts on their own, and a national incentive programme has been set up to further the transition. The central government is flood-proofing thirteen national vital and vulnerable functions.

*** Delta Decision on Spatial Adaptation**
See DP2015, Paragraph 2.4, Delta Decision on Spatial Adaptation.

On schedule

For the schedule of studies, measures, and provisions relating to spatial adaptation, refer to the new Delta Plan on Spatial Adaptation (Part III).

Delta Plan on Spatial Adaptation

Under the supervision of the Delta Programme Commissioner, municipalities, district water boards, provinces, and the central government have drawn up a first version of the Delta Plan on Spatial Adaptation. This new Delta Plan is aimed at expediting the transition to a climate-proof and water-resilient living environment, and combating the non-committal nature of the efforts. This is essential in view of the increasing urgency of climate adaptation. The interim evaluation of the Delta Decision on Spatial Adaptation shows that acceleration and intensification are imperative if we want to attain the goal of a climate-proof and water-resilient design by 2050. In this first Plan, the focus is on waterlogging and heat stress, but it also addresses drought and reducing the impact of flooding through spatial planning.

The Delta Plan on Spatial Adaptation reflects the interim goals as set down by the joint governments (see Figure 2). By no later than 2019, all the municipalities, district water boards, provinces, and the central government (including Rijkswaterstaat) will conduct stress tests, in collaboration with the stakeholders, in both urban and rural areas in order to gain insight into the vulnerability to climate extremes. This stress test will be repeated every six years. The central government will take the lead to develop a “standardised” stress test in 2017, in close collaboration with the district water boards, municipalities, providers of existing stress tests, and knowledge institutes such as the Foundation for Applied Water Research STOWA and the RIONED Foundation [umbrella organisation in the field of urban water management and sewer systems]. In addition to the standard components, this stress test will provide sufficient scope for local and regional customisation, considering the location-specific issues and requirements.

On the basis of this analysis of the tasking the governments will set down the ambitions at the local and regional levels. Subsequently, they will draft spatial adaptation strategies and implementation agendas, in consultation with NGOs. The governments will embed the ensuing spatial adaptation ambitions in their policies on the physical living environment, for example, in the Environmental Visions drawn up under the Environment Act.

The Delta Plan comprises an overview of instruments, agreements on the exchange of knowledge, and a nationwide governance framework. The Delta Plan will be reviewed and updated annually. The Delta Plan at hand is a first version. The Delta Programme Commissioner monitors whether its elaboration is given sufficient impetus. His findings will be reflected in the subsequent reviewed Delta Plan.

In 2015, the House of Representatives adopted a motion* requesting the government to develop, in concert with municipalities, district water boards, and other parties a forceful action plan in 2016 to foster urban greening and water storage in the cities. This motion is substantiated with the Delta Plan on Spatial Adaptation. It also accommodates the promotion of private initiatives aimed at urban greening and water retention. This plan thus substantiates another motion* adopted by the House of Representatives. Finally, this Delta Plan substantiates the Visser motion* (July 2016), in which the House of Representatives requests the government to come up with a plan, in consultation with the district water boards and municipalities, that would facilitate a more rapid response in extreme situations in order to minimise the damage.

*** motion Jacobi en Dik-Faber**
Motion submitted by MPs Jacobi and Dik-Faber regarding an Urban Water Management action plan, Parliamentary Document 34300-J no. 22.

*** motion Jacobi en Leenders**
Motion submitted by MPs Jacobi and Leenders regarding financial incentives for private individuals for greening and water retention, Parliamentary Document 34550-J no. 23.

*** Visser motion**
Motion submitted by MP Visser & co regarding a plan for a more rapid response to extreme waterlogging, Parliamentary Document 34436 no. 8.

The concerted governments in the provinces of Noord-Brabant and Limburg have decided to speed up their climate adaptation efforts, in order to be better prepared for climate change (see text box Giving impetus to climate adaptation – Invitation to South-Netherlands in Paragraph 4.8). The approach adopted in the southern part of the country has also been taken into consideration in the drafting of the first Delta Plan on Spatial Adaptation. The Minister of Infrastructure and the Environment has thus substantiated the promise to embrace this initiative, following the Geurts motion* in November 2016.

*** Geurts motion**
Amended motion by MP Geurts regarding the nomination of the Code Orange action plan as a pioneering project Parliamentary Document 34550-J no. 21.

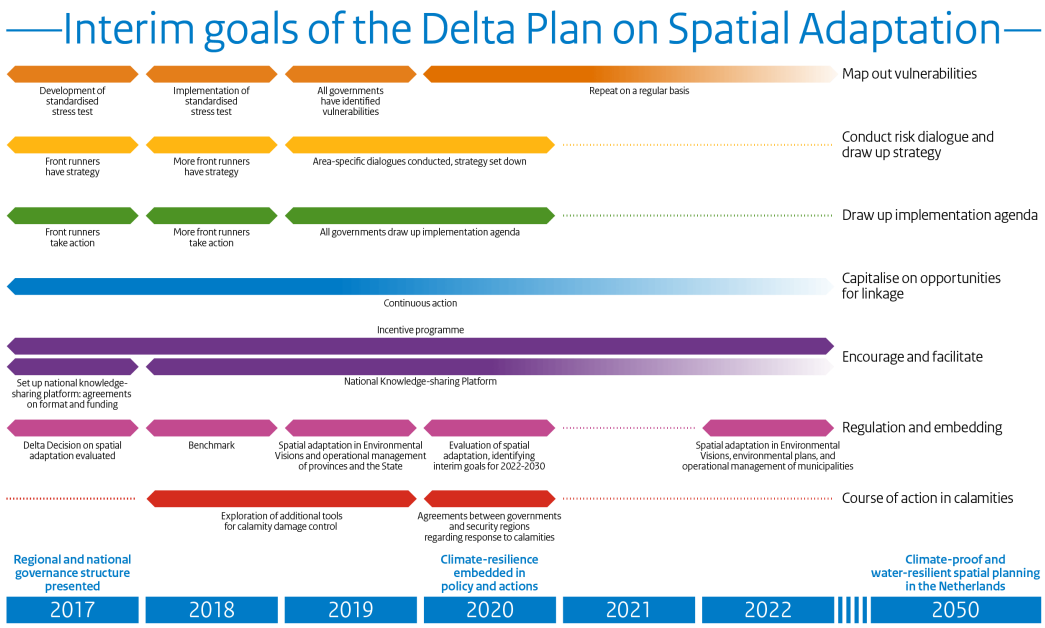


Figure 2
Interim goals

Interim evaluation

The first interim evaluation of the Delta Decision on Spatial Adaptation was completed at the beginning of 2017, earlier than announced in Delta Programme 2015. The evaluation shows the progress made with respect to the transition to climate-proof and water-resilient action among the authorities, and whether the instruments and measures developed will suffice to attain the goals set for 2020 and 2050. The interim evaluation reveals that acceleration and intensification are essential, in order to accomplish the goals set out in the Delta Decision. The evaluation was conducted ahead of schedule, in order to be able to incorporate the results into the Delta Plan on Spatial Adaptation. So they have been.

The evaluation shows that spatial adaptation is still a rather vague concept. There is a need for sharp problem analyses, and clear goals and ambitions for areas such as economic development, health, safety, and liveability. Organisations do not always possess sufficient knowledge, and often lack concrete courses of action. The applicability of expertise and insights from practical examples must be expanded. The regional level is aptly suitable for concretising goals, instruments, and action plans, and for linking climate taskings with other physical taskings. This calls for shared ownership and ambitions at the regional level. The evaluation further shows that the sense of urgency differs considerably from one topic to the next (flood risk management, vital and vulnerable functions, waterlogging, heat, and drought). Large organisations and organisations that have experienced adverse consequences tend to be more active than other organisations. Finally, it appears that parties are exploring insufficient new avenues for ensuring that spatial adaptation will be an integral element of policy and implementation by 2020. The Delta Plan on Spatial Adaptation is taking the results of the evaluation into account. The results will also be used for the National Climate Adaptation Strategy.

Incentive Programme

In 2017, for the third consecutive year, the Incentive Programme initiated various activities and measures to support the transition, as planned. The lessons from the evaluation have been used to shift emphases and intensify some components. For example, a new living lab* was launched in Dordrecht. The Incentive Programme has also actively fostered the performance of stress tests and the embedding of climate adaptation in Environmental Visions. Collaboration with NGOs has been continued, and the first steps have been taken to enter into dialogue with housing corporations. The efforts focused on the second layer of multi-layer flood risk management (spatial planning) have been given impetus under the Incentive Programme, through the follow-up study "Marken boven water II*"[Marken above water II], and a meeting document for policy-makers on spatial design in flood protection taskings and the role of spatial professionals in such taskings. The next step will involve the preparation of an assessment framework for multi-layer flood risk management to support choices for water-resilient spatial planning. The ten impact projects selected in the first and second rounds have been completed. The results were presented during the Spatial Adaptation Network Day in early 2017. In 2017, the five impact projects selected in the third round will be completed. The results and lessons (do's and don'ts) will be available in the knowledge portal (www.ruimtelijkeadaptatie.nl/english), through the Ruimtelijke adaptatie [Spatial adaptation] newsletter, and in theme-based meetings. The knowledge portal was updated in 2017, in response to requirements and suggestions put forth by users; the Climate Impact Atlas was updated with the latest climate scenarios.

*** Marken boven water II**
See text box Cultural heritage and the Delta Programme, this Paragraph 2.4.

*** living lab**
For a description of a living lab, see Paragraph 4.2, under Implementation of spatial adaptation strategy.

Under the Incentive Programme, several studies have been conducted into spatial adaptation in urban areas. Amsterdam University of Applied Sciences has published a research report entitled Het klimaat past ook in uw straatje [The climate, up your alley too]. This report features a climate-proof design for ten typical urban streets. The costs and benefits show that in many cases, a climate-proof design will not be more expensive than a traditional design. Furthermore, a study has been completed into active groundwater management in urban areas, aimed at the prevention of excessively low and high groundwater levels. The Delta Plan on Spatial Adaptation sets out that a new Incentive Programme will be set up for the period 2018-2022.

Within the context of the "Monitoring, Analysing, Acting" system, the Netherlands Environmental Assessment Agency is investigating how spatial adaptation can be monitored, and is exploring experience gained in this field abroad. This study is funded under the Incentive Programme. The project will run until mid-2018.

Sharing knowledge

Knowledge sharing is essential to spatial adaptation, especially with a view to its increasing urgency and because the taskings require a coherent approach. That is why a national knowledge exchange platform is being set up. This platform involves a scale-up of the successful network approach adopted by Amsterdam Rainproof and other successful network initiatives. In 2017, the parties involved exchanged expertise in well attended meetings on topics such as the stress test, environmental visions, tailor-made projects, and guidelines for spatial adaptation. The NKWK* Climate-proof Cities focus area has been publishing knowledge newspapers since March 2017. The first edition revolved around waterlogging. The projects tour* organised by this focus area visited Twente (Climate-active City Partnership), Culemborg, Nijmegen, and Dordrecht. These working visits enabled the participants to share expertise and experience. Since 2017, the www.ruimtelijkeadaptatie.nl/english website has featured various "knowledge clips" (short video films) developed in collaboration with the climate adaptation network of the professional higher education sector. Knowledge has also been disseminated at the Spatial Adaptation Network Day and through the spatial adaptationnewsletter, newspaper and magazine articles, the ROmagazine Stad in het nieuwe klimaat [City in the new climate] special, and the networks of the Climate-proof Cities Alliance and the Climate Adaptation City Deal.*

*** NKWK**
National Water and Climate Knowledge and Innovation Programme.

*** projects tour**
Climate-proof City.

*** Climate Adaptation City Deal.**
See under Participation in this chapter 2.4 Progress in spatial adaptation.

National vital and vulnerable functions

The efforts of the central government to improve the flood protection of the thirteen national, vital and vulnerable functions are on schedule in the purview of the interim goal for 2020: by 2020, the central government must have adopted the required policy and regulations pertaining to the national vital and vulnerable functions. The Derde voortgangsrapportage Aanpak nationale Vitale en Kwetsbare functies [Third progress report on the Approach to national vital and vulnerable functions]outlines the progress made in the period September 2016 to September 2017. The report focuses particular attention on the interconnectivity between the ambition levels for the thirteen functions. The Delta Plan on Spatial Adaptation is utilising the data from this progress report.

The progress report shows that with respect to nuclear plants and laboratories working with infectious substances (including genetically modified organisms), policy and regulations are up to par, as is their implementation. The report points out that there is no uniform standard for a "water-resilient design". It is up to each Ministry to formulate, in consultation with the sector, what is necessary and proportionate for a particular function. The Ministries do keep pace with one another, and largely follow the same time schedule, with the "Analysis, Ambition, Action" steps (see Figure 3). Furthermore, whenever possible they use the same flood scenarios, and they are aware of interdependencies between the functions. For example, this chain dependency means that any power failure during and after a flood will have a major impact on other sectors, such as natural gas, telecom, and IT facilities, the health sector, the water chain, and the chemical sector.

The realistic point of departure that the power will fail in flooded areas has a considerable impact on the ambition levels pertaining to functions that are power-dependent. With respect to other functions, the ambition is to keep operating as best and for as long as possible (drinking water, emergency communication, and health), or prevent major consequences for people and the environment (chemical industry, nuclear plants, and laboratories working with infectious substances). For any areas that are not flooded, the ambition is to keep the national vital and vulnerable functions operational. This also requires measures. The same applies to the ambition of designing the vital and vulnerable functions in a manner that enables the rapid restoration of an area. In deep polders, pumping stations constitute a key factor to this end. However, rapid draining will only make sense if the other vital and vulnerable functions can subsequently be restored rapidly as well. The "backbone" concept seems effective in the purview of restoration, i.e., the basic functions and protection measures required to have a flooded area operational again. An element of this "backbone" is the "continuous" operation of the main pumping station.

The approach to the national vital and vulnerable functions is interrelated with other efforts, such as the Government-wide strategy for vital infrastructure, the National Climate Adaptation Strategy, and the Water and Evacuation project. The interconnectivity between the ambition levels for the thirteen functions* and the local and regional area pilots for vital and vulnerable functions (Westpoort, Botlek, IJssel-Vechtdelta, and Zeeland) has been discussed in a collective consultative group.

*** interconnectivity between the ambition levels for the thirteen functions**
See Background Document D, Derde voortgangsrapportage Aanpak nationale Vitale en Kwetsbare functies [Third progress report on approach to national vital and vulnerable functions], for a first exploration of policy ambitions pertaining to "continued operation in flooded areas" and "accelerated restoration".

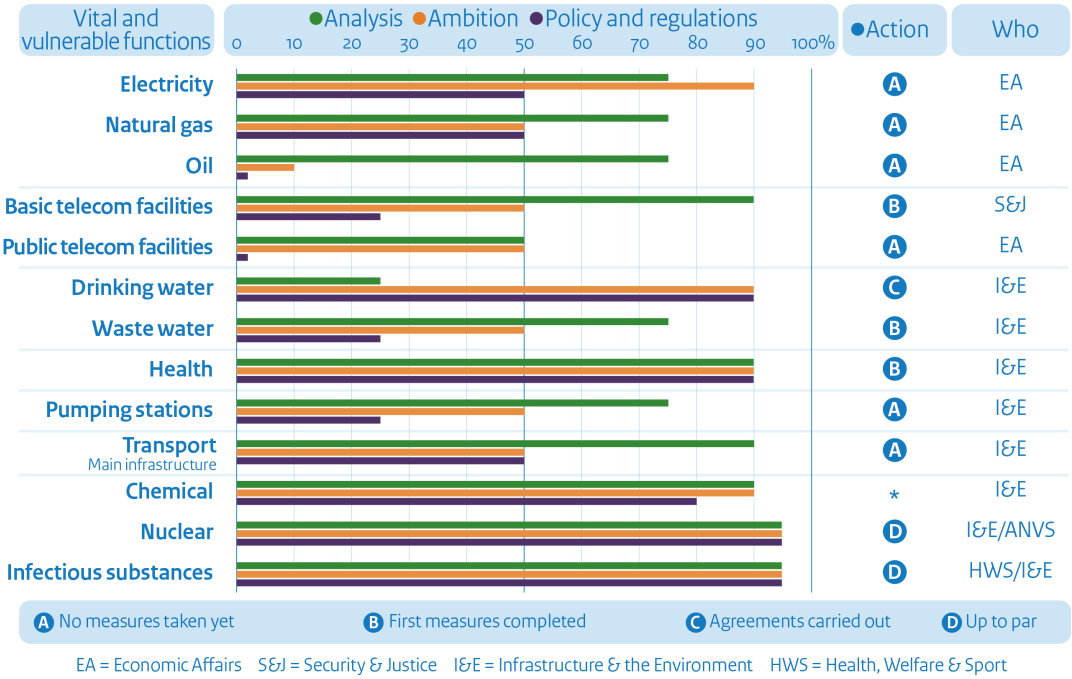


Figure 3
Summary of progress among vital and vulnerable functions with respect to "Analysis, Ambition, Action" steps (situation as of 2017)

* 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.

On track

The interim evaluation presents a picture of the progress made, and compares such progress with what is needed to attain the long-term goals set for 2050. The conclusion is that acceleration and intensification remain essential, despite the many efforts that the parties have already initiated under their own steam. Some stakeholders are still failing to take sufficient action. In addition, the parties lack sufficient expertise and thus fail to develop concrete courses of action. The initiatives rely too much on some committed individuals. Many initiatives are based on current policies related to water, including waste water: as yet, insufficient attention is being paid to additional activities and integration with the strategies to tackle heat, drought, and vital and vulnerable functions. The new Delta Plan on Spatial Adaptation is intended to effect the required acceleration and intensification, and develop a systematic approach within the municipalities.

With respect to vital and vulnerable functions, the interim evaluation concludes that attention among local and regional governments is lagging behind, yet awareness and knowledge of the potential impact of a flood have increased. The sense of urgency has also increased, and the central government has developed "ownership" of the topic.

Integrated approach

An integrated approach, by connecting water and spatial planning, is an inherent component of the Spatial Adaptation Delta Programme. This also extends to the topics of drought and heat. Spatial planning always involves multiple functions, which calls for integrated considerations. It is imperative for climate-proofing to eventually become a standard element in spatial developments, such as the construction of infrastructure, housing, and nature development ("*mainstreaming*").

The Environment Act, that will go into force within a few years, requires the central government, provinces, and municipalities to draw up integrated Environmental Visions, comprising strategic long-term key choices for the physical living environment. It is important for these visions to identify the impact of climate change on the area concerned, and to embed climate-proofing policies. Many provinces and municipalities have already formulated such visions, or are working on them. At the national level, the project brief entitled De opgaven voor de Nationale Omgevingsvisie [The taskings involved in the National Environmental Vision] constitutes the prelude to the Environmental Vision. One of the four strategic taskings identified in this document is a climate-proof and climate-neutral society.

Actual practice already features many examples of an integrated approach to spatial adaptation. In the *Cooling and utilising heat* impact project, the Utrecht region is setting up two business cases in which surface water cooling (to combat heat and improve water quality) is combined with energy transition taskings. Through co-creation with residents, Dordrecht is combining the green-blue Dordtwijk zone with a water storage area, while ideas for climate-adaptive residential neighbourhoods, improved water quality, and nature are elaborated in a *living lab*. Breda is already addressing long-term climate adaptation taskings in long-term projects, such as new developments, restructuring of residential areas, and road construction. The authorities in Rijk van Nijmegen and Land van Meuse en Waal are drawing up a joint Regional Climate Adaptation Strategy.

Cultural heritage and the Delta Programme

The water tasking is a tasking for the future generations. They can draw inspiration from the manner in which previous generations have dealt with water: to them, reckoning with water was a matter of course, as was the utilisation of water for, e.g., land reclamation, energy, and transport. The Handreiking Water, erfgoed en ruimte [Guidelines for Water, heritage, and spatial planning] and the corresponding time line feature concrete examples and show how cultural history can be useful to an integrated approach in taskings involving water.

In the purview of its Visie Erfgoed en Ruimte [Heritage and Spatial Planning Vision], the Cultural Heritage Agency of the Netherlands (RCE) is working on best practices and methods for incorporating cultural history into water-related spatial developments. On account of the preparations for the National Environmental Vision the implementation programme of the Heritage and Spatial Planning Vision has been extended by two years, up to and including 2018. During this period of time the RCE will be focusing on consultation and collaboration with Delta Programme partners in order to disseminate expertise and translate knowledge into practice.

A good example is the study into drainage mill systems in stream valleys, which shows how humans have ingeniously moulded stream valley landscapes to their will, and how such systems operate. From this study, opportunities can be inferred for re-allocating such systems to other purposes, such as combating waterlogging and drought, and improving water quality. The Aa en Meuse district water board will use this study to develop effective ways to use water heritage for water management purposes.

Another example involves the Marken boven water [Marken above water] studies, that have been conducted as a follow-up to the MIRT Study into multi-layer flood risk management on the island of Marken. The studies show how current habitation is interrelated with the island's topography, water management, and cultural history, and explain the options for water-resilient new developments and water-resilient restructuring of existing houses in low-lying parts of the island. These options have been combined with aims in the fields of energy, cultural history, the coping capacity of individual residents, habitation requirements, and affordability. Residents and local entrepreneurs have actively weighed in. Several basic models have been elaborated for houses to be constructed on the (new) docks, in which the primary functions and utility connections are located on the first and second floors. Each house has its own power storage, rain water reservoir, and emergency facilities. For the low-lying existing (private) properties, a long-term strategy has been devised which enables occupants to tackle the water-resilience of their houses themselves. A remarkable fact is that all the old housing locations (docks), even those outside the dykes, remain dry during severe downpours. The historical iconic typology can be used as a source of inspiration for the design of new, contemporary and water-aware houses (on pillars), but also for flood risk management and water storage. The study constitutes an example of an approach in which government authorities reflect on sustainable and water-proof area development together with the residents involved.

Participation

The spatial adaptation goals call for active and broad-based participation within society, primarily at the local level, among municipalities and district water boards. For that reason, government authorities tend to involve businesses, NGOs, knowledge institutes, educational establishments, and residents in the implementation of the Delta Decision on Spatial Adaptation. This also extends to the national level. For example, in 2016 the Red Cross signed the general Declaration of Intent on spatial adaptation. The public and private signatories to this national agreement – approx. 120 in the spring of 2017 – thus voluntarily enter into an obligation to develop implementation agreements in the period leading up to 2020. In addition to the governments, other parties have also contributed to the interim evaluation of the Delta Decision on Spatial Adaptation, among which are the Dutch Association of Insurers, the association of construction and infra companies Bouwend Nederland, the umbrella organisation in the field of urban water management and sewer systems RIONED, a real estate company, and the association of consulting engineers NLengineers. In the spring of 2017, dozens of NGOs participated in the round table discussions on the Delta Plan on Spatial Adaptation.

Representatives of the central government and of regional and local pilots have been involved in the progress report on the Vital and Vulnerable project, in order to discuss its progress and the ambitions. Insurance companies have contributed to a theme-based meeting on insurances in 2017.

In the Climate Adaptation City Deal, fifteen public partners (among which eight municipalities, five district water boards, a province, and the Ministry of Infrastructure and the Environment) are collaborating closely with twelve (semi) private partners on spatial adaptation through an open culture of learning, experimentation, and innovation. The goals are set out in a brochure. The main goal is to foster the 2020 goal of the Delta Decision on Spatial Adaptation: presenting best practices with pilot projects, removing obstacles, learning, and exporting. The partners are focusing on multi-layer flood risk management, climate-resilient area development, nature-based solutions, competency development, social initiatives, and international entrepreneurship. The collaborating partners draw up an annual agenda. This City Deal is a component of the Dutch Urban Agenda. Its lessons to be learned are used as input to the Delta Plan on Spatial Adaptation.

Interventions are launched at various scale levels and by a host of initiators. For example, in the Dordrecht and Breda Sharing City impact projects, municipalities encourage their residents to make their private space available for climate-proofing and water-resilience in order to turn this into a collective social tasking. Dozens of organisations have joined *Operatie Steenbreek*, a project aimed at enthusing residents to green their gardens. Rotterdam has constructed several water squares and other municipalities are following suit. Nursing homes are preparing for increasing heat, as recommended by the health authorities.

Operatie Steenbreek

Operatie Steenbreek is a private initiative aimed at encouraging residents to green their (paved) gardens, by disseminating the benefits of green gardens and identifying opportunities for greening. Residents who green their gardens make a significant contribution to the liveability and climate-resilience of their neighbourhoods: private property accounts for some 40 per cent of the urban area. Greening gardens enhances the biodiversity (more birds, insects, and other animals) and reduces waterlogging during severe downpours. Operatie Steenbreek approaches municipalities who may join for a fee. They are provided with expertise and support to encourage entrepreneurs and residents to initiate greening efforts. Meanwhile, some 40 municipalities have joined, with a potential outreach of four million residents.

2.5 Progress in freshwater supply

The Delta Decision on Freshwater Supply* and the associated Delta Plan on Freshwater Supply are fostering a sufficient freshwater supply in the Netherlands, now and in the future, an attractive living environment, and a strong economic position. All over the Netherlands measures aimed at the efficient use, retention, storage, and supply of fresh water are in progress. A new programme of measures for the period 2022-2028 is being prepared. The freshwater supply regions and the central government are providing clarity regarding the responsibilities by substantiating the Water Availability instrument.* Consultations with major water consumers regarding a more economical use of water are under way. The water managers are working collectively on Smart Water Management, inter alia, with a view to a more efficient distribution of water during water shortages.

*** Delta Decision on Freshwater Supply**
See DP2015, Delta Decision on Freshwater Supply.

*** Water Availability instrument.**
The Water Availability instrument indicates the availability of freshwater and the probability of water shortage in a particular area, in both normal and dry situations.

On schedule

For the schedule of studies, measures, and provisions relating to freshwater supply, refer to the Delta Plan on Freshwater Supply (Part III). The Delta Decision on Freshwater Supply is implemented along three tracks: the Delta Plan on Freshwater Supply, the Water Availability instrument, and the Knowledge Track. The three tracks are on schedule.

Delta Plan on Freshwater Supply

The measures set out in the Delta Plan on Freshwater Supply are being implemented according to schedule. All the freshwater supply regions and Rijkswaterstaat are working on the preparation and implementation of the measures agreed upon. For some measures, an integrated approach has been adopted by linking the freshwater supply tasking to other taskings. In several cases, this has caused some delay. For example, the area development project in Dulf-Mersken and the vicinity is likely to incur a delay of one year, because the required terrain is not yet available. However, the entire set of measures is expected to have been completed by 2021, as scheduled (see Part III, Delta Plan on Freshwater Supply).

The Smart Water Management measure from the Delta Plan is aimed at efficient operational water management using IT and reaching across the management boundaries. New applications to this end, such as lines of reasoning and information screens, have proven their value in recent calamities. Tools to effect a cultural change, such as serious games, also prove effective. Several studies support the introduction of "Smart Water Management", such as the use of a risk-based approach to (fresh) water availability in operational water management.

Interconnectivity with the Delta Plan on Spatial Adaptation and the Environmental Visions* calls for attention. The impact of drought in built-up areas is a point of focus in terms of spatial adaptation. Drought in rural areas is addressed under the freshwater supply strategy. Soil subsidence is considered in the project brief for the National Environmental Vision. The Environmental Visions that the central government, provinces, and municipalities are going to draw up, by virtue of the Environment Act, open up opportunities for incorporating agreements set down under the Water Availability instrument, and link taskings to other social taskings.

*** Environmental Visions**
The central government and the provinces must have environmental visions in place once the Environment Act comes into force. Following its entry into force, the municipalities have a period of five years to draw up environmental visions.

Progress with Water Availability

The first results of the area processes ensuing from the Water Availability instrument are becoming manifest. For example, in the Haarlemmermeer polder, measures have been taken to promote more efficient flushing, with new automated inlet control. The Hollands Noorderkwartier district water control board and farmers are jointly measuring the surface water salt content of the Oostpolder, and the Hunze en Aa's district water board has set up a measuring network to monitor how ceasing to flush will affect the chloride content in Oldambt. The Vitens drinking water company, the association of drinking water companies VEWIN, and the province of Gelderland are conducting initial explorations into the availability of groundwater for the drinking water supply. Vitens is also hooking up with a water availability pilot in the eastern part of the Netherlands. The drinking water companies can use the experience gained in the process to gauge water availability.

The main water system is also making headway on the provision of transparency regarding water availability. In 2016, the Wabes project* produced a map with 150 locations for which the probability of sufficient freshwater will be charted in 2017. To this end, Wabes has subjected the results of the National Water Model to statistical post-processing. In four regional sessions, the regions and consumers have gained an initial picture of the information they may expect from Wabes. In 2016, an intensive dialogue and two rounds of sector and regional meetings have generated the Main Water System Water Availability Dummy 0.1. In 2017, the central government will substantiate this in concert with the regions and consumers. Thus, a joint picture of water availability in the main water system will gradually evolve.

*** Wabes project**
Dutch acronym for water availability of the main system.

In January 2016, the Freshwater Administrative Platform set down semi-annual water availability benchmark dates, in order to be able to monitor and adjust progress in the regions and the main water system. The May 2017 assessment showed that the elaboration of the Water Availability instrument is in full swing. All over the country regional elaborations are being produced. The implementation is thus on schedule, and the first results are becoming manifest. At the behest of consumers, wherever possible the efforts are geared to other taskings and area processes in fields such as climate adaptation, waterlogging, water quality, and the updating of water level ordinances. The perception of problems is not equivocal. Particularly with respect to the major freshwater stocks, such as the IJsselmeer, Hollandsch Diep, and Haringvliet, some of the parties feel less urgency to elaborate the Water Availability instrument. The transition from taking sufficient water for granted to a shared responsibility for water availability is under way, but takes time. The governments concerned will compile a roadmap to explain how water availability is gradually substantiated to a nationwide picture in 2021, in accordance with the Delta Decision on Freshwater Supply. The roadmap also provides insight into the interconnectivity between the agreements on water availability, the updating of the bottleneck analysis, and the national freshwater supply goals, in preparation for the second phase of the Delta Plan on Freshwater Supply (2022-2028). It is important for water availability to be incorporated into environmental policy at all levels. Several regions are already working on that; it still requires further attention.

In the autumn of 2017, the evaluation of the water availability process, instruments, and ambitions will commence. The results will be available in 2018, as set out in Delta Programme 2015, and will be incorporated into Delta Programme 2019. The Delta Decision stipulates that the Water Availability instrument must have been elaborated everywhere by 2021. The benchmarks and the evaluation will prove whether such ambition is feasible. An initial picture of the area-based elaboration will be available in 2018.

Knowledge Track

The Freshwater Supply Knowledge Track is aimed at generating new expertise on the water system, improving model instruments, providing insight into the effectiveness of hydrological and economic measures, and securing knowledge for the review of the freshwater supply strategy. The studies are on schedule.

In 2016, the Rhine-Meuse Estuary System Analysis study (Deltares) and the study into the salt tolerance of agricultural crops (Alterra) generated more insight into salinisation and its impact. The results are now being put to use in the National Water Model, the Agriculture Water Guide, Bottleneck Analysis 2.0, and Smart Water Management. The combination of technical detail studies (e.g., into the Meuse-Waal connection), joint fact-finding processes exploring alternative freshwater supply routes to the western part of the Netherlands, and field tests (such as the innovative climate adaptation pilots) have generated more insight into the effectiveness of freshwater supply measures. The study scheduled for 2017 will provide more in-depth knowledge. Several (knowledge) projects have been launched regarding soil and water improvement, and the interconnectivity of soil and water. This fosters a transition to sustainable agriculture. For example, the long-term research programme Lumbricus provides insight into a climate-resilient soil and water system on the sandy soils. In 2017, the new methods for modelling the probability of water shortage and its hydrological and economic impact will be put to use in, e.g., the Bottleneck Analysis 2.0. In addition, the knowledge on local scale impact will be expanded to the impact at the regional scale.

On track

The Freshwater Supply Delta Programme is on track. Currently, there is no reason for reviewing the preferential strategy. The expectation is that the current and scheduled measures will suffice to realise the goals set out in the preferential strategy properly and in good time. The preferential strategy is reviewed every six years; the next review is scheduled for 2020. The reviews are based on new insights, such as the latest climate scenarios, the impact of external developments, and the Bottleneck Analysis 2.0.

The Adaptive Delta Management Indicators and Threshold Values project focuses on a system that indicates whether a next step in the freshwater supply adaptation path is coming into view. This provides points of departure for timely investment decisions (not too early, not too late). The Bottleneck Analysis that commenced in 2017 also underpins measures scheduled in phase 2 of the Delta Plan on Freshwater Supply (2022-2028).

Integrated approach

An integrated point of view is common practice in freshwater supply measures. The stakeholders in the freshwater supply regions gather various water quality and water quantity goals, respond to climate change, and factor in other interests of consumers. For example, the area processes involving water availability also address issues such as waterlogging, water quality, and climate adaptation. In many cases, water shortage and waterlogging are two sides of the same coin: water availability solutions often also constitute a solution to waterlogging. Increasingly more freshwater supply measures are being linked to spatial adaptation measures, especially those involving drought issues. The provinces of Noord-Holland and Flevoland have set up integrated Soil-Water programmes, in which farmers actively participate in solutions to water quality, water shortage, and waterlogging. The municipalities in Parkstad Limburg have developed ideas and measures to reduce the impact of both drought and waterlogging in the urban area. The joint fact-finding process exploring alternative water supply routes to the western part of the Netherlands also identifies opportunities for other functions and other regions, such as nature in lake Haringvliet.

A topical item is the integration with energy issues. The innovative freshwater-saltwater separation near the Krammer locks is opening up opportunities for the generation and storage of sustainable energy. Such options are also being explored in the remodelling of the Irene locks, if the preferential alternative is a bypass. The Kop van de Betuwe area exploration combines the supply of freshwater with the generation of thermal energy from surface water.

The Declaration of Intent on the Delta Approach to Water Quality and Freshwater Supply, which the governments, NGOs, and knowledge institutes signed at the end of 2016, fosters an integrated approach to the freshwater supply and water quality taskings. This approach, in its turn, constitutes an incentive to the Delta Plan on Agricultural Water Management, which combines water and agriculture taskings.

Participation

In the freshwater supply regions of West-Netherlands, IJsselmeer Region, Elevated Sandy Soils, and Southwest Delta, the agriculture, drinking water, and in most cases, nature sectors also participate in the administrative regional consultative bodies. Entrepreneurs are involved in the regional consultative body of the IJsselmeer Region. (Local) stakeholders are involved in concrete measures. For example, Rijkswaterstaat has set up an intensive process involving all the stakeholders, in order to develop a water level ordinance for the IJsselmeer Region in which all the interests concerned have been taken into consideration. Power grid managers and power suppliers are involved in the plans for the generation and storage of sustainable energy near the Krammer locks.

The participation of municipalities is focused on the water availability process (West-Netherlands, IJsselmeer Region, Southwest Delta). With respect to the Elevated Sandy Soils, the wider involvement of municipalities in water availability is a point of attention. The province of Limburg now actively involves municipalities, along with other water consumers, in the pilots. The East region has drawn up the Realisation Strategy for freshwater supply measures in the eastern part of the Netherlands, aimed in part at expanding the involvement of municipalities and other partners. Linkage of freshwater supply and climate adaptation is likely to open up additional opportunities in this respect. This calls for proper coordination with the Delta Plan on Spatial Adaptation and the existing working units under the Administrative Agreement on Water (water chain). A positive result is that the provincial arrangements for parties that had not yet submitted projects have generated many applications from municipalities (and farmers) in the South region. Several projects will be launched in 2017.

2.6

Embedding, knowledge and innovation, international collaboration

Continue reading

» 2.6.1 Embedding

» 2.6.2 Knowledge

» 2.6.3 Innovation

» 2.6.4 International efforts

2.6.1 Embedding

The central government, provinces, municipalities, and district water boards have incorporated the policy ensuing from the Delta Decisions and preferential strategies proposed in Delta Programme 2015 into their policy and management plans. The central government has done so in the National Water Plan and the Management and Development Plan for the National Waters; the district water boards have done so in their Water Management Plans, and the provinces in their framework visions, Environmental Visions, and provincial water (management) plans. The municipal efforts mainly pertain to policy that ensues from the proposed Delta Decision on Spatial Adaptation. This is embedded into land use zoning plans and municipal sewerage plans, but also into operational plans such as management and maintenance plans.

The Environment Act, that will come into force in a few years' time, requires the central government, provinces, and municipalities to draw up integrated Environmental Visions *, featuring long-term strategic key choices with respect to the physical living environment. These Environmental Visions afford the provinces, municipalities, and district water boards a pre-eminent opportunity for connecting the Delta Programme taskings with other social taskings and vice versa. At the national level, the project brief entitled De opgaven voor de Nationale Omgevingsvisie [The taskings involved in the National Environmental Vision] constitutes the prelude to the National Environmental Vision.

*** Environmental Visions**
The central government and the provinces must have environmental visions in place once the Environment Act comes into force. Following its entry into force, the municipalities have a period of five years to draw up environmental visions.

The Frisian approach

In the province of Fryslân, municipalities, the province, and the district water boards are joining forces in the preparations of the Environmental Visions, which both the municipalities and the province will draw up for their own territories. Rather than a single, collective Environmental Vision, this collaboration will yield jointly formulated "building blocks" for supra-regional taskings. The *mienskip* support group, composed of interest groups, experts, entrepreneurs, and local residents, will be actively involved in drawing up the "building blocks" for physical living environment policy. What sort of Fryslân would you like to live in by 2030? How do we climate-proof Fryslân? How will we address issues such as depopulation? In the Environmental Visions, the answers to such questions are compiled into an integrated vision of the living environment. This is intended to provide more clarity regarding the developments that can be expected and the desired developments, and to increase the scope for customisation and initiatives.

2.6.2 Knowledge

One year ago, the Delta Programme knowledge agenda was revised and updated in its entirety, in order to enable new questions to be addressed. The progress of the study is outlined under the progress per theme (Paragraphs 2.3 to 2.5) and the progress per region (Part II). Knowledge issues that are relevant to the entire Delta Programme, such as the development of the National Water Model and the implementation of the "Monitoring, Analysing, Acting" system, are on schedule. An exploratory study is under way into the options for the financial valuation of an adaptive approach to dyke improvements and river widening.

The Kennisagenda Zoetwater [Freshwater Supply Knowledge Agenda] builds on previous years. Shifts ensued from the knowledge requirements in the policy process, the results of current studies, and the semi-annual meeting of developers and users of expertise on this theme. New emphases involve, inter alia, the applicability of (system) knowledge gained, the use of newly developed model instruments, the contribution of individual measures to the (regional) freshwater supply tasking, and the review of the freshwater supply strategy. The Flood Risk Management Knowledge Agenda sets out new knowledge requirements regarding, e.g., the failure definition of flood defence systems, the piping and macrostability failure mechanisms, the effect of standards on the water system (coast and rivers), waterlogging, spatial design, and adaptive delta management.

National Water and Climate Knowledge and Innovation Programme

Knowledge issues in which collaboration between knowledge institutes, governments, and the private sector is feasible and desirable have been accommodated in the National Water and Climate Knowledge and Innovation Programme (NKWK). In the past year, collaboration has got into its stride, in particular with respect to the themes of Coastal Genesis, Rivers, Climate-proof Cities, Smart Water Management, Markerwadden, models, water and energy, Lumbricus, and flood protection. The NKWK parties are in touch with the Netherlands Organisation for Scientific Research (NWO) regarding a new call for "*living labs in the delta*" in 2018. The annual NKWK conference was held on 11 April 2017.

The preservation and reinforcement of the research capacity for water- and climate-related research is of crucial importance to the Delta Programme. This can be substantiated in several research themes of the National Science Agenda, for example, in the so-called Blue Route ("water as the way to innovative and sustainable growth").

2.6.3 Innovation

The Delta Programme and innovation are of paramount importance to one another. Innovations enable us to realise the ambitious Delta Programme taskings by 2050, and within the Delta Programme, conditions are created that invite innovations.

Many Delta Programme projects generate innovations. The Delta Plan on Flood Risk Management fosters innovative concepts in General Explorations. Several innovations have already been tested in such an exploration and have found their way to application in a dyke, such as the Vertical Sand-tight Geotextile from the Piping exploration, the dyke nailing concepts from the Macrostability exploration, and the dyke cladding methods from the Wadden Sea Dykes exploration. Innovations also materialise outside the Flood Protection Programme. For example, private parties are contributing to the development of knowledge on tidal plants and "energy dykes" (dykes used for the generation of sustainable energy). The reopening of the Flakkee sluice in 2017 opens up opportunities for the development of a tidal technology centre. Private parties are applying for the required permits and grants, have pledged co-funding, and are working on the design of the turbines. Among other things, they intend to test and certify turbines here in terms of fish friendliness. The results can be used for tidal plants or hydro-electric power stations in rivers and estuaries at home and abroad.

Start-ups are also attempting to bring innovations to application. Universities and the Ministry of Infrastructure and the Environment are supporting such start-ups, for example, through the Delta Technology & Water Valorisation Programme set up by Delft University of Technology, and the Making Waves event organised by the Ministry, which was held on the IJsselmeer Closure Dam in September 2017. Concrete successes achieved by start-ups include the Hillblock (innovative dyke cladding), the Tube barrier (mobile flood defence system as an alternative to sandbags), and the Polder rooftop (controlled water storage for the temporary retention of rainwater, to be discharged when the time is right).

2.6.4 International efforts

Climate change, population growth, and water competition are causing ever increasing problems across the globe in terms of flood risk management and water security. From an international perspective, the Netherlands is regarded as a pioneer in the field of water management, which carries a significant responsibility for helping to resolve these issues. The Delta Programme Commissioner, the Special Envoy for International Water Affairs for the Kingdom of the Netherlands, and the Special Envoy for International Climate Affairs are collaborating closely in this respect. The Delta Programme supports other (delta) countries (among which Vietnam, Bangladesh, Myanmar, and the United States) with the expertise amassed in the Netherlands, markets this expertise, and gains new expertise abroad. For example, the Netherlands has contributed to the compilation of the Bangladesh Delta Plan 2100. This national plan comprises regional adaptive strategies, an investment agenda, and proposals for an institutional framework. The Dutch Delta Programme has served as a source of inspiration for this plan. The Bangladesh Delta Plan 2100 is expected to be adopted in 2017. The Dutch government will continue to support the further elaboration and implementation phases.

International Water Ambition

The international water and climate adaptation policies pursued by the Netherlands are set out in the International Water Ambition (2016-2021). In his capacity of theme ambassador, Special Envoy for International Water Affairs for the Kingdom of the NetherlandsHenk Ovink reinforces the Dutch international water ambition, and markets the Dutch expertise and know-how, including the experience gained within the Delta Programme. The Delta Programme contributes in particular the preventative approach, multi-layer flood risk management, climate-resilient cities, and Building with Nature as building blocks for foreign climate adaptation strategies, and collaborates closely with other delta countries. Attention is also paid to international coordination in smaller transnational waters, especially during crisis situations.

Delta Coalition

Since its launch in May 2016, twelve nations have joined the Delta Coalition: Bangladesh, Colombia, Egypt, France, Myanmar, Indonesia, Japan, Mozambique, the Philippines, South Korea, Vietnam, and the Netherlands. Within the Delta Coalition, the countries work together to improve the resilience of deltas and prevent global water issues, by agenda setting, knowledge sharing, and the promotion of practical applications. The Netherlands is one of the co-founders of this platform and would like to exchange its expertise and know-how, including the knowledge from the Delta Programme.

International knowledge development

Together with other knowledge institutes, the Delta Programme is expanding international expertise on deltas. In the Delta Alliance, the Delta Programme works together with Delft University of Technology, Wageningen University and Research Centre / Alterra, UNESCO IHE, and Deltares on the “Delta Approach”, as a contribution to a sustainable and realistic climate adaptation strategy. In the Society for Decision-Making under Deep Uncertainty, experts exchange methodological knowledge on dealing with uncertainties in decision-making processes. In 2017, the UN Environment Programme, Japan, and the Netherlands took the initiative of setting up the Global Centre of Excellence for Adaptation in the Netherlands. This international knowledge network focuses on the development of knowledge on effective climate adaptation methods. The input provided by the Delta Programme pertains in particular to the participatory approach and the administrative organisation.

Climate Treaty

In addition to the adaptation to climate change (climate adaptation), combating climate change (climate mitigation) is of vital importance, in order to avoid “fighting a running battle”. Mitigation and adaptation are, in part, communicating vessels: two sides of the same coin. However, even if mitigation proves successful, the effects of climate change will continue to lag for a long time, which is why adaptation remains imperative. The Paris agreement has radically changed the “climate landscape” by setting distinct long-term goals: climate neutrality, climate resilience, and the required restructuring of investments. The agreement thus focuses on both mitigation (limiting global warming) and adaptation (preparing the country for the consequences of climate change).

In the Netherlands, the Council of Ministers adopted the National Climate Adaptation Strategy 2016 (NAS) on 2 December 2016. The NAS covers the entire scope of climate adaptation and is closely interconnected with the Delta Programme: a major part of the adaptation tasking – the tasking that ensues from waterlogging, heat, drought, and river/coastal flooding – is substantiated by the Delta Programme. The Netherlands also aims to capitalise on the opportunities opened up by climate adaptation, by making expertise on adaptation, water, and safe deltas available to other countries and marketing such expertise. Parties abroad may use this expertise in the realisation of their Intended Nationally Determined Contributions (INDCs), the foundation underpinning the Paris agreement.

3 Delta Fund

Foreshore replenishment near the Westkapelle sea wall

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 status of 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. Text boxes highlight projects with an exceptional financial underpinning.

3.1 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 concrete measures scheduled under the Delta Programme, including the budget allocated (Part III).

Delta Fund budgets

In September 2016, upon the official opening of Parliament, the Rutte II Cabinet presented its response to the inter-ministerial policy study on flexibility in infrastructural planning to the House of Representatives. This announced that the Delta Fund will annually be extended by one year. This intention has now been carried into effect, which means that in 2018, the Delta Fund will run up to 2031 inclusive. With this step, the Cabinet provides certitude regarding the manner in which the budgetary horizon of the Delta Fund will be extended. This secures the future budget for the implementation of the taskings set out in the Delta Programme.

In the period 2018-2031, a sum of some 17 billion euros will be available in the Delta Fund, which brings the annual budget to an average of nearly 1.2 billion euros. This is evident from Table 1, which reflects the itemised and total Delta Fund budgets for the budget year 2018 and the period 2017-2031. Figure 4 reflects the itemised development in the budgets for the years up to and including 2031. New vis-à-vis Delta Programme 2017 is the IJsselmeer Closure Dam project reserve in Item 4, Experiments. This project will be marketed under a DBFM contract. The tender procedure is scheduled to be completed in 2018.

Delta Fund budgets in 2018 and totals, based on the 2018 draft Budget (in millions of euros)

		2018	Total (2018-2031)
Item 1	Flood risk management investments	526,7	6.811,5
Item 2	Freshwater supply investments	21,9	158,5
Item 3	Management, maintenance and replacement	188,8	2.883,4
Item 4	Experiments	47,7	910,3
Item 5	Network-related expenses and other expenditure	294,7	4.176,9
	Investment scope: programme scope	*9,9*	797,1
	Investment scope: policy scope	-	713,9
Item 6	Contribution from other national budgets	-	-
Item 7	Water quality investments	29,6	617,4
Total expenditure under Delta Fund		**1.119,3**	**17.069,2**

Table 1
Delta Fund budgets in 2018 and totals, based on the 2018 draft Budget (in millions of euros)

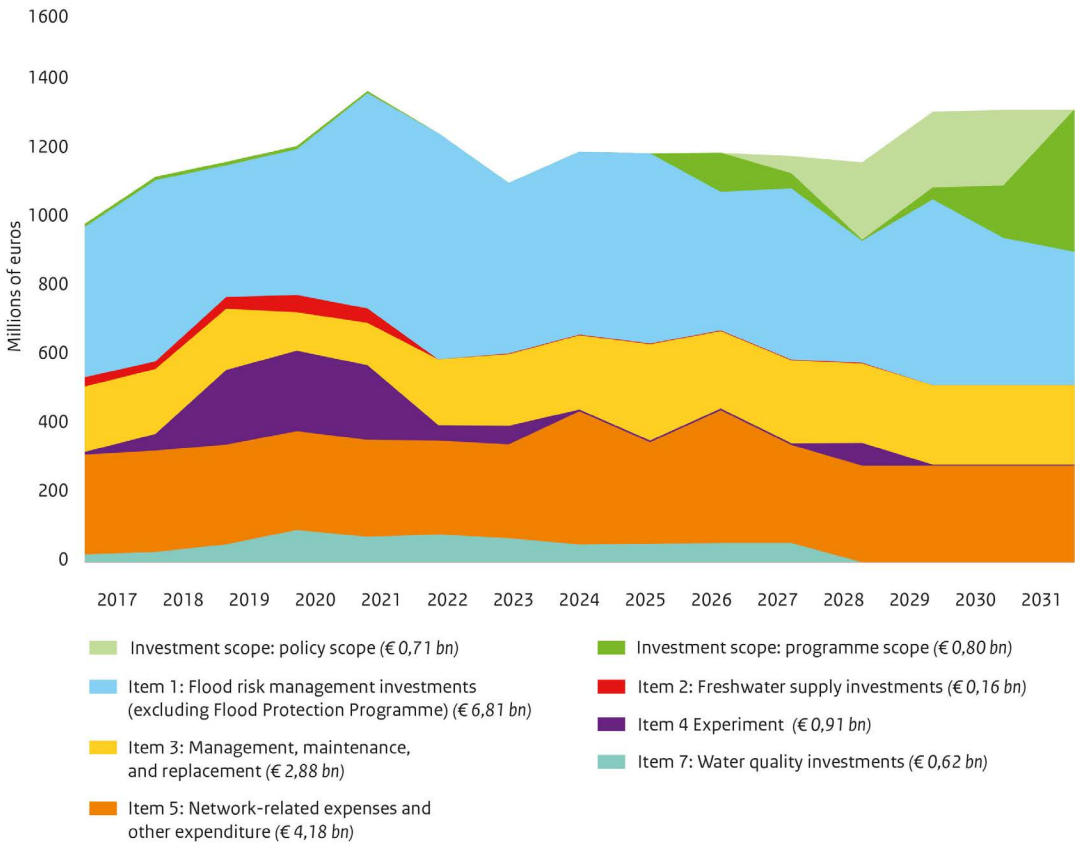


Figure 4
Delta Fund budgets in 2018, per item and totals, based on 2018 draft Budget

Programme scope and policy scope

As a result of the inter-ministerial study into flexibility in infrastructural planning*, the Delta Fund budget for 2018 includes a table reflecting the proportion of the construction budgets (including non-allocated budget available for investment) that the Cabinet deems sufficiently flexible to be taken into account in new plans. This concerns the budgetary scope that has not yet been allocated to a final solution, leaving it free to be allocated to an alternative use or solution. With respect to the Delta Fund, the bulk of this budgetary scope concerns the "non-allocated budget available for investment".

*** infrastructural planning**
See https://www.rijksoverheid.nl/documenten/rapporten/2016/09/20/kabinetsreactie-ibo-flexibiliteit-in-infrastructurele-planning.

Following the extension of the Delta Fund and the budgetary modifications below, the generic non-allocated budget available for investment amounts to 1.5 billion euros. A proportion of this non-allocated budget is kept entirely free at the disposal of future Cabinets. This non-allocated budget is earmarked as policy scope (0.7 billion euros). Scope available to the Cabinet is designated as programme scope (0.8 billion euros, of which 0.4 billion euros set aside for risks in ongoing projects).

This generic non-allocated budget (1.5 billion euros) available for investment is available to the new Cabinet to tackle the priority policy issues related to water. In the years ahead, ongoing efforts such as the assessment based on the new flood risk management standards, the exploration of the long-term river widening ambition, the Delta Plan on freshwater supply, and the Delta Approach on Water Quality and Freshwater Supply will prompt a further and adaptive allocation of these investment resources. For more details, see Paragraph 3.4, Financial security of the Delta Programme.

3.2 Resources from other partners

Delta Programme: integrated approach

The Delta Programme is working on effective, integrated solutions to flood protection and freshwater supply taskings that are of national importance. This year, a concrete delta plan on spatial adaptation will be added. In comprehensive projects, whose scope extends beyond flood risk management and freshwater supply, financial responsibility is usually shared by several Delta Programme partners. This also extends to flood risk management and freshwater supply solutions involving both additional costs and additional benefits. This year, the Delta Programme also features a concrete Delta Plan on spatial adaptation. Non-central governments play a pivotal role in addressing this national tasking.

The integrated approach of the Delta Programme offers opportunities for nature-inclusive solutions to water and nature taskings.

Blue Connection

The Blue Connection is a thirteen kilometre long open watercourse in Rotterdam, Rhoon, and Barendrecht. The watercourse connects the Zuiderpark in Rotterdam, the Zuidelijk Randpark, the Landschapspark Buytenland to be constructed in Rhoon, and the Zuidpolder in Barendrecht. The municipality of Rotterdam and the Hollandse Delta district water board are developing a plan to improve water management, expand recreational facilities, and boost liveability in the surrounding residential areas. One of the building blocks is a link between the Blue Connection and the swimming pool in the Zuidelijk Randpark. This requires the watercourse to intersect the A15 motorway and the Betuwelijn railway; it also requires additional excavation. The parties involved have applied for a government grant for this project. Success factors are the early signing of a covenant by eight regional parties and the link with the expansion of the A15 motorway (through an implementation agreement with Rijkswaterstaat).

The Delta Plans also comprise measures that are fully funded by local governments, such as freshwater supply measures in the regional water system.

District water boards

Under the Water Act, the central government and the district water boards are responsible for funding the improvement of the primary flood defences. In the 2017-2020 period, the aggregate district water boards expect to invest a total of 5.2 billion euros, of which 2.3 billion euros will be for flood defence systems.* A substantial part of this investment is the so-called water authorities' contribution to the improvement of the primary flood defences managed by the district water boards. Over recent years, this contribution has increased to a structural sum of 181 million euros per annum, with effect from 2015 (see Delta Plan on Flood Risk Management).

*** flood defence systems.**
Source: ABF Research, WAVES- Financial data of the district water board budgets.

The investments by the district water boards mainly concern the long term. The expenditure involved is not directly charged to residents but rather divided over several years, similarly to the approach used by the other government authorities (apart from the central government). Expenditures on water management will total 2.7 billion euros in 2017, i.e., a 1.8% increase vis-à-vis 2016.

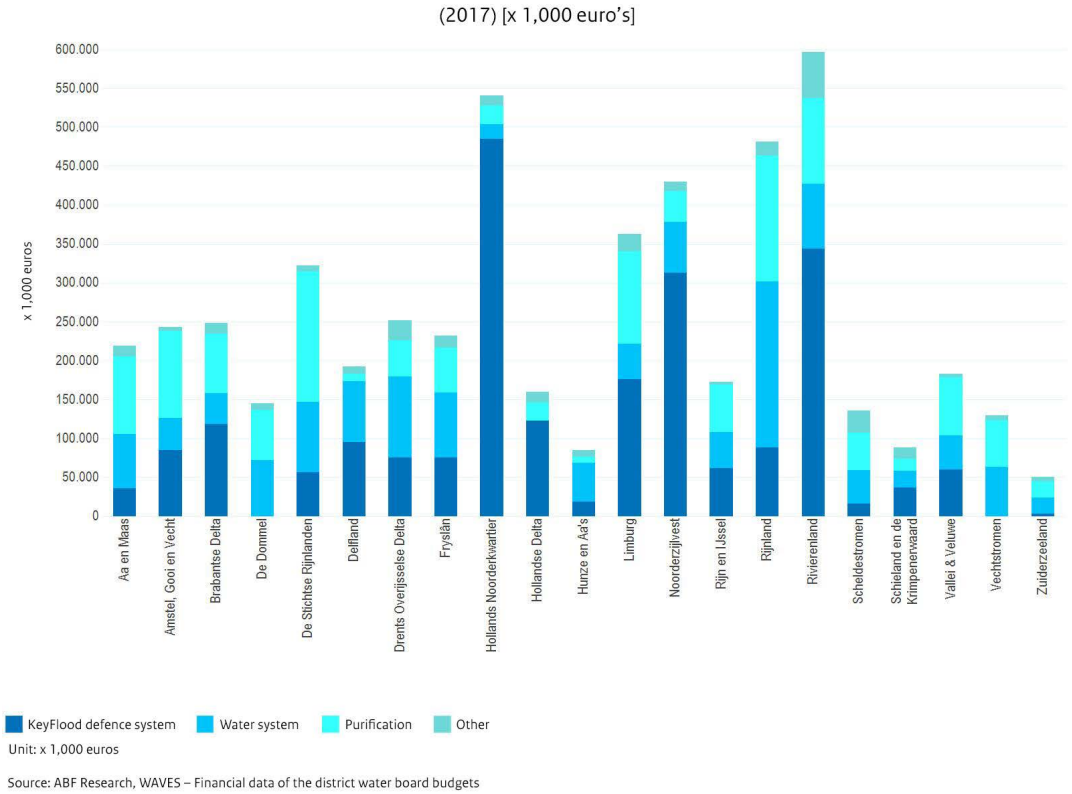


Figure 5
Investments by district water boards 2017-2020

Total district water board expenditure for 2017 is estimated at 2.7 billion euros. Of this amount, 39% pertains to the construction and operation of waste water purification plants, 28% involves the development and management of the water system, 13% is used for the construction and maintenance of flood defence systems, and 19% goes to the other policy domains. Spending on the construction and maintenance of flood defence systems accounts for a relatively minor part of total expenditure, yet this share has risen due to the water authorities' contribution to the Flood Protection Programme: from 5% in 2011 to 13% in 2017.*

*** from 5% in 2011 to 13% in 2017.**
Source: https://www.waterschapsspiegel.nl/belastingen/kosten-van-het-waterschapswerk/.
See www.destaatvanonswater.nl/financien-en-doelmatigheidswinst for a comparison with 2010 en 2016.

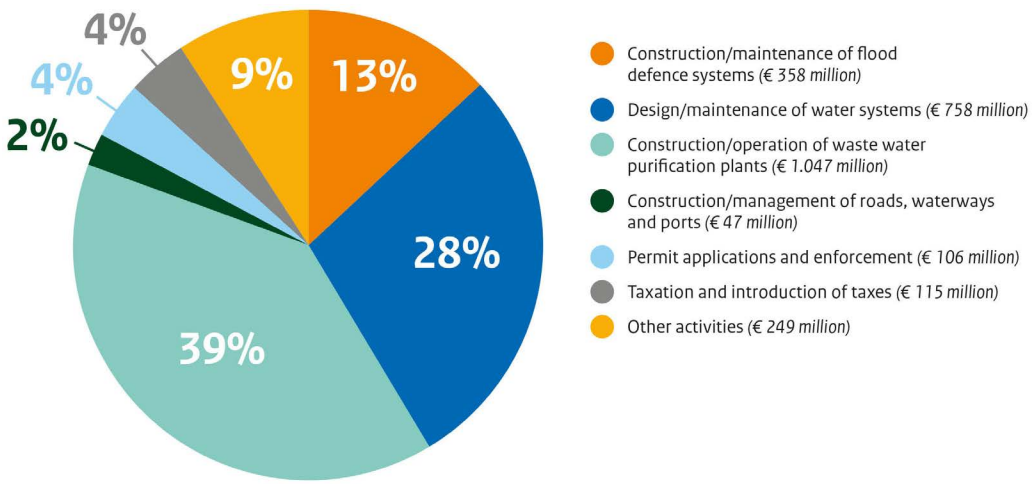


Figure 6
Operating costs 2017 by policy field

Provinces, municipalities, and NGOs

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 measures. The provincial efforts are mainly focused on linking the various regional taskings to the Delta Programme taskings, and the supervision of water availability. The scope of the commitment – in terms of staff and funding – differs from one region to the next; it is dictated by the provincial interests at stake in a particular region.

Various provinces, among which are Gelderland and Noord-Brabant, are contributing staff and process funds to the realisation of the Delta Decision on Flood Risk Management. The provinces are also participating in various implementation projects, for example, by linking other taskings to the flood protection tasking. Cases in point are Groningen (dyke improvement with opportunities for nature), Zeeland, Utrecht, Gelderland, and Zuid-Holland (where the provinces are pro-actively looking for opportunities to link dyke improvements to other spatial taskings such as urban development, leisure activities, nature, and cultural history). The provinces of Gelderland, Noord-Brabant, Overijssel, Zuid-Holland, and Limburg are involved in the Rhine and Meuse programmes.

All the provinces are actively participating in the freshwater supply regions, in which the central government, district water boards, provinces, and NGOs are collaborating on the implementation of the Delta Decision on Freshwater Supply. For example, the province of Zuid-Holland bears responsibility for the national working group on water availability, and plays a coordinating role in the freshwater supply region of West-Netherlands. The province of Noord-Brabant has set up a subsidy scheme for projects that lead to water savings. The province of Flevoland is committed to the Flevoland Soil and Water Action Plan, comprising projects to expand the water storage capacity of the soil.

Spatial adaptation is another topic in which the provinces play a part. The provinces are responsible for drawing up regional water plans, and setting down standards for waterlogging in their regulations. The provinces engage in spatial adaptation in other ways as well. For example, the province of Utrecht is exploring how projects initiated in that province can contribute to the climate adaptation of public space. The province of Zeeland is working on the water resilience of its vital and vulnerable functions. The province of Zuid-Holland has published a climate atlas that presents all the information on the impact of climate change and soil subsidence in story maps, to support policy and administrative decisions. The province of Gelderland has also compiled a climate atlas.

Municipalities

In 2015, the municipalities spent 1.56 billion euros on urban water management, i.e., an average of 92 euros per resident. This is not the amount paid by each resident, as businesses also contribute and the costs differ from one municipality to the next. The municipalities spend approximately one-third of this sum 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). This is in addition to the municipal investments in, e.g., sewering (650 million euros per annum) and combating waterlogging due to rising groundwater levels (an increase of more than 20% to 36 million euros per annum). 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.

Self-realisation of Grensmaas

The Grensmaas project is a large river project in the province of Limburg. The work covers a 43 kilometre stretch between Maastricht and Echt-Susteren. The project is carried out by the Grensmaas Consortium and increases flood protection along the Meuse. Widening the Meuse channel and lowering the banks will reduce flood risk by a factor of five. Furthermore, Zuid-Limburg will have a new nature reserve along the river, covering some 1000 hectares. The work commenced in 2008 in Itteren. The Borgharen and Geulle aan de Meuse locations have already been completed.

The implementation of this project is quite remarkable. The Grensmaas Consortium is carrying out the work at its own expense and risk. In this so-called self-realisation project, the government is a partner rather than a principal. The province, Rijkswaterstaat, and the Ministry of Infrastructure and the Environment (united into Rijkswaterstaat Meuse Projects) monitor the Consortium's observance of the agreements set down in the implementation contract signed in 2005. The river widening and nature development project, costing some 550 million euros, is largely paid for from the proceeds of some 54 million tons of gravel and 10 million tons of sand. Many remarkable archaeological remains have been found in the area. The Grensmaas Consortium has funded the archaeological research and provides the locations with cultural-historical information through walking and cycling routes and an information centre.

3.3 The financial taskings of the Delta Programme

DP2015 contained an initial indication of the costs of the Delta Programme up to and including 2050. The taskings have been estimated at approx. 20 billion euros + PM; by far the largest proportion of this sum pertains to investments in flood risk management. The PM item in the cost estimate consisted of a non-specific reserve for other projects, additional management and maintenance costs ensuing from increased acreage and risks. Based on further analyses, the risk reserve in DP2016 has been raised by 5 billion euros; the anticipated costs item has been raised by some 1 billion euros. The implementation of the Delta Programme up to and including 2050 is thus costed at 26 billion euros +/- 50%, a realistic bandwidth at this stage of the programme (see DP2016). This estimate still holds good.* The cost estimate for the implementation of the Delta Programme will be revised following the adoption of the long-term ambition for the Rivers.*

*** This estimate still holds good.**
See DP2016, 5.4 The financial tasking of the Delta Programme.

*** long-term ambition for the Rivers.**
See Paragraph 2.3 Progress in flood risk management.

3.4 Financial security of the Delta Programme

The Delta Fund constitutes the financial foundation of the Delta Programme. It is essential for the future flood protection of our country and to secure a sufficient supply of freshwater. With its decision to annually extrapolate the Delta Fund by another year, with effect from the 2018 budget, the Cabinet provides clarity regarding its annual new investment scope. This also reinforces the foundation underpinning the Delta Programme. Assuming that the Delta Fund is annually extrapolated by 1.3 billion euros will give an indication of the sum available in the 2032-2050 period for the implementation of the Delta Programme.

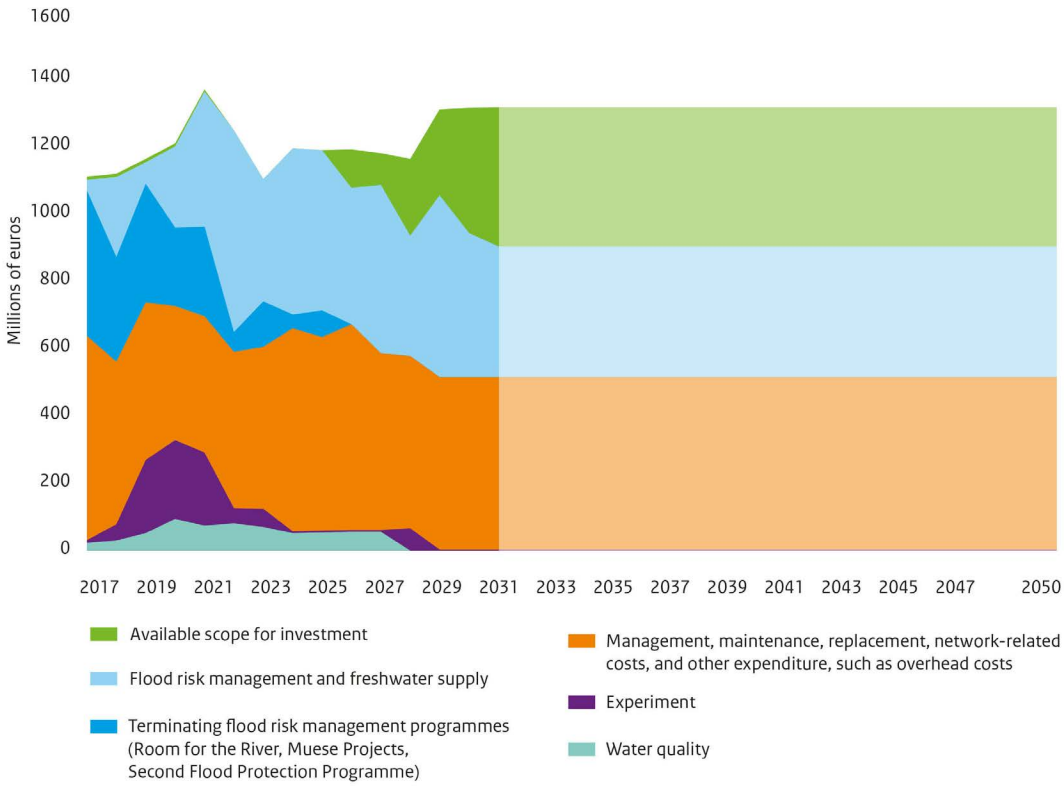


Figure 7
Tentative extrapolation of the Delta Fund

The tentative extrapolation in Figure 7 is based on the year 2031. 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 2031. A "flat" extrapolation shows that out of the approx. 1.3 billion euros going around annually in the Delta Fund in the period from 2032 to 2050, an annual sum of approx. 0.5 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, including the series available / earmarked for new flood protection measures by the district water boards), an annual sum of approx. 0.8 billion euros will be available in the period 2032-2050. The investment budget available in the period 2032-2050 would thus amount to more than 15.2 billion euros. This means that, from the first implementation of the Delta Programme up to and including 2050, a total sum of some 23 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.

In the purview of the financial security of the Delta Programme, the Delta Programme Commissioner has prepared three recommendations to ensure that the projects can continue to make sufficient headway. These recommendations have been set down in a separate cover letter to DP2018.

Part II
Regions

4 Progress per region

Reevediep recreational craft locks

4.1 IJsselmeer Region/freshwater supply region IJsselmeer Region

The essence of the Delta Decision on the IJsselmeer Region* is twofold: maintenance of the average winter level up to 2050 in the purview of flood risk management, and enforcing flexible water level management in the purview of the freshwater supply. In terms of flood risk management, the preferential strategy sets out two operational measures: drainage by gravity if possible, and pumping if need be. The preferential strategy also encompasses dyke improvements. Increasing attention is paid to linkage with other social functions and interests. Furthermore, spatial measures are being prepared for the IJssel-Vecht delta to raise its flood protection. Disaster management is boosted and requires additional efforts, in particular in the field of interprovincial evacuation strategies.

*** Delta Decision on the IJsselmeer Region**
See DP2015, Preferential strategy IJsselmeer Region.

Implementation of flood risk management strategy

On schedule

The implementation of the Delta Decision and the preferential strategy is on schedule. The placement of pumps in the IJsselmeer Closure Dam to expand the discharge capacity – a component of the IJsselmeer Closure Dam Project – will be contracted out in 2018. The contractor will be required to have the additional discharge capacity operational by no later than 2022. The final water level ordinance for the IJsselmeer Region, which sets out flexible water level management, is expected to come into force in early 2018. The pumps and the water level ordinance are essential elements of the Delta Decision on the IJsselmeer Region.

The MIRT Studies into multi-layer flood risk management in the IJssel-Vecht delta and Marken were completed in 2014/2015. In 2016, the outcomes were translated into a comprehensive implementation strategy for the IJssel-Vecht delta, aimed at improving the coherence between dyke improvement, spatial planning, and disaster management. With respect to Marken, dyke improvement (layer 1) turned out to be the most cost-effective measure in terms of flood risk management. The MIRT exploration concerning the Marken dyke improvement has meanwhile resulted in a basic choice for a dyke improvement variant; the plan elaboration is in progress. As a result of the MIRT Study into multi-layer flood risk management at the island of Marken, disaster management measures (layer 3) were elaborated and implemented in 2016. Subsequent steps are scheduled for 2017. A further elaboration of layer 2 measures should reveal whether such measures are appropriate for Marken in the longer run.

The improvement of the Houtrib dyke and the Markermeer dyke between Hoorn and Amsterdam (Delta Plan on Flood Risk Management) is a key precondition for flood risk management in the IJsselmeer Region. The projects are scheduled to be completed by no later than 2022. The improvement of the IJsselmeer Closure Dam (IJsselmeer Closure Dam Project) is also on schedule and will be completed in 2022 as well. All in all, a stretch of 88 kilometres of primary flood defence systems will thus have been improved.

In early 2017, the Hollands Noorderkwartier district water control board, the province of Noord-Holland, and the Ministry of Infrastructure and the Environment decided to postpone the public review period for the Water Act Project Plan and the other planning documents concerning the Markermeer dyke, in order to allow more time for the completion of the participation procedures in Uitdam and Durgerdam. At the behest of the governments concerned and other stakeholders, the Delta Programme Commissioner has set down recommendations regarding the Uitdam dyke improvement, based on an open and transparent process (cf. box Coordinating role for Delta Programme Commissioner in Markermeerdijken-Uitdam dyke improvement, Paragraph 2.2.4). A separate Water Act Draft Project Plan will be drawn up for Durgerdam. At the request of the authorities concerned, the participation process in Durgerdam has been extended to September 2018 in order to be able also to consider other spatial ambitions and wishes in addition to the flood risk management tasking.

On track

Currently, there is no need for a reconsideration of either the Delta Decision or the preferential strategy. The additional discharge capacity in the sluice complex near Den Oever (installation of pumps) is scheduled to become available at the end of 2022. This will provide Rijkswaterstaat with an additional operational measure, along with drainage by gravity.

Rijkswaterstaat is mapping out the effectiveness of the combination of drainage by gravity and pumping by means of long-term water level measurements. Such measurements will indicate whether the chosen preferential strategy requires adjustment. The external developments being explored by the Delta Programme Signal Group will also be taken into consideration.

The Integrated Study into Flood Risk Management and Water Level Management (abbreviated to ISWP in Dutch) is intended to gain more insight into the interconnectivity between water discharge, flood risk management, and water level management in the IJsselmeer Region. In early 2017, the study generated coherent water level management strategies for the period beyond 2050 and a methodology for analysing these strategies (phase 2). Phase 3 will involve the refining and expansion of the methodology, and a further analysis of the strategies. The study is progressing as scheduled.

Integrated approach

Comprehensive regional and local cooperatives are developing in the IJsselmeer Region. The Delta Programme has intensified the collaboration between governments, water managers, NGOs, and the business community in the IJssel-Vecht delta, Amsterdam-Westpoort, and on the island of Marken. Such collaboration involves, e.g., the exchange of knowledge on water, spatial planning, and climate change, and the exploration of combined solutions to spatial planning and the regional economy. The IJsselmeer Region is too vast to warrant effective cooperatives for the entire area.

The attention to linkage opportunities with dyke improvements has yielded various integrated solutions, such as a city beach near Hoorn, a cycle path on the Hoorn-Amsterdam dyke, the “soft” improvement of the Houtrib dyke, a small surf beach near Lelystad, and a fish migration river near the IJsselmeer Closure Dam. To preserve the traditional Spakenburg portscape, the district water board has opted for a flexible flood defence system to substantiate the flood risk management tasking near Spakenburg: when the flood comes in, a wall emerges that under normal conditions remains concealed in the quay.

In 2016, the central government and the provinces organised regional dialogues concerning the spatial interconnectivity between themes such as climate adaptation, energy transition, and nature. These discussions are used to underpin the Regional Agenda for the IJsselmeer Region 2050: a comprehensive perspective featuring an adaptive implementation agenda as well as a knowledge and innovation agenda.

The Security Regions, that play a pivotal role in disaster management, are working on contingency management on the basis of national agreements. They have organised extensive evacuation drills on the island of Marken (2016) and in the IJssel-Vecht delta (2017). The Marken drill has shown that collaboration between the Security Regions in times of calamity merits intensification.

Participation

In the purview of identifying linkage opportunities in dyke improvements in the IJsselmeer Region, several meetings are organised for the annual consultation on the Flood Protection Programme. The meetings are held in various parts of the region in order to accommodate the diversity of issues and of the stakeholders.

In the IJsselmeer Region, participation among stakeholders is mainly established in the projects. The participation of residents, nature and landscape organisations, and local authorities is running smoothly. However, involving the business community remains a challenge. The business community is, however, participating in various private initiatives revolving around the IJsselmeer Closure Dam improvement tasking.

In Amsterdam-Westpoort and the IJssel-Vecht delta, the governments are pursuing future-proof solutions in layers 2 and 3, in consultation with the business community. The MIRT Study into multi-layer flood risk management on Marken has afforded residents the opportunity to weigh in.

Implementation of freshwater supply strategy (IJsselmeer Region freshwater supply region)

The preferential strategy for freshwater supply* in the IJsselmeer Region comprises a coherent set of measures involving the main water system (flexible water level management), the regional water systems (optimisation), and consumers (more economical use of water), in order to keep the freshwater supply in the IJsselmeer Region up to par.

*** preferential strategy for freshwater supply**
See DP2015, preferential strategy for the freshwater supply in the IJsselmeer Region.

On schedule

The introduction of a flexible water level is on schedule. Once the new water level ordinance* becomes available in early 2018 and the required permits have been issued, flexible water level management will be legally possible. Prior to the introduction, Rijkswaterstaat and the district water boards will field-test the new information and decision systems, including by serious gaming, and draw up protocols for operational water level management in the main water system and the regional water systems.

*** new water level ordinance**
See Paragraph 4.1, under Implementation of flood risk management strategy, On schedule.

The Administrative Agreement of the IJsselmeer Region freshwater supply region comprises various programmes and measures. Most of them are on schedule, such as the Spaarwater [Water Saving] project (which spans four of the five provinces), the Dwarsdiep project, and the Optimalisatie Inlaten [Inlet Optimisation] project. In 2018, the interim results of Spaarwater 2 will become available. Several projects have sustained delays. The area development project Dulf-Mersken and vicinity is likely to incur a delay of one year, because required terrain is not yet available. Several projects initiated within the testing ground of the Hunze en Aa's and Noorderzijlvest district water boards have been awarded grants from the European Rural Development Programme and can commence.

Water availability is addressed in all the sub-regions, but not all the organisations have made equal headway. The urgency is not felt equally strongly everywhere. In some cases, organisations are holding off their assessment of water availability in order to be able to link up with other area processes.

On track

As yet, there is no reason to adjust goals or measures.

Change in water demand

The advent of a new Google data centre in the Eems harbour has raised the demand for (cooling) water from the IJsselmeer lake. The district water board and the province are in touch with Google with a view to minimising water demand. The bottleneck analysis will show whether this situation will affect the preferential strategy.

Integrated approach

Many freshwater supply projects are of an integrated nature. The provinces of Noord-Holland and Flevoland have set up integrated soil-water programmes in which the province, the district water board, and farmers are working on solutions to water quality, water shortage, and waterlogging. Throughout the region, stakeholders are integrating water availability programmes with programmes initiated under the Framework Directive on Water and projects addressing waterlogging. In the northern provinces, the Regional Consultation Committee has integrated with the freshwater supply administrative consultative body.

Another topic that commands attention is the economy: extensive economic analyses are conducted in the Spaarwater [Water Saving], Gouden Gronden [Golden Soils], and Optimalisatie Inlaten [Inlet Optimisation] projects. In 2017, the Waternet water company will conduct a pilot involving the use of brackish seepage water to produce drinking water. This will obviate the need for flushing brackish seepage water with an excessive volume of Markermeer water.

Participation

Governments and consumers are participating in virtually all the freshwater supply programmes. The Dutch Federation of Agriculture and Horticulture LTO and the Groningen Water Company sit on the Administrative Consultatative Body for the IJsselmeer Region Freshwater Supply Region. LTO administrators, drinking water companies, entrepreneurs, and other stakeholders have joined forces in the IJsselmeer Region Regional Consultation Committee and signed the IJsselmeer Region Pact, with the intention of working on measures relating to flood risk management, freshwater supply, and spatial adaptation together with the authorities concerned. Such efforts are already under way in several freshwater supply projects. Consumers are also participating in the water availability pilots (agriculture, nature, municipalities).

In the purview of the new IJsselmeer Region water level ordinance, Rijkswaterstaat has organised an intensive process involving all the stakeholders in order to develop a decision that best serves all interests. Water managers and consumers are also actively weighing in on the operationalisation of the water level ordinance and Smart Water Management.

Implementation of spatial adaptation strategy

The Flood-proof Westpoort adaptation strategy, focused on vital infrastructure and vulnerable functions, was completed in 2017. Its implementation is expected to commence in 2018. Westpoort (west of Amsterdam) is the largest petrol and cocoa port in the world. It accommodates several crucial facilities for the city and the region, such as infrastructure for the distribution of power to the city and a kerosene pipe to Schiphol Airport. Westpoort is situated above average sea level, but a flood may nonetheless have far-reaching consequences for the region. The pilot and the climate stress test have shown that tackling these flood risks can be linked to tackling waterlogging following severe precipitation. This is also important in the communication with businesses. Entrepreneurs appreciate the identification of flood risks in discussions about measures to combat waterlogging. The municipal authorities are making a case for linking waterlogging and flood risks to national vital and vulnerable functions policy, and have adopted this approach in their own projects. Drought is not an issue in Westpoort and the climate stress test has not identified any opportunities for linkage with heat stress measures.

In the Overijssel Living Lab, Zwolle, Kampen, Zwartewaterland, the Drents Overijsselse Delta district water board, the IJsselland Security Region, and the province of Overijssel are collaborating on a flood-proof and climate-resilient IJssel-Vecht delta, including the protection of vital and vulnerable infrastructure. The parties are gaining experience by carrying out projects. The pragmatic approach has yielded various lessons to be learnt: take an extra good look at the functions over which the government has authority, either directly or through shareholdership; feed awareness and the sense of responsibility in the managing authorities of the vital and vulnerable infrastructure (this leads to commitment); and do not stop after a few years, but continue to work on this. In the new Environmental Vision, the province of Overijssel sets out the outlines of a water-resilient design and translates these into the environmental regulations. This commitment ties in with the ambition of being among the first provinces to realise a climate-adaptive design.

4.2

Rhine Estuary-Drechtsteden/West-Netherlands freshwater supply region

Implementation of flood risk management strategy

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 can raise the safety level, for example, by smart combinations* at the Eiland van Dordrecht. 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.

*** preferential strategy for flood risk management in the Rhine Estuary-Drechtsteden area**
See DP2015, Preferential strategy Rhine Estuary-Drechtsteden.

*** smart combinations**
See DP2015, p. 66, Multi-layer flood risk management.

On schedule

The implementation agenda of the Rhine Estuary-Drechtsteden area features various measures and studies, virtually all of which are running as planned. The paragraphs below reflect the progress made with respect to several measures.

The dyke improvements scheduled for the Rhine Estuary-Drechtsteden region under the Flood Protection Programme are on schedule. The Capelle and Moordrecht dyke improvements have been completed. With a lead time of 5.5 years, from exploration to realisation, the Moordrecht project is one of the fastest completed dyke improvements in the Netherlands. For the other Hollandse IJssel bank, an exploratory study has been launched: the Krachtige IJsseldijken Krimpenerwaard [Krimpenerwaard Strong IJssel dykes] exploration. The ongoing Kinderdijk-Schoonhovenseveer dyke improvement project won both the InfraTech Innovation award and the Cobouw public award in 2016.

The study into reduction of the probability of failure and the partial closure of the Maeslant storm surge barrier has generated insights to raise the flood protection level of the Rhine Estuary-Drechtsteden area. Partial operation of the Maeslant storm surge barrier, by closing one of the two sector doors, turns out to be technically feasible. In addition, technical improvement measures relating to the barrier itself have been explored. Within the Rhine Estuary-Drechtsteden Delta Programme, Rijkswaterstaat is exploring which measures can be implemented in interconnection with the dyke safety task for 2028. Such measures will improve mid-term flood protection and do not impact the decision on the Locks Plan (Geurts motion). The Locks Plan option will be considered in the study as a fully-fledged alternative, if the rising sea level dictates replacement of the Maeslant storm surge barrier (this study is expected to commence around 2040.)

A component of the Delta Decision on the Rhine-Meuse delta is that in 2017, the central government will decide, in consultation with the provinces and district water boards, whether or not the option of changing the discharge distribution among the Rhine tributaries after 2050 will remain open. The study into the benefit and necessity of this option is taking longer than planned (see Paragraph 4.3 Rhine). The Rhine Estuary-Drechtsteden Regional Consultative Body and the Rhine Administrative Platform are involved and provide input wherever required.

The Schieland en de Krimpenerwaard district water control board launched the Voorlanden [Forelands] General Exploration in 2016. The outcomes are relevant to the Rhine Estuary-Drechtsteden area, Rhine, Meuse, IJsselmeer Region, and Wadden Region.

The MIRT Study into the operationalisation of the strategy to enhance the coping capacity of Eiland van Dordrecht (follow-up to the MIRT Study into multi-layer flood risk management around Dordrecht) will be completed in 2017. Subsequently, the administrative bodies concerned will decide whether a smart combination with compartmentalisation dykes (inner dykes) can be an alternative to improving the primary flood defence systems. The MIRT Study concerning Alblasserwaard-Vijfheerenlanden was completed in 2016. The regional parties involved are continuing their collaboration and elaborating potential linkage opportunities, in anticipation of the dyke improvements required up to 2050. In this context, they are also exploring whether multi-layer flood risk management will open up additional opportunities.

The Rotterdam-Noord Disaster Management case study generated an improvement strategy for crisis plans in 2016, with tailored solutions for evacuation (vertical evacuation in most cases, in some cases supplemented with horizontal evacuation), risk zoning with specific courses of action for each zone, and enhancing individual and collective coping capacities. In the first half of 2017, the district water boards, municipalities, Rijkswaterstaat, and the Security Region will decide on the follow-up to this strategy. In addition, the Security Regions are working on the ambitions set out in the Water and Evacuation project.

The four pilot projects relating to the flood risk management of (unprotected) areas outside the dykes (Noordereiland/Kop van Feijenoord, Dordrecht historic port area, Merwe-Vierhavens, and Botlek flood protection) were completed in early 2017. The projects have generated information on flood risks outside the dykes as well as potential adaptation strategies and measures. The municipality of Rotterdam will use this information as the basis for drawing up, in collaboration with the stakeholders, the regional strategic adaptation agenda for areas outside the dykes.

On track

Currently, there is no reason for reconsidering the preferential strategy. The expectation is that the ongoing measures and the measures scheduled under the preferential strategy will enable attainment of the goals, properly and in good time. As per agreement, the preferential strategies will be reviewed every six years. The first review will take place in 2020. The Delta Programme Signal Group will map out the external developments that could constitute reason for readjusting the strategies. In order to provide substantive input to this process and initiate a timely discussion within the region on the course of the preferential strategy, Rhine Estuary-Drechtsteden will be monitoring the developments in the area, such as regional economic developments. The first assessment of the dykes under the new standards will also be factored in.

Integrated approach

The Delta Programme has fostered closer collaboration among governments, NGOs, and the business community. Knowledge is exchanged about issues such as water, spatial planning, and climate change, as are combined solutions to spatial planning and the regional economy.

In November 2016, the district water boards and the Rhine Estuary-Drechtsteden Delta Programme organised a meeting on connecting spatial planning and water, within the context of the annual consultations on the Flood Protection Programme. This meeting has generated an overview of potential linkage opportunities in the scheduled dyke improvements. The Water-Spatial Planning Evaluation shows that the collaboratives in the region are successful in connecting water and spatial planning. The evaluation has also generated several points for attention in this respect.

The Alblasserwaard-Vijfheerenlanden MIRT Study shows how flood risk management can be connected to the cultural-historical identity, spatial quality, and economic strength of the area. To address the taskings along the Hollandsche IJssel, the region has conducted a comprehensive exploration by examining the role of the Hollandsche IJssel storm surge barrier, dykes, and forelands in interconnection. Attention has also been paid to linkage opportunities, such as improving access to the Krimpenerwaard. The parties are reviewing the developments and results through regular administrative coordination meetings. The regional perspective for the northern rim of Voorne-Putten (Geuzenlinie) has identified various linkage opportunities in dyke improvements. In 2017, this perspective will be elaborated into an area-based programme. In this process, the parties will also pay attention to opportunities for linking regional taskings to the flood risk management tasking. The district water board is closely involved in the efforts.

Participation

In addition to local authorities, nature organisations such as Natuurmonumenten and Staatsbosbeheer also participate in the annual meeting on linkage opportunities in dyke improvements (consultation on the Flood Protection Programme). In addition, stakeholders are involved in the projects. The participation of local authorities is running smoothly, but involving private individuals and businesses remains a challenge. A complicating factor is that many projects are still in an exploratory stage.

Some positive exceptions can be observed. Residents are participating in the MIRT Study into the operationalisation of the strategy to enhance the coping capacity of Eiland van Dordrecht. The "innovation table" in Alblasserwaard Vijfheerenlanden is an innovative way to give the business community a say. The Rotterdam Port Authority is in charge of the Botlek flood risk management pilot, in which the business community is also participating. In the Noordereiland/Kop van Feijenoord and the Dordrecht historic port area pilots, residents have weighed in on the study into a water-resilient design. This has generated measures for individual buildings and points for attention with respect to communication before and during flood water situations.

Implementation of freshwater supply strategy (Western Netherlands)

Key elements in the preferential strategy for the freshwater supply in Western Netherlands* are the expansion of the Central Netherlands Climate-proof Water Supply (KWA+) system, to raise the supply capacity, and the optimisation of the water supply from the Brielse Meer lake.

*** freshwater supply in Western Netherlands**
See DP2015, preferential strategy for freshwater supply in Rhine Estuary-Drechtsteden.

On schedule

Across the board, the measures in the Western Netherlands freshwater supply region are on schedule. With respect to the capacity expansion of the Central Netherlands Climate-proof Water Supply system, the planning stage for the largest sub-section has commenced, aimed at water intake from the Amsterdam-Rijn canal and the river Lek during dry spells. In 2017, an extended exploration will be carried out for a section of the route (the Lopikerwaard route) in order to examine, e.g., whether the costs will remain within the budget set aside. In the context of the exploration regarding the Irene locks bypass, Rijkswaterstaat is exploring what volume of freshwater intake through the Irene locks will be required during dry spells to combat salinisation of the water inlets and the Amsterdam-Rijn canal, and to supply sufficient water under the KWA+ and Water agreements. The additional salt burden resulting from the new sea lock near IJmuiden will be mitigated by selective extraction; this additional salt burden will not raise the capacity demand at the Irene locks. If the preferred variant is a bypass, a study into options for energy generation may be called for. The Irene locks exploration shows that the measures agreed upon probably cannot be realised under the Delta Fund budget agreed upon. For that reason, water intake through both lock chambers is considered as a restrained alternative option that can be realised under the budget available. A joint fact-finding process is identifying alternative freshwater supply routes to the western part of the Netherlands. Several working sessions have been organised to explore the pros and cons of alternative supply routes for the regional and main water systems.

The measure aimed at optimisation of the Brielse Meer water supply will be elaborated this year.

Many freshwater supply measures funded by regional authorities are incorporated into area-based plans and also address waterlogging and water quality. The measures set out in the Delta Plan on Agricultural Water Management (DAW) are focused on nutrients. The Dutch Federation of Agriculture and Horticulture LTO and the district water boards involved are attempting to capitalise on these measures to improve the freshwater supply. The Oasen and Dunea drinking water companies are expanding their purification plants in response to climate change and salinisation.

District water boards and provincial authorities in the freshwater supply region have gained experience with water availability. At the behest of consumers, the authorities are combining this process with more comprehensive area processes. This takes more time, but accommodates the need for information among consumers.

On track

There is no reason for adjusting the course of the preferential strategy regarding the freshwater supply. Many measures and area processes relating to water availability are approached from a more comprehensive perspective than originally envisaged. This impacts the pace of their implementation, but not their course: attainment of the goals is not jeopardised, which means that the strategy itself does not need adjusting. With respect to external developments such as the IJmuiden sea lock construction and the deepening of the Nieuwe Waterweg, agreements have been made regarding additional monitoring. Compensating and mitigating measures will be taken to counteract potential salinisation effects.

Integrated approach

Measures and area processes relating to freshwater supply are usually comprehensive in nature, because the parties regard freshwater supply as an element of the soil and water system. In many cases, measures fostering the resilience of the regional water system also prove conducive to other taskings, such as improving water quality, combating waterlogging, and regional area developments. Many area processes relating to water availability are also integral by nature: in addition to the availability of sufficient water, local water consumers also have an interest in, for example, the prevention of waterlogging. The area processes can also be utilised for the dialogue on spatial adaptation. Examples of integrated projects and processes are Haarlemmermeer Flushing, Krimpenerwaard Area Plan, and the joint fact-finding process concerning water supply routes in Western Netherlands.

Participation

Participation takes place at several levels. The agriculture, nature, and drinking water sectors are represented in the administrative consultations of the freshwater supply region. Farmers weigh in on water availability measures in area processes. Examples are the measuring of salt content by farmers in the Oostpolder and the implementation of water saving measures at the operational level in the Boskoop greenport region. Measures taken by the sector fit into the Delta Plan on Agricultural Water Management. The drinking water sector is improving the resilience of the drinking water production while exploring opportunities for, e.g., re-use of effluent. Nature organisations are involved in the joint fact-finding process regarding alternative supply routes. Municipalities are involved at the project level, for example, in the area processes regarding water availability and the exploratory study regarding the capacity expansion of the climate-proof water supply system.

Implementation of spatial adaptation strategy

The municipality of Dordrecht, the Hollandse Delta district water board, and the province of Zuid-Holland have set up a *living lab* to substantiate their ambition to expedite spatial adaptation at the Eiland van Dordrecht. Dordrecht aims to present an image as a green-blue city in the Dutch delta, among other ways through climate-resilient and attractive residential areas. The living lab is supporting this aim with three pilot projects focused on urban water quality, urban water quantity, and a climate-resilient design for the new Dordtse Kil IV industrial estate. Knowledge institutes and private parties are anxious to participate and, in some cases, provide co-funding. Residents and consumers are also involved in the living lab. Erasmus University and Deltares are supporting the collaborative process by creating conditions for continued development in the objectives, design, and evaluation of the pilots. They thus aim to ensure that the conditions set for the pilots are not too limiting to generate any useful effect ("pilot's paradox"). This living lab can have considerable added value for both the region itself and other parties in the Netherlands engaged in adaptation.

The Climate-proof City action programme initiated in The Hague comprises three elements: analysis, ambition, and action. In the analysis context, Delft University of Technology is examining heat islands in the city, in a study entitled *Haagse Hitte* [Heat in The Hague]. The study builds on earlier projects carried out in Amsterdam and Rotterdam: Amsterwarm and Hotterdam. Students investigate how the temperature in the city affects the well-being of its residents. One hundred residents of The Hague are participating in the study by hanging up a small digital weather station in their homes.

The port area and the industrial complex of Rotterdam are largely located outside the dykes. Both areas are of major economic significance for the Netherlands and Europe. Flood risks in the elevated port are small, but heavy storms on the North Sea can cause waterlogging in parts of the Botlek area, and in extreme cases even minor coastal flooding. The Botlek pilot shows that coastal flooding will cause mainly economic damage here, with only limited environmental pollution and hardly any fatalities, if at all. The pilot generates information on the vulnerability and chain dependency of vital and vulnerable infrastructure, such as the interdependency of businesses in the area, and their dependency on power supply, nitrogen supply, and the A15 motorway. The pilot also provides insight into the degree of acceptability of risks, and into the various perceptions of public and private parties. Several companies are already taking action on the basis of their own assessment frameworks. It is important for the businesses also to continue to work collectively on the recommended adaptation strategy. The national Vital and Vulnerable project can also capitalise on the knowledge and experience from the pilot.

In the Share My City project (third round of impact projects), residents are being encouraged to make private space available for public purposes such as water storage, more greening, and less paving. Share My City is both a platform and a movement, aimed at facilitating the implementation of water retention measures in private spaces. The project provides insight into the private space potential of each building, and links the opportunities to locations that require water storage. Subsequently, a campaign encourages residents to make space available. Residents immediately see what they can do at their own premises, and what is in it for them. Climate-proof and water-resilient planning thus becomes a collective social tasking, rather than a government tasking only.

4.3 Rhine/ Area around the major rivers freshwater supply region

Implementation and updating of flood risk management strategy

The preferential strategy for flood risk management along the Rhine* focuses in particular on the prevention of flooding and control of consequential damage. The tasking is comprehensive and urgent. The core of the strategy is a powerful interaction of dyke improvement and river widening. This generates a safe, resilient, and vital area around the major rivers, and opens up opportunities for tying in with efforts in the fields of the economy, spatial planning, and nature.

*** preferential strategy for flood risk management along the Rhine**
See DP2015, preferential strategy for the Rivers.

On schedule

The implementation agenda for the Rhine features several measures and studies, virtually all of which are progressing as planned. The study into the benefit and necessity of keeping open the option of changing the discharge distribution among the Rhine tributaries after 2050 is taking longer than planned. In the purview of this study, a tool that has already been developed is currently being prepared for use in the Nederrijn-Lek area. This is expected to enable completion of the study in 2017. Subsequently, the Minister of Infrastructure and the Environment will decide whether or not the option will be kept open, at the suggestion of the Delta Programme Commissioner and following consultation with the provinces and district water boards. This decision, expected by early 2018, will be incorporated into Delta Programme 2019. The Rhine Estuary-Drechtsteden Regional Consultative Body and the Rhine Administrative Platform are involved in the process and provide input wherever required.

The dyke improvements set out in the Flood Protection Programme (HWBP) are on schedule. Urgent projects include the improvement of the north bank of the Waal and of the Grebbe dyke, as in relative terms, the safety of these locations falls considerably short of the new standards that have been in force since 1 January 2017. The assessment of the Grebbe dyke by the Vallei en Veluwe district water board is the first one conducted in accordance with the new standards and approved by the Human Environment and Transport Inspectorate. The Central Holland General Exploration* shows that improvement of the Lek dyke, between Amerongen and Wijk bij Duurstede, is urgent as well. More urgent sections may follow. Virtually all the dyke sections along the north bank of the Waal have entered the exploration phase (Gorinchem-Waardenburg, Tiel-Waardenburg, Nederbetuwe, and Wolferen-Sprok). One of the alternatives in the Wolferen-Sprok exploration involves relocation of the dyke near Oosterhout. This looks ahead to the preferential strategy for the period beyond 2030-2050. The region thus aims to capitalise on an opportunity for the "powerful interaction". The exploration of the Gameren project, on the south side of the Waal, was completed in 2016; the plan elaboration phase will commence in 2017.

*** Central Holland General Exploration**
As regards the primary flood defence systems, this general exploration has been renamed project Sterke Lekdijk [Strong Lek dyke].

In accordance with the Regional Proposal for the Rhine, explorations and plan elaborations have commenced for river-widening measures. The Varik-Heesselt MIRT exploration and the Tiel-Waardenburg HWBP exploration, for which a joint environmental impact assessment procedure has been launched, are on schedule. A Scope and Level of Detail Memorandum for these projects was adopted on 15 November 2016. The MIRT exploration regarding the IJsselpoort River Climate Adaptation Park is taking a year longer than planned on account of its interconnection with the study into river widening in the bifurcation points area and the intended participation process. The exploration will be completed in the spring of 2019. The Gelderland Provincial Executive has reported this to the Minister of Infrastructure and the Environment in January 2017. With respect to the IJssel delta/Reevediep phase 2, the central government, the provinces of Overijssel and Flevoland, and the Zuiderzeeland district water board signed an Administrative Agreement on 14 December 2016 to expedite the implementation: all the measures are scheduled to be completed by 2022, including the removal of the Roggebot lock. This will produce a significant fall in flood level, ranging from more than 0.5 metre near Zwolle to 1 metre south of Kampen.

On track

The Administrative Platform on the Rhine Delta Programme has agreed to update the preferential strategy in the Rivers Ambition project. The goal is to develop a realistic and feasible long-term proposal for the dyke improvement – river widening combination. In 2017, the region will be working on updating the preferential strategy for the IJssel, Waal, and the bifurcation points area. The aim is for the regional parties and the Minister of Infrastructure and the Environment to enter into an administrative agreement in early 2018, as proposed by the Delta Programme Commissioner, regarding long-term river-widening measures in interconnection with dyke improvement along the Rhine tributaries. The joint ambition is to embed the measures in a programme (involving a substantial number of measures) in order thus to ensure the long-term resilience of the river system. The new preferential strategy will therefore be more than a strategic compass.

The administrative agreement will comprise agreements regarding a realistic bandwidth for the water level line along the Rhine tributaries to be set down in the future (to be set down in the Design Tools), short-term and long-term co-funding (possibly via a fund), the embedding of the agreement in law, and the governance (status, allocation of responsibilities, procedures, agendising, and regulatory framework for river widening).

In the preferential strategy, retention in the Rijnstrangen is an option for the period beyond 2050. In 2017, another study will be conducted into the optimum use and an optimum design of this retention area under the new standards. The study will also address the value of retention in an adaptative strategy and contribute to the updating of the preferential strategy.

Measures pertaining to the bifurcation points need to be considered from an interconnected perspective in order to preserve the current discharge distribution. To this end, measures in the Huissensche Waarden and the Meinerswijk neighbourhood (Arnhem) are being reviewed. The province of Gelderland is exploring, in collaboration with Rijkswaterstaat, whether these additional measures are feasible and can count on public support. A study by Rijkswaterstaat shows that the IJsselpoort River Climate Adaptation Park project can impact the discharge distribution among the Rhine tributaries. IJsselpoort River Climate Adaptation Park comprises several river-widening projects along the IJssel, for which scenarios have been developed featuring different degrees of river widening in terms of both landscape and time. Rijkswaterstaat is investigating the scope available for water level decline in IJsselpoort River Climate Adaptation Park, if other measures in the bifurcation points area prove impossible.

A further study has been conducted into the need for raising the dykes along the Nederrijn and Lek. The results show that on account of the rising sea level and soil subsidence, the western part of this area presents the biggest challenge: along the Lek downstream from the Hagestein weir. However, this part of the Nederrijn and Lek offers few opportunities for river widening. The results of the study also show that upstream of the Hagestein weir, there is little or in some sections, no need at all for raising the dykes. In this section of the Nederrijn and Lek, river widening would be an option. Local opportunities for river widening, whether or not in combination with dyke improvements, measures under the Framework Directive on Water, and other linkage opportunities, are currently being explored. In 2017 it will be decided whether and how the Nederrijn and Lek will be accommodated in the updated preferential strategy.

Collaboration with North Rhine-Westphalia

The Netherlands (Rijkswaterstaat) and the German state of North Rhine-Westphaliaare jointly investigating the flood risk along the Rhine in the border area. With respect to the two cross-border dyke rings, they have adopted the Dutch flood risk approach, as developed in the Veiligheid Nederland in Kaart [Safety Map of the Netherlands] and the Delta Programme. A remarkable feature of these dyke rings is that flooding in the Dutch section leads to wet feet in the German section and vice versa. For that reason, these areas are considered as a single entity in this study.

The study maps out the differences in flood risk management, current and future flood risks for inhabitants on both sides of the border, and potential measures to reduce the risk of flooding. It also seeks to share knowledge on the impact of the climate on the Rhine discharges. The study thus provides the building blocks for coordinating future flood risk management measures on both sides of the border. The analyses have commenced; the first results will be available at the end of 2017.

Integrated approach

The powerful interaction between dyke improvement and river widening has embedded an integrated approach into the preferential strategy for the Rhine. It will be substantiated further in the updated preferential strategy, which will be aimed at an adaptive implementation programme for the Rhine area, with spatial quality as an integral component. The Exploration into the spatial quality of the Rhine tributaries provides tools for the preservation, enhancement, and renewal of spatial qualities along the IJssel and the Waal-Merwedes, and in the bifurcation points area.

The Administrative Platform on the Waal-Merwedes and the HWBP Waal administrative support group have amalgamated into a single administrative consultative body in order to foster the combination of flood risk management measures and integrated area development. Such efforts are currently under way in, e.g., the combined environmental impact analysis procedure for the Tiel-Waardenburg HWBP exploration and the Varik-Heesselt MIRT exploration, and by including the Oosterhout dyke relocation as a variant in the Wolferen-Sprok HWBP exploration.

The district water boards along the IJssel are working on an adaptive implementation strategy* to bring the IJssel dykes up to standard in interconnection with spatial developments and quality along the IJssel. The IJssel steering group has adopted this implementation strategy as a building block for the combination of dyke improvement and river widening. Another example of an integrated approach is the Grebbe dyke project. In collaboration with the municipality of Wageningen, the provinces of Utrecht and Gelderland, Staatsbosbeheer, and Rijkswaterstaat, the Vallei en Veluwe district water board has launched an exploratory study into the improvement of the Grebbe dyke along the Nederrijn, in which the surrounding area is closely involved. Through an area-based process, the parties are mapping out the options for connecting flood risk management with the improvement of spatial quality, thus creating opportunities for nature, recreational facilities, cultural history, the economy, and mobility. In the IJsselpoort River Climate Adaptation Park project, the parties are also looking for a smart adaptive implementation strategy in which river widening, dyke improvement, nature development, recreational functions, navigation channel improvement, and preservation of economic activity are optimally substantiated.

*** implementation strategy**
See report Naar een adaptieve uitvoeringsstrategie IJsseldijken [Towards an adaptive implementation strategy for the IJssel dykes].

Participation

The stakeholders are closely involved in the MIRT and HWBP explorations. For example, private citizens, designers, and urban developers are weighing in on dyke improvements along the Waal, e.g., in the residents working groups for the Gorinchem-Waardenburg exploration. Groups of residents are involved in the improvement of the Grebbe dyke (design and opportunities for spatial quality) and the IJssel dyke between Olst and Zwolle. The participation of committed residents, governments, businesses, and NGOs in the Varik-Heesselt/Tiel-Waardenburg exploration has generated eighteen potential solution strategies. In a transparent process, this number has been reduced to several promising solution strategies. After the summer of 2017, an intensive participation process will be launched for the IJsselpoort River Climate Adaptation Park project, to gather wishes for this park among residents and users.

With effect from October 2015, NGOs have been represented by two participants in the Rhine Administrative Platform: the chair of the Waal-Merwedes Reflection Group (who also sits on the Waal-Merwedes Administrative Platform) and a representative of the Rijn-Oost Regional Consultation Committee (who also sits on the IJssel steering group). The Rhine Delta Programme organises bi-monthly broad-based information meetings on the current progress of the preferential strategy, projects, and studies, for the benefit of both government bodies and the NGOs in the region. Every two years, a major regional conference is organised (the Rivers Day) to keep the broad Rhine community up to date.

Implementation of freshwater supply strategy (area around the major rivers freshwater supply region)

The preferential strategy for the freshwater supply in the area around the major rivers* involves the optimisation of the water supply to the region and the promotion of economical water consumption, by way of Smart Water Management and adjustments to the main inlets.

*** The preferential strategy for the freshwater supply in the area around the major rivers**
See DP2015, preferential strategy for freshwater supply to the area around the major rivers in DP2015.

On schedule

The implementation of the preferential strategy for the freshwater supply in the area around the major rivers is on schedule. The preferential strategy is substantiated with model-based calculations of the demand for water from the main water system, the exploration of water availability measures, and adjustments to the main inlets.

The Rivierenland district water board is drawing up supply models to determine the efficiency of the water consumption. The study pertaining to the first sub-area was completed in 2016. This study shows that the water that is let in is used efficiently. Supply models for two sub-areas will be completed in 2017. The study, that is intended to yield supply models for all ten sub-areas by 2021, is thus proceeding as planned.

In 2016, the water availability pilot was completed under the Kop van de Betuwe area development. Temporary adaptive weir management, irrigation prior to drought, and extraction from deep pools seem promising measures. The first two require additional water from the main water system immediately before a dry spell.

Together with Deltares and Rijkswaterstaat, the Rivierenland district water board has examined how regional freshwater supply measures impact water availability in the main water system. The study shows that most regional measures have a quite local and temporary effect, and hardly, if at all, reduce the demand on the main water system. Furthermore, choices made regarding points of departure for the irrigation data turn out to have a clear impact on the outcomes of the model. Irrigation is a significant factor in the demand for water on the (main) water system, as is spraying in fruit orchards in order to prevent crops from being scorched. The current models do not reflect an accurate picture. In order to standardise model input with respect to irrigation at the national level, Rijkswaterstaat aims to use derivatives to draw up new calculations. In addition, flushing flows, pumping and inlet capacities, and structural water levels may be adjusted when concrete and complete relevant data is provided. A final effort concerns the exploration of autonomous linked capacity expansion.

In the period ahead, the freshwater supply region will recalculate regional water demand once data is available on water availability through the main water system.

In 2016, Rijkswaterstaat completed a study into the benefit and necessity of supplying Waal water to the Meuse at low water levels. During dry spells, Meuse discharge volumes can fall considerably, which hampers maintenance of the water level in the canalised sections and water supply to the Land van Meuse en Waal. In addition, low water levels compromise water quality in the Meuse, as a result of which it may be necessary temporarily to suspend the intake of water for the production of drinking water. The conclusion is that a water supply from the Waal to the Meuse in dry spells can be effective in improving the quality of Meuse water for the provision of drinking water, and can reduce damage for agriculture and shipping. There is insufficient reason for a structural measure. However, it would be useful to elaborate the transfer of water from the Waal to the Meuse as an emergency measure. A follow-up study to this effect was launched in 2017.

At the end of 2016, an inland navigation vessel collided with the Grave weir. The incident has made clear what the consequences will be of a sudden drop in water levels in the Sambeek-Grave section and the Maas-Waal canal. Similar effects may occur if, in the future, Meuse discharge volumes will drop to an extremely low level. In 2028, Rijkswaterstaat will replace the Grave weir under the replacement tasking for hydraulic structures.

On track

There is currently no reason for adjusting the course of the preferential strategy for the freshwater supply to the area around the major rivers.

Integrated approach

The Kop van de Betuwe area development combines the supply of freshwater with the generation of thermal energy from surface water (for neighbourhoods that are not on the natural gas grid) and multi-layer flood risk management (spatial planning, evacuation routes). A pilot involving the combination of heat-cold generation from surface water and freshwater supply, at a supply pumping station in the densely built-up district of Arnhem-Zuid, appears to hold promise for upscaling. Studies presented at the National Climate Summit in 2016 show that heat generated from water can meet approx. 12% of the national heat requirements in the Netherlands.

The innovation scheme for consumers in the area south of the major rivers is linked to the Delta Plan on Agricultural Water Management. The parties are thus fostering an integrated approach to water and agricultural issues.

Participation

In the area south of the major rivers the Rivierenland district water board, the Southern Agriculture and Horticulture Organization ZLTO, and a group of pioneering farmers and market gardeners have joined forces. In 2017, the district water board will open up an innovation scheme. Freshwater consumers may apply to this scheme if they want to invest in (innovative) water-saving measures.

In the Kop van de Betuwe freshwater supply pilot, the Dutch Federation of Agriculture and Horticulture LTO Noord has involved a representative group of farmers and growers. The parties have exchanged information and thus gained clarity regarding water requirements. This forms part of step 1: transparency. Water awareness can be regarded as sufficient to good. The district water board is passing on the experience to the learning environment of the Freshwater Supply core team.

Implementation of spatial adaptation strategy

The climate policy pursued by the municipality of Nijmegen is aimed at being climate-proof by 2050. This policy is focused on mitigation of and adaptation to four climate effects: flood threat from the rivers Waal and Maas, severe precipitation and storms, heat stress (especially during the night), and drought (in greenery and nature). Nijmegen has already embarked on the disconnection of downpipes and is now also engaged in other measures, such as the development of green-blue structures in the city. On 9 March 2017, the National Water and Climate Knowledge and Innovation Programme (Climate-proof City focus area) visited Nijmegen to exchange knowledge and practical experience.

In collaboration with the province, municipalities, Security Region, and utility companies, the Rivierenland district water board is examining how they can contribute to spatial adaptation. The study focuses, inter alia, on measures to reduce the impact of a flood in the eastern part of the Betuwe between Arnhem and Nijmegen, with attention for water resilience and reducing the risk of fatalities. The study also explores the water requirements and water availability in the area, and measures to expand water availability. Finally, the study maps out how energy can be generated from surface water to be used for residential heating. The project will be completed in 2017.

Together with the other governments, the municipality of Zwolle is working on a unique combination of room for the river, dyke improvement, and multi-layer flood risk management. Key elements are collaboration with local stakeholders and innovation. The efforts also address adaptation issues extending to the very capillaries of the city. The Climate-active City network (KAS-IJVD) is looking for solutions to vulnerable locations in the city and private value creation that fosters climate-proofing. In early 2017, Zwolle adopted a climate plan featuring climate adaptation goals and courses of action for the years ahead.

The *Expeditie Hemels Water, van het dak in de …*[water from heaven expedition, from the roof top into the..] project, is an impact project carried out under the Spatial Adaptation Incentive Programme (third round of impact projects). Two primary schools in Zutphen are disconnecting their downpipes and greening their schoolyards. Pupils weigh in on the design of solutions to the disconnection, more efficient use, and drainage of rainwater. The point of departure is a positive attitude: what can we do with all that free water? The project provides educational programmes to involve children and their parents in the topic. The primary schools also serve as a showcase for drawing attention to opportunities for disconnecting downpipes among parents and residents in the vicinity. The approach of reaching parents through their children to encourage them to take climate-adaptive measures appears to be effective.

4.4 Meuse

Implementation and updating of flood risk management strategy

Under the preferential strategy for the Meuse*, flood protection is provided through a powerful interaction of dyke improvements and river widening. In 2016, the Meuse region submitted a regional proposal to the Minister of Infrastructure and the Environment: a coherent set of short-term measures, in which the required flood risk management is established in combination with area developments. The regions along the Meuse – the Meuse valley and the Dyked River Meuse – are elaborating the preferential strategy for the long term, in collaboration with the central government, on the basis of the new flood protection standards.

*** the preferential strategy for the Meuse**
See DP2015, preferential strategy for the rivers.

On schedule

In the MIRT Consultation Committee meeting of October 2016, the central government and the region adopted the Regional Proposal for the Meuse comprising eleven short-term measures. The proposal features eight explorations and three studies pertaining to river widening projects.

Three of the explorations involve MIRT explorations regarding Oeffelt, Venlo, and Ravenstein-Lith (the latter two also encompass dyke improvement taskings); five are HWBP explorations for Thorn, Venlo-Velden, Baarlo, Arcen, and Well (aimed at system restoration of the Meuse). All the explorations have embarked on a detailed problem analysis and analyses aimed at developing solution strategies. In the explorations, river widening is examined in interconnection with dyke improvement and spatial and economic area development. In the years ahead, this will generate proposals for plan elaborations.

The three MIRT Studies pertain to the Maasoeverpark near 's-Hertogenbosch-Maasdriel, Zuidelijk Maasdal near Maastricht, and Lob van Gennep. The studies and elaborations have commenced. The MIRT Consultation Committee is expected to be able to take a decision regarding subsequent steps in the autumn of 2017 or in 2018.

The preparations for dyke improvements scheduled under the Flood Protection Programme are also proceeding as planned. For nine dyke sections, the Limburg district water board has launched explorations regarding the improvement of the existing alignment (Northern Meuse Valley exploration). The substantive elaboration has commenced, as has communication with the surrounding area. In order to make a choice regarding the height of the dykes, an analysis has been conducted of river widening measures that will reasonably feature in the long-term strategy for the Meuse. The results will constitute the basis for the design of the dyke improvements that will need to be executed in the near future. This process has produced a substantiated and transparent proposal for dyke heights that accommodates the mix of measures – river widening and dyke improvement – on which agreements will be made in 2018.

On track

In the preferential strategy for flood risk management, the focus is on the first layer of multi-layer flood risk management (prevention), in respect of both the short and the long term. The measures set out in the Regional Proposal for the Meuse 2016 constitute a first step towards resolving the flood protection issue. Based on estimates for the period 2017-2030 and an initial look ahead to the period 2030-2050, it is expected that approx. 75% of the measures needs to be implemented in the second period in order to have all the flood defence systems meet the new standards by 2050. This major challenge will require a substantial acceleration of the pace with effect from 2030.

In the Ambition for the Rivers project, the Meuse region is updating the preferential strategy in concert with the central government. The aim is a realistic and feasible long-term proposal for the combination of dyke improvement and river widening: the Adaptive Implementation Strategy for the Meuse. The national agreement (for the Meuse and the Rhine tributaries) is that the long-term ambition will be set down in the form of a water level line for 2050, which will constitute the point of departure for dyke improvements and river widening. The preferential strategy for the Meuse is currently being updated and elaborated on the basis of, inter alia, the flood protection standards that entered into force on 1 January 2017. To this end, regional processes have been set up for the Meuse Valley and the Dyked River Meuse, for which responsibility is borne by the provinces of Limburg and Noord-Brabant. All the district water boards and municipalities are involved in these efforts. In 2017, the regional processes will generate potential sets of measures involving river widening. These sets of measures will be used as input for a social cost-benefit analysis for the Meuse. This analysis, which will be coordinated at the national level, will serve as a building block for the administrative decisions to be taken by the central government and the region regarding the Adaptive Implementation Strategy for the Meuse, which is scheduled to be completed by 2018. The administrative decisions pertain to the bandwidth of the water level line to be set down in the future, funding of the entire operation, governance in river widening projects, and the date by which the measures must be embedded in (spatial planning) policy.

Integrated approach

Wherever possible, the Meuse region takes account of ambitions relating to other fields. The measures contained in the Regional Proposal for the Meuse will be substantiated as integrated area projects. In collaboration with stakeholders, the municipalities, provinces, and district water boards will map out linkage opportunities in the studies and explorations. As a rule, linkage requires additional funding. Opportunities for linkage with flood risk management measures concern, e.g., the development of the industrial port in the Venlo project, and nature and leisure facilities in the Ravenstein-Lith project. Spatial quality is an integral part of the preferential strategy for the Meuse, as it is in the Rhine strategy.

Participation

During the past year, participation was focused on the identification of the main opportunities and issues in the explorations and studies. To this end, the governments organised project-level participation meetings for all the stakeholders. The Meuse Delta Programme Steering Group confers with the Meuse Consultative Group in this respect. In the Meuse Valley and Dyked River Meuse regional processes, the administrative support bases are consulted (municipal councils, general district water board meetings, and Provincial Executives).

For example, the Limburg district water board already entered into a dialogue with the surrounding area regarding dyke improvement and dyke relocation projects even before it had elaborated the exact locations and improvement methods. The participation process runs via environment working groups, design workshops, and information meetings. All the interests in the area are represented, including those of residents, the business community, nature organisations, and farmers. This produces excellent results.

Administrators of the various governments are participating in project-related steering groups. Stakeholders and interest groups collaborate on solutions in, e.g., workshop meetings. In addition, the parties involved are kept informed about the projects through information meetings, mailings, flyers, or websites. The means of communication are dictated by the nature and scope of the projects.

Supra-regional interest organisations are also participating in the Meuse Consultative Group. This group coordinates the decision-making on Meuse-wide issues.

Implementation of freshwater supply strategy (freshwater supply to the area around the major rivers)

See Rhine (freshwater supply to area around the major rivers) and Elevated Sandy Soils.

Implementation of spatial adaptation strategy

In the spring of 2017, parties in Noord-Brabant and Limburg jointly presented their report Uitnodiging Zuid-Nederland: versneld aan de slag met klimaatadaptatie [Invitation to South-Netherlands: giving impetus to climate adaptation] to the Delta Programme Commissioner and the Ministry of Infrastructure and the Environment (see box in Paragraph 4.8, Elevated Sandy Soils, text box Giving impetus to climate adaptation – Invitation to South-Netherlands).

Waterlogging in June 2016: stress test for climate resilience

The entire month of June 2016 saw an extreme volume of precipitation in the area between Tilburg and Venlo. Local volumes exceeded 300 mm in this month, five times the June average. Even in the latest KNMI climate scenarios, 300 mm of rain in a single month is an extreme situation. Ditches, brooks, and sewer systems overflowed, which caused a great deal of damage and trouble, especially among farmers.

This calamity can be regarded as a stress test for the future-resilience of the water system. Climate change will bring more extreme periods. For this reason, the De Dommel district water board has scrutinised its strategy, its policy, and the lay-out of the area as regards both urban and rural environments. Are we sufficiently prepared for the 2050 climate? Can we handle periods of waterlogging and drought? The district water board has requested farmers, residents, experts, students, and civil servants to present their views. This has resulted in the Leven-de-Dommel action plan, featuring 24 concrete measures. The district water board adopted the plan on 19 April 2017 and will set aside an additional sum of nearly 15 million euros to improve the climate-resilience of the water system.

4.5 Southwest Delta/Southwest Delta freshwater supply region

Implementation of flood risk management strategy

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 refrain is "flexible where possible, rigid where needed". The taskings are linked to environmental and other spatial ambitions wherever possible. In the Flemish-Dutch Scheldt Commission (VNSC), the Flemish Region and the Netherlands are working on a joint "Agenda for the Future" for the Scheldt estuary. The authorities in Zeeland are collaborating on disaster management and developing standards for inner dykes that can serve as buffers during a flood.

*** preferential strategy for the Southwest Delta**
See DP2015, preferential strategy for the Southwest Delta.

On schedule

Virtually all the flood risk management projects in the Southwest Delta are on schedule. Some of these projects are highlighted below.

The dyke improvements under the Flood Protection Programme are proceeding as planned. Three dyke improvements on the island of Schouwen-Duiveland were completed in 2017: Burghsluis-Schelphoek, De Ruyter farm/Flaauwershaven, and Zierikzee-Bruinisse.

The beach nourishment programme for the coast and the Westerschelde is aimed at keeping the sandy system in sustainable balance with the rising sea level. The programme is being carried out as planned. The Coastal Genesis 2.0 programme and the VNSC working group on coastal flood risk management in the Westerschelde estuary are exploring the long-term development in the sand budget. The results will be available in 2018 (VNSC) and 2020 (Coastal Genesis 2.0). In the Oosterschelde, sand replenishment is the most effective measure to combat sand deficit and preserve the intertidal area. Sand replenishment to the Roggenplaat shoal is scheduled for the winter of 2017/2018.

The final report on the MIRT Study into integrated flood risk management in the Oosterschelde was completed in the spring of 2017. The report shows that according to the modelling, the Oosterschelde storm surge barrier can prevent storm surges until 2050, assuming a maximum rise in sea level of 85 cm until 2100. In that case, the only measures required up to 2050 will involve re-paving the locks platform (on account of overtopping water) and possibly reinforcing part of the stone cladding on the Tholen dykes and the Oesterdam (or adapting the forelands at these locations). 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. This may have serious consequences for the environment and land use. If the sea level rises by more than 50 cm, some components of the Oosterschelde storm surge barrier will probably need to be adapted. Delta Programme 2020 will report on such potential consequences and adaptations.

Within the Flemish-Dutch Scheldt Commission (VNSC), the Flemish Region and the Netherlands are working on a perspective for the sustainable development of the Scheldt estuary (Agenda for the Future). The corresponding study is proceeding as planned. One of the questions is how smart(er) sediment management can enhance the balance between flood protection, port accessibility, and nature in the estuary. In 2018, the Commission will draw up the closing balance of the first research programme, together with the stakeholders.

The Security Region is using the latest insights to review the disaster management plans pertaining to floods in Zeeland, based on the guidelines provided by the national Water and Evacuation project. All the parties involved in the province (governments, businesses, stakeholders) are providing input. The plans will be ready in 2018.

On track

There is currently no reason to adjust the preferential strategy for the Southwest Delta.

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. In the Delta Plan on Flood Risk Management, the timely identification of linkage opportunities is already common practice. This has produced linkage opportunities in, e.g., Sint-Annaland (Tholen), Hansweert, and Yerseke (Zuid-Beveland). Within the framework of the Doing More With Dykes project, administrators have set down a top ten of projects enabling synergy between dyke improvement projects implemented by the district water board and spatial projects initiated by municipalities. A case in point is the restructuring of the Sint-Annaland port front, which is also pre-funded by the municipality.

Another good example of an integrated approach to flood defence systems is the pilot involving five tidal turbines in a flood gate of the Oosterschelde storm surge barrier. The industrial partners of the plant consortium intend to further develop existing technology with the aim of garnering broad social acceptance, by factoring in vulnerable natural values and taking account of requirements in terms of flood risk management and water quality. The knowledge institutes Wageningen Marine Research, Deltares, Delft University of Technology, and Utrecht University have joined forces to map out how this project will impact tidal dynamics, ecology, and the sand budget. The Oosterschelde National Park and the nature organisations are monitoring the project closely. The plan is to install a second set of tidal turbines in another flood gate in 2018. The turbines will power some 1000 households in the province of Zeeland via the Delta grid.

Participation

The extent of participation is dictated by the nature of the project. In the Southwest Delta, participation ranges from joint studies to joint implementation and co-funding.

The participation process in the Southwest Delta commenced quite some time ago. The ambitions and goals for the area have been set down in collaboration with local stakeholders. A Delta Community is actively providing input and practical support. Every year, four newsletters are published. The annual working conference and network day support the joint approach. In the Southwest Delta Advisory Group, municipalities and NGOs in the fields of nature, the environment, shipping, recreation, and agriculture provide advice to the Regional Consultative Body for the Southwest Delta. The Advisory Group has, inter alia, drawn up an environmental vision for the Grevelingen and Volkerak-Zoommeer lakes, which has been incorporated into the draft National Framework Vision for these lakes. On the initiative of the Advisory Group, participation in several substantive themes has been intensified in 2017.

The Flemish Region and the Dutch governments have set up the Scheldt Council to proactively involve relevant stakeholders in the development of forms of management and policy for the Scheldt estuary. This Council is composed of delegates from various bodies such as the Scheldt ports, regional and local governments, employers, agricultural associations, and nature organisations. In 2016, the focus was on sharing the interim results of the research programme, e.g., through the VNSC Scheldt symposium held in November 2016, digital newsletters, so-called Scheldt topics, and the annual Scheldt magazine (see http://www.vnsc.eu/publicaties).

Co-funding is another form of participation. A case in point is the sand replenishment at the Roggenplaat shoal: this project has been funded with contributions from local residents (through crowd funding), the Natuurmonumenten and Het Zeeuwse Landschap nature organisations, eight municipalities, the province of Zeeland, central government, and a European grant (INTERREG).

Implementation of freshwater supply strategy (Southwest Delta freshwater supply region)

The preferential strategy for the freshwater supply in the Southwest Delta* is aimed at securing a sufficient external supply of freshwater (including under changing climate conditions) and, if possible, making more efficient use of the water available. A key component is the preservation or improvement of the freshwater supply from the Biesbosch, the Hollandsch Diep, and the Haringvliet. The measures are founded on water availability agreements between water managers and consumers. The freshwater supply is closely related to the development perspective set out in the National Framework Vision for the Grevelingen and Volkerak-Zoommeer lakes.

*** preferential strategy for the freshwater supply in the Southwest Delta**
See DP2015, preferential strategy for the Southwest Delta.

On schedule

The Administrative Agreement on freshwater in the Southwest Delta sets out the measures and pilots aimed at ensuring the resilience of the freshwater supply. Virtually all of them are proceeding as planned. The Roode Vaart project in Zevenbergen will be completed at the end of 2018. The Evides water company is engaged in preparations for improving the resilience of the reservoir system in the Biesbosch. Several pilots implemented under the Southwest Delta Freshwater Supply Testing Ground project have been completed. The results include a map of the freshwater-saltwater distribution in the Zeeland soil, insight into the potential of using brackish ambient water as process water, and expertise on the adaptation of various potato crops to saline conditions. An exploratory study into the application of a so-called Area Freshmaker (replacing saline groundwater by fresh groundwater) shows that this method is technically feasible. An Area Freshmaker of some 25 hectares can supply an area of some 200 hectares with freshwater. In this case, the cost price of the water will be some 20% less compared to the application of a small, farm-size Freshmaker. The report also outlines the organisational aspects and funding options involved in setting up an Area Freshmaker.

The decisions on a resilient water supply from the Biesbosch, Hollandsch Diep, and Haringvliet, and any alternative supply to areas around the Volkerak-Zoommeer lake are awaiting a decision on the National Framework Vision for the Grevelingen and Volkerak-Zoommeer lakes. Consequently, it is not certain whether phase 1 of the Roode Vaart transfer to West-Brabant, Tholen, and Sint Philipsland will be completed in 2021 as scheduled. For that reason, the four regional parties involved are reconsidering the process and the funding of the freshwater supply.

The three provinces in the Southwest Delta have set down an action plan for the determination of water availability, and several pilots are under way. The plan elaboration for the restoration of freshwater-saltwater separation in the Krammer locks will be completed in 2017.

On track

Currently, there is no reason for reconsidering the preferential strategy. The expectation is that the ongoing measures and the measures scheduled under the preferential strategy will enable attainment of the goals, properly and in good time.

The course to be steered with respect to the Grevelingen and Volkerak-Zoommeer lakes depends on the final adoption of the National Framework Vision and the introduction of an associated alternative freshwater supply around the Volkerak-Zoommeer lake. The authorities have not yet managed to arrange the funding of the measures. Currently, this does not have any consequences for the integrated preferential strategy for the Southwest Delta. For the time being, the draft National Framework Vision and the Administrative Agreement between the region and the central government regarding the development of the Grevelingen and Volkerak-Zoommeer lakes will remain in force. Until further notice, the provinces, municipalities, and the central government have continued to budget their financial commitments. This ties in with the Declaration of Intent regarding the Delta Approach on Water Quality and Freshwater Supply (an element of the Major Waters strategy).

Integrated approach

The options for adopting an integrated approach differ considerably from one measure to the next, as do linkage opportunities. Improving the resilience of the Biesbosch basin system entails opportunities for linking up with nature. The realisation of the Roode Vaart transfer in Zevenbergen has become promising because the ambitions of the municipality of Moerdijk, the Brabantse Delta district water board, the provinces of Zeeland and Noord-Brabant, and the central government converged at the right time.

The adapted flushing management in the Volkerak-Zoommeer and the innovative freshwater-saltwater separation at the Krammer locks, using an air bubble screen, are also integrated in nature. These measures entail the following linkage opportunities:

1. improved fish migration options at the Krammer locks;
2. shorter passage times for commercial shipping at the Krammer locks;
3. reduced energy consumption for freshwater-saltwater separation at the Krammer locks;
4. generation and storage of sustainable energy;
5. more options for Smart Water Management in the Rhine-Meuse estuary.

The plan elaboration for the freshwater-saltwater separation will be completed in 2017.

Within the STRONG project and in the Policy Memorandum on Drinking Water, the provinces are identifying, in collaboration with the drinking water companies, Additional Strategic Supplies in order to ensure the resilience of the drinking water supply.

Participation

The freshwater supply measures set out in the preferential strategy are widely supported among entrepreneurs and NGOs in the Southwest Delta. These parties are represented in various bodies, including the Southwest Delta Advisory Group, that provides the Regional Consultative Body with solicited and unsolicited advice at the preferential strategy and Administrative Agreement on Freshwater Supply levels.

Involvement of local stakeholders differs from one measure to the next, and also depends on the phase that a measure is going through. For example, local residents in the Zevenbergen port district are submitting their wishes for the Roode Vaart transfer, via workshops. The province of Zeeland and the Scheldestromen district water board are together substantiating the freshwater supply policy pursued in the province (freshwater supply testing ground) and the water availability process. Representatives of the recreational shipping sector are contributing expertise in the study into air bubble screens in the Krammer locks. Grid managers and power suppliers are weighing in on plans for the generation and storage of sustainable energy in this lock complex.

A showcase for broad-based participation is the Waterpoort project. On the basis of a collective agenda, entrepreneurs, governments, and NGOs around the Volkerak-Zoommeer lake are exploring new developments in the fields of water, nature, and heritage that can enhance the region's economic vitality.

Implementation of spatial adaptation strategy

Zeeland is one of the four pilots of the national Vital and Vulnerable programme. The province of Zeeland, Rijkswaterstaat, the district water board, municipalities, the Security Region, and Zeeland University of Applied Sciences are collaborating on the Zeeland Climate Adaptation programme aimed at reducing the impact of coastal flooding, waterlogging, drought, and heat stress. The province is focusing on the power supply and the chemical industry as important vital and vulnerable functions. The power supply is crucial to the continued performance of the other vital and vulnerable infrastructure during and after a flood. The chemical sector is represented relatively heavily in Zeeland. In the next two years, the parties will conduct various studies to substantiate the "Analysis" step. In 2019, the focus will be on the course of action ("Ambition" and "Action").

The Zeeland Security Region has embarked on the area elaboration regarding vital and vulnerable functions, in coordination with the Vital and Vulnerable pilot referred to above and the Climate Adaptation programme. This year, an impact analysis will be launched to provide insight into the effects of coastal flooding and serious waterlogging on the vital and vulnerable functions. In the Regional Flood Defence Systems Standards project, the province, district water board, Rijkswaterstaat, Security Region, municipalities, and stakeholders will subsequently explore which inner dykes can be used to reduce flood risks. In 2017, the experience gained in the Noord-Beveland pilot will be translated into a method to be used for all the dyke sections in Zeeland.

Municipalities in Zeeland are mapping out the risks of climate change by conducting climate stress tests. Such a test has already been completed in Noord-Beveland. In addition to the potential impact of a flood, the test also provides insight into the effects of extreme precipitation, drought, and heat. A climate stress test manual is available. The aim is that by 2020, all the municipalities in Zeeland will have a picture of their vulnerabilities during extreme weather and an overview of potential measures to reduce negative effects. They can factor in such measures when making choices in the spatial planning domain.

The current heat stress calculation model is primarily focused on urban areas. In the impact project involving the development of a heat stress instrument for cities and villages in rural areas (third round of impact projects), Wageningen University and Research Centre and the Climate Adaptation Services Foundation have developed a calculation model in which region-specific conditions can also be factored in. The model is currently being tested in Zeeland. In early 2017, the municipalities of Vlissingen, Middelburg, and Borsele have installed measuring equipment. By the end of 2017, an analysis of the data will provide answers to the questions of whether rural areas in Zeeland are affected by heat stress, whether proximity to the sea will have a cooling effect during a heat wave, and where drought can be expected to cause damage to farmland. The final result of this impact project will be incorporated into the Climate Impact Atlas, in order to enable other rural regions to utilise the methodology and the tool.

4.6 The Coast

Implementation of flood risk management strategy

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 Minister of Infrastructure and the Environment and the coastal partners involved have drawn up a Coastal Pact and will set down a zoning plan to regulate construction in the coastal zone. Substantiation of the Decision on Sand*, which is focused on keeping the sand budget along the Dutch coast up to par by means of sand replenishment, has been initiated with the Coastal Genesis 2.0 research programme.

*** preferential strategy for the Coast**
See DP2015, preferential strategy for the Coast.

*** Decision on Sand**
See DP2015, Decision on Sand.

On schedule

The implementation of the Decision on Sand and the preferential strategy for the Coast are largely on schedule.

Coastal Genesis 2.0 is a long-term research programme focused on sand transport along the Dutch coast (morphology) and future sand replenishment. All the sub-studies to be conducted under the framework programme have been outsourced. The demand for knowledge regarding "sand extraction", "ecology", and "spatial planning and the economy" will be elaborated further under the National Water and Climate Knowledge and Innovation Programme (NKWK). Constructive consultations regarding these open questions are being conducted with the Ministry of Economic Affairs, the provinces, district water boards, universities, and private parties. Rijkswaterstaat is mapping out the environmental effects of sand extraction and replenishment in its regular Coastal Maintenance programme, in collaboration with Coastal Genesis 2.0 and the long-term Ecologically Targeted Replenishment programme. Under this programme, the Ministry of Economic Affairs is monitoring benthic life. By 2020, the results of Coastal Genesis 2.0 will enable well substantiated decisions regarding the question of whether and how replenishment policy needs to be adjusted.

On 21 February 2017, the Minister of Infrastructure and the Environment signed the Coastal Pact along with nearly sixty other parties, among which are provinces, coastal municipalities, district water boards, nature organisations, and the (private) leisure sector. The Coastal Pact sets out final agreements on the regulation of new recreational construction along the coast, based on a zoning plan. The provinces are elaborating the zoning plan in consultation with the parties involved. In anticipation of its adoption, the parties are gearing their preparation of any new spatial plans to the zoning plan wherever possible. The governments will anchor the final zoning in policy and regulations. In addition, the parties involved in the Coastal Pact underscore that any new developments to accommodate leisure functions in the coastal zone must always fit within the preconditions pertaining to flood risk management, drinking water supply, and nature preservation.

In collaboration with the North Sea coastal municipalities, nature and environmental organisations, tourist interest groups, the Southern Agriculture and Horticulture Organization ZLTO, Rijkswaterstaat, and the district water board, the province of Zeeland has drawn up the Coastal Vision for Zeeland comprising three taskings: maintenance and improvement of the dykes and beaches, preservation of nature and landscape values, and the future of the leisure sector. In 2018, the province will translate the Coastal Vision into a new Provincial Environmental Vision. The coastal provinces of Zuid-Holland and Noord-Holland are making preparations for drawing up similar visions.

At the end of 2016, the Weak Links on the Coast programme was rounded off with the official completion of the last section of the West-Zeeuws-Vlaanderen weak link, in the new marina in Cadzand. The entire coast will thus be secure for the decades ahead, and has been given a boost in terms of spatial quality. In the Meijendel area in Zuid-Holland, the development of artificial inlets in the sea strip is being monitored. Along the coast of Delfland, a monitoring process is mapping out the impact of dune compensation on the Maasvlakte port extension and the impact of the Sand Engine (consequences in terms of flood risk management and natural values). The Sand Engine has evolved into an internationally acclaimed innovation icon and has actually expanded the coastal zone.

On track

Currently, there is no need to reconsider the preferential strategy. With respect to flood risk management, the coastal system will remain up to par for the decades ahead, if the required maintenance with sand replenishment is continued. The coast will also be subjected to an assessment based on the new standards. The expectation is that the coast will largely meet those standards. This statutory twelve-year assessment, the results of Coastal Genesis 2.0, and the insights provided by the Signal Group* enable an adequate response to the potentially accelerated rise in sea level and other unexpected developments. The monitoring process has shown that the sandy coast is well supplied with sand. Consequently, in the next four years, less sand will be required than originally planned.

*** Signal Group**
See Paragraph 2.1, textbox Community of Practice and Signal Group.

Within the context of Coastal Genesis 2.0, a study is being conducted into a new coastal management method. By way of a pilot project, approx. 5 million cubic metres of sand will be replenished in the outer delta between the islands of Ameland and Terschelling, in the Amelander tidal inlet. Good relations are being maintained with the SEAWAD research project (see Paragraph 4.7, Wadden Region).

Integrated approach

Regional parties may indicate their wishes regarding sand replenishment during the annual consultations on the Coastal Care programme, in order to ensure that the replenishments tie in with leisure functions, nature, and other developments in the area. Where possible, Rijkswaterstaat will incorporate such wishes into the programme. In the programme for 2016-2019, the deposit locations for replenishment of the coastal foundation have been selected on the basis of the consultations in such a manner as to accommodate the regional wishes to the maximum extent possible.

The coastal pearls are tackled in the purview of an integrated approach. At the Kop van Schouwen and Brouwersdam coastal pearls, a re-distribution of replenishment sand has produced gains for nature, leisure facilities, and the economy. The replenishment process was completed in 2016. The dynamic dune management pursued in the Kop van Schouwen and De Manteling coastal pearls greatly fosters the nationwide programme to reduce nitrogen emissions.

The province of Zuid-Holland is realising the Hollandse Duinen National Park. The municipality of The Hague is drawing up plans to revitalise the coast around the port of Scheveningen.

Participation

The establishment of the Coastal Pact has shown that commitment to the coast is great, and that parties are liaising quickly. The Pact involves a joint effort by a wide range of national and regional parties. Every year, the National Consultation Committee on the Coast organises a National Coast Day, enabling all the parties involved in the coast to exchange knowledge and experience regarding the progress of the National Coastal Vision: governments, the business community, NGOs, and research institutes. The regional area processes relating to the coast also demonstrate broad-based commitment. The annual consultations on the national Coastal Maintenance programme are also conducive to participation.

Implementation of spatial adaptation strategy

An energy-neutral and climate-proof new residential area will be built in the coastal municipality of Noordwijk. The impact project on climate-proof development in Noordwijk (third round of impact projects) is drawing up a step-by-step plan for this region regarding climate-proof area development in future residential areas. The plan contains information on, e.g., the criteria to be met by climate-proof neighbourhoods, and the resources and parties required for their design. The impact project also yields knowledge on costs and benefits, and rules for climate-adaptive planning and design.

4.7 Wadden Region

Implementation of flood risk management strategy

The preferential strategy for the Wadden Region* focuses on the preservation of the buffering function of islands, outer deltas, and intertidal areas. Wherever possible, natural materials and processes are used, and the measures are carried out in an integrated manner. Sand replenishment and dynamic dune management ensure a sustainable balance between the sand system of the island coast and the rising sea level. Monitoring, system studies, and pilot projects generate increasing knowledge about the functioning of the system, as a basis for future coastal management (Coastal Genesis 2.0). Wherever possible, dyke improvements foster nature and sustainable forms of human use. The Wadden Sea Dykes General Exploration maps out which innovative dyke concepts are appropriate to particular locations. For each Wadden island, a multi-layer flood risk management strategy is being developed.

*** preferential strategy for the Wadden Region**
See DP2015, preferential strategy for the Wadden Region.

On schedule

The preferential strategy for the Wadden Region is being substantiated through various measures. All measures are on schedule. Some of the measures are highlighted below.

The Coastal Genesis 2.0 research programme has commenced (cf. Paragraph 4.6). This study needs to provide answers to knowledge questions such as: “How much sand will our coastal system require in the long run?” and “Where and when will we deposit that sand?”. Sub-studies relevant to the Wadden Region include the one into the functioning of the tidal inlets.

Since September 2016, three universities have been working on SEAWAD: a four-year research project that will provide more insight into the sand system of the underwater deltas between the Wadden islands. The key question is whether large-scale sand replenishment on the outer deltas of the tidal inlets, similar to the Sand Engine along the Zuid-Holland coast, will enable coastal maintenance of the Wadden islands. SEAWAD thus provides answers to a number of significant questions from the preferential strategy for the Wadden Region.

Regular coastal maintenance with sand replenishment is proceeding as planned. Channel margin replenishment off the islands of Ameland and Vlieland will commence in 2017-2018. A monitoring process will show how effective sand replenishment at these locations is in terms of coastal protection. Within Coastal Genesis 2.0, a pilot is being developed involving a sand reservoir of some 5 million cubic metres on the outer delta between the islands of Ameland and Terschelling. This pilot is scheduled to be launched in 2018. Its impact in terms of both morphology and ecology will be monitored for several years. The pilot is intended to examine whether this method of providing the coast with the required volume of sand will cause less nuisance and disruption to the environment and nature than traditional sand replenishment (*learning by doing*). This question bears a strong relation to the sand deficit issue in the Wadden Sea.

The dyke improvements set out in the Flood Protection Programme are also on schedule. The contract for the Eemshaven-Delfzijl dyke improvement was awarded in December 2016. This is the first improvement project in the Netherlands to be carried out under the new flood protection standards. The dyke will have an earthquake-proof construction.* In 2016, Rijkswaterstaat launched a further study into the flood protection tasking for the Vlieland dyke. In 2017-2018, potential solutions for the required improvement will be explored. Phase 1 of the Wadden Sea Dykes General Exploration has generated a selection of twelve solution strategies for integrated and innovative dyke improvements. The solution strategies involve new dyke concepts, the use of materials, and hydraulic preconditions. In Phase 2, pilots will be conducted to map out the effect of the solution strategies on dyke improvements scheduled along the Wadden Sea. The assessment of the technical aspects of some projects is taking more time than expected, but the study will be completed by the end of 2017, as planned.

*** The dyke will have an earthquake-proof construction.**
In this region, mild earthquakes occur in relation to the exploitation of deep natural gas reservoirs.

On track

Currently, there is no need to reconsider the preferential strategy

Integrated approach

Regular coastal maintenance, involving sand replenishment and dynamic dune management, is conducive to flood protection, leisure functions, nature, and the economy. The Ameland Sea Gate replenishment pilot shows whether sand replenishment to the outer deltas will be a useful adjustment to current replenishment policy, and whether it will contribute to the realisation of the nature tasking.

The goal of innovative dyke concepts is combining flood protection with other functions. Lessons learnt in the Wadden Sea Dykes General Exploration are already being put to use in dyke improvements. The Eemshaven-Delfzijl dyke improvement is a fine example of an integrated approach: this dyke will be earthquake-proof, and give impetus to innovation, nature, leisure functions, and the regional economy.

Participation

Various stakeholders are active in the Wadden Sea Dykes General Exploration. In the exploration phase of regular dyke improvement projects to be implemented under the Flood Protection Programme, stakeholders and interested parties are not only provided with information; they are also invited to actively weigh in. They are taking advantage of this opportunity. Representatives of various interest groups are participating in the consultative groups for the dykes and the sandy coast.

Implementation of freshwater supply strategy (IJsselmeer Region freshwater supply region)

See IJsselmeer Region (IJsselmeer Region freshwater supply region).

Implementation of spatial adaptation strategy

The first phase of Waddenlei, the study into multi-layer flood risk management on the Wadden islands, has been completed (impact project). In collaboration with the Fryslân Security Region, the island municipalities are preparing an action plan aimed at developing a multi-layer flood risk management strategy for each island in the second phase, with active involvement of the island residents, and in collaboration with bodies such as Rijkswaterstaat and the Wetterskip Fryslân district water control board. The strategy involves a resilient design to reduce the impact of floods and ensure the continued performance of vital functions (second layer of multi-layer flood risk management), courses of action, and relief through the facilities available on the islands (third layer of multi-layer flood risk management). The second layer is mainly dictated by the economic strength of the island municipalities and nature legislation. Measures may be required to enable ferry services and outer infrastructure outside the dykes to operate. The third layer measures are particularly important because the islands are left to their own devices in times of emergency, 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. An impact analysis has generated individual flood risk maps for each island.

4.8 Elevated Sandy Soils South and East

Implementation of freshwater supply strategy

The preferential strategy for the Elevated Sandy Soils* focuses on the efficient use and preservation of water, optimisation of the water supply, and adaptations to the impact of climate change such as drought and waterlogging.

*** preferential strategy for the Elevated Sandy Soils**
See DP2015, preferential strategy for the Elevated Sandy Soils.

On schedule

The preferential strategy for the Elevated Sandy Soils is being substantiated through a large number of measures. No milestones have been set down for each individual measure; the measures have been incorporated into the area-specific schedules of the Delta Programme partners. In many cases, implementation of a measure requires linkage with other taskings.

In 2016, the district water boards mainly focused on the preparation of integrated plans and the implementation of projects. The preparation of integrated plans is taking more time than had been foreseen. The expectation is that the district water boards will make up for this delay in the years ahead. The district water boards in the Eastern region expect to have completed some 35% of the measures set out in the working programme by the end of 2017. In the Southern region, the district water boards and other parties are expected to carry out a considerable proportion of their measures in 2017. Several have already been launched, such as those pertaining to the desirable groundwater and surface water regimes in Leigraaf and Biesenloop (both implemented by Aa en Maas district water board), the Schalkhaar canal (Drents Overijsselse Delta district water board), and the restoration of brook valleys (Vechtstromen, Rijn en IJssel, and Brabantse Delta district water boards). The Vallei en Veluwe district water board is investing in projects under the heading of Climate Active City. The expectation is that the Realisation Strategy* will prompt the agricultural sector and terrain managing bodies also to launch measures in 2017.

*** Realisation Strategy**
Realisation strategy for freshwater supply measures in East-Netherlands.

The implementation of freshwater supply measures calls for collaboration with local governments, the business community, and NGOs. Several parties in the Eastern region, among which is the Vitens drinking water company, had not yet submitted measures under the implementation programme (BOK Freshwater supply) but are now willing to contribute. The Southern region has set aside 20% of its total budget for such “newcomers”. In 2016, the provinces of Noord-Brabant and Limburg set down the “other target groups” scheme to this end. The newcomers have submitted more than 40 proposals in 2016. Twelve projects have been outsourced and will be carried out in 2017. The final tenders will follow in 2017. This means that the entire budget available to the Southern region up to and including 2021 will have been appropriated in 2017, and all the projects initiated by municipalities, agricultural parties, nature reserve managing organisations, water companies, and the business community will commence.

The supply of water from the main system via the Noordervaart in Limburg turns out to take more time and cost more than originally estimated. The expansion of the Noordervaart requires several costly interventions to objects. The additional costs of the project have already been reduced considerably through “smart combinations” of measures pertaining to shipping, flood risk management, and the supply of water. The Ministry of Infrastructure and the Environment (Directorate-General for Spatial Development and Water Affairs and Rijkswaterstaat) is working on a solution in collaboration with the region.

The climate adaptation pilots, such as the Smart Weir (SAWAX), and the Lumbricus research programme are proceeding as planned.

On track

Currently, there is no reason for adjusting the preferential strategy. In early 2017, a water availability bottleneck analysis (quick scan) was carried out for the southern region of the Elevated Sandy Soils, based on the adapted KNMI scenarios. Water shortages appear to be falling, but nonetheless water shortage will still be an issue in the future. Water distribution will increase in relevance, in terms of both space and time. For the time being, no new comprehensive models will be set up. The results of the study will be used in the area-specific models and theme-based pilots, such as the provincial groundwater balance in Noord-Brabant. Ongoing and scheduled integrated area processes will also utilise the results.

Integrated approach

An integrated approach, as proposed in the Delta strategy on water quality and freshwater supply *, is already common practice with respect to the Elevated Sandy Soils: consolidating various water quality and water quantity goals (groundwater and surface water), setting up a resilient water system, addressing all the aspects of climate change, and connecting measures with other interests of consumers.

*** Delta strategy on water quality and freshwater supply**
Appendix to Parliamentary Document 27625 no. 379.

The taskings and measures pertaining to the optimisation of freshwater availability and the reduction of waterlogging are closely intertwined. Both taskings require more space, by taking measures in the fields of spatial design and management, and better gearing the use of land and space to the performance of the (ground) water system. The Elevated Sandy Soils Delta Plan had already set this integrated approach in motion. The waterlogging during the summer of 2016 has raised both awareness and the urgency of an integrated approach in the area. The integrated approach involves the closely interconnected elaboration and implementation of water availability and spatial adaptation measures.

Participation

Collaboration with consumers was the point of focus during the project initiation meetings in the Eastern and Southern regions. NGOs and organisations presented ideas for a more resilient freshwater supply. The project-based working method always involves a dialogue with land owners and other stakeholders.

In the Southern region, consumers have been weighing in from the outset, in the consultative group, the Delta Programme for the Elevated Sandy Soils South project group, and the Meuse Steering Group. A point of attention is the wider involvement of municipalities in the water availability process. Linkage with climate adaptation will probably open up additional opportunities to that effect. This calls for proper coordination with the Delta Plan on Spatial Adaptation and the existing working units operating under the Administrative Agreement on Water. A positive result is that the provincial arrangements for parties that had not yet submitted projects have generated many applications from municipalities in the Southern region. Several projects will be launched in 2017 (see *On schedule*). The agricultural sector has also submitted more proposals. In the Eastern region, the agricultural sector and the terrain managers are standing partners in the Regional Consultation Committee, as is the drinking water company. These consumers have actively contributed to the Realisation Strategy for freshwater supply measures in East-Netherlands.

Implementation of spatial adaptation strategy

The district water boards have scheduled area-specific measures for 2017 aimed at improving the resilience of the water system and adaptation to longer periods of drought. Wherever possible, the measures are combined with measures to combat waterlogging as set out in the Delta Plan on Spatial Adaptation.

In 2017, the city of Eindhoven set down a climate adaptation plan featuring goals and plans for climate mitigation and adaptation, and the actions envisaged for the years ahead. The city will be climate-proofed in various ways, including by restoring water systems and constructing new green and blue structures. For quite some time, Eindhoven has been committed to greening public (and private) outdoor spaces, in order to reduce the volume of paved surfaces in the city, and enhance the quality of greenery and biodiversity.

Giving impetus to climate adaptation – Invitation to South-Netherlands

In June 2016, parts of the provinces of Limburg and Noord-Brabant were struck by extreme rainfall and hail. District water boards, provinces, and municipalities have collectively analysed the events, and decided to give impetus to climate adaptation. The ensuing report Uitnodiging Zuid-Nederland: versneld aan de slag met klimaatadaptatie [Invitation to South-Netherlands - Giving impetus to climate adaptation]calls on all parties in the region and the central government to contribute to water-proofing and ensuring the climate resilience of the region. The invitation sets out “the need” (the tasking is urgent and acute), the “ambition” (the region has identified many opportunities for combining water taskings with other spatial taskings), and the “capability” (expediting and intensifying regional initiatives). The governments intend to spend the contributions on, e.g., expanding the capacity of water systems, “cooling” heat spots in the city, greening public spaces, improving rainwater collection, and expanding the options for infiltrating water into the soil.

Part III
Delta Plans

Delta Plan on Flood Risk Management
Measures to protect the Netherlands from flooding

Delta Plan on Freshwater Supply
Measures to ensure the availability of freshwater in the Netherlands

Delta Plan on Spatial Adaptation
Measures to render the Netherlands climate-proof and water-resilient

5 Delta Plan on Flood Risk Management

Measures to protect the Netherlands from flooding

Flexible flood defence system, Spakenburg

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 the Environment 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 features diagrams and tables reflecting the progress, scheduling, planning, and phasing of the flood risk management projects. In addition, it provides information on the question of whether the implementation of the Delta Plan on Flood Risk Management is on schedule in accordance with the "Monitoring, Analysing, Acting" system.

5.1 Implementation programmes

Continue reading

» 5.1.1 Flood Protection Programme

» 5.1.2 Second Flood Protection Programme

» 5.1.3 Room for the River

» 5.1.4 Meuse Projects

» 5.1.5 WaalWeelde

» 5.1.6 IJsselmeer Closure Dam

» 5.1.7 Repair of Oosterschelde and Westerschelde stone claddings - Zeeland foreland deposits

5.1.1 Flood Protection Programme

The primary flood defence systems of our country provide protection against flooding from the North Sea, the major rivers, the IJsselmeer, Markermeer,Volkerak-Zoommeer, and Grevelingenmeer lakes, the tidal section of the Hollandsche IJssel river, and the Veluwerandmeren lakes. With effect from 1 January 2017, once every twelve years the primary flood defence systems will be subjected to a statutory assessment, in order to verify whether the dykes and dams meet the statutory standards. The report on the most recent (third) assessment was drawn up in 2011 and followed by the extended third round of assessments. The national Flood Protection Programme sets out the measures that are required to ensure that the primary flood defence systems meet the statutory safety standards, now and in the future. The Flood Protection Programme is drawn up by an alliance of the district water boards and the central government. The dyke improvements are carried out by the managers of the dyke sections concerned.

Under certain conditions, the district water boards qualify for a government grant for dyke improvement projects. This is funded under a specific “dykes funding arrangement”, which is a component of the Delta Fund. The projects are funded on a fifty-fifty basis, i.e., equal contributions from the central government and the district water boards. The collective district water boards contribute 40% to the dykes funding arrangement (via a cost allocation key). The remaining 10% concerns a project-related contribution from the district water board responsible for the dyke improvement.

The Flood Protection Programme is an ongoing programme; the measures are scheduled for a period of 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 Minister of Infrastructure and the Environment sets down the programme annually under the Delta Plan on Flood Risk Management. To this end, the alliance draws up a new programme proposal every year, that builds on the preceding year’s schedule. The schedule is based on the principle that the most urgent dyke improvements will be carried out first. The urgency is determined on the basis of the new standards that have come into effect in January 2017. The grants from the dyke funding arrangements are awarded on the basis of an effective, restrained implementation of the dyke improvement projects.

The (extended) third round of assessments has generated the current picture of the flood risk management tasking; the projects have been prioritised on the basis of data from the National Flood Risk Analysis for the Netherlands study part 2. In the years ahead, the flood protection tasking will be fine-tuned increasingly further, as more assessment results based on the new standards become available. The nationwide assessment of all primary flood defence systems and engineering structures will be completed in 2023. This will enable the Delta Plan on Flood Risk Management to present an updated picture of the flood risk management tasking in the Netherlands, based on the new standards. The years ahead constitute a transitional period for the Flood Protection Programme: the schedule features dyke improvements ensuing from the (extended) third round of assessments under the old standards (most of which are in progress), while new dyke improvements will gradually be added on the basis of the first round of assessments under the new standards. The dyke improvements based on an assessment under the old standards will be dimensioned in accordance with the new standards.

Flood risk management with added value

The Delta Plan on Flood Risk Management is evidently focused on the flood protection tasking, yet the operating method of the Flood Protection Programme projects is aimed at creating social added value in other fields as well. By carrying out dyke improvement projects, the water managers foster area developments by anticipating the regional preferential strategies, by smart combinations of various taskings in the regions prior to the implementation of a project, by providing room for linkage opportunities, and by involving local residents, stakeholders, and the business community at an early stage.

Dyke improvement in kilometres per year

The aim of the Flood Protection Programme is to bring the primary flood defence systems up to par. Currently, the flood risk management tasking involves the improvement of a total of 1302 kilometres of dykes and 799 engineering structures (based on the third national assessment). The improvement of 748 kilometres of dykes and 275 engineering structures is covered by the Flood Protection Programme. The other projects are carried out under other ongoing implementation programmes.

Figures 8 and 9 present a forecast of the dyke improvements and engineering structures to be improved. Both figures show that the number of completed improvements is rising sharply after the start-up years. The Flood Protection Programme is getting off the ground.

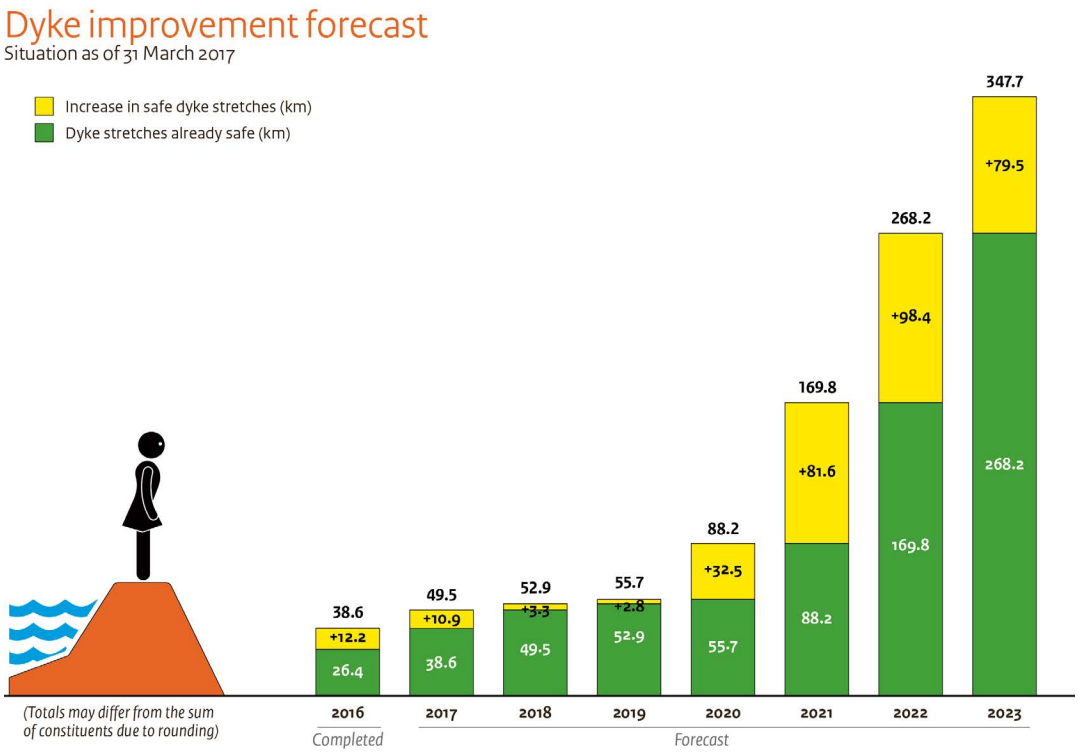


Figure 8
Forecast of the implementation of dyke improvements under the Flood Protection Programme in kilometres. Data pertaining to 2016-2022 is based on realisation in 2016. Data for 2023 is based on the proposed programme for 2018-2023.

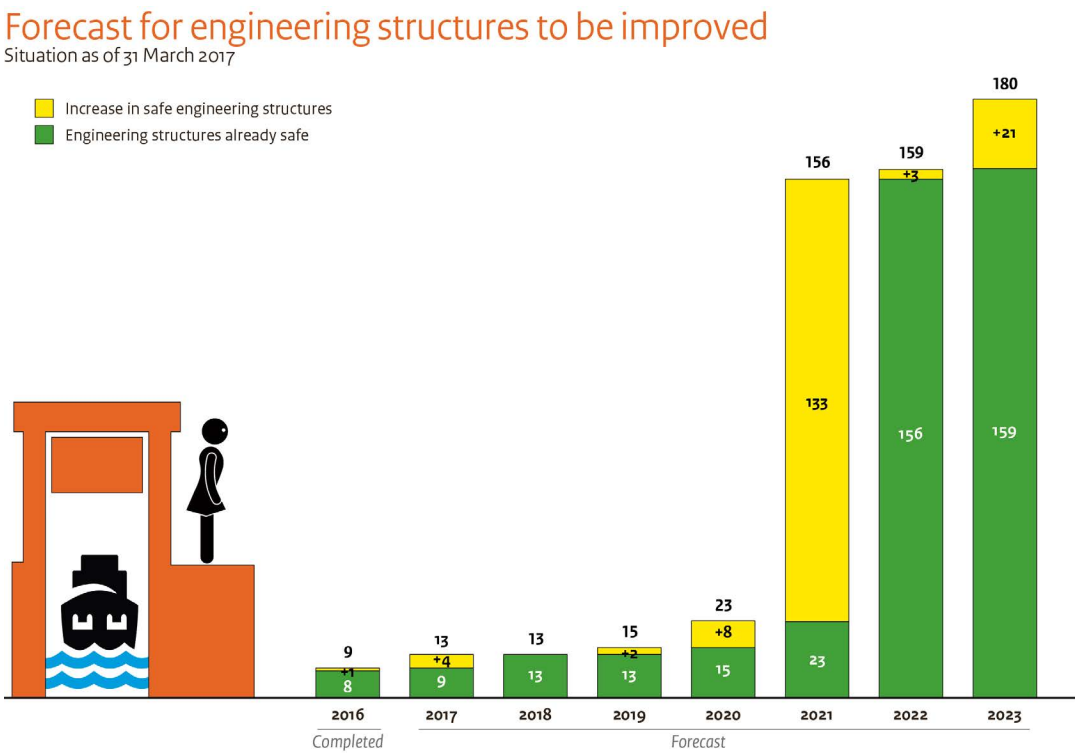


Figure 9
Forecast of the implementation of engineering structure improvements under the Flood Protection Programme. Data pertaining to 2016-2022 is based on realisation in 2016. Data for 2023 is based on the proposed programme for 2018-2023.

Lead times and average cost per kilometre

The alliance partners in the Flood Protection Programme are working on smart and widely supported solutions. Their aim is to shorten the lead times of dyke improvement projects and reduce the cost per kilometre:

- *project lead times*: the Flood Protection Programme observes a lead time of two years for explorations, two years for plan elaborations, and two years for realisations (in accordance with the MIRT system). For projects involving a cost of more than 40 million euros, the lead times for plan elaborations and realisations are three years. In the long run, the programme aims to halve the overall lead time of projects.
- *price per kilometre*: the cost price of dyke improvements under the Second Flood Protection Programme averages 9 million euros per kilometre. The programme aims to reduce the average cost price by 30%, to 6 million euros per kilometre.

These indicators are still under development. The associated goals are challenging, ambitious, and directive for the course of the programme in the years ahead. The Flood Protection Programme is still in the start-up phase and many dyke improvement projects are still in the exploration phase. In a few years' time, a larger number of dyke improvements will enter the plan phase and the realisation phase. This will generate sufficient qualitative information to properly monitor the price per kilometre and the lead times. Until such time, the alliance is focusing its efforts on knowledge development.

Knowledge development and innovation essential

(Technological) innovations and knowledge development among the managers constitute an important driving force in the reduction of the cost per kilometre to 6 million euros and the halving of project lead times. To this end, the Flood Protection Programme has set up various tools, such as the two instruments below:

- General Explorations;
- Communities of Practice.

General Explorations

General Explorations are intended to develop new knowledge and innovative solutions that bear application in multiple projects. General Explorations are thus an important tool for the entire Flood Protection Programme to increase the efficiency of project implementations, and to develop smarter, widely supported, and cheaper solutions. In order to foster innovation and knowledge development, General Explorations qualify for a 100% grant from the Flood Protection Programme; they are not subject to a project-related 10% contribution from the district water board.

Table 2 contains an overview of the General Explorations that have been launched and the corresponding schedule. The Central Holland General Exploration was completed in 2016. The resulting improvement tasking has been accommodated in the regular programme. The Piping General Exploration will be completed in 2018. This General Exploration will generate innovative measures to combat the piping failure mechanism. The schedule for 2018-2023 comprises the new General Exploration regarding dyke improvement using local soil. The aim is to develop knowledge and innovative solutions for improving dykes using soil from the immediate vicinity. This knowledge will also foster the sustainability of the programme.

Innovations are also realised in individual projects. In 2016, nine projects involving an innovative element were completed. The General Explorations and the innovative project elements contribute to the aim of reducing the average cost per kilometre of dyke improvement.

Outcomes of the Central Holland General Exploration

The completion of the Central Holland General Exploration in 2016 marked an important step in the flood protection of a major part of the Randstad conurbation. The collaboration between the Rijnland, Amstel Gooi en Vecht, and De Stichtse Rijnlanden district water boards and Rijkswaterstaat has generated considerable social gains through the supra-regional solution to the flood risk issue of Central Holland developed by the parties. This has halved the originally expected investment of more than 1 billion euros. At the same time, the parties have gained practical experience with the new Design Instruments and the assessment of flood defence systems in accordance with the new Water Act. The General Exploration has shown that a section of the Lek dyke between Amerongen and Schoonhoven, covering a distance of some 53 kilometres, is in need of improvement. The Stichtse Rijnlanden district water control board is carrying out the dyke improvement under the Strong Lek Dyke project, in the spirit of the new Environment Act. In various pilots the district water board is exploring opportunities for enhancing the appeal of the dyke along with improving its strength. The pilots are being conducted in collaboration with local residents, the municipalities involved, the provinces of Utrecht and Zuid-Holland, Rijkswaterstaat, and NGOs such as the Dutch Federation of Agriculture and Horticulture LTO and Staatsbosbeheer. In addition to improving flood protection, the focus is also on an optimum quality improvement in terms of spatial design, landscape, nature, and cultural history. The improvement of the first section will commence in 2020 at the earliest.

General Exploration Projectoverstijgende Exploration		2018	2019	2020	2021	2022	2023	>
No. on map	**Name of General Exploration**							
321	Piping General Exploration							
322	Wadden Sea General Exploration							
322	Clay and grass cladding (Wadden Sea General Exploration)							
322	Dyke with forelands (Wadden Sea General Exploration)							
322	Kerkhovenpolder – Germany pilot (Wadden Sea General Exploration)							
*	Macrostability General Exploration							
*	JLD earth anchor (Macrostability General Exploration)							
*	Cables and Pipes General Exploration							
323	Vecht flood perspective system elaboration							
*	Voorlanden General Exploration							
*	General Exploration regarding dyke improvement using local soil							

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

Research Exploration Plan elaboration Realisation Completed

Table 2
General Explorations in progress and schedule

Community of Practice

Good knowledge is the mainstay of the Flood Protection Programme. The mutual sharing of new knowledge and experience is important. Within the Flood Protection Programme, the communities are the vehicle for developing knowledge and promoting collaboration within the alliance. A total of eight communities focus primarily on the project implementation systems, involving matters such as the technical application of innovative measures, but also the approach adopted to a dyke improvement project and ways to substantiate local participation. Knowledge developed within the communities helps to achieve the aim of gradually reducing project lead times.

Flood Protection Programme			2018	2019	2020	2021	2022	2023	>
Budget incl. project-related share (10%): total 5,3 billion euros (up to and including 2031).									
Budget available for district water board projects including project-related share (10%) in millions of euros per year in the period 2018-2023			84	154	261	518	424	308	
Budget available for Rijkswaterstaat projects in millions of euros per year in the period 2018-2023			15	11	6	23	39	89	
No. on map	**Project nr.**	**Project name**							
201	22VLBO16-4 22W	Fort Everdingen-Ameide Sluis							
202	22W	Vianen							
203	25VLBO45-1 25P	Grebbe dyke							2025
204	22AI + 22AJ + 22VLBO43-4 22AI + 22VLBO43-5 22AJ+22VLBO43-4 22AC	Wolferen-Sprok							
205	22D + 22VLBO43-5 22AB	Neder-Betuwe							
206	24AG	Zuid-Beveland-West, Westerschelde							
207	24VLBO30-2 24AG	Zuid-Beveland-West, Westerschelde S1							
208	05C	Gouda IJssel dyke Gouda (phase 2)							
209	05D	Gouda IJssel dyke improvement (VIJG) track 1							
210	05E	Gouda IJssel dyke improvement (VIJG) track 2							
211	06D	Capelle/Zuidplas							2024
212	06F	Remainder of Hollandsche IJssel tasking							
213	22AG + 22VLB043-4 22AG	Sprok-Sterreschans							2026
214	22AH	Sterreschans-Heteren							2026
215	22K	City of Tiel							
216	22VLBO43-6 22AD	VLRT-4 City of Tiel							
217	22X	Gorinchem-Waardenburg (GoWa)							
218	22VLBO43-6 22AA	VLRT-4 GoWa							
219	22Y	Tiel-Waardenburg (TiWa)							
220	22VLBO43-6 22AE	VLRT-4 TiWa							
221	16E	V3T flow slide							
222	16VLBO20-3 16M	VLRT-4 – section no. 20_3 (new standard)							
223	22VLBO16-3 22AK	Ameide-Streefkerk							
224		Strong Lek dyke							2026
225	22VLBO43-3 22AH	Sterreschans-Heteren							2026
226	13VLBO36-3 13D	Ravenstein-Lith							2025
227	24AC	Ritthem/Baarland							
228	24AH	Zuid-Beveland-West, Westerschelde S2							
229	24VLBO30-3 24AH	Zuid-Beveland-West, Westerschelde S2							
230	24VLBO30-3 24AI	Zuid-Beveland-West, Westerschelde S3							
231	12B	SVK Hollandsche IJssel storm surge barrier (gate)							
232	06K	Strong IJssel dykes Krimpenerwaard (KIJK)							2026
233		Intermediate section: KIJK							
234	21C	Pannerden/Loo							
235	15Q	Zwolle-Olst							2026
236	15E	Zwolle							
237	15N	Zwolle flood gate							

238	15P	Vecht-Zuid	2026
239	22E	Gameren	
240	15O	Vecht-Noord	2025
241	18A	Eemshaven-Delfzijl	
242	15J	Mastenbroek IJssel	2029
243	24AE	Zuid-Beveland-Oost, Oosterschelde	
244	15K	Mastenbroek Zwarte Meer	2031
245	15L	Mastenbroek Zwarte Water	2031
246	28F & 28G	Koehool-Lauwersmeer	
247	18D	Lauwersmeer/Vierhuizergat	
248	15C	Around Kampen	
249	25K	IJssel dyke Apeldoorns Kanaal	
250	10A	Vlieland	
251	09D	Marken	
252	07-19A	Bosscherveld lock	
253	25L	Northern Randmeer dyke	
254	09C	IJmuiden	
255	03E	Wieringermeer storm surge barrier	2025
256	08A	Drongelens Kanaal (P52)	
257	27C	Noordoostpolder engineering structures	
258	01-2-5-11A	Central Holland - category C dykes	2025
259	03I	North Sea Canal (D31 - D37)	
260	03F + 03V	Engineering structures	

Research Exploration Plan elaboration Realisation Completed

Table 3
Schedule of measures, Delta Plan on Flood Risk Management

Administrative Agreement on the Meuse			2018	2019	2020	2021	2022	2023	>
No. on map	**Project nr.**	**Project name**							
331	23ABC	Alexanderhaven							
332	19C	Blerick, near the old foundry							
333		Round A *							
333		Round B *							
333		Round C *							

* Rounds A to C include the following projects: 333a : Steyl-Maashoek, 333b : Thorn, 333c: Heel, 333d: Arcen, 333e: Well, 333f: Venlo-Velden, 333g: Baarlo, 333h: Nieuw Bergen, 333i: Buggenum, 333j: Beesel, 333k: Belfeld, 333m: Kessel, 333n: Blerick Groot-Boller. A decision on the sub-distribution of projects in the rounds is still pending.

Research Exploration Plan elaboration Realisation Completed

Table 4
Measures set out in the Administrative Agreement on the Meuse

Reserve for pre-financing			2018	2019	2020	2021	2022	2023	>
No. on map	**Project nr.**	**Project name**							
350	24AK	Sint-Annaland					€		
351	24AJ	Kop van Ossenisse					€		
352	14A	Geertruidenberg/ Amertak							
353	17D	Kerkhovenpolder-Germany							
354	24R	Zuid-Beveland-Oost, Westerschelde				€			
355	28J*	Lemsterhoek							
356	04A	Spuihaven Schiedam				€			
357	21A	Rijnkade					€		
358	21F	Twente Canal					€		
359	28H	Lauwersmeer dyke							
360	21H	Havenstraat					€		
361	21I	IJsselpaviljoen					€		
362	21K	Vispoorthaven					€		
363	03N	Balgzand dyke (D88) – Amsteldiep dyke (D89)				€			
364	24AF	Zuid-Beveland Canal				€			
365	03O	Wieringen sea wall (D90)				€			
366	21E	Grutbroek industrial estate					€		
367	03-	Markermeer dyke connection				€			
368	03R	Gouwzee & Buiten IJ				€			
369	03S	Markermeer dyke connection				€			
370	06H	Stolwijk lock				€			
371	24H	Michiel de Ruyterhaven (Koopmanshaven lock)					€		
*		Recalculation of Meuse agreement							

* This pre-financing does not pertain to any specific location and is, therefore, not reflected on the map.

Table 5
Reserve for pre-financing

5.1.2 Second Flood Protection Programme

The Second Flood Protection Programme mainly comprises projects ensuing from the first and second assessments of the primary flood defence systems. The final projects under this programme are in progress. More information is provided in the 11th progress report on the Second Flood Protection Programme.

Table 6
Second Flood Protection Programme

5.1.3 Room for the River

This programme encompasses measures along the Rhine tributaries and the downstream part of the Meuse, as set down in the Room for the River Key Planning Decision. For more information: see the 29th Room for the River progress report.* This also sets out the progress of the Further Elaboration of the Area Around the Major Rivers programme (NURG).

*** 29th Room for the River progress report.**
See Parliamentary Document 30080 no. 85.

Table 7
Room for the River measures

5.1.4 Meuse Projects

The Meuse Projects concern the Grensmaas and Zandmaas areas. For more information: see the 31st Zandmaas and Grensmaas progress report.*

*** 31st Zandmaas and Grensmaas progress report.**
See Parliamentary Document 18106 no. 239.

Meuse Projects		2018	2019	2020	2021	2022	2023	>
Grensmaas budget: a total of 151 million euros, of which 76 million euros will be available with effect from 2018								
806	Grensmaas project, 11 locations							2024
807	Final element embankments, Limburg district water board							
808	Final element embankments, Limburg district water board							

Research Exploration Plan elaboration Realisation Completed

Table 8
Meuse Projects measures

5.1.5 WaalWeelde

In the WaalWeelde project, regional parties, the central government, companies and residents have joined forces under the direction of the province of Gelderland in order to work on a safe, natural and economically viable Waal river. For more information: see waalweelde.gelderland.nl.

Waalweelde		2018	2019	2020	2021	2022	2023	>
Budget: 30 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	Heeselt floodplains							
Province of Gelderland projects								
434	Fluvia Tiel							
435	Loenensche Buitenpolder							
436	Beuningse floodplains							

Research Exploration Plan elaboration Realisation Completed

Table 9
WaalWeelde measures

5.1.6 IJsselmeer Closure Dam

The IJsselmeer Closure Dam (Afsluitdijk) project encompasses dyke improvements and provisions for the expansion of the discharge capacity. For more information: see www.theafsluitdijk.com.

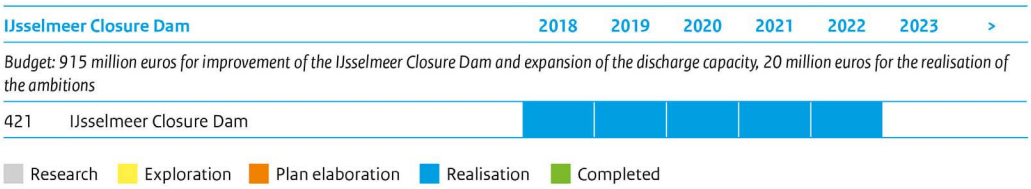


Table 10
IJsselmeer Closure Dam measures

5.1.7

Repair of Oosterschelde and Westerschelde stone claddings - Zeeland foreland deposits

The Repair of Oosterschelde and Westerschelde stone claddings - Zeeland foreshore deposits project involves the reinforcement of the stone cladding of dykes along the Oosterschelde and Westerschelde. The repair of the stone claddings in the province of Zeeland was completed in 2015. Additional efforts involve the foreshore defences of the dykes in the Oosterschelde and Westerschelde areas. The foreshore deposits project is divided into several clusters that will be carried out over time. A number of foreshore deposit tracks will be launched in 2018.

Repair of Oosterschelde and Westerschelde stone claddings, Zeeland foreshore deposits		2018	2019	2020	2021	2022	2023	>
Budget: a total of 823 million euros of which 53 million euros will be available with effect from 2018								
Foreshore deposits								
912	Breskens-C							
913	Breskens							
914	Borssele							
915	Zierikzee							
916	Burghsluis							
917	Schelphoek							
918	Ellewoutsdijk							
919	Nieuw-Neuzenpolder							
920	Margarethapolder							
921	Kleine Huissenspolder							
922	Eendragtpolder							
923	Molenpolder							
924	Waarde- en Westveerpolder							
925	Vlissingen							
926	Oost-Bevelandpolder							
927	Wemeldinge-West							
928	Wemeldinge-Oost							
929	Hoedekenskerke							

Research Exploration Plan elaboration Realisation Completed

Table 11
Schedule of measures pertaining to repair of Oosterschelde and Westerschelde stone claddings, and foreshore deposits in Zeeland

5.2 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 in 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 the Environment has agreed to the MIRT explorations listed in Table 13.

With respect to the river Meuse, the MIRT explorations and studies listed will be supplemented by a further exploration of five system restoration measures. The explorations, to be conducted under the Flood Protection Programme, pertain to dyke relocations and dyke improvement; see the Administrative Agreement on the Meuse, Table 14.

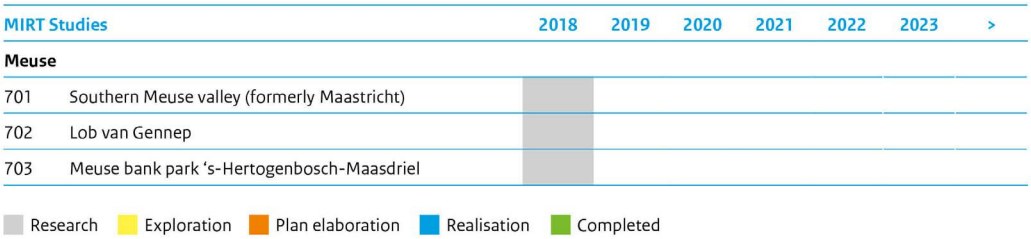


Table 12
MIRT Studies into river widening

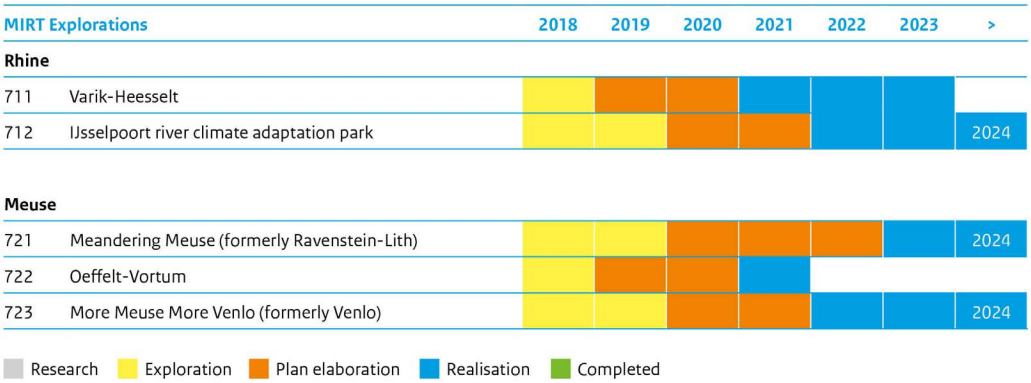


Table 13
MIRT explorations into river widening

Table 14
Realisation of river widening

5.3 Studies ensuing from knowledge agenda and in regions

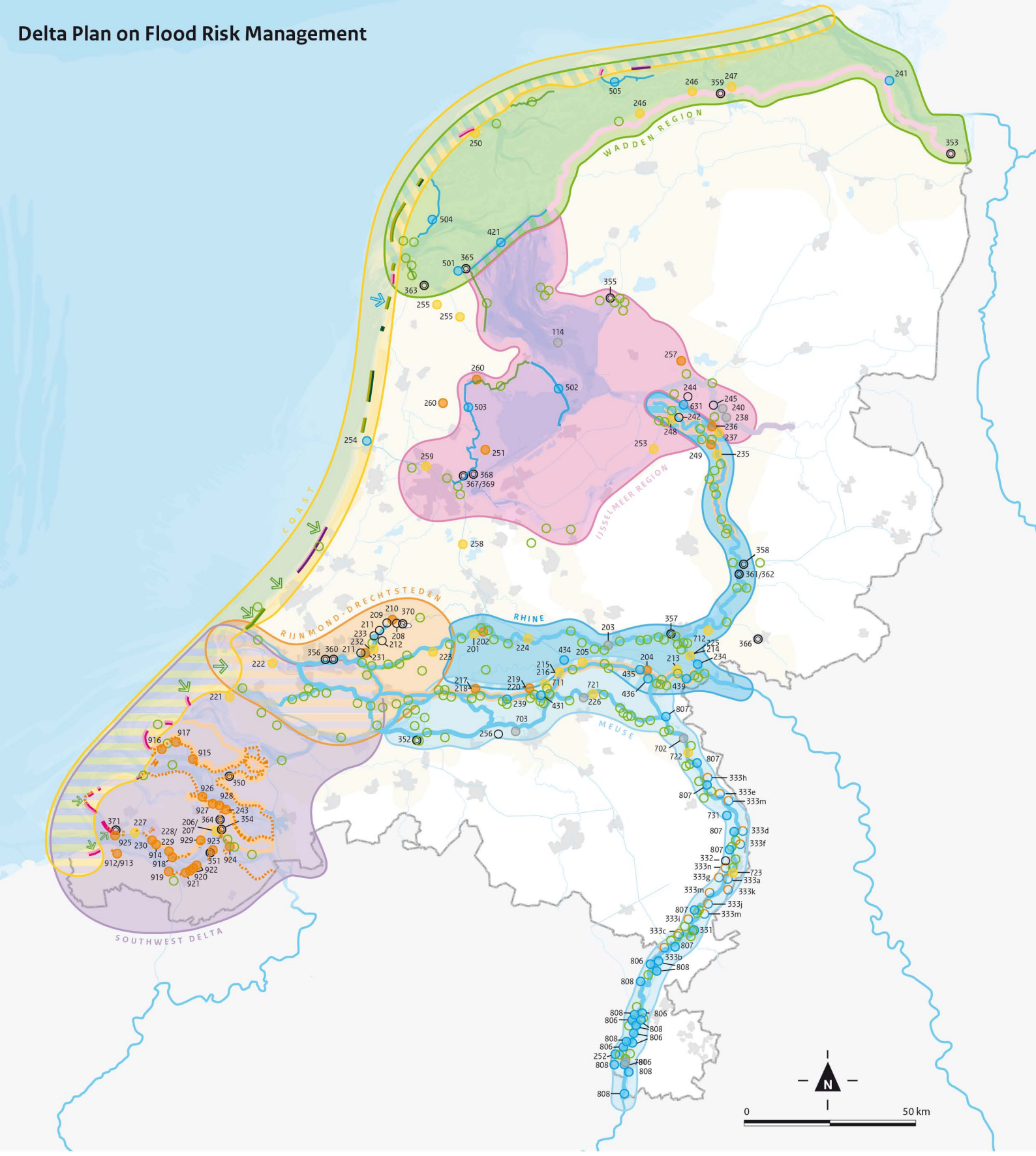
Several follow-up studies have been scheduled to elaborate Delta Decisions, preferential strategies, and measures and provisions contained in the Delta Programme.

Studies into flood risk management and spatial adaptation		2018	2019	2020	2021	2022	2023	>
Flood risk management								
Tools and instruments								
101	Supplementary support instruments for the statutory assessment of flood defence systems							
102	Knowledge development for Statutory Assessment Tools 2023 including National Water Model							
Optimisation issues								
114	IJsselmeer Region system study							
Fundamental research								
131	Additional monitoring, research, and pilots regarding sand system (under Coastal Genesis 2.0)							
132	Morphological behaviour of river systems and stability of bifurcation points							
Spatial adaptation								
151	Spatial Adaptation Incentive Programme							
152	New Spatial Adaptation Incentive Programme cf. Delta Plan on Spatial Adaptation							

Research Exploration Plan elaboration Realisation Completed

Table 15
Schedule of studies into flood risk management and spatial adaptation

Delta Plan on Flood Risk Management



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

Delta Programme studies
- 100 project number
- project location

Flood Protection Programme 2018-2023
- 200/300 project number
- dyke improvement project
- General explorations: Piping (321), Wadden Sea dykes (322), Flood management vision Vecht/Systemanalysis(323)
- Meuse agreement project
- pre-financed dyke improvement project

Second Flood Protection Programme (HWBP-2)
- 500 project number
- Improvement to dyke, dune, dam, or engineering structure
- dyke section
- Weak Links on the Coast project

Room for the River project
- 600 project number
- project location

(MIRT) river widening
- 700 project number
- project location

Meuse projects: Grensmaas and Zandmaas
- 800 project number
- project location

Other projects
- 400 project number
- project location
- WaalWeelde

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

Sand replenishment location
- beach replenishment
- beach replenishment completed
- shore face replenishment
- shore face replenishment completed

Status per project: Plan phase as of 2018
- scheduled
- study
- exploration
- plan elaboration
- between elaboration and realisation
- realisation
- completed

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

6 Delta Plan on Freshwater Supply

Measures to ensure the availability of freshwater in the Netherlands

Low water level in the Meuse, July 2017

The Delta Plan on Freshwater Supply comprises all the measures, studies, and knowledge issues scheduled and envisaged which pertain to a sustainable freshwater supply and which are – in whole or in part – funded from the Delta Fund.

6.1

Measures to ensure the availability of freshwater in the Netherlands

Table 16 lists the studies and measures scheduled and envisaged to elaborate the Delta Decision and the preferential strategies pertaining to freshwater supply. These studies and measures ensue from the Freshwater Investment Programme 2015-2021, as set down in DP2015. 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.

This year, the implementation programmes of the Southern and Eastern Elevated Sandy Soils will set up a website presenting all the individual projects and their progress.

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 18 specifies the Delta Fund – regional funding ratio for each measure.

*** Administrative Agreements on Freshwater Supply**
See DP2015, Paragraph 2.5.

Delta Plan on Freshwater Supply 2017-2022		2018	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	Mitigating measures, Rijkswaterstaat 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					
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 (FRESHEM)					
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 (cf. measures outlined for each region)						
189	Water availability in the Main Water System (MWS)					
190	Smart Water Management (SWM)					

Research Exploration Plan elaboration Realisation Completed Climate adaptation pilots Policy development

Table 16
Schedule of measures set out in the Delta Plan on Freshwater Supply (MWS: Main Water System)

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

Table 17
List of water availability pilots

Delta Plan on Freshwater Supply 2018-2022		Delta Fund	Regions*	Total (2018-2021)	Total contribution from Delta Fund 2015-2021
IJsselmeer Region					
171	*Flexibilisation of IJsselmeer lake water level, involving:*				
171a	MWS: new IJsselmeer lake water level ordinance (2017)	0,0	0,0	0,0	1,0
171b	MWS: operationalisation of flexible water level management	0,6	0,0	0,6	0,9
171c	MWS: measures pertaining to Frisian IJsselmeer lake shores	0,0	0,0	11,8	12,0
171d	MWS: robust and natural shores in IJsselmeer Region, phase 1	0,6	0,0	0,4	2,5
171e	Mitigating measures, Rijkswaterstaat water level ordinance	3,7	0,0	3,7	3,7
172	*Northern region elevated grounds project programme, involving:*				
172a	Natural design of Dwardsdiep area	0,5	1,3	1,8	0,5
172b	Climate-proofing Drentse Aa basin	0,2	2,5	2,7	0,2
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	2,4	2,5	0,2
173	*IJsselmeer Region testing ground, involving:*				
173a	Spaarwater	0,2	0,6	0,8	0,7
173b	Gouden gronden	0,0	2,2	2,3	0,1
173c	Hunze en Aa's testing ground	0,2	0,2	0,3	0,2
173d	Wetterskip Fryslân testing ground	0,2	0,2	0,4	0,2
Elevated Sandy Soils					
174	Implementation programme for Elevated Sandy Soils Delta Plan, Southern Region	24,7	79,7	104,4	32,9
175	Implementation programme for Elevated Sandy Soils freshwater supply, Eastern Region	20,3	67,1	87,4	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)	2,9	0,0	2,9	3,0
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	14,5	14,5	0,0
Southwest Delta					
184	Roode Vaart transfer to West-Brabant and Zeeland	11,7	11,6	23,4	12,5
185	*Climate adaptation pilot Zeeland freshwater supply testing ground, involving:*				
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 - Reprocessing	0,0	0,0	0,0	0,1
185d	E6 - Adaptation of crops to raise salt tolerance	0,0	0,0	0,0	0,1
185e	E7 - DeltaDrip	0,1	0,3	0,4	0,1
185f	E8 - More fruit with less water	0,0	0,3	0,3	0,1
185g	E9 - Walcheren Waterhouderij project	0,0	0,5	0,5	0,1
185h	E10 - Area Freshmaker	0,0	0,0	0,0	0,0

Area around the major rivers					
186	MWS: study into longitudinal control dams	0,1	0,0	0,1	0,1
187	Launch of measures in area south of the major rivers	0,3	1,0	1,3	0,5
188	Climate adaptation pilot regarding sustainable use of shallow groundwater	0,1	0,2	0,3	0,1
Main water system (cf. measures outlined for each region)					
189	Water availability in the Main Water System (MWS)	0,4	0,0	0,4	1,2
190	Smart Water Management (SWM)	3,0	0,0	3,0	4,8
Total		**118,7**	**185,2**	**303,9**	**148,1**

* 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.

Table 18
Freshwater supply investment programme 2018 - 2021 (in millions of euros)

Delta Plan on Freshwater Supply

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

Freshwater measures

- main water system
- climate adaptation pilot
- water availability pilot
- freshwater measures
- development of policy on availability of water from main water system
- slim watermanagement
- 181 pilot or measure number

Status per measure: plan phase as of 2018

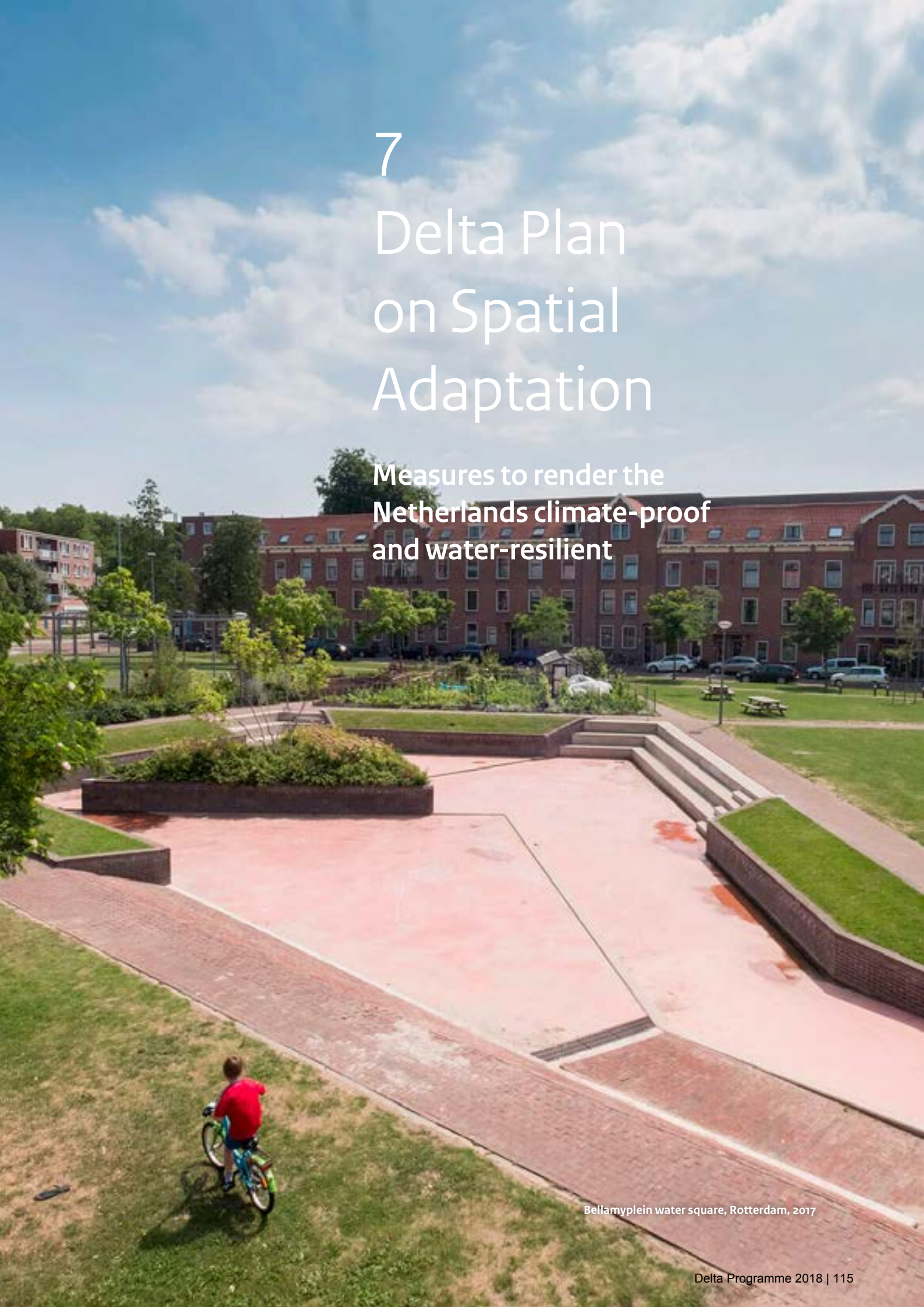
- not yet entered plan phase
- study
- exploration
- plan elaboration
- realisation
- completed

Basic map

- administrative region border
- freshwater
- saltwater / brackish water
- no supply of freshwater
- limited supply of freshwater
- area outside the dykes
- urban area
- docks
- border

7 Delta Plan on Spatial Adaptation

Measures to render the Netherlands climate-proof and water-resilient



Bellamyplein water square, Rotterdam, 2017

7.1 Introduction

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7.1.1 Justification

Adaptation to climate change is necessary

Climate change increases the probability of waterlogging, heat, drought, and floods.* This entails risks to our economy, health, and safety. It is imperative for the Netherlands to adapt to such changes. If we refrain from taking action the damage in our cities may rise to some 70 billion euros in the period up to 2050.* Rural areas may also sustain considerable damage. Here, severe downpours and prolonged precipitation will cause waterlogging, while at other times drought may cause damage. Heat causes expansion-related problems in railways, bridges, and other infrastructure. In addition, heat will affect the health of vulnerable population groups, such as older people and young children. According to the World Disasters Report drawn up by the International Red Cross, the heatwave that hit France in the summer of 2015, with a death toll of some 3,300 people, was the second deadliest natural disaster of that year, after the earthquake in Nepal.

*** Climate change increases the probability of waterlogging, heat, drought, and floods.**
The Flood Protection Programme has been set up to prevent flooding. This Delta Plan on Spatial Adaptation focuses on reducing the impact of flooding through spatial planning, should a flood occur nonetheless.

*** If we refrain from taking action the damage in our cities may rise to some 70 billion euros in the period up to 2050.**
Source: Report Schades door watertekorten en -overschotten in stedelijk gebied [Damage caused by water shortages and excess water in urban areas] (Deltares 2012) and Manifest Klimaatbestendige stad [Climate-proof Cities Manifest] (Coalities Klimaatbestendige stad, 2013).

Expediting and intensifying the strategy

The Netherlands has been working on spatial adaptations to climate change for some time. However, the urgency of adaptation has grown. The consequences of climate change are already noticeable, as confirmed by recent studies. The frequency of extreme precipitation already exceeds that of the 1950s, and the probability of such severe downpours is expected to increase even further in the future.* The impact of extreme precipitation is clearly illustrated by the waterlogging that particularly affected the southern part of the country in the summer of 2016. Another significant fact is that recent years virtually all rank among the ten warmest years ever recorded, both in the Netherlands and across the globe.

*** The frequency of extreme precipitation already exceeds that of the 1950s, and the probability of such severe downpours is expected to increase even further in the future.**
Stowa, 2015. Nieuwe neerslagstatistieken voor het waterbeheer: extreme neerslaggebeurtenissen nemen toe en komen vaker voor. [New precipitation statistics for water management: extreme precipitation events are increasing both in scope and frequency].

How exactly the climate in the Netherlands will develop is uncertain. This depends on worldwide developments. Global warming may give rise to cascading effects and abrupt changes, such as the accelerated breaking up of ice caps, the disappearance of sea ice around the North Pole, the thawing of permafrost areas, changes in ocean currents, and changes in rainfall patterns (more intense and longer). For the Netherlands, as a low-lying and densely populated country, climate change may have a substantial impact. For that reason, the Netherlands will need to take an adaptive stance in responding to changing insights and developments regarding the climate. Since 2010, adaptive delta management has been the central approach in the Delta Programme.

With the current working method, we are making insufficient headway with spatial adaptation. The interim evaluation of the Delta Decision on Spatial Adaptation shows that its implementation has got off to a good start, yet the current approach fails to sufficiently encourage the parties involved to adopt spatial adaptation as an inseparable component of their policies and implementation efforts with effect from 2020. This prevents us from attaining the goals set down earlier. The evaluation of the Delta Act has already demonstrated that, as yet, spatial adaptation is largely perceived as noncommittal, while regions and municipalities differ widely in terms of both awareness, and analysis and approach. In several motions* the House of Representatives has urged that these efforts be expedited. One such motion requested the government to develop, in collaboration with municipalities, district water boards and other parties, a sound urban water management action plan in 2016 in order to promote water storage and greening in the cities (Jacobi/Dik-Faber motion).

*** motions**
Jacobi/Dik-Faber motion, Parliamentary Document 34300-J no.22 dated 30 November 2015: "... requests the government to develop, in collaboration with municipalities, district water boards, and other parties a sound urban water management action plan in 2016, setting out every conceivable way of promoting water storage and greening in the cities." Visser motion, Parliamentary Document 34436 no. 8 dated 4 July 2016: "... requests the government to enter into consultations with the district water boards and municipalities to draw up a plan for responding more rapidly in the future in such extreme cases in order to minimise the damage." Jacobi/Leenders motion Parliamentary Document 34550-J no. 23 dated 22 November 2016: "... requests the government to encourage, in the Delta Plan on Spatial Adaptation, private initiatives in the fields of greening and water retention, and remove (any) obstacles to such efforts." Geurts motion Parliamentary Document 34550-J no. 21 dated 14 November 2016: "... requests the government to recommend the Code Orange action plan of the Peel en Maasvallei district water board, at the collaborative level of the southern part of the country, as a pioneering project within the framework of the Delta Programme on Climate Adaptation."

Ergo, we need to do more. We need to step up our efforts and take more targeted, concrete action. Acceleration is also urgent in areas not acutely under threat: in order not to miss out on opportunities ensuing from investments in buildings and infrastructure, many of which will, after all, continue to exist for many decades.

In order to achieve the desired acceleration, the Delta Programme partners, at the proposal of and under supervision of the Delta Programme Commissioner, have decided to compile this Delta Plan on Spatial Adaptation.

7.1.2 Aim and state of affairs of the Delta Plan

The Delta Plan on Spatial Adaptation is a collective, national plan set down by municipalities, district water boards, provinces, and the central government. It features concrete actions and goals for the responsible authorities. The aim of this Delta Plan is to expedite the spatial adaptation process and make it less noncommittal on the basis of agreements regarding the goals, working methods and monitoring of its implementation. To achieve this aim, the "Analysis, Ambition, Action" approach has been adopted, in accordance with the working method set down in 2014 in the Delta Decision on Spatial Adaptation: mapping out the vulnerabilities (Analysis), subsequently formulating goals (Ambition), and then setting to work to render our living environment climate-proof and water-resilient (Action).

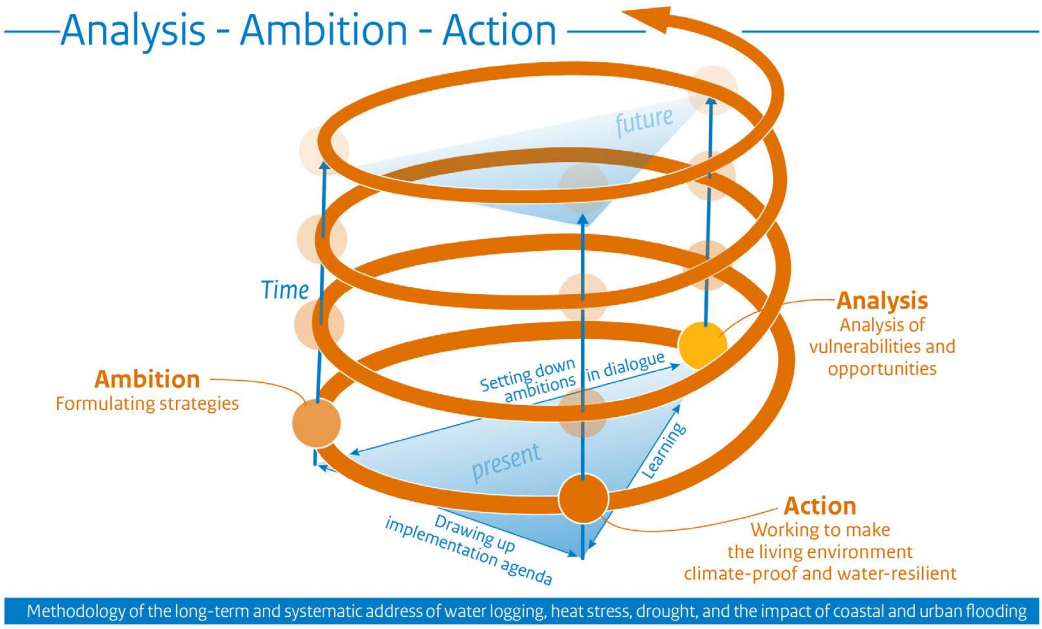


Figure 10
"Analysis – Ambition - Action"

The Netherlands is faced with the major, long-term tasking of redesigning a great many locations in order to reduce the increasing damage caused by waterlogging, heat, drought, and urban flooding. Moreover, this tasking differs from one location to the next. This Delta Plan encompasses the strategy for tackling this large, location-specific tasking. It accommodates the main recommendations ensuing from the evaluation of the Delta Act, by encouraging the integration of taskings, fostering participation by non-government bodies and residents, and increasing effectiveness at the local and regional levels through a proposal for its governance.

This process must lead to a long-term, systematic strategy for tackling waterlogging, heat stress, and drought, and reducing the impact of urban flooding. The Delta Plan on Spatial Adaptation is a component of the Delta Programme. It is updated annually, as are the other Delta Plans. Every year, the Delta Programme Commissioner submits a proposal to this end.

With this Delta Plan on Spatial Adaptation the government is also addressing the above motions put forward by the House of Representatives.

7.1.3 Collective realisation

The increasing urgency of spatial adaptation poses a challenge to the Netherlands that can only be tackled by governments, the business community, NGOs, and residents collectively. We need to adapt our living environment to permanently accommodate increasing waterlogging, heat stress, drought, and flood damage ensuing from climate change: from the major (infrastructure) grids down to the very capillaries of society. In cities and small built-up nuclei as well as in rural areas. Spatial adaptation encroaches upon a wide range of domains, such as the ways in which we construct our houses and business premises, the ways in which we design our gardens and public spaces, the ways in which we construct, maintain, and manage our infrastructure, and the ways in which we practice agriculture, and design nature.

In the build-up to this Delta Plan, five regional meetings with administrators and two theme-based round table discussions with NGOs were organised in 2017. These have garnered more support for spatial adaptation. The meetings have generated views on the contents of this Delta Plan: what agreements do we want to make, who can contribute what, and how are we going to collaborate? The interim evaluation of the Delta Decision on Spatial Adaptation, in which many parties have been involved, has also generated recommendations that have been incorporated into this Delta Plan.

In March 2017, the umbrella organisations of the municipalities, district water boards, and provinces drew up the joint investment agenda for the new Cabinet. This agenda, entitled Towards a sustainable Netherlands, sets out how they intend collectively to contribute to climate adaptation.

In addition, the Infrastructure and the Environment Consultative Body (OIM) has produced an advisory report. This report and the response to it by the Delta Programme Commissioner are contained in Background Document B to Delta Programme 2018. Final input was provided by the advisory report on waterlogging that the Advisory Committee on Water (AcW) submitted to the Minister in May 2017, with a view to the Delta Plan on Spatial Adaptation.

7.2 Context

Delta Decision on Spatial Adaptation

In 2014, the Delta Programme Commissioner presented proposals for Delta Decisions, including a proposal for the Delta Decision on Spatial Adaptation, in order to be prepared for future climate developments in good time. Subsequently, the Cabinet set down the national policy ensuing from the proposed Delta Decision on Spatial Adaptation in the National Water Plan. The goal set out in the Delta Decision on Spatial Adaptation is that by 2050, the lay-out of the Netherlands must be as climate-proof and water-resilient as possible to accommodate waterlogging, drought, heat, and urban flooding, while (re)developments must not entail any additional risks of damage and fatalities insofar as this is reasonably feasible. To attain this goal, the Delta Decision sets out the interim target of having climate-proof and water-resilient spatial planning incorporated into the policies and actions of government authorities: in regional and local spatial considerations, the authorities will factor in the water resilience and climate proofing of their own region. In essence this Delta Plan is the implementation programme of the Delta Decision on Spatial Adaptation.

Over recent years, many parties have committed to the Delta Decision on Spatial Adaptation. In an administrative agreement, the central government and the umbrella organisations of the provinces, municipalities, and district water boards have set down their commitment to endorse and implement all the Delta Decisions, including the Delta Decision on Spatial Adaptation. In this context, the central government is working on improving the flood protection of the national vital and vulnerable functions, to which end policy and regulations will have been set down by 2020 or as much earlier as possible. 119 parties, among which are many businesses and NGOs, have embraced the principles of the Delta Decision on Spatial Adaptation by signing a declaration of intent. Fifteen additional declarations of intent have been signed regarding specific projects. In 2016, several cities, with governments, NGOs, and the business community as participating parties, committed to the Climate Adaptation City Deal.

National Climate Adaptation Strategy

In the Paris Climate Agreement (2015), the signatory states acknowledge that climate change is already causing damage, and that adaptation is equally as important as combating climate change. In 2007, the Netherlands was among the first countries to set down a national adaptation strategy. The introduction of the Delta Programme in 2010 substantiated a major part of the adaptation tasking: adaptation to accommodate waterlogging, heat, drought, and urban flooding. At the end of 2016, the Cabinet set down the second National Climate Adaptation Strategy (NAS), in response to the European Commission's request to all member states to have in place a national strategy in the field of climate adaptation by no later than 2017. The NAS covers the entire scope of climate adaptation and all economic sectors. The NAS implementation programme, to be drawn up in 2017, will focus on the adaptation efforts required as a supplement to the Delta Programme and the interconnectivity between the various sectors. Ergo, the NAS implementation programme and the Delta Programme, which includes this Delta Plan, complement one another. The efforts are being expended in close collaboration wherever such is necessary.

7.3 “Analysis, Ambition, Action” – state of affairs

The taskings set out in this Delta Plan pertain to the issues of waterlogging, heat stress, drought, and urban flooding.* These issues already have a noticeable impact: extreme heat is already taking a death-toll, and extreme rainfall and drought are already causing major damage. However, the four issues do not pose a threat everywhere, nor are they equally important everywhere.

*** urban flooding.**
Urban flooding: insofar as measures concern adaptations in spatial design to reduce the impact of any urban flooding (second layer, multi-layer flood risk management).

The Delta Decision on Spatial Adaptation has introduced the “Analysis, Ambition, Action” method in the purview of a structured approach to the four issues. In order to effectively tackle undesirable effects, we must first map out the challenges in a specific area (“Analysis”). This produces differences between urban and rural areas, between built-up and undeveloped areas, between elevated and low-lying parts of the country, between sandy soils and peaty areas. The next step involves the formulation and embedding of goals (“Ambition”). These goals will subsequently be substantiated through measures (“Action”).

In recent years, government authorities and other parties have already embarked on the “Analysis, Ambition, Action” process. The progress made differs from one theme to the next. The results constitute the point of departure for this Delta Plan.

7.3.1 Waterlogging

Under the "Water Policy in the 21st century" memorandum, we have been working on reducing waterlogging for some fifteen years. During this period, the focus has been on the prevention of waterlogging caused by prolonged rainfall, in accordance with the "retention, storage, drainage" triad. Municipalities have expanded sewer systems, disconnected downpipes, and created more room for water in public greenery (wadis) and on streets (lowered street profiles). District water boards have created additional rainwater storage facilities in the water system, and improved the discharge efficiency. The provinces have set down function-specific waterlogging protection levels in provincial regulations, thus marking the boundaries of government responsibility.

District water boards and municipalities have invested significant budgets in these measures. Over the period from 2003 up to and including 2015, the aggregate district water boards have spent some 1.5 billion euros on water system measures to combat waterlogging. In 2015 alone, municipalities spent a total of 1.56 billion euros on urban water management, of which 225 million euros to tackle pluvial flooding. Despite these efforts, waterlogging is occurring with growing frequency, due to climate change, and due to the increasing proportion of paved and built-up surfaces.

Climate change is visible: extreme precipitation is increasing

Recent analyses show that climate change is already manifest in the statistics on extreme downpours. The frequency of extreme precipitation has already increased by a factor of two to five compared to the 1950s, and it will increase even further in the future: by a factor of up to five by 2050, and by a factor of up to ten by 2085 vis-à-vis the current situation (based on the KNMI'14 climate scenarios). How this will affect the probability of waterlogging differs for each individual area, but by and large, the probability of waterlogging is increasing. Waterlogging can be caused by prolonged precipitation (usually in winter), but also by short, extremely severe precipitation (more often in summer). The impact of these two types of precipitation differs and also depends on the location hit by the precipitation: whether in rural areas or in a city.The impact may be so large that local residents or businesses sustain damage despite the preventative measures taken by the government authorities. The district water board and the municipality are not accountable for such damage. Although residents and businesses have a responsibility of their own, in many cases they are insufficiently aware of the risk and of measures to limit such risk. Consequently, not many of them are insured against damage caused by waterlogging. Furthermore, such damage is not fully covered by insurance companies, nor does the central government disaster fund provide a comprehensive safety net.

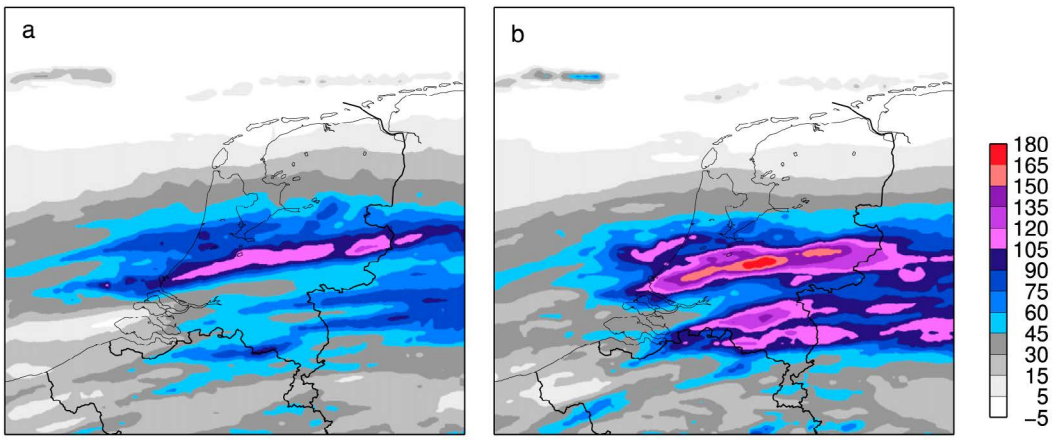


Figure 11
Situation involving more than 100 mm of precipitation in two days in August 2010 (left) and the transformation to a 2 degrees temperature rise in the climate (right); source: KNMI

Urban areas: short downpours are particularly problematic

In cities, short but extremely severe downpours have a disproportionally large impact. The densely built-up and largely paved urban areas need to drain most of the rainwater via sewers and public roads. The capacity of the sewer system is insufficient for draining so much water in such a short time. The excess water flows to lower-lying locations, where it can cause damage such as obstruction of roads or railroads, or can inundate houses and business premises. The impact differs strongly from one location to the next, and in addition to financial damage, repeated urban flooding can cause major emotional damage. Water storage on rooftops and in gardens, streets, and parks to combat waterlogging as a result of severe downpours is a more cost-effective strategy than the further expansion of the sewer system. In principle, local residents and businesses are themselves responsible for dealing with rainwater in their own premises.

Rural areas: the impact of downpours is increasing

In rural areas, prolonged precipitation poses more of a problem than do severe downpours. District water boards and provinces have developed a solution, in collaboration with municipalities and farmers, by creating water storage facilities in rural areas: during prolonged precipitation, farmlands are left wet, taken out of production, or converted to water storage areas. In recent years, short downpours have also caused occasional disruption in rural areas. Occasionally, rain volumes are such that even these areas cannot drain the water fast enough, despite the fact that rural areas have much more room for water than do urban areas, and water is more easily absorbed by the soil. For example, in such situations, sections of motorways may be inundated, or the banks of roads or railways may subside. Many such downpours occur in the summer season, which may cause entire crops to fail.

7.3.2 Heat stress

City warmer than rural areas

According to the Netherlands Environmental Assessment Agency, heat stress may soon have a major impact on the population in the near future.* Additional consequences could include, e.g., the expansion of moving bridges, which prevents the bridge from closing or opening.

*** According to the Netherlands Environmental Assessment Agency, heat stress may soon have a major impact on the population in the near future.**
Source: Netherlands Environmental Assessment Agency, 2014. Aanpassen aan klimaatverandering. Kwetsbaarheden zien, kansen grijpen [Adaptation to climate change. Identifying vulnerabilities, capitalising on opportunities]. PBL publication 1454.

During the summer, urban environments are an average of 1°C warmer than rural environments. Occasionally, the night-time temperature difference may rise to more than 7°C.* For that reason, minimum temperatures tend to remain fairly high. This is an important factor in the negative impact of heat, especially if it results in minimum temperatures exceeding 20°C. The KNMI climate scenarios show that around 2050, the summers will only become warmer. Heat stress may also occur in rural areas, and proximity to water does not by definition have a cooling effect. For example, during the recent hot spells in August and September 2016, the coastal province of Zeeland ranked among the warmest regions of the Netherlands. On some days, the KNMI weather stations in Zeeland outside the urban areas even recorded national highs, with occasional minimum temperatures remaining higher than 20°C. Other significant contributing factors to heat stress, in addition to temperature, are shade, ventilation (wind), and humidity.

*** Occasionally, the night-time temperature difference may rise to more than 7°C.**
CPC report, Rovers et al., 2015.

Health effects are expanding

Heat stress-related health problems are not just caused by the heat itself, but also by the combination of heat and air pollution (high ozone content and summer smog). Heat stress affects increasingly more people due to growing urbanisation and population ageing, and the fact that vulnerable people continue to live independently for longer. Among vulnerable groups, heat stress can result in rising absentee rates, increased illness, and premature death. During the heatwave that plagued Europe in 2003, the number of deaths in the Netherlands totalled 1,400 more than usual.

Low sense of urgency, limited knowledge

The prevention of heat stress is still insufficiently perceived as urgent. In recent years, more information has become available on the health consequences of extreme heat and potential courses of action for residents, organisations, and governments. However, this information is still quite fragmentary, and does not always end up with the parties that could give impetus to a reduction of the risks or a change in behaviour. There is a great deal to be learned from parties that have already developed and deployed instruments. For example, the municipalities of Rheden, The Hague, and Utrecht, and the province of Zeeland have compiled heat maps and explored adaptations in the spatial design aimed at reducing heat stress in the medium or long run, such as greening public spaces and urban restructuring. Knowledge about the health effects of heat is available, in particular from the National Institute for Public Health and the Environment RIVM, the area health authorities, and the Red Cross. The National Climate Adaptation Strategy identifies heat stress as one of the most urgent climate risks for the decades ahead.

7.3.3 Drought

Wide range of drought-related issues

Drought is defined as a shortage of water of satisfactory quality in the soil and the water system. The impact increases as the drought persists. Potential consequences include:

- accelerated soil subsidence, foundation damage, and other damage to structures due to falling groundwater levels;
- drying up of nature reserves and loss of crops due to lack of precipitation and falling groundwater levels;
- limitations for the shipping sector;
- issues related to water quality (salinisation, blue-green algae infestations) and water quantity.

Soil subsidence particularly affects areas with peaty soils. Decomposition of organic matter releases CO_2. Soil subsidence calls for water level adjustment in order to continue to meet the consumption needs of an area. Low groundwater levels also cause damage to the foundations of infrastructure and buildings, resulting in a considerable increase in management and maintenance costs of public and private spaces. Desiccation of green areas and farmland will reduce crop evaporation, whereas evaporation is important in the crusade against heat stress. In many cases, the impact of drought will only manifest itself in the long run. Occasionally, its impact will be acute, such as the failure of the dried-up peaty embankment near Wilnis in 2003.

Drought leads to more heat

A Deltares study* shows that urban heat increases substantially in periods of drought. This is because drought cuts by half evaporation by trees and plants in the city compared to normal conditions. For that reason, an interconnected strategy is imperative when tackling drought and heat stress. The most effective measures for combating desiccation are reducing the proportion of impermeable paving, disconnecting downpipes, and the expansion of surface water.

*** Deltares study**
Deltares, 2016. Ecosystem services provision; dependence of water quality and quantity.

High cost, in particular due to foundation damage

According to Deltares forecasts, drought tops waterlogging when it comes to societal costs.* The restoration of private and public foundations accounts for a large proportion of such costs.

*** drought tops waterlogging when it comes to societal costs.**
Climate-proof Cities Manifest, DPNH 2013 based on Deltares.

Insight into water availability, duty of care with respect to groundwater

An imminent water shortage in the main water system will carry a temporary shift in the distribution of water available in rivers, canals, and lakes. This national “prioritisation scheme” ensues from the Water Act. The Delta Decision on Freshwater Supply has introduced the Water Availability instrument: this provides insight into the volume of water available to various consumers under normal and dry conditions. The instrument is now being gradually substantiated, region by region. The municipalities have a duty of care regarding groundwater flooding and phreatic decline in public areas, but real estate owners also have a major responsibility of their own with respect to groundwater-related damage.

7.3.4 Consequences of urban flooding

Low probability, high consequences

The probability of urban flooding from the sea, major rivers, or major lakes is very low in the Netherlands, yet if such a flood occurs, it will have a major impact. The probability of urban flooding from regional waters is higher, but the impact will be less devastating (with the exception of the deep polders that are protected by regional flood defence systems: here, the risks will be quite high, especially if protection is provided by peaty dykes). In the past, floods used to be taken into account in spatial planning, for example, by choosing or constructing elevated sites. In flood risk management, attention has gradually shifted to raising and improving dykes, and creating more room for rivers. However, despite the strong dykes and wider rivers, factoring in the impact of a flood continues to be important, by limiting the damage, fatalities, and social disruption if a flood occurs nonetheless, and improving the water resilience of urban and rural areas. In the long run, this may even reduce the need for dyke improvements and river widening.

First steps

The evaluation of the Delta Decision on Spatial Adaptation shows that few parties feel the urgency to limit the impact of urban flooding through spatial adaptations. This is because the probability of a flood is small, and ownership of the problem is not acknowledged. In the Climate Adaptation City Deal, the cities of Zwolle, Amsterdam, Rotterdam, and Dordrecht are sharing experience with the planning of water-resilient areas. The Marken project has generated designs for a water-resilient planning of the island. Obstacles related to the sense of urgency and funding are hampering their implementation.

Limiting consequences for national vital and vulnerable functions

In recent years, steps have been taken to improve the flood protection of national vital and vulnerable functions, particularly in the fields of “Analysis” and “Ambition”. Vital and vulnerable functions include, e.g., energy supply (including electricity), communication (telecom/IT), transport, health, the chemical industry, and the water chain. The “water-resilient design” is geared to each individual function. The Ministries responsible set down a strategy in collaboration with the sector concerned, and determine which measures are essential and proportionate to the function. The Delta Programme coordinates the joint approach in order to ensure that the Ministries largely follow the same methods and time frames. In addition, the parties are working with the same flood scenarios wherever possible, and they acknowledge the mutual dependencies between the individual vital and vulnerable functions.

Demarcation: only where flood depth remains limited

Whether adaptations hold promise depends, inter alia, on the features of an area. In collaboration with the district water boards and provinces, the municipalities will conduct stress tests to visualise the consequences of a dyke failure. In deep polders, impact-limiting measures are often expensive. In such cases, focusing on evacuation will be more effective. Measures to limit the impact of deep floods are often closely interrelated with the flood defence system tasking. For that reason, options for linking the Delta Plan on Spatial Adaptation and the Delta Plan on Flood Risk Management will be elaborated in 2018. Spatial adaptations are particularly (cost) effective for flood depths of no more than 20 to 30 cm. Furthermore, in many cases, this enables concurrent limitation of the impact of waterlogging: although waterlogging occurs much more frequently compared to flooding, the adaptation solutions are similar.Because the impact of flooding is highly dependent on the location, a national standard or nationwide goal for flood impact limitation (multi-layer flood risk management, second layer) would not serve its purpose. It would be appropriate to develop a collective ambition at the local or regional level, in collaboration with the stakeholders.

7.3.5 Current approach

National level

The parties involved in the Delta Programme have been working on the implementation of the Delta Decision on Spatial Adaptation since October 2014. The Delta Programme supports their efforts through the development and exchange of knowledge, the Incentive Programme, the Knowledge Portal, and a learning evaluation process based on monitoring (2015, 2016) and an interim evaluation (2017). Municipalities mapping out vulnerabilities qualify for support in the performance of stress tests. The Delta Programme has supported the launch of fifteen impact projects, ten of which have already been completed. The results have been disseminated in various ways, including through the Knowledge Portal.

New knowledge has also been generated by national research programmes such as Knowledge for Climate and the Climate-proof Cities focus area of the National Water and Climate Knowledge and Innovation Programme (NKWK). Municipalities, provinces, district water boards, local residents, and NGOs have been gathering knowledge on the implementation of measures. Governments and other parties are exchanging experience and knowledge in networks such as the Climate-proof Cities Alliance and the Climate Adaptation City Deal. The various types of knowledge are important for the improvement and acceleration of spatial adaptation. In addition, attention has been focused on supporting the education sector in order to enable future professionals to acquire the knowledge and skills to embark on spatial adaptation.

The central government is improving the flood protection of national vital and vulnerable functions. The interim goal is for the central government to have set down policy and regulations pertaining to vital and vulnerable functions by no later than 2020. In four area pilots, the Delta Programme has linked the national vital and vulnerable functions track to the regional track. Two of the thirteen national vital and vulnerable functions (nuclear plants and laboratories working with infectious substances) have already been rendered water-resilient. Several waste water purification plants and hospitals are also being rendered water-resilient. The current focus is primarily on the interconnectivity between the ambition levels for the various national vital and vulnerable functions and the embedding of the ambitions based on knowledge regarding the (chain) dependencies between the functions.

Pioneers at the local and regional levels

In recent years, several municipalities and regional collaboratives have already visualised the spatial adaptation tasking using stress tests, climate scans, or other methods. One in every four municipalities has conducted some form of stress test. Pioneers in this field are, e.g., Amsterdam, Breda, Dordrecht, Rotterdam, and Zwolle. The interim evaluation of the Delta Decision on Spatial Adaptation shows that the stress test has borne fruit, in the sense that parties have developed a feeling for the issues, and have been able to concretise the threats and opportunities relevant to them. However, the methods, topics considered, and depth of the studies still differ widely.

Many showcases of concrete projects already exist. In the southern part of the Netherlands, the Aa en Maas district water board and Staatsbosbeheer are jointly working on profitable wet cultivation. Wet cultivation can be combined with water storage, and is conducive to better water quality and biodiversity. In Noordoost-Twente, several measures have been implemented to prevent drought-related damage: raising brook beds, construction of weirs, replacing culverts by “fords”, and creating retention facilities in brook valleys. Rotterdam has adopted a structural approach to combating heat stress and has initiated many small-scale projects to this end. For example, a car park was recently renovated with green façades and a park garden featuring footpaths, lawns, and ornamental grasses. Residents of the Zomerhofkwartier district have replaced paving stones with green (façade) gardens. The municipality has filled redundant parking spots with plants and flowers.

The inner city of Breda is being greened with an eye for cultural history and opportunities for entrepreneurs. In rural areas, the province and district water boards are creating additional water storage facilities in combination with nature, smart surface water level management, and improving the "sponge" function of the soil. The provinces are linking the substantiation of climate taskings to area planning projects such as Waterdunen in Zeeland, Land van Cuijk in Brabant, and brook restoration projects such as the Eckelsebeek in Limburg. Hoogeveen has carried out the "Analysis" and "Ambition" steps in parallel, through the collaborative efforts of staff engaged in various disciplines – green, sewerage, water, and spatial planning. The city can thus quickly embark on the "Action" step, aimed at climate-proofing the Hoogeveen city centre.

The business community is also taking initiatives. For example, the Wehkamp online emporium has rendered its national distribution centre in Zwolle "climate active" through green rooftops, solar panels, and by boosting biodiversity in the vicinity. The building has been rendered water-resilient by locating energy and IT facilities on the top stories, and constructing small dykes around the building. Increasingly more entrepreneurs are opting for green rooftops, or filtering and reusing rainwater. Through Amsterdam Rainproof, the residents of Amsterdam are discovering what they themselves can do with water and greenery. Simple measures are enhancing the appeal of the neighbourhood and rendering it climate-proof.

This run-down is by no means exhaustive. Throughout the country, projects have been realised at various scale levels.

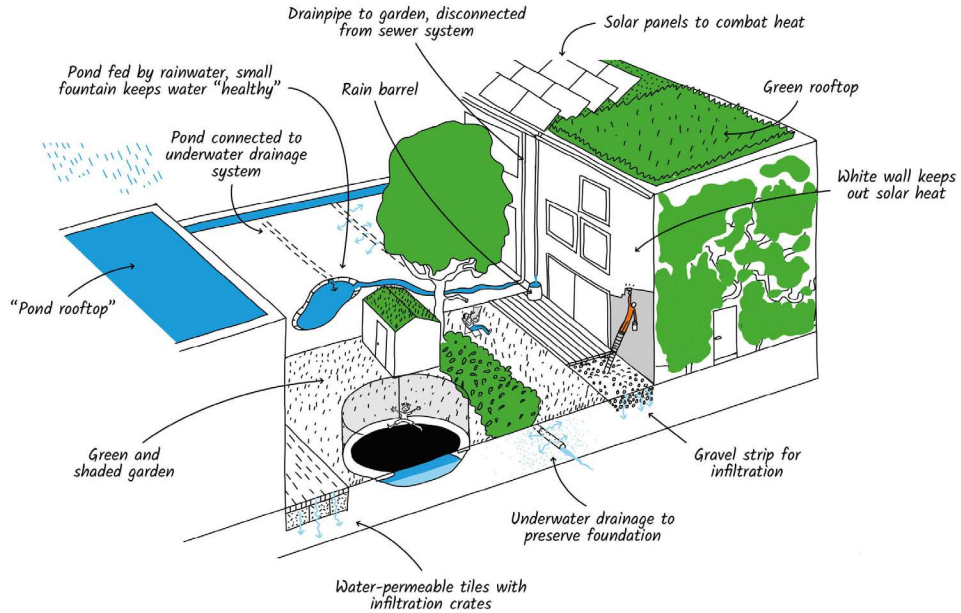
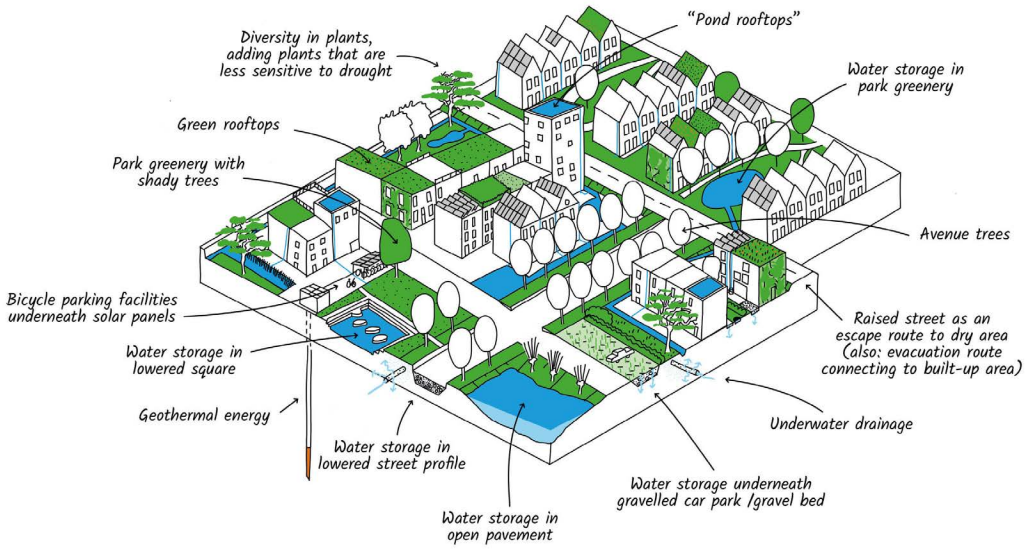
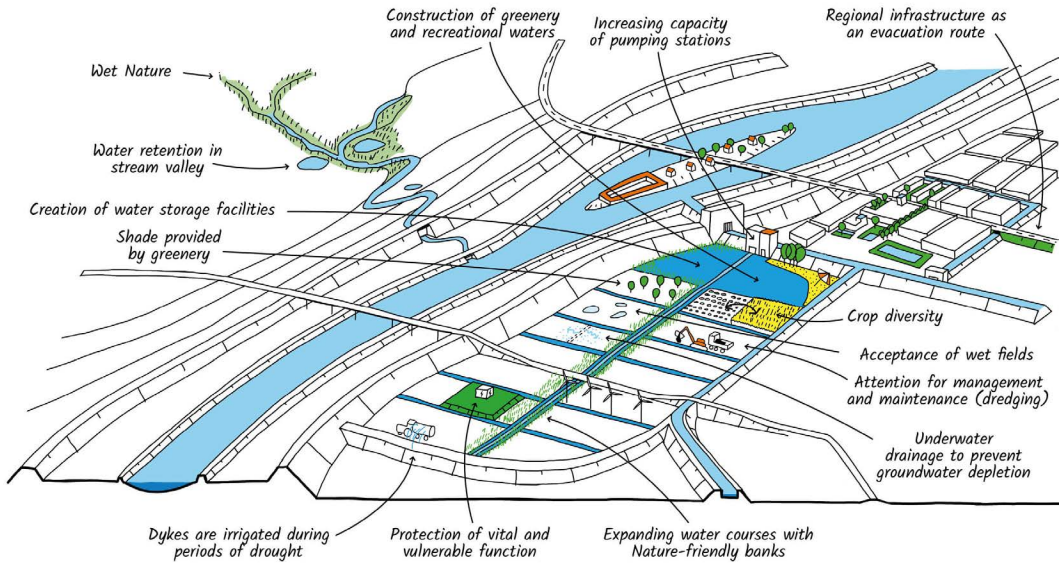


Figure 12a
Potential design that may help to reduce the negative impact of waterlogging, heat, and drought at the parcel level.



b) in the neighbourhood

Figure 12b
Potential design that may help to reduce the negative impact of waterlogging, heat, and drought at the neighbourhood scale level.



c) at the regional scale level

Figure 12c
Potential design that may help to reduce the negative impact of waterlogging, heat, and drought at the regional scale level.

7.4 Our intentions: expediting and intensifying

Continue reading

» 7.4.1 Vision: from the present to 2050

» 7.4.2 Ambition and strategy

» 7.4.3 Interim goals

» 7.4.4 Nationwide governance framework regarding spatial adaptation

» 7.4.5 Funding

7.4.1 Vision: from the present to 2050

The goal of this Delta Plan is to expedite and intensify adaptation efforts in order to ensure that the Netherlands will be water-resilient and climate-proof by 2050. Rather than biding our time, we want to prepare preventatively and adaptively for climate change. This is in line with the overall vision of the Delta Programme.

In this respect, it is important to realise that climate-proof spatial planning can prevent some waterlogging, heat stress, prolonged drought, and urban flood threats, but never entirely so. To a certain extent, we must accept that such conditions will hit us more frequently, and ensure that in such cases the damage will be contained. We can achieve this by restructuring our living environment.

A water-resilient and climate-proof design requires efforts in every quarter. The governments, the business community, NGOs, and society: everyone must do his part and set to work. In one's own back garden, on rooftops, on private business properties, and in public spaces. Each individual party can take measures, under local supervision.

Above all, we need close collaboration: between residents, businesses, and governments; between sectors; and between the local, regional, and national levels, for example, in adapting the water system or the sewer system. Furthermore, collaboration opens up opportunities for co-funding and knowledge exchange. Investments in spatial adaptation will gain in cost-effectiveness if measures are linked to other taskings, such as the energy transition, accessibility, and the circular economy. Such an integrated approach ties in with the intention of the Environment Act.

The tasking pertaining to water-resilient and climate-proof spatial planning is one that involves all scale levels, but particularly the local and regional ones. For that reason, the ambitions are being set down in municipal, provincial, and national Environmental Visions, and in the implementation plans of municipalities, district water boards, NGOs, and the business community. This Delta Plan aims to expedite and intensify this approach by setting out a number of collective ambitions, interim goals, and actions at the national level.

7.4.2 Ambition and strategy

We will expedite and intensify the realisation of a water-resilient and climate-proof design by working on seven ambitions:

1. mapping out vulnerabilities;
2. conducting a risk dialogue and drawing up a strategy;
3. drawing up an implementation agenda;
4. capitalising on linkage opportunities;
5. promoting and facilitating;
6. regulating and embedding;
7. responding to disasters.

The above ambitions have been formulated in concert during the preparation of this Delta Plan, and thus expressly reflect the ambitions of all government authorities involved: municipalities, district water boards, provinces, and the central government. In part, the seven ambitions can be substantiated concurrently and the sequence may differ from one location to the next. Any steps that have already been taken constitute the point of departure for the new approach. And at locations at which bottlenecks have already been identified, the parties will take no-regret measures in anticipation of the vulnerabilities analysis and the dialogue. After all, this Delta Plan is intended to boost rather than stem the implementation.

Figure 13
Seven ambitions

7.4.2.1 Mapping out vulnerabilities

How will extreme precipitation, heat, drought, and urban flooding affect our cities, villages, and rural areas? Insight into the vulnerability to weather extremes is the foundation that underpins spatial adaptation. For that reason, by no later than 2019, the aggregate municipalities, district water boards, provinces, and the central government (including Rijkswaterstaat) will conduct stress tests, in collaboration with the stakeholders in their area, to map out its vulnerability, insofar as such a test has not yet been conducted. The stress tests will subsequently be repeated every six years. Municipalities, district water boards, provinces, and the central government are setting down regional agreements regarding collaboration in these analyses, in order to safeguard uniformity and to capitalise on the expertise available. They will embed these agreements in their policies; in the future, the agreements will be incorporated into the Environmental Visions and Environmental Plans.

The stress tests can be characterised as follows. The stress test:

- covers an entire area, in both urban and rural environments;
- targets an area's vulnerability to waterlogging (caused by severe downpours or prolonged rain), heat stress, drought, and urban flooding;
- focuses specific attention on vital and vulnerable functions;
- takes account of other developments that raise an area's vulnerability (such as soil subsidence and changing groundwater levels).

The central government is taking the lead by developing a "standardised" stress test in 2017 to support this process, in close collaboration with district water boards, municipalities, provinces, knowledge parties such as the Foundation for Applied Water Research STOWA and the RIONED Foundation [umbrella organisation in the field of urban water management and sewer systems], and the providers of the current stress tests. The Cabinet thus follows the recommendations of the Advisory Committee on Water, viz. to introduce a standardised stress test for waterlogging, and making such a test mandatory.

The "standardised" stress test comprises several future scenarios, reflecting, e.g., the probability of extreme downpours and extremely hot days. Each stress test features, as a minimum, the rainfall scenarios corresponding to the current waterlogging standards, as well as scenarios for "supra-normative" conditions. In addition to the standard points of departure, the "standardised" stress test will offer sufficient room for local and regional customisation, considering the location-specific issues and requirements. The parties developing the stress test will utilise the experience gained with the existing stress test methods, including those used for the Delta Programme*, and the Climate Impact Atlas. They will also use the guidelines for impact analyses of serious waterlogging and urban flooding, an instrument ensuing from the Water and Evacuation project which is carried out by the Security Regions. If need be, the scenarios used in the stress tests will eventually be adapted to new climate insights.

*** Delta Programme**
New Urban Developments and Restructuring Delta Programme, 2014. Guidelines for conducting climate-proofing stress tests.

The use of a standardised methodology has various advantages: it obviates the need for every individual party to re-invent the wheel, it enhances inter-comparability, it facilitates the exchange of experience, and it generates a national picture of the scope of the taskings. The agreement is that with effect from 2018, all the parties will use the "standardised" stress test and the standard scenarios in the analyses yet to be conducted; however, stress tests that have already been scheduled but may not quite be up to standard will nonetheless be performed as planned.

Regular repetition of the stress test should visualise the effect of the measures that have been carried out. In 2018, a study will be conducted to explore what is required to this end, and how the municipalities can utilise digital spatial information in this process. Municipalities, district water boards, provinces, and the central government will publish the results of the stress test before 2020 in order to enable local residents and businesses to gain insight into the vulnerability of their areas and the urgency of measures.

7.4.2.2 Conducting a risk dialogue and drawing up a strategy

Once the results of the stress test are available (by no later than 2019), the municipalities, district water boards, provinces, and Rijkswaterstaat will launch a dialogue with all the relevant partners in each region or sub-region (such as housing corporations, grid managers, farmers, nature managers). At locations that have already undergone a stress test, the dialogue will commence earlier. The goal is twofold: to raise awareness of a region's vulnerability to climate extremes, and subsequently to discuss how concrete measures can reduce this vulnerability. The OECD has also emphasised the need for raising water awareness.*

*** water awareness**
OECD, 2014. OECD studies on water. Water governance in the Netherlands: fit for the future?

The dialogues will be conducted at several levels, from neighbourhoods to the central government; all the stakeholders will collectively work on solutions to the tasking that ensues from the stress test. Based on the experience of pioneering regions, a guideline will be drawn up to help conduct such a dialogue. This past year, the Southern Netherlands region already embarked on social dialogues, prompted by the waterlogging that occurred in the summer of 2016.* The Foundation for Applied Water Research STOWA, the RIONED Foundation [umbrella organisation in the field of urban water management and sewer systems], and the Royal Netherlands Meteorological Institute KNMI can use their expertise and experience in public communication to help develop this guideline.

*** the waterlogging that occurred in the summer of 2016.**
Cf. "Giving impetus to climate adaptation – Invitation to South-Netherlands"

Within the framework of the National Climate Adaptation Strategy (NAS), comprehensive national adaptation dialogues on several themes are being conducted with supra-regional NGOs in order to fine-tune the agenda, the issues, and the courses of action. Agreements ensuing from these national dialogues will be accommodated in the regional dialogues. Wherever relevant, the parties will enter into close collaboration with the team working on the NAS implementation programme. Preparations for the national adaptation dialogues on, e.g., the insurability of climate risks, and heat and health have already commenced. The dialogue on heat and health builds on the initial impetus that the parties have given during the round table discussion on this theme. Preparations for the dialogues on cultural heritage and climate-proof construction in urban areas, and on agriculture have commenced as well. The dialogues will be continued in 2017 and 2018.

The governments are helping to raise awareness through communication at the local, regional, and national levels, focusing on the risks, the individual responsibilities of residents and businesses, and the course of action for all parties concerned.

In each area, the municipalities, district water boards, and provincial authorities will set down the additional efforts* they intend to undertake to reduce the vulnerability of the area, how they intend to support residents and businesses in taking their own measures, and what damage will be acceptable for the time being. Strategic choices will be made in this process, if need be, taking account of the interconnectivity in the system (urban/rural areas), synergy with other spatial developments, priorities, and the division of tasks. Wherever relevant, the provinces will incorporate this joint spatial adaptation strategy relating to waterlogging, drought, heat, and urban flooding into the more comprehensive regional NAS climate adaptation strategies. Among other things, the regional climate adaptation strategies contain the spatial consequences of the climate tasking for the design of the physical living environment. These consequences will be accommodated in Environmental Visions, Environmental Plans, and Environmental Programmes.

*** additional efforts**
In supplement to efforts ensuing from the statutory duty of care regarding rainwater and waterlogging standards.

7.4.2.3 Drawing up an implementation agenda

Within three years (by no later than 2020), the governments will have drawn up implementation and investment agendas for their regions, based on the adaptation strategy. These agendas set out the agreements regarding the efforts to be expended by each party, based on the dialogues. Agreements will also be made regarding bottlenecks to be addressed shortly and issues that can wait, issues that require a collective approach, issues that require an individual approach, and measures that will be carried out in interconnection with other taskings (see 4.2.4). This working method does not alter the fact that the parties may take no-regret measures with respect to bottlenecks that have already become manifest, in anticipation of the stress test and the implementation agenda.

With respect to the most urgent bottlenecks, the implementation agenda features a set of preventative measures to be carried out by the parties themselves, and actions to link solutions to other (public and private) efforts. The measures and actions are underpinned by the stress tests and the dialogues. The central government, municipalities, provinces, and district water boards will invest in their own real estate and the social real estate for which they are responsible, such as schools, public grounds, sports facilities, and traffic networks. Spatial adaptation will constitute one of the criteria in tendering procedures.

Methods will be developed to gauge the effectiveness of measures and determine an optimum, cost-effective mix of measures. In addition, it would be advisable jointly to map out the interconnectivity between damage prevention by governments, courses of action for residents and private parties, and coverage of the residual risks by insurance companies and disaster funds. A plan of action to this effect will be submitted to the Spatial Adaptation Steering Group.

7.4.2.4. Capitalising on linkage opportunities

Wherever possible, we want to utilise the synergy with other taskings, by creating work with work. In many cases, particularly in highly dynamic urban areas, "breaking up a street" in the purview of spatial adaptation alone is neither efficient nor effective. In the decades ahead, we will also need to tackle other substantial spatial taskings, such as (major) renovations of buildings, public spaces, greenery, and infrastructure; the energy transition; and the transition to a circular economy. Furthermore, the demand for new urban developments is expected to pick up again. This Delta Plan aims to capitalise on the opportunities for climate-proofing offered by these types of developments. To this end, we are setting side by side and interlinking, wherever possible, the implementation and investment agendas for various taskings in the spatial domain. In addition, synergy between the taskings covered by this Delta Plan and the other Delta Programme taskings (flood risk management and freshwater supply) can be achieved by considering the taskings in an interconnected manner. For example, in many cases, water shortage and waterlogging are two sides of the same coin; solutions to drought sometimes also entail a solution to waterlogging.

In recent years, several municipalities, district water boards, and central government implementation organisations have gained positive experience with linking spatial adaptation to other investment agendas. A case in point is the Amsterdam Rainproof project. A range of businesses, among which are garden centres, horticulturists, contractors, and project developers, have also linked spatial adaptation to their own activities. With effect from 2018, we will be sharing this experience through the Climate-proof Together Platform (see 4.2.5).

With effect from 2018, the municipalities, district water boards, and NGOs will step up their efforts to link spatial adaptation with regular management and maintenance measures, investment programmes, incentive schemes, or eco system services. For example, a contribution to adaptation constitutes a criterion for awarding grants to green rooftops and green schoolyards. The central government can impose the utilisation of opportunities for synergy as a condition in agreements on co-funding. With effect from 2017, the central government, provinces, municipalities, and district water boards have been committed to linking spatial adaptation to the energy transition and environmental policies. A structural symbiosis between the Delta Plan and the follow-up to the National Climate Adaptation Strategy (NAS) is self-evident.

Yet the interim evaluation of the Delta Decision on Spatial Adaptation has shown that linkage will not always suffice. Larger system changes will occasionally be needed. Furthermore, waiting for linkage opportunities may also entail the risk that no-regret measures will be withheld.

7.4.2.5 Promoting and facilitating

Climate-proofing calls for commitment among a wide range of public and private parties. Spatial adaptation must become an automatic element in the physical efforts being expended in urban and rural areas. In order to expedite such commitment, it is important that we optimise the exchange of the available knowledge, instruments, and experience, to obviate the need for reinventing the wheel and to encourage everyone to do their part. The Delta Plan sets out several instruments to achieve this goal:

1. A knowledge-sharing platform will be set up (Climate-proof Together Platform). With effect from 2018, this platform will gather information, expertise, and experience, and support the exchange of knowledge among local governments and private professionals working on spatial adaptation at the local and regional levels. The goal is for such parties to provide input, based on their practical experience, in terms of process and content, and regarding the wider application of instruments and solutions developed locally.
2. The existing Spatial Adaptation Incentive Programme supports parties in the implementation of spatial adaptation by organising theme-based meetings and investing in living labs, pilots, and experiments. This programme will be continued after 2017. A decision on its format and working methods will be made in the autumn of 2017.
3. The Spatial Adaptation Knowledge Portal is the central portal in the Netherlands where governments, private parties, and NGOs can find information relating to climate-proof and water-resilient spatial planning. This knowledge portal will be expanded further in order to cover the entire scope of climate adaptation in the future.

With respect to knowledge development, we will tie in with the knowledge agendas of the National Water and Climate Knowledge and Innovation Programme (NKWK), the Delta strategies pertaining to water quality and freshwater supply, and the National Climate Adaptation Strategy (NAS). Further agreements will be made with the parties involved. Governments, businesses, and organisations abroad are also seeking effective climate adaptation methods. The Netherlands can learn from foreign experience in this field. For that reason, the Netherlands, Japan, and the United Nations (UN Environment) are initiating the foundation of a Global Centre of Excellence on Climate Adaptation in the Netherlands. This Centre is intended to help expedite climate adaptation by collecting lessons learned from policy, programmes, and projects. This will generate a global knowledge pool regarding what works and what does not work.

With effect from 2018, the local governments will draw up collective incentive programmes for their regions to encourage private spatial adaptation initiatives. Each local government is free to determine the mix of communication and financial incentives it will use to this end. Examples are Rainproof in Amsterdam, KAS in Twente, and the Climate-proof Southern Netherlands programme. Prior to 2020, the central government will explore, in collaboration with district water boards, municipalities, and provinces, the feasibility and effectiveness of using financial incentives, such as tax differentiation, to foster climate-proofing efforts by private parties.

7.4.2.6 Regulating and embedding

Working on climate-proofing is no longer a noncommittal challenge. The parties will embed their contributions in policy and regulations. Governments and private parties must be able to be held to account regarding their contributions, as underpinned by the agreements set down in this Delta Plan. The Delta Programme Commissioner is charged with the statutory duty to monitor the progress of the Delta Programme, including spatial adaptation, and to report on the progress made to the Ministers in the annual Delta Programme. Within the framework of the "Monitoring, Analysing, Acting" approach, the Delta Programme Commissioner is working on a monitoring system, in collaboration with the knowledge institutes. To this end, the Netherlands Environmental Assessment Agency is conducting an exploratory study into the options for monitoring spatial adaptation. The Delta Programme will carry out a baseline measurement in 2018 and an interim evaluation in 2020. The interim evaluation may give reason to adjust the course of the present Delta Plan.

We will retain the current standards pertaining to waterlogging caused by an excess of water in the water system or the sewers. The standards provide clarity regarding responsibilities, and constitute the point of departure for the stress tests and dialogues referred to above. Tackling waterlogging calls for a tailored approach, with an eye for the interconnectivity between the regional soil and water systems, the drainage system, and spatial planning. The current system of standards leaves room for developing tailormade standards based on the requirements ensuing from the regional dialogues, and tying in with new insights into climate change. The Foundation for Applied Water Research STOWA and the RIONED Foundation [umbrella organisation in the field of urban water management and sewer systems] are taking the initiative of drawing up guidelines for the regional differentiation of standards, prior to 2020. The water assessment remains a key instrument for taking into account the damage caused by waterlogging, drought, and urban flooding in spatial plans and decisions.

In the next five years (by no later than 2022), the municipalities and provinces will explore whether local regulations need to be amended. Some municipalities have already amended their regulations. For example, Eindhoven has set down requirements regarding floor levels in its building regulations pertaining to new urban developments. Laren can make it mandatory upon residents and businesses to process rainwater on their own premises through its local rainwater decree. Municipalities can incorporate such regulations or specific regional standards into policy plans. Prior to 2020, the central government will explore whether additional (building) regulations can be effective and useful in promoting climate-proofing, with sufficient scope for a tailored approach. In addition, the central government will explore how an amendment to the Housing Act can afford housing corporations more scope for contributing to spatial adaptation in new urban developments and maintenance.

Municipalities, district water boards, and provinces are embedding the importance of spatial adaptation in (practical) guidelines regarding urban water, public spaces, greenery, and construction, focusing attention on planning, implementation, procurement, and management. Deventer, Amsterdam, and the Vechtstromen district water board have launched good examples in this regard, which they are sharing through the new Climate-proof Together Platform. The central government, provinces, and municipalities are embedding their spatial adaptation strategies in the new Environmental Visions.

The central government is continuing to work on embedding the strategy pertaining to the national vital and vulnerable functions in accordance with the Delta Decision on Spatial Adaptation. The outcomes of the stress tests conducted on vital and vulnerable functions will be taken into consideration in this process.

Municipalities and district water boards can also encourage private individuals to assume responsibility for reducing the impact of climate change. We are examining whether the potential of existing regulations is used sufficiently, and whether effective and useful additional regulations are conceivable. Reticence in increasing the regulatory burden is the point of departure in this respect. Before 2020, the central government will explore, in collaboration with the bodies involved, whether and how private responsibilities for spatial adaptation can be embedded through performance guidelines and designations (such as BREEAM*, municipal performance guidelines for sustainable building, or the Water label).

*** BREEAM**
Instrument to gauge and assess the sustainability of buildings, areas, and demolition projects.

Municipalities and district water boards want to be better prepared for disasters caused by waterlogging, heat, drought, and urban flooding. They will see to it that the Security Regions incorporate such risks in the risk diagrams by no later than 2021, based on the outcomes of the stress tests. Before 2021, these government bodies will set down agreements with the Security Regions regarding the response to disasters caused by extreme weather situations, for which they are jointly preparing in collaboration with the fire brigades, area health authorities, and police departments. Special attention will be focused on emergency facilities and the rapid restoration of vital and vulnerable infrastructure.

Furthermore, the municipalities and district water boards will explore, by no later than 2020, how they themselves can contribute to damage reduction immediately before, during, and after a disaster, through communication, management, and maintenance. Learning from earlier events is important in this respect. This requires attention to be paid to recording data during calamities. The authorities are also exploring which instruments may be helpful to predict extreme weather sooner and more accurately. Timely warnings help to anticipate potential disasters.

Comprehensive dialogue with society (see 7.4.2.2) addresses, inter alia, the additional relief that the various parties could provide during disasters. In addition to government bodies, such parties include NGOs (such as the Red Cross with respect to heat stress), businesses (such as contractors in urban areas and contracting firms in rural areas), and local residents. A case in point is the German university town of Münster, that was hit by extreme rainfall in 2014 (300 mm). As pumping the water away proved ineffective, a volunteer army of students was mobilised to help people in distress. Amsterdam was also hit by waterlogging in 2014. The Waternet water company subsequently set up a taskforce to visit affected residents in their homes, and to recommend preventative measures to prevent any new damage. Government bodies and NGOs can set down agreements in public-private covenants or codes of conduct regarding preparation for disasters, and collaboration before, during, and after a disaster. The continued insurability of damage and proper handling of damage claims is covered by the comprehensive national adaptation dialogue on this theme.

7.4.3 Interim goals

In this Delta Plan, the seven ambitions have been translated into short-term and mid-term agreements. In the Delta Programme, these agreements are reviewed annually and adjusted if need be, in order collectively to set down new interim goals for the subsequent period.

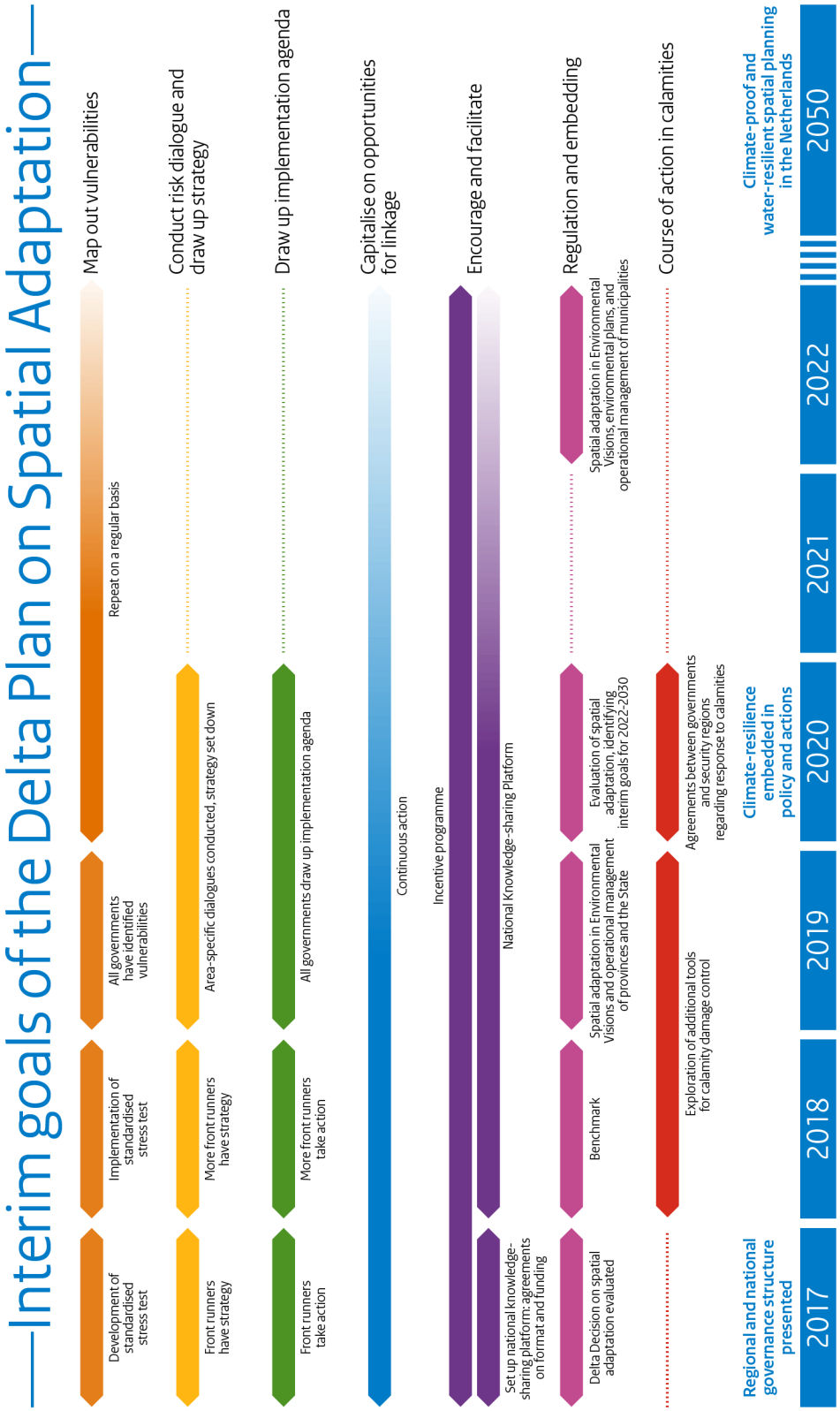


Figure 14
Interim goals

7.4.4

Nationwide governance framework regarding spatial adaptation

The ambitions, agreements, and actions contained in this Delta Plan on Spatial Adaptation can only be realised if all the governments engage in close collaboration on the higher goal, each based on their own responsibilities. That is the essence of the modus operandi within the national Delta Programme! This definitely involves seeking collaboration with private parties, NGOs, and citizens, not only to raise awareness of climate-proofing and improving the water-resilience of the Netherlands, but also to leverage societal energy optimally around this topic.

With respect to spatial adaptation, there is a strong focus on the efforts and commitment of all the provinces, municipalities, and district water boards. After all, the increase in waterlogging, heat stress, and drought is particularly felt locally and regionally.

For that reason, policy and measures will need to be formulated at the local and regional levels. In consultation with the district water boards, provincial and municipal authorities are setting down relevant frameworks in their Environmental Visions, under their responsibility for spatial planning. The municipalities will translate these Visions into environmental plans, in consultation with the district water boards. A tailored approach and collaboration between the governments is indispensable to attain all the spatial adaptation goals in the years ahead. No one can accomplish this on his own. At the local and regional levels, proper connections must be established between the spatial adaptation tasking and other spatial taskings, such as house-building and the energy transition. In all this, it is the responsibility of the central government to substantiate the spatial adaptation tasking that is linked to its own real estate, the main water system, and the main infrastructure. In addition, the central government bears responsibility for improving the resilience of the national vital and vulnerable functions to the consequences of climate change.

The implementation of the Delta Plan on Spatial Adaptation starts with municipalities and district water boards, which traditionally collaborate within the region managed by the district water board. With respect to rural areas, the provincial authorities join in under their overarching responsibility for spatial planning and nature. Rijkswaterstaat is a partner in issues involving the main water system. Any spatial interventions required will, as a matter of course, be incorporated into the provincial and municipal Environmental Visions and environmental plans. Such efforts will also be linked with other programmes (NAS, energy transition). It is up to the responsible administrators of the above governments to initiate such collaboration. This can and will differ from one region to the next. Some fine examples of such local and regional collaboratives already exist: regional projects such as the Invitation to the Southern Netherlands, Kop van de Betuwe, Rijk van Nijmegen, the northern Vechtstromen, the *living labs* in Dordrecht and Overijssel, and the Zeeland Climate Adaptation programme. A great deal of experience has also been amassed in the major cities. The local governments have made an agreement with the Delta Programme Commissioner to the effect that such collaboration will be realised nationwide by the end of the year (2017).

Furthermore, it is essential to establish a connection between the spatial adaptation efforts being expended by municipalities, district water boards, and provinces, and the national Delta Programme efforts under the supervision of the Delta Programme Commissioner. This is important to be able to monitor their progress, inter alia, in the purview of the annual report to be presented through the Delta Programme (a statutory duty of the Delta Programme Commissioner), but also to exchange experience and establish relations with the other Delta Programme taskings pertaining to flood risk management and freshwater supply. To this end, the parties involved in the Delta Programme Steering Group have agreed that they will tie in with the current Regional Consultative Bodies of the Delta Programme, on which all the government authorities of either the freshwater supply regions or the flood protection regions are represented. If need be, representation on these Regional Consultative Bodies will be amended to this end, for example, by involving local and regional administrators holding the spatial planning portfolio. By no later than 1 November 2017, a decision will be made regarding the freshwater supply regions and/or flood protection regions to be involved in the nationwide reporting line between the local and regional collaboratives and the national Delta Programme level. The Spatial Adaptation Steering Group serves as a consultative body to the National Delta Programme Steering Group in this respect.

With a view to the additional tasking this may entail, the staff of the Delta Programme Commissioner will earmark a limited budget (300,000 euros per annum, to be divided across the regions) for two years (2018 and 2019) to substantiate the expansion of the current role of the Regional Consultative Bodies, with a particular focus on involving the regional municipalities in the spatial adaptation tasking.

The point of departure for tackling spatial adaptation is the mapping out of vulnerabilities – insofar as these have not yet been identified – by conducting a "standardised" stress test in every municipality, as was also recommended by the Advisory Committee on Water in its recent advisory report on waterlogging. The outcomes of the stress test will be used to draw up an implementation agenda for measures, and formulate recommendations pertaining to the spatial domain in the purview of the provincial and municipal Environmental Visions. Subsequently, the parties will jointly address the ambitions and actions that have been formulated, working along the lines of the seven ambitions set out in the Delta Plan on Spatial Adaptation. The aim is to ensure that by 2020, climate-proof and water-resilient thought and action will have been fully embedded in the policies and implementation efforts pursued by municipalities, district water boards, provinces, and Rijkswaterstaat. Among other things, this means that from the outset, provinces and municipalities will incorporate the topic of spatial adaptation, in mutual coordination, into their Environmental Visions and environmental plans, based on their role as policy makers in the physical domain. The recommendations and insights provided by the district water boards will be taken into consideration from day one.

7.4.5 Funding

The measures are funded under the parties' current responsibilities and from their current sources of funding. In the years ahead, the local and regional implementation programmes will generate a further substantiation of the additional investments needed to expedite spatial adaptation.

The investment agenda entitled *Towards a sustainable Netherlands*, set down by the umbrella organisations of the provinces, district water boards, and municipalities provides an initial estimate to this end. The district water boards have indicated that in their view, the intensification of spatial adaptation efforts will entail an additional investment of a total of 500 million euros. The district water boards aim to have realised this tasking, in collaboration with the central government, by 2025. This will require an annual sum of 60 million euros. The district water boards are requesting the central government to contribute half of this sum, viz., 30 million euros per annum. The municipalities are currently allocating an annual minimum of 200 million euros to waterlogging, and asking the central government for a contribution of 200 million per annum. All in all, the municipalities and district water boards are requesting the central government to contribute 230 million euros per annum in the period up to 2025, in the purview of measures relating to the regional water system and the built-up environment. In addition, they are requesting the central government to allocate 20 million euros per annum to boost implementation capacity and knowledge development. If the central government fails to make this funding available as requested, attainment of the goals will be delayed.

Under this Delta Plan, the municipalities, district water boards, provinces, and central government implementation bodies will map out the regionwide spatial adaptation taskings in more detail. Once the scope of the taskings is clear, preparations will commence for a decision on the government grants. The Minister has decided to set aside a sum of 5 million euros for the period 2018-2022 in the new draft Delta Fund budget, to cover the continuation of the current Spatial Adaptation Incentive Programme which will terminate in 2017. It is up to the new Cabinet to decide whether a substantial additional budget will be set aside for spatial adaptation. Should the Cabinet decide to do so, a sound legal basis will be required to enabling the co-funding of measures.

7.5 Appendix 1. Action programme

Action	When	Initiator
Development of stress tests using standardised climate scenarios	2017	Central government in collaboration with provinces, district water boards, and municipalities
Conducting stress tests	2018-2019	Provinces, district water boards, municipalities, central government
Regular repetition of stress tests	Every six years	Provinces, district water boards, municipalities, central government
Publication of results of stress tests	Before 2020	Municipalities
Conducting risk dialogues	2017-2020	Municipalities, provinces district water boards, central government
Drawing up guidelines for risk dialogues	2018	Central government in collaboration with provinces, district water boards, and municipalities
Setting down regional risk agreements	2018-2023	Municipalities, provinces district water boards, central government
Conducting comprehensive national adaptation dialogues	2017-2018	Central government
Communication on raising risk awareness	2017-2020	Central government, provinces, district water boards, and municipalities
Drawing up implementation and investment agendas	No later than 2020	Provinces, district water boards, municipalities
Developing methods to gauge effectiveness of measures	2017-2019	Initiated by the central government
Conducting comprehensive analysis of instruments	2017-2019	Initiated by the central government
Linkage with other taskings	With effect from 2017	All
Setting up Climate-proof Together Platform	2018	Central government in collaboration with provinces, district water boards, and municipalities
Setting up Spatial Adaptation Incentive Programme 2.0	2018-2022	Central government in collaboration with provinces, district water boards, and municipalities
Expanding Spatial Adaptation knowledge portal	Continuously	Central government in collaboration with provinces, district water boards, and municipalities
Linking up with ongoing knowledge agendas	Continuously	All + knowledge institutes
Fostering private initiatives at the regional level	With effect from 2018	Regional governments
Exploring financial incentives to foster spatial adaptation	Before 2020	Central government in collaboration with provinces, district water boards, and municipalities
Drawing up guidelines for regional differentiation of standards	Before 2020	STOWA and RIONED
Exploring amendment of local regulations	2018-2022	Municipalities, provinces
Exploring scope for housing corporations in regulations	2018	Central government
Embedding in local practical directives	2018-2023	Municipalities and district water boards
Embedding in Environmental Visions	2019	Central government, provinces, and municipalities
Embedding of strategy pertaining to national vital and vulnerable functions	2015 – 2020	Central government in collaboration with the sectors
Exploring amendment of national regulations	Before 2020	Central government
Setting down regional risk agreements in Environmental Plans	2019-2023	Municipalities and provinces
Exploring regulation of private responsibilities, including guidelines and certification	Before 2020	Central government in collaboration with the bodies involved
Incorporating risks into risk diagrams of the Security Regions	Before 2021	
Setting down agreements with Security Regions regarding response to disasters caused by extreme weather	Before 2021	
Exploring deployment of non-government bodies during disasters	Before 2021	Municipalities and district water boards
Exploring additional instruments to restrict damage during disasters	Before 2020	Municipalities and district water boards
Exploring continued insurability of residual risks (element of national adaptation dialogue on insurability)	2017-2018	Central government
Reporting on regional progress with spatial adaptation	With effect from 2018	Municipalities, district water boards, provinces
Conducting baseline measurement	2018	Delta Programme
Conducting interim evaluation of spatial adaptation	2020	Delta Programme

7.6

Appendix 2. Outcomes of regional meetings and round table discussions

Preface

In February and March 2017, five administrative regional meetings were held with administrators of municipalities, provinces, and district water boards. In addition, two round table discussions were conducted with a wide group of delegates from the business community, interest groups, sector associations, knowledge institutes, and NGOs. Comprehensive reports on the meetings and discussions are available via http://ruimtelijkeadaptatie.nl/english/delta-plan-spatial/.

General outcomes of the administrative regional meetings:

In all the administrative regional meetings, the following points of attention came up:

1. Tasking is local/regional and everyone's responsibility

The Delta Plan is a national plan, operated by four government tiers, whose taskings differs from one municipality, region, and even neighbourhood to the next, as do the parties involved. Consequently, the Delta Plan cannot be a uniform plan; it must be tailored to the regional differences. As a considerable proportion of the territory is in private hands, the challenge is to develop solutions together with private and public sectors. This will require "border-defying" collaboration between all the parties involved.

2. Spatial adaptation is connected with other social taskings

Spatial adaptation is not an isolated issue. By definition it is a tasking that needs to be linked to other social taskings in the spatial domain, such as the energy transition. For that reason, it is particularly important for spatial adaptation to be taken into consideration in the Environmental Visions and environmental plans, in tender procedures, in management and maintenance of infrastructure and public spaces, and also in small-scale private initiatives.

3. Instruments: communication, knowledge sharing, and funding

Spatial adaptation encompasses several issues (waterlogging, heat stress, drought, urban flooding). The diversity in urgency, taskings, and ownership, complicates its embedding in uniform legislation and regulations. The aim is for the incorporation of adaptation to become a matter of course in various taskings involving the physical living environment. Spatial adaptation is urgent, it is a major tasking, and the challenge is to secure a course of action for everyone. Consequently, there is a wide need for knowledge sharing. The Delta Plan on Spatial Adaptation needs to safeguard proper communication, make sure that knowledge is up to date and accessible, and ensure the availability of financial resources required for communication and knowledge sharing.

Region-specific outcomes

The administrative regional meetings have also generated specific points of attention for a particular region, or for existing collaborations in a region:

Northern region (Friesland, Groningen, Drenthe)

- Many efforts have already been launched, but not all of them are visible.
- Spatial adaptation is intertwined with other taskings in the region. It is not a goal in itself.
- The tasking pertaining to waterlogging and drought is largely one for the agricultural sector.
- Freshwater supply from the IJsselmeer lake is cumbersome for some areas on account of the distance. In such areas, drought is the main challenge.

Eastern region (Overijssel and Gelderland)

- Give room to private initiatives, and facilitate both pioneers and slow starters.
- Capitalise on major maintenance works to link the tasking.
- Communicate on a wide scale and with everyone. Incorporate climate adaptation into liveability, and economic and social goals.

Northwestern region (Flevoland, Utrecht, Noord-Holland)

- Do not differentiate between rural and urban areas.
- 80% of the space in urban areas is in private hands: focus on local residents and private parties. Link the urgency to a distinctly positive course of action.
- Soil subsidence is an issue that as yet is receiving insufficient attention.

Southwestern region (Zuid-Holland and Zeeland)

- The focus needs to shift from prevention to curative care.
- The taskings, including the one pertaining to soil subsidence, must be mapped out at the regional level.
- Link up with existing regional structures, yet ensure sufficient coordination. The province has offered to take up that role.

Southern region (Noord-Brabant and Limburg)

- Collaborate in a "border-defying" manner; avoid shifting responsibilities onto other areas.
- Map out the costs and benefits.
- The agricultural sector is also faced with a tasking (drought and waterlogging).
- A regional approach would have to be developed, involving collaboration between all the relevant regional parties on an equal basis.

Round table discussions

Two round table discussions on spatial adaptation have been conducted with a wide group of delegates from the business community (including investors, insurance companies, and project developers), interest organisations, sector associations, knowledge institutes, and NGOs such as the Red Cross, Natuurmonumenten, and the Nationaal Groenfonds. The discussions were focused on the following question: how do we collectively render the Netherlands climate-proof and water-resilient by 2050? This question was addressed on the basis of the following themes:

- heat stress & health;
- urban & rural areas;
- principalship & contractorship.

These are the main outcomes of these meetings:

- Creating a sense of urgency and raising awareness remains important; the adaptive capacity of society must remain the point of focus.
- The participants have sketched the first outlines of an agenda pertaining to the topic of heat stress.
- There is a need for the room to experiment and for coherent regulations from the various governments.
- Spatial adaptation needs to be incorporated into tendering procedures and performance guidelines.
- The Environmental Visions open up opportunities to intertwine the spatial adaptation tasking with other taskings, such as energy transition, house building, and recreation.

Examples: investment resources for adaptation solutions in land allocations; rooftop doctors: water is to be regarded as a resource rather than waste material; Operatie Steenbreek [depavement project]; the Water Coalition.

Background Documents

Heat stress, July 2015, Zeilbrug Amsterdam

Background documents

Background Document A (in Dutch)
Progress report on freshwater supply in the delta: working on freshwater supply in the delta, looking back on 2016 and looking ahead to 2017-2018

Background Document B (in English)
Report and findings of the Delta Programme 2018 Signal Group including fact sheets and references

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 Dutch)
Third progress report regarding Approach to national vital and vulnerable functions

Click here to download the entire Delta Programme 2018 in pdf format for printing.

The maps of DP2018 are available for download in English:

Map 1 – Delta Plan on Flood Risk Management

Map 2 – Delta Plan on Freshwater Supply

The background documents and maps are also available at www.deltacommissaris.nl

Colophon

Het Leeuwse Veld, Beneden-Leeuwen climate adaptation measures

Colophon content Delta Programme 2018

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Segeren Tekst, The Hague

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Photos

- Urban flooding, May 2016, Cuijk: ANP Foto, SK-media
- Eemshaven-Delfzijl dyke improvement, 2017: photo provided by Noorderzijlvest district water board, Eemsdelta drones
- Urban flooding, June 2016, Someren: ANP Foto, Bram van de Biezen
- Foreshore replenishment near the Westkapelle sea wall, 2017: photo provided by Rijkswaterstaat
- Reevediep recreational craft locks, 2017: photo provided by Room for the River IJsseldelta, photographer: Freddy Schinkel
- Flexible flood defence system, Spakenburg, 2017: ANP Foto, Robin van Lonkhuijsen
- Low water level in the Meuse, July 2017: Marielle van Uitert
- Bellamyplein water square, Rotterdam, 2017: Bart van Vliet
- Heat stress, July 2015, Zeilbrug Amsterdam: De Telegraaf
- Het Leeuwse Veld, Beneden-Leeuwen climate adaptation measures, 2017: August Swietkowiak

Maps and figures

Map 1 Delta Plan on Flood Risk Management
Image: Posad

Map 2 Delta Plan on Freshwater Supply
Image: Posad

Figure 1
Periodical coordination between output and outcome (blue line) and external developments (green line)
Image: Rikker Infographics

Figure 2
Interim goals
Image: Rikker Infographics

Figure 3 Summary of progress among vital and vulnerable functions with respect to "Analysis-Ambition-Action" (situation as of 2017)
Image: Rikker Infographics

Figure 4 Delta Fund budgets in 2018, per item and totals, based on 2018 draft Budget
Image: VormVijf

Figure 5 Investments by district water boards, 2017-2020
Source: ABF Research, WAVES – Financial data regarding district water board budgets

Figure 6 Operating costs 2017 by policy field
Image: VormVijf

Figure 7 Tentative extrapolation of Delta Fund
Image: VormVijf

Figure 8 Forecast of dyke improvements scheduled under the Flood Protection Programme, in kilometres
Image: Rikker Infographics

Figure 9 Forecast of engineering structures to be improved under the Flood Protection Programme
Image: Rikker Infographics

Figure 10 "Analysis-Ambition-Action"
Image: Rikker Infographics

Figure 11 Situation involving more than 100 mm of precipitation within two days in August 2010 (left) and the transformation to a 2-degrees warmer climate (right)
Source: KNMI

Figure 12 a,b,c Potential design that may contribute at the scale level to reduce the negative impact of waterlogging, heat, and drought
Image: Jutta Raith

Figure 13 Seven ambitions
Image: Rikker Infographics

Figure 14 Interim goals
Image: Rikker Infographics

Flood Risk Management

Freshwater supply

Spatial Adaptation

Rhine Estuary-Drechtsteden

Southwest Delta

IJsselmeer Region

Rivers-Rhine

Rivers-Meuse

Coast

Wadden Region

Elevated sandy soils

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 civic society organisations, knowledge institutes, citizens, 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 freshwater and to climate-proof our country in order to prevent major damage.

Delta Programme

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The Delta Programme Commissioner submits an annual proposal for the Delta Programme to the Minister of Infrastructure and the Environment, fosters the implementation of the Delta Programme, and monitors progress. The proposal comprises all the measures scheduled and provisions made to reduce floods, pluvial flooding and water shortages. The Delta Programme is presented to the States General every year on *Prinsjesdag*, the state opening of Parliament.

Eight areas are working on the further elaboration and implementation of the strategies outlined in the Delta Programme. These areas cover the entire country. They are:

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

www.rijksoverheid.nl/deltaprogramma
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