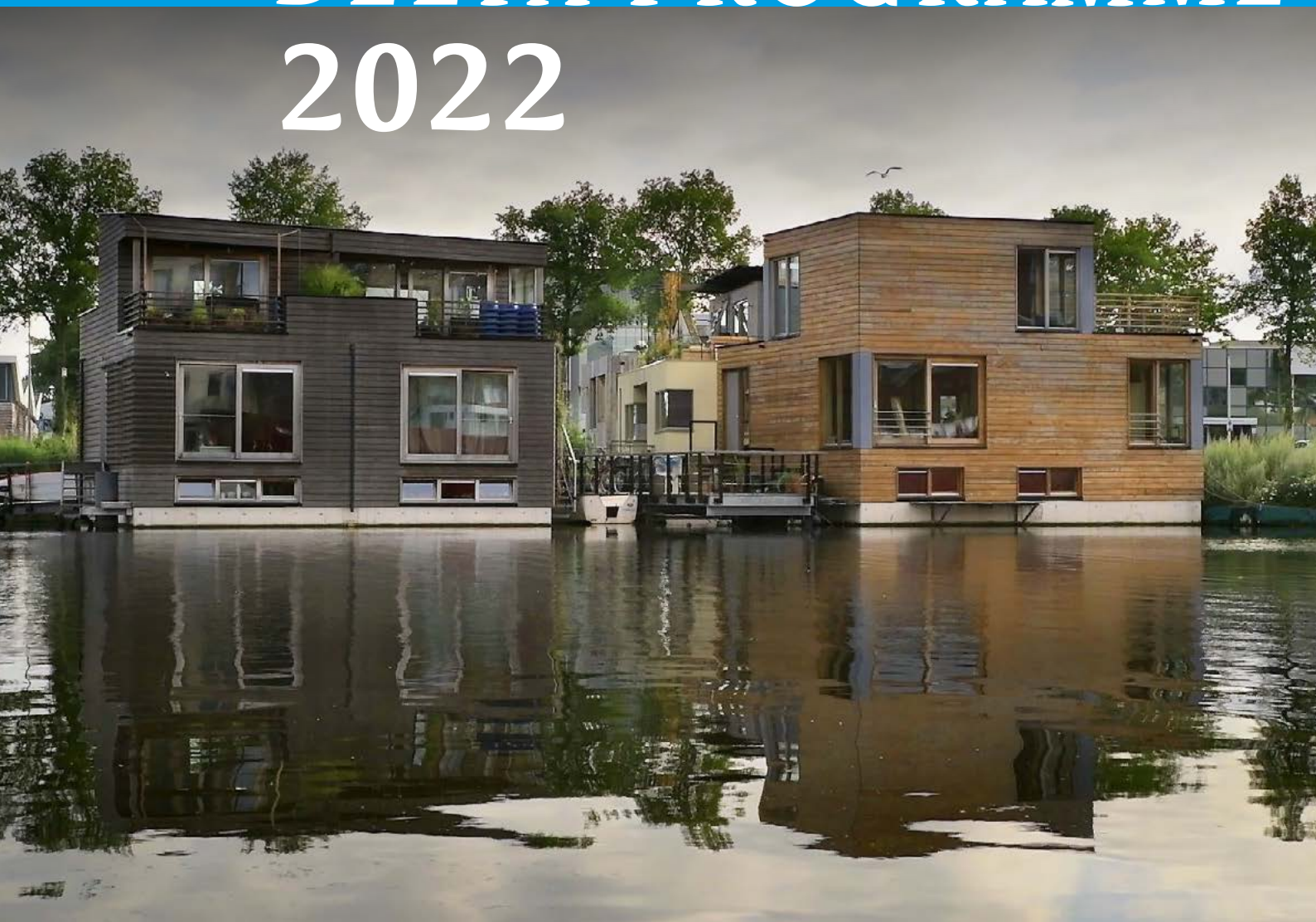
EVERY NEW DEVELOPMENT
CLIMATE-PROOF

NATIONAL DELTA PROGRAMME 2022



The annual Delta Programme 2022

We appreciate your reading the Delta Programme. Under the Delta Programme, we are rendering the Netherlands water-resilient and climate-proof.

The Dutch Water Act stipulates that the Delta Programme Commissioner is to draw up an annual proposal for the Delta Programme. The Delta Programme Commissioner drafts this proposal in consultation with Ministries, regional governments, and local authorities. On Prinsjesdag - the State Opening of Parliament - the Minister of Infrastructure and Water Management presents the Delta Programme to the House of Representatives to be considered in the budget debates.

The Delta Programme comprises three Delta Plans featuring studies, measures, and provisions pertaining to flood risk management, spatial adaptation, and freshwater supply in the Netherlands. For the first six years, the measures have been scheduled in detail, with an indicative schedule for the subsequent six years and a look ahead to 2050 (in accordance with Art. 4.9 paragraph 5 of the Water Act).

Delta Programme 2022 addresses the following topics:
Chapter 1: the administrative introduction and the outlines for an effective continuation of the efforts to climate-proof the Netherlands
Chapter 2: the working methods of the programme, focusing attention on such issues as knowledge development, interconnectivity with other transitions, participation, and international developments
Chapter 3: progress in the field of flood risk management, including the Delta Plan on Flood Risk Management
Chapter 4: progress in the field of freshwater issues, including the Delta Plan on Freshwater Supply
Chapter 5: progress in the field of spatial adaptation, including the Delta Plan on Spatial Adaptation
Chapter 6: the progress of specific measures in various parts of the Netherlands
Chapter 7: the resources available in the Delta Fund for the realisation of measures, provisions, and studies

Would you like to know more about the situation in a particular area? This map will set you up. The paragraph numbers in the pins refer to the appropriate Delta Programme chapter.

Themes

CHAPTER 3
Flood Risk Management

CHAPTER 4
Freshwater Supply

CHAPTER 5
Spatial Adaptation

Delta Programme 2022

Every new development climate-proof

Cover photo: Floating houses near Buiksloterham, Amsterdam, July 2021

Contents

> Return address Postbox 20901 2500 EX The Hague

Ministerie van Infrastructuur
en Waterstaat

The Chair of the House
of Representatives
Binnenhof 4
2513 AA THE HAGUE

Ministry of Infrastructure and Water Management

Rijnstraat 8
2515 XP The Hague
Postbox 20901
2500 EX The Hague

T 070-456 0000
F 070-456 1111

Our reference
IENW/BSK-2021/160042

Annex(es)
1

Date: 21 September 2021
Subject: Cabinet response to Delta Programme 2022

Dear Madam Chairperson,

It is my pleasure to present to you the Delta Programme 2022 (DP2022). The Delta Programme is the annual proposal developed by the Delta Programme Commissioner concerning the fields of flood risk management and freshwater supply, which – as stipulated in Article 4.10 Paragraph 1 of the Water Act – is presented to you once a year. The recent events in Limburg underscore the significance of the Delta Programme. The Cabinet will shortly take steps to learn from the situation. Delta Programme 2022 has been developed in close collaboration between the national government, the municipalities, the regional waterauthorities, the provinces, NGOs, and the business community; it is widely supported by all the parties concerned.

In his cover letter to Delta Programme 2022, the Delta Programme Commissioner has included five recommendations:

1. An appeal to the Cabinet to add additional resources to the multi-year budget of the Delta Fund;
2. An appeal to all the governments and social partners, bearing in mind the recent Climate Adaptation Summit, to schedule substantial investments in the connection of climate adaptation with other taskings. To this end, the Delta Programme Commissioner is also recommending that the Cabinet should strengthen the implementation capacities of both the central government and the regional governments;
3. An appeal to the Cabinet to ensure that water managing bodies – as co-initiators - are involved at an early stage in the National Environmental Vision area processes, on the basis of their roles and responsibilities. In this respect, the Delta Programme Commissioner is requesting the Cabinet to pay specific attention to two major taskings:
   - At new, large-scale housing locations, ensuring that all developments are climate-proof and water-resilient;
   - Actively focusing on a combination of three societal taskings founded on the water and soil system: the Delta Programme, the agricultural transition, and biodiversity, especially in terms of combating soil subsidence in peat grasslands and of combating drought damage in agricultural areas, nature reserves, and (green) cultural heritage in the more elevated parts of the Netherlands;

4. A recommendation to the Cabinet, with a view to the potentially substantial impact of (accelerated) climate change on our rivers, to make resources available for a Knowledge Programme to study cross-border river discharge and discharge distribution (high water and low water), analogous to the Sea Level Rise Knowledge Programme;
5. An appeal to the Cabinet to initiate, in consultation with the government umbrella bodies involved, a process to concretise the substantive climate adaptation goals (and the derivative interim goals), if need be, differentiated at the regional level.

Cabinet response

Below, as stipulated by Article 4.9, paragraph 7 of the Water Act, I will indicate how the Cabinet intends to accommodate the Delta Programme Commissioner's recommendations.

1. Adding additional resources to the Delta Fund
   The taskings that we will be facing together in the years ahead remain vast. Keeping flood protection, freshwater availability, and spatial planning sustainable and resilient in the Netherlands, and being able to cope with climate extremes, requires major efforts from all the parties associated with the Delta Programme.

   Concurrently, I have observed that the Delta Fund budgets are under pressure, albeit that the exact scope of the taskings is still clouded in uncertainty and calls for further validation. I have already informed you about this in my letter dated 10 June 2021[1]. The growing maintenance tasking will require an ever-increasing structural proportion of the funds to be spent on the preservation of the networks. However, it is up to the new Cabinet to decide on the desired quality of the main water system and on the resources available for construction and maintenance.

2. Substantially expanding investments in linking climate adaptation to other taskings
   Over recent years, we have collectively managed to considerably raise awareness of the climate adaptation taskings. The National Adaptation Strategy (NAS) and the Delta Programme have made significant contributions to this end. However, we are not there yet. I endorse the Delta Programme Commissioner's appeal to commit to linking climate adaptation to other taskings. This will generate spatial choices and opportunities that call for a comprehensive perspective of the taskings to be addressed in any one area. The National Environmental Vision constitutes an important basis at the national level, but the perspective needs to be elaborated further at the regional and local levels. The central government must remain closely involved in this elaboration.

   As for the Delta Programme Commissioner's recommendation to the Cabinet to strengthen the implementation capacities of both the central government and the regional governments, it is up to both the new Cabinet and to the regional authorities to decide on this.

[1] *Parliamentary Documents II* 2020/21, 35 570 A, no.*61*

3. Ensuring that water managing bodies – as co-initiators - are involved in the National Environmental Vision processes at an early stage
   Current choices and investments in the spatial domain may have a major impact on future spatial adaptations required in the purview of water management and on management taskings (related to, inter alia, flood risk management). Consequently, I deem the integration of climate adaptation into spatial choices – in order to have decisions assessed not only in terms of their sectoral effects but also in terms of the desired spatial integration and long-term societal costs – vitally important.

   Several parties are working on embedding climate-proof construction in large-scale new development locations. I am pleased that the Delta Programme Commissioner is underscoring the importance of these efforts.

   I support the appeal made by the Delta Programme Commissioner to involve water managing bodies at an early stage of the National Environmental Vision area processes, in areas where no such efforts have been made yet, but also in other relevant areas, such as the urbanisation strategies and the 14 large-scale housing locations.

   The National Environmental Vision sets out that the water and soil system must become more directive in choices pertaining to spatial developments. This principle will need to be elaborated in more concrete terms, specifying what it entails for the spatial planning and use (design and management) of water and soil systems. This involves, for example, identifying the adjustments required to prevent drought damage in nature reserves and in (green) cultural heritage, but also defining any adjustments required or feasible in the infrastructure and the shipping sector. It also involves questions such as what it would entail for agricultural land use at the elevated sandy soils, in areas prone to settling, on weak soils, and in areas prone to salinisation; and the course to be taken regarding house-building in the lowest sections of low-lying areas. Such issues will need to be elaborated by the various Delta Programme partners, within the context of National Environmental Vision implementation programmes, such as the National Rural Areas Programme, the Urbanisation and Living Programme, and within the NOVI areas.

   Furthermore, I endorse the importance of interconnectivity between the societal taskings founded on the water and soil system. In this respect, I expressly foresee a leading role for the provinces, in which collaboration must be sought with the other water managing bodies on account of the statutory division of roles.

4. Making resources available for a Knowledge Programme to study cross-border river discharge and discharge distribution
   I endorse the conclusion of the Delta Programme Commissioner that climate change is impacting our rivers. Addressing drought issues requires us to consider riverbed situations and the water distribution in rivers at times of low discharge and, e.g., pursuing maximum water retention in the capillaries of the water system (the smallest bodies of water and groundwater). Concurrently, during periods of rising water in the area around the major rivers, excess water must be discharged safely. This calls for a proper balance and many efforts are already being expended in preparation.

This has prompted me to instigate the Integrated River Management (IRM) programme. This programme is addressing these issues in an integrated manner in order to make system-based choices regarding discharge capacities and riverbed situations, and regarding the short-term and medium-term planning of the area around the major rivers (up to 2050). The IRM programme is working on taskings that ensue from climate change and riverbed erosion. What I regard as a key tasking in this respect is the navigability of the rivers during periods of drought, an issue which has seen pressure points over recent years. Other taskings pertain to freshwater availability, flood protection, nature development, and spatial economic development in the area around the major rivers.

More knowledge is needed to warrant essential system-based choices. Such knowledge is being developed in collaboration with Rijkswaterstaat, Deltares, and several other research institutes. Once the programme that is being set up under the Environment Act (POW-IRM) has been published, knowledge development will remain imperative. In addition to developing knowledge, it is also important, in the purview of making appropriate policy choices, for the knowledge thus developed to be shared with the other countries in the Rhine and Meuse catchment areas, and for these countries to join forces. These goals will also be pursued under the IRM programme.

Furthermore, since 2018, fundamental research has been conducted, in collaboration with Rijkswaterstaat and universities, into the impact of climate change on the rivers. The outcomes of such research are already being applied within the IRM programme. In addition, I am discussing, with Rijkswaterstaat and Deltares, the (knowledge) issues that are relevant to long-term developments in the area around the major rivers.

In addition, in the draft National Water Programme (NWP) I am announcing my intention to conduct an Exploratory Study into the National Water System in the years ahead. This Study will assess, in an integrated manner and at the national level, the taskings with which we are faced, in order to develop an interconnected and comprehensive strategy to address all the water-related societal taskings. Such taskings involve flood protection, freshwater, spatial adaptation, water quality, surface water, and groundwater issues, in relation to spatial developments such as agriculture, farming, cultural heritage, housing, and energy generation.

I agree with the Delta Programme Commissioner that it is important for us to have the right knowledge available at the right time. Depending on the extent to which this is the case, we will consider how this can best be substantiated and organised. In this respect, I also intend to assess the need for a Knowledge Programme, as proposed by the Delta Programme Commissioner, in addition to the processes I have outlined above; I will discuss this with him.

5. <u>Concretising the substantive climate adaptation goals (and the derivative interim goals)</u>
As I have already indicated, awareness of the importance of climate adaptation has grown over recent years. Under the Delta Plan on Spatial Adaptation, great strides have been made towards translating the general goals into concrete steps. The Delta Programme Commissioner justifiably mentions the stress tests and risk dialogues with which the taskings have been mapped out at the regional level, as well as the implementation agendas that are co-funded from the Temporary Climate Adaptation Incentive Scheme which was introduced in early 2021 and for which I have made available EUR 200 million.

At the same time, I support the Delta Programme Commissioner in his conclusion that it is time to start mapping out and monitoring the substantive progress, in addition to the progress made in the process steps. Rendering the Netherlands climate-proof and water-resilient by 2050 is a matter of the utmost urgency. I therefore endorse the Delta Programme Commissioner's appeal to the Cabinet to initiate, in consultation with the government umbrella bodies, a process to concretise the substantive climate adaptation goals (and the derivative interim goals), differentiated, if need be, at the regional level.

In conclusion, I would like to inform you that the central government policy ensuing from the amended Delta Decisions and Preferential Strategies will be incorporated into the National Water Programme 2022 – 2027 (NWP). The draft NWP has already been submitted to your House and has been available for perusal for the past six months. Expectations are that your House will receive the NWP by March 2022.

Yours sincerely,

THE MINISTER OF INFRASTRUCTURE AND WATER MANAGEMENT,

Drs. B. Visser

Deltacommissaris

> Return address Postbox 90653 2509 LR The Hague

C. van Nieuwenhuizen - Wijbenga
Minister of Infrastructure and Water Management
Postbox 20901
2500 EX The Hague

Delta Programme Commissioner
Postbox 90653
2509 LR Den Haag
www.deltacommissaris.nl

Our reference
DC-2021/393

Annex(es)
1

Date 23 June 2021
Subject Presentation of Delta Programme 2022

Your Excellency,

The Cabinet holds the key to our continued living and working in safety in the Netherlands, well into the foreseeable future. Although 2050 and 2100 seem far away at times, the Cabinet is now already making defining choices in terms of housing, agriculture, energy, nature, and economic recovery. Such choices and the measures that will be implemented in this regard during the coming Cabinet term will substantiate the spatial planning of the Netherlands for the decades ahead and with respect to some components thereof, well beyond. We must ensure that such choices and measures are climate-proof, in order to secure the future of our low-lying delta and to preserve the appealing business climate of the Netherlands. It is for good reason that the Delta Programme 2022, which I am presenting herewith, is entitled "Every shovel in the ground climate-proof".

Climate adaptation is urgent
Fully aware of the pivotal role of climate mitigation in reducing global warming, we must concurrently continue to invest in climate adaptation. Commitment to reducing CO_2 emissions in order to achieve the Paris climate agreements remains crucial. Supplementary to these efforts, we need to step up our commitment to climate adaptation in order to cope with the consequences of climate change: more extreme weather and an increasing probability of flooding, drought, and heat stress. This was also expressly put forward during the Climate Adaptation Summit held in January 2021. Climate change appears to be accelerating and our adaptive approach must keep pace. This requires additional efforts and forces us to expedite the implementation of some measures that have already been agreed upon. That is why I am urging the government, residents, and the business community to step up their climate adaptation efforts, on the basis of our shared responsibility, in order to ensure that the Netherlands will remain a beautiful country in which people can live and work safely and comfortably. Under the Delta Programme, we are fostering these efforts, with our own Fund, a wide network, and a tried and tested implementation programme.

The core domains of the Delta Programme work are flood risk management, freshwater supply, and spatial adaptation. The water and soil system constitutes the main carrier for the above major taskings in the fields of housing, agriculture, energy, and nature in the Netherlands. Water has a great deal to offer but also

demands attention. The Delta Programme acknowledges the need to actively seek linkage between the taskings, for example, within the framework of the elaboration of the NOVI areas, the instruments to which government bodies commit for multiple years in pursuit of the collective realisation of the various taskings.

In determining the goals, the course, and the pace, the Delta Programme is continuously taking account of scientific and societal signs. The pace and the consequences of climate change are evident causes of increasing concern in society, among residents but also in the business community. We recognise and share such concerns, which is exactly why the Delta Programme parties are staying "down to earth, alert, and prepared" (as Delta Programme 2020 was titled)**:** for example, by mapping out, under the Sea Level Rise Knowledge Programme, the tenability and flexibility of the current Delta Decisions and Strategies, and by exploring potential long-term action perspectives. Although the second review of the Delta Decisions and Preferential Strategies is scheduled for Delta Programme 2027, we expect to have clarity regarding their direction at an earlier date.

Meanwhile, our country is preparing for a major recovery operation following the COVID-19 crisis. The key tasking in these times, for society and thus for the Cabinet, is to establish efficient links between urgent transitions in the physical, socio-economic, and ecological domains. It is the responsibility of the Cabinet to push and enhance such links, in order to ensure that measures can actually be implemented nationally and at the regional level, where such taskings converge.

Recommendations of the Delta Programme Commissioner
Against the backdrop of these challenges and conditions, I have formulated five recommendations in the purview of the Delta Programme.

1. In the coming Cabinet term, the continued implementation of the statutory Delta Programme tasks will require an additional EUR 200 million annually (EUR 800 million in the period 2022 – 2025), followed by a structural sum of EUR 100 million annually with effect from 2026. I urge the Cabinet to add such resources to the Delta Fund multi-year budget. In the light of the increasingly manifest climate taskings, putting off Delta Programme measures would be irresponsible.

2. With the recent Climate Adaptation Summit in mind, I am calling on the central government and all the local and regional governments to invest substantial sums in the connection of climate adaptation with other taskings. The elaboration of the above statutory tasks into actual investment projects and the serious pursuit of linkage with the other taskings will require multi-billion euro investments up to 2050. This calls for reinforcement of regional and national implementation capacities. The water taskings are highly intertwined with more comprehensive economic and spatial developments at the regional level. On the one hand, the water and soil system entails physical preconditions for any developments in this respect; however, on the other hand, it offers many opportunities for an integrated approach. The government needs to go all out to safeguard several basic conditions for the future: safety, a healthy living environment, and preventing problems from being passed on to the environment or to future generations. The Delta

Programme can contribute by bracketing water interests and water opportunities together with innovative solutions to other policy fields, in implementation schemes involving collaboration between the national government and regional governments. I advise the Cabinet to reinforce national and regional implementation capacities to this end, by investing in sufficient quality and capacity among all the parties, for now and for the future.

3. In support of the above, I am requesting the Cabinet to anchor the early involvement of water managing bodies as co-initiators of the NOVI areas process, based on their roles and responsibilities. Fortunately, such involvement has already been achieved in several fields, but ensuring a similar consideration of climate adaptation at an early stage of new plans will require a more forceful and generic approach. In more specific terms, this extends to the two major taskings outlined below:
   - Anchoring climate-proof and water-resilient construction methods for all new, large-scale housing locations. Among other things, this will entail: no additional consequential damage in the event of flooding; combating heat as an integrated component of urban development plans; setting down requirements for construction plans aimed at preventing waterlogging; and water retention with a view to periods of drought. Encouraging and supporting municipalities to make the most of all the opportunities to this end offered by existing regulations. Expanding stress tests to include soil subsidence risks, in both new development projects and existing urban areas;
   - In increasingly more areas, we are approaching the limits of current land use. A climate-proof future for our frequently quite wet country will require greater commitment to water retention in order to prevent damage caused by increasing periods of drought. This calls for technical interventions as well as restrictions on the use of surface water and groundwater. I am advocating active commitment to a combination of societal taskings that depend on the water and soil systems: the Delta Programme, the agricultural transition, and biodiversity - specifically in terms of combating soil subsidence in peat grassland areas and of reducing drought damage in farmland, nature reserves, and (green) cultural heritage in the more elevated parts of the Netherlands. Furthermore, this offers opportunities for combined gains in the fields of climate mitigation (CO_2 and other greenhouse gases) and nitrogen issues.

4. With a view to the potentially major impact of (accelerated) climate change on our rivers, I advise the Cabinet to make resources available for a Knowledge Programme focused on cross-border river discharges and discharge distributions (high and low discharges). This would be analogous to the Sea Level Rise Knowledge Programme, comprising five focus areas: scientific insights into the consequences of cross-border climate change; potential leads for interventions; monitoring; what-if scenarios; societal support and a design-oriented approach. As a great deal of knowledge is already being developed regarding the theme of cross-border river discharges and discharge distributions, expectations are that the results of this Knowledge Programme could become available concurrently and in interconnection with the results of the Sea Level Rise Knowledge Programme,

thus constituting input for the second six-year review of the Delta Programme in Delta Programme 2027.

Rendering the Netherlands climate-proof and water-resilient by 2050 involves a major tasking. If we refrain from taking action, the damage could amount to some EUR 170 billion by 2050[1]. Under the Delta Plan on Spatial Adaptation, stress tests and risk dialogues have been conducted to map out the taskings at the regional level. This process is still in full swing and requires some scope for elaboration. On the other hand, there is a wide need for guidelines and frameworks from the central government, as is demonstrated, for example, by the response to the National Environmental Vision (NOVI). In my opinion, the time has come to start mapping out and monitoring the substantive progress, in addition to the progress in process steps. In the purview of concrete agreements on results, I would like to make a case for concretising the substantive spatial adaptation goals (and the derivative interim goals), if need be differentiated at the regional level. This will also provide clarity for private parties. Initiatives to this end, set up under the Spatial Adaptation Delta Programme, deserve national-level support across the full spectrum of spatial planning, housing, water, and the economy. In order to enable all the parties involved (the central government, municipalities, provinces, and regional waterauthorities) to properly accommodate such concrete interim goals in their processes, I am requesting the Cabinet to initiate this process in consultation with the government umbrella organisations involved. The insights being gained under the Spatial Adaptation Delta Programme can constitute a basis in this respect.

In the years ahead, the Netherlands will see a major overhaul. Let us join forces in capitalising on the opportunities this affords us to render our country climate-proof and increase its appeal.

P.C.G. Glas
Government Commissioner for the Delta Programme

[1] Source: Climate Damage Assessor

Waterlogging and flooding in Limburg

Extreme precipitation in Limburg

For three days this summer, the Rhine and Meuse catchment area was stricken by prolonged extreme precipitation (13-15 July 2021). Some locations saw 150-250 mm of rain. The saturated soil and local buffer reservoirs were unable to cope with such volumes, and at breakneck speed the water ran off to the inhabited valleys of the Eifel and Ardennes ranges and the hilly province of Limburg.

Flash floods in the hilly landscape

Within a short period of time, devastating water flows (so-called flash floods) not only caused major damage but also deaths, particularly in the Eifel and Ardennes ranges. In Limburg, the Geul and Gulp valleys were hit most severely. Fortunately, no lives were lost, but thousands of people were forced to leave their homes in great haste, and the floods wreaked huge havoc. The damage they caused to houses, businesses, farmland, bridges, roads, motorways, railroads, cultural heritage, and to the power supply, communications, and drinking water facilities has resulted in substantial and prolonged societal disruption in the area.

Largest Meuse discharge volumes ever measured

On 15 July, the volumes of water discharged by the river Meuse and its branches peaked at 3,260 m^3/s: the largest discharge volume since records began in 1911. The probability of such a large discharge occurring is 1/100 per annum. Moreover, this peak occurred in the summer, which makes it all the more exceptional. The discharge forecast featured many unknown quantities, particularly due to the uncertainty regarding the precipitation development. The discharge volume exceeded that of the winter of 1993 - featuring severe flooding in the Meuse valley - by approximately 100 m^3/s. Since 1993, dykes and embankments have been constructed along the river Meuse, within the framework of the Meuse Projects. Furthermore, several river-widening measures have been carried out, such as the Ooijen-Wanssum flood channel which was completed this year. This flood channel has reduced flood levels by 40 cm locally and by 20 cm near Venlo. These measures have saved the Meuse valley from flooding this summer. However, critical conditions occurred at several locations, viz. where excessive Meuse levels prevented the water from the rivers Geul, Rur, Swalm, and Niers from flowing into the Meuse, or where embankment improvements had not yet been completed. Ultimately, the areas protected by flood defence systems were not flooded. Residents of several Maastricht districts, and later on residents of Meerssen, Roermond, Arcen, and Well were evacuated by way of precaution. A hospital in Venlo was also evacuated. Emergency dykes prevented Wessem, Arcen, and Well from being flooded. Water management bodies took local preventative measures in downstream regions of Limburg and along the Rhine branches, but threatening situations did not occur, and these areas did not need to be evacuated.

Climate change

The extreme precipitation was caused by a depression that kept circulating over the same region. Over the past few decades, this has happened more often in Central Europe, resulting in, inter alia, severe flooding of the rivers Elbe, Oder, and Danube in 2002, 2006, 2009, and 2013. Such extreme summer precipitation was a first for South Limburg. Global warming has raised the moisture content of the air. Measurements have shown that as a result, extreme precipitation intensities have increased by some 20 per cent over recent decades. Researchers are exploring whether climate change is also leading to increasingly frequent “immobile” low pressure areas.

By 2023, the Royal Netherlands Meteorological Institute KNMI will present new climate scenarios for the Netherlands, derived from the worldwide scenarios that the IPCC is expected to draw up by 2022. These new climate scenarios will underpin the six-year review of the Delta Programme scheduled for 2026. In the time ahead, lessons will be drawn from this extreme precipitation, for example, regarding the relation between the main water system and the regional system; the role of changes in land use, involving pavement and rapid dehydration; new insights into weak spots and bottlenecks, ensuing also from building in valleys; disaster control; and the relation between water retention measures (to address low water levels and drought) and high-water situations. These lessons will also be utilised in the six-year review of the Delta Programme in 2026.

Next steps

The Limburg events have confronted us with our vulnerability to waterlogging and flooding caused by severe

precipitation and with the serious consequences entailed. The situation constituted a practical stress test from which we can and must draw lessons. In the very near future, we need to focus additional attention on the occurrence of flash floods in the valleys of the hilly landscape. The multi-layer flood risk management approach that is being pursued with respect to flood protection (flood defences, spatial adaptation, and calamity response) can also serve as a line of thought for the hilly province of Limburg.

This crisis has shown that our strategies regarding flood protection, water availability, and climate-proofing are effective and unabatedly important, and must be continued in full force. Measures such as the Meuse Projects and many recent dyke improvements have proven their value: they have prevented large-scale flooding from the main water system. Under the Delta Programme, efforts to reduce the vulnerability of the region continue. It is imperative to press ahead with the remaining dyke improvements in Limburg and to complete the projects as scheduled, in order to achieve a minimum protection level of 1/100 per annum for the entire Meuse valley as soon as possible. The same goes for the climate-proofing measures that have been scheduled. Under the Delta Plan on Spatial Adaptation, research is being conducted into local vulnerabilities to waterlogging and flooding caused by severe precipitation. The waterlogging standards, the stress tests, and the risk dialogues constitute the basis for pressing ahead with these studies at the local and regional levels.

The first step in learning from the Limburg events is to properly map out the facts in collaboration with all the parties involved (water managing bodies, Security Regions, Royal Netherlands Meteorological Institute KNMI, neighbouring countries, insurance companies, et cetera), and involving the regional evaluations in the process. In the next evaluation, attention must be focused on the following issues:

- The operational efforts of the Security Regions, including upscaling and collaboration between the emergency services and the other crisis partners;
- Correlation between waterlogging in regional water system and extreme discharge volumes in the major rivers (Meuse);
- International cooperation in and coordination of policies and measures pertaining to cross-border rivers;
- The relation to current spatial planning, land use, and potential adjustments thereof;
- The potential effect of the extreme weather situation on precipitation statistics and scenarios.

This should foster well-substantiated considerations regarding the measures and strategies that are justified to prevent or reduce future damage, casualties, and societal disruption in these areas, and regarding the risks that we will need to accept.

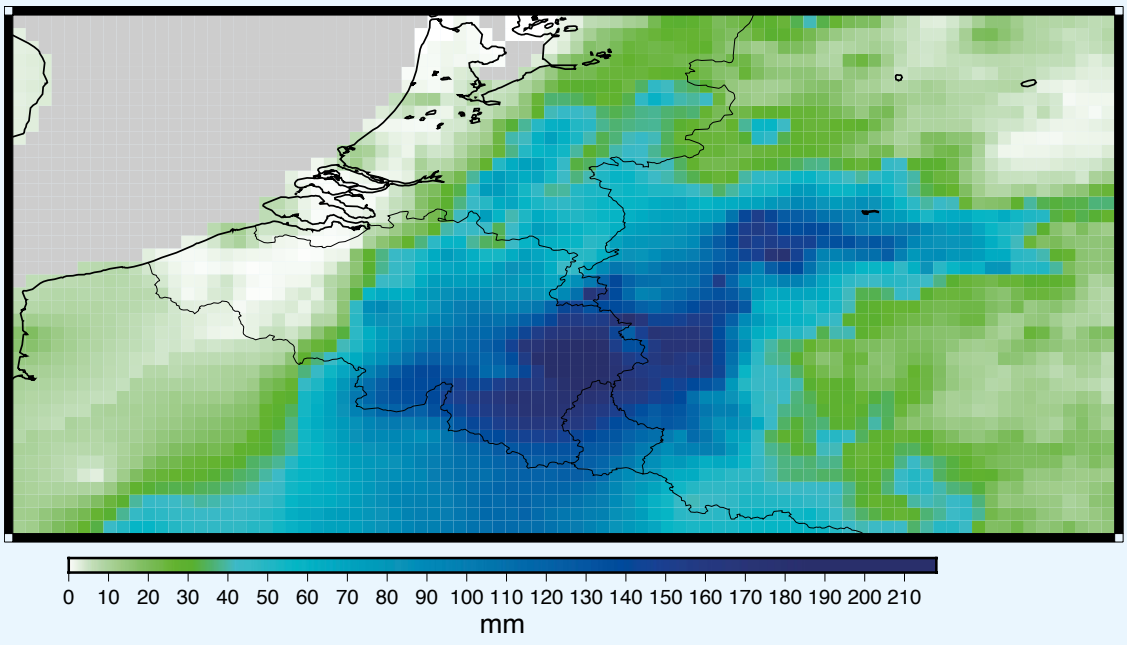


Figure 1 *Precipitation volumes, 12 to 15 July inclusive, 2021 Source: KNMI, E-OBS*

CHAPTER 1

Administrative introduction: outlines of Delta Programme 2022

Glass flood defence in flood-prone village of Neer, Limburg, July 2021

The acute crisis caused by the COVID-19 pandemic slowly appears to be coming under control. However, in the years ahead, many far-reaching choices will need to be made in order to enable our country to recover powerfully from this crisis. Concurrently, the taskings ensuing from climate change are increasing. Limiting global warming by committing to a reduction of greenhouse gas emissions remains crucial in order to curb climate change. In addition to climate mitigation, we need to step up our climate adaptation efforts, in order to cope with the consequences of the more rapidly changing climate. We are experiencing increasingly more extreme weather, involving torrential rain, heat, and drought, whilst we also need to reckon with an accelerated rise in sea level, changing river discharges, and continued soil subsidence; such issues also call for far-reaching decisions. Combining the range of major societal taskings in an efficient manner will enable us to render the Netherlands safe, economically strong, and future-proof - thus enhancing its appeal.

The spatial and water domains are faced with serious developments. In some areas, we are already approaching the limits of tenable land use and water consumption. At the sandy soils, the current water system - based on drainage and groundwater extraction - is causing structural damage to nature. Regional waterauthorities and farmers have taken a range of measures over recent years aimed at prolonged water retention and water storage. Nonetheless, large volumes of water are still being discharged and various sectors are still withdrawing groundwater from the system. In addition to causing structural damage to nature, this is reducing farmland production capacities. In peat grasslands affected by soil subsidence, low groundwater levels are producing greenhouse gas emissions and causing damage to infrastructure and buildings. The years ahead - involving major national transitions in the fields of housing, energy, nature restoration, and agriculture - will be crucial in terms of rendering the delta safe and climate-proof, in order to ensure that we can continue to live and work here in the future, enjoying prosperity and well-being.

In the purview of attaining the flood risk management and freshwater supply goals, and of ensuring that the Netherlands will be climate-proof and water-resilient by 2050, the Delta Programme last year put on the agenda the necessity of using the limits and preconditions of the water and soil systems as the point of departure for choices relating to the spatial planning of the Netherlands. Several recent reports[1] have underscored the urgency of this matter and state that the soil and water systems must be directive with respect to spatial decisions on (new) developments in land use.

[1] Major taskings in a confined space, Netherlands Environmental Assessment Agency and the Inter-ministerial Policy Study on Spatial Planning.

The three paragraphs below outline the goals to be pursued under the Delta Programme in the years ahead:

- The financial basis must remain up to par and implementation efforts must be expedited;
- Water must become more directive in spatial planning: from vision to action;
- Enhancing the implementation capacity is vital: hands on the shovel.

In its pursuit of the urgent delta taskings, the Delta Programme - as a national programme of collaborating governments with implementation capacity - can and wants to contribute to the interconnected efforts to tackle the housing tasking, the energy transition, the restoration of nature and of sustainable eco systems, and the agricultural transition.

1.1 Keeping the financial basis up to par and expediting implementation

The signs are clear, as are the scenarios of the Royal Netherlands Meteorological Institute KNMI: as a result of climate change, extreme weather is occurring increasingly more frequently in the Netherlands. International climate scenarios demonstrate that the climate is changing more rapidly than expected. If we refrain from taking measures, the probability of casualties and of economic, societal, and social damage ensuing from extreme weather and sea level rise will increase. Casualties and damage to - in particular - infrastructure and vital and vulnerable processes disrupt the entire society of the Netherlands. The Delta Programme strives to remain ahead of a disaster: we have the capability and willingness to be prepared for the future, to prevent major damage, and to mitigate the consequences.

Nearly 60 per cent of the Netherlands is prone to flooding from the sea and the main water system. In 2017, flood protection standards for 2050 were set down. According to current insights, approximately 1,500 kilometres of our dykes still fail to meet these standards. The same goes for the numerous engineering structures in the Flood Protection Programme. In addition, many other engineering structures will be replaced or renovated in the decades ahead, since they are reaching the end of their lifespan. The implementation of Delta Programme measures - pertaining to flood risk management, freshwater supply, and spatial adaptation - is in full swing. These measures are essential in order to enable us to continue to live and work in the Netherlands, now and in the long run. This offers an excellent opportunity: a future-proof approach will prevent the eventual need for costly climate adaptations. It is also a duty: it prevents the bill from being passed on to future generations. The financial basis for these measures - the Delta Fund - is, however, under great pressure. The management and maintenance of the main water system is taking up an increasing proportion of the Delta Fund (see Chapter 7), which will impact the Delta Programme as a whole.

In order for people to be able to continue to live and work in the Netherlands, now and in the future, the Delta Fund needs to continue to provide sufficient financial scope for the implementation of the Delta Programme measures, especially if climate change, sea level rise, and soil subsidence are necessitating the acceleration of efforts to bring flood defences up to standard, to combat drought and waterlogging, and to render the Netherlands climate-proof and water-resilient.

1.2 Water more directive for spatial planning: from vision to action

The Cabinet is faced with major taskings in the fields of the climate, the environment, biodiversity, and economic recovery. Housing, energy facilities, infrastructure development, and industrial estates are taking up a great deal of space. The housing market is under pressure; the political ambition is to construct some 1 million houses in the decades ahead. The aggregate functions and developments accommodated in an area inevitably impact the Delta Programme taskings.

The interconnectivity of spatial considerations and the Delta Programme taskings is manifest, for example, in the IJsselmeer Region. A recent stress test has demonstrated that the probability of water shortages in the IJsselmeer Region may increase more sharply than foreseen.[2] The probability of freshwater shortages is increasing: on the supply side, as a result of decreasing water supply via the river IJssel, more salt intrusion at the IJsselmeer Closure Dam, and less optimum supplementation of the lake IJsselmeer buffer than originally expected. On the demand side, combating soil subsidence in peat grasslands is requiring increasingly more water. Spatial choices such as new data centres or new islands also affect water requirements and thus the probability of water shortages. Ergo, pressure on the lake IJsselmeer buffer is increasing. The facilitation of water requirements must continuously be assessed in interconnection with its impact in terms of, e.g., flood protection, waterlogging, and nature. This area, therefore, requires administrative considerations that are being agendised in various platforms - both within and outside the Delta Programme - and that need to be gathered together (see paragraphs 4.3 and 6.2.3).

The National Environmental Vision (NOVI) and the (draft) National Water Programme 2022-2027 (NWP) both substantiate the appeal made in Delta Programme 2021 to have water play a more directive role in spatial planning choices[3]. In this respect, the Netherlands Environmental Assessment Agency refers to the "layer approach": the "subsoil" layer stipulates conditions for spatial developments, based on the physical structure of the soil and water systems. The (draft) NWP also calls for an integrated approach to water issues and other taskings involving the physical environment, on account of the rising sea level, soil subsidence, increasing drought, the probability of more frequent waterlogging, and increasingly frequent heat stress.

> The vision has been set down and now needs to be converted into action. We must avoid reaching the limits of what our water and soil systems can provide and can cope with. Such limits are emerging increasingly frequently and at increasingly more locations. A more directive role for water is urgent. It requires a radical change in mindset, a drastic change of course, and conversion into actual guiding principles for spatial planning. The Delta Programme is the driving force behind this change.

Directive frameworks for spatial adaptation

Societal disruption and major economic damage can be prevented if we adopt climate-proof and water-resilient construction methods and if we take local water availability into account when allocating functions to an area, in addition to the continuous commitment to primary flood risk management under the Flood Protection Programme and the programmes pertaining to the secondary flood defences managed by the regional waterauthorities. This will prevent an additional risk of damage and casualties in the event of flooding or extreme weather. Furthermore, we urgently need to invest in boosting the resilience of vital and vulnerable functions and processes (such as roads, railways, waterways, electricity, IT, drinking water, natural gas) against more extreme weather conditions. Smart construction now will save money in the future, whilst bolstering liveability and public health. More commitment is needed - among both public and private parties - to climate-proof construction methods and to climate-proofing new industrial estates, IT facilities, energy facilities, and existing buildings. Meanwhile, practical efforts to this end are cautiously getting off the ground, albeit not nationwide. For example, the province of Zuid-Holland has entered into a Climate-adaptive Construction Covenant with building companies, financiers, NGOs, other governments, and project developers. The covenant sets out specific requirements for the climate resilience of new construction projects. This example is worth following at other locations.

The Delta Programme is focusing on climate adaptation as an integrated component of new developments and regional processes, in both urban and rural areas. Furthermore, climate adaptation must be a precondition

[2] Deltares (2021), Stress test for the Delta Plan on Freshwater Supply phase II - the effect of new insights and uncertainties on bottlenecks in the freshwater supply (in Dutch).

[3] One of the policy choices in the National Environmental Vision is that the Netherlands must be climate-proof and water-resilient by 2050. This policy choice entails the following: "In (re)developments, an increased risk of damage and casualties ensuing from flooding or extreme weather must be prevented, insofar as is reasonably feasible. We must preserve and reserve sufficient room for future flood protection measures."

in economic recovery measures. We have reached the point that we must explicitly wonder where we can and want to build if we want to continue to work and live - safely and in a climate-proof manner - in our delta in the long run. How can we keep proper protection against an excess or a shortage of water feasible and affordable? To this end, the Delta Programme is contributing, along with government authorities and private parties, to proposals for national policy, design, and implementation instruments. In this, we seek to preserve maximum flexibility, whilst keeping an eye on practicability. The practical instruments must foster transparency, speed, and a level playing field. This is what we are exploring:

- instruments to be used in construction projects in areas prone to waterlogging, drought, flooding, and soil subsidence, which minimise their vulnerabilities. These types of instruments resonate with the inter-ministerial policy study on spatial planning governance - Van woorden naar daden: over de governance van de ruimtelijke ordening (IBO-RO) - which recommends translating flooding, waterlogging, drought, and heat scenarios into concrete instruments (such as maps), advisory reports, and guidelines (such as building regulations). Another recommendation involves designating areas in which no more construction will be planned, such as deep polders or areas along the major rivers, if the climate scenarios so dictate and if such a decision can be properly substantiated from a flood risk management perspective;
- the feasibility of (supplementary) national normative frameworks for climate-adaptive new construction and restructuring projects, water availability, and land use. Eventually, such frameworks must be accommodated in, inter alia, the National Environmental Vision approach, rolled out on a nationwide scale, and incorporated in practical terms in the implementation agendas of municipal and provincial environmental vision documents.

The map of climate projects being developed by the Ministry of Infrastructure and Water Management is an example of a tool to initiate a dialogue on long-term climate-proof options for the urbanisation tasking. The map shows the vulnerability of locations to flooding and precipitation, and compares potential locations in terms of efforts required up to 2150 to reduce such vulnerabilities. The insights are relevant to the location selection and the design of future residential areas (new construction or densification of existing areas). The map demonstrates how choices made one hundred years ago are still hampering us in a flexible response to climate change.

The Ministry of the Interior and Kingdom Relations and the Ministry of Infrastructure and Water Management have requested the Delta Programme Commissioner to produce an advisory report on housing and climate adaptation by the autumn of 2021.

Freshwater supply and drought

Climate change, current water consumption, and current land use are adding to the pressure on available surface water and groundwater, in terms of both quantity and quality. This is affecting nature, agriculture, soil subsidence, shipping, and the production of drinking water. The dry years since 2018 have caused structural damage to groundwater-dependent nature at the sandy soils, as well as damage to crops that are vulnerable to water shortages. This calls for a reconsideration of groundwater extraction, of the water system, and of land use aimed at drainage and dependent on (soil) water extraction. In addition, new water requirements are emerging, e.g., to combat soil subsidence, to green cities, and to cool data centres. Expediting the efforts to render the Netherlands resilient against freshwater shortages will require substantial investments in measures aimed at economising water consumption, at more efficient water retention and water distribution, at promoting land use that fosters the availability of water, and at more efficient ways to cope with shortages. Such measures must be geared to each region and to each sector. In the Freshwater Supply Implementation Programme 2022-2027 (Delta Plan phase II) - a component of this Delta Programme 2022 - the central government and the regional authorities have set down a broadly supported set of measures to the amount of EUR 800 million, EUR 550 million of which will be provided by the freshwater supply regions; EUR 250 million will come from the Delta Fund. Policy must be based on the principle that land use needs to adapt to water availability. This means that in some areas, land use will change, for example, by extensification of agriculture, through operational management that bolsters resilience to climate extremes, and through other business models that also value the fostering of landscape management, the restoration of biodiversity, and CO_2 sequestration. This calls for proper coordination between the Delta Programme and the National Rural Areas Programme, which has entered the initial phase. The National Rural Areas Programme is developing a directive strategy for the future-proof development of functions in rural areas.

The stress test regarding the freshwater supply from lake IJsselmeer has shown that in the next few years, new policy choices will be needed in order to reduce the probability of water shortages in the IJsselmeer Region in the decades ahead.

Sea level rise

In the long run, the potential acceleration in sea level rise will have a major impact on our flood risk management tasking and our freshwater supply. The partners associated

with the Delta Programme have embarked on analyses of the tenability and flexibility of existing regional strategies. For each area, we are exploring the regional impact of an extreme rise in sea level, short-term and long-term options, and the potential interaction with the investment agendas for sustainable energy, housing, infrastructure, agriculture, and nature. In several regions, the parties have expressed a need for clarity on how to factor in uncertainties regarding the rising sea level. In the Cabinet term ahead, the Sea Level Rise Knowledge Programme will generate important information for decisions on potentially accelerating the adaptation and implementation of the existing regional strategies and Delta Decisions, and on the preparation of new pilot projects, additional measures, and studies (cf. paragraph 2.1).

The Inter-ministerial Policy Study on Spatial Planning has proposed to periodically draw up scenarios to identify the conditions for continuing to live and work safely in the long run. According to this Study, in areas in which sea level rise dictates spatial reserves to ensure sufficient flood protection in the future (e.g., room for expanding flood defences and for water storage), the required space must be reserved. This room can temporarily be used for other purposes ("temporary use"). Following the response of the new Cabinet to the Inter-ministerial Policy Study on Spatial Planning, we will review what this may entail for the Delta Programme.

Soil subsidence

Soil subsidence in urban and rural areas is causing damage to infrastructure and buildings, whilst adding to the risk of waterlogging. Furthermore, the combination of soil subsidence, sea level rise, and periods of high river discharges will entail a higher risk of flooding. In order to attain the goals set out in the Paris agreement, the Climate Agreement and the National Environmental Vision encompass agreements on reducing CO_2 emissions in peat areas (via regional strategies). Reducing CO_2 emissions and combating soil subsidence in the peat areas requires saturation through adapted groundwater weir management, which increases the demand for water. During periods of drought, such additional water requirements can cause additional water shortages, for example, in the IJsselmeer Region. The regional peat grassland strategies and water availability processes call for integrated considerations. To this end, we need to have clarity regarding the consequences that the strategies to combat soil subsidence will have in terms of freshwater supply, water distribution, and transfer to regional systems. A thorough analysis, based on a joint fact-finding process, of the water volumes required to combat soil subsidence and of the consequences is essential in order to be able to determine the impact of such strategies within the Delta Programme. Soil subsidence does not fall under the statutory scope of the Delta Programme. However, since the impact of falling groundwater levels and of soil subsidence constitutes an integral component of the water availability process and the risk dialogues, it can be translated into the measures set out in the regional strategies and in the implementation agendas.

Groundwater

The dry years since 2018 have demonstrated that in many regions, groundwater constitutes a vulnerable key factor in terms of freshwater availability. Following the recommendations of the Drought Policy Platform, the sandy soil regions have embarked on research, which is meanwhile already being translated into sets of measures. Groundwater has been accommodated more firmly in the Delta Plan on Freshwater Supply, seeking coordination with the Supplementary Strategic Supply processes for drinking water provision. The Water Steering Group has set up a study group to elaborate national frameworks for the sustainable management of groundwater stocks. The Delta Programme is actively contributing to these efforts.

Design-oriented approach to put the Netherlands on the map for future generations

In addition to increasing the implementation capacity, we must have long-term taskings for the water and soil systems become more directive in terms of spatial planning. In combination with a design-oriented approach and design studies, this will enable us to literally map out how the Netherlands can remain habitable for future generations. The substantive interconnectivity between the various societal taskings - for the next few decades and in the longer run - calls for a nationwide design procedure in collaboration with the parties involved in the implementation. This is more than a water map. It is a map (or an atlas featuring maps and map layers) that provides a picture of water opportunities and water threats but also visualises the water-dependent, vital, and vulnerable (economic and ecological) processes for the next generations. Much information is already available. It is now a matter of supplementing this information and of compiling area-specific translations of urgent taskings, interests, and disciplines into an adaptive design. This map must continuously be adapted to the developments and to current requirements.

Dealing with uncertainties

The pace of external developments and new insights regarding sea level rise, groundwater stocks at the sandy soils, (cross-border) river discharges, water availability in lake IJsselmeer, and drought, show that the further optimisation of the current system might come up against limits in the future. The pace at which the developments are proceeding may clash with the current pace of adaptation. In the run-up to the next six-year review, the outcomes of

which will be presented in Delta Programme 2027, the Delta Programme is committed to a supplementary approach that will generate both realistic and adequate alternatives. Incremental adjustments, aimed at enhancing the current system, may need to be supplemented by measures pursuing, at a more fundamental level, a system that is better equipped to meet the challenges it will be faced with in the second half of this century and beyond. This calls for further research into the desirability and feasibility of radical, system-level measures.

Developments such as sea level rise, changes in river discharges and in river discharge distribution, and increased drought involve many uncertainties. This means that resilience and flexibility must always be explicitly incorporated into strategies and measures, as has already been effected in, e.g., the IJmuiden Sea Lock and the IJsselmeer Closure Dam projects. Another example is the temporary repurposing of zones destined for future dyke improvements.

1.3 Enhancing implementation capacity is vital

Regional implementation capacity is under pressure as a result of the wide range of taskings converging here. This comprehensive administrative issue falls beyond the scope of the Delta Programme, yet it is increasingly being faced with the impact of this issue. The question is whether sufficient capacity, expertise, professional skills, and financial resources will remain available both among the regional governments' implementation agencies and within Rijkswaterstaat. The partners associated with the Delta Programme indicate that they are approaching the limits of the available capacity and possibilities. Failure to properly address this issue could entail a real risk for the Delta Plan measures scheduled to be implemented between now and 2050. Co-production and co-funding - between the central government and the regions - are indispensable for concerted implementation.

At the regional level, a tailored approach is essential to accommodate and tackle all the societal taskings converging in the regions. No one is more aware of the opportunities and concerns than the regional governments. Concurrently, major national taskings are also calling for a regional translation. The central government and the regional authorities will need to come to terms in this respect and join forces to achieve the goals relating to flood risk management, climate adaptation, urbanisation, agriculture, nature, and sustainable energy.

In fact, every region in the Netherlands should adopt a water-based National Environmental Vision approach: a strategy based on the principle that land use must be adapted to water availability and climate efforts. The central government is pursuing this approach, which requires additional staff capacity. The Delta Programme working processes can provide impetus to the efforts. The continuity of the Delta Programme and the proven effective approach offer considerable added value: supported by tried and tested instruments; joint fact-finding; trusted consultation structures between the central government and the regional authorities; shared ownership; and liaising between parties at the regional level to enhance implementation capacity.

Spatial quality

All the taskings converge and are integrated in the regions. The need for preserving and, wherever possible, enhancing the spatial quality of the environment is a key element in this integration. Working on spatial quality is important to garner support for such major projects as dyke improvements and water storage provisions. The Inter-ministerial Policy Study on Spatial Planning advocates setting up joint government teams to bolster spatial quality. Another recommendation is the development of more tools and options for quantifying spatial quality, by incorporating spatial quality into evaluations. Amassing a database of evaluation material will enable more efficient pre-assessment of spatial quality in the future.

The national Delta Programme

Under the national Delta Programme, the Netherlands is addressing three interconnected taskings in order to climate-proof the Netherlands:

- Flood risk management: proper flood protection;
- Freshwater supply: sufficient fresh water where needed and drought-resilient;
- Spatial adaptation: resilient planning to mitigate the impact of flooding, waterlogging, drought, and heat.

The first point on the horizon is 2050. By then, the Netherlands must be climate-proof and water-resilient. Meanwhile, the Delta Programme is also looking further ahead: to 2100. Because climate change is continuing.

Since 2010, the Netherlands has been pursuing a unique approach under the Delta Programme to tackle these taskings: collectively working towards common goals within a national framework; preventing disasters, major damage, and societal disruption, rather than waiting to be hit by a new disaster caused by flooding or extreme weather conditions. To this end, we are pursuing adaptive delta management: anticipating the taskings ahead of us; collectively setting down measures; continuously checking whether we are working at the right pace and in the right direction; keeping options open and, if need be, adjusting the strategy in time.

Within the Delta Programme, national and regional parties have been collaborating closely from the start: the central government, provinces, regional waterauthorities, and municipalities. All these parties have committed - on the basis of their own responsibilities - to the collective national goals and to the implementation of the Delta Programme. Overall control is exercised by the Delta Programme Commissioner, under the political responsibility of the coordinating Minister, the Minister of Infrastructure and Water Management. Businesses, security regions, knowledge institutes, and NGOs all do their part. The combination of substantial regional involvement and national control has generated a successful organisational format in the purview of developing widely supported Preferential Strategies, ensuring speedy implementation, and securing joint funding. This is also demonstrated by the various evaluations that have been conducted since the commencement of the programme.

In order to ensure that all the parties involved are pursuing the same line, Delta Decisions and regional Preferential Strategies were proposed in 2014, comprising goals and ambitions for 2050 and looking ahead to 2100. The Delta Decisions constitute the national frameworks, whilst the regional Preferential Strategies plot the course for the regional measures. The Delta Programme is keeping a finger on the pulse and checks every six years whether its course needs to be adjusted. In 2020, the Delta Decisions and Preferential Strategies were reviewed on the basis of new insights. A potential acceleration in sea level rise could jeopardise our delta. In 2019, the Sea Level Rise Knowledge Programme was launched, in order to come up with well-founded proposals regarding the need for adjusting the Delta Decisions and Preferential Strategies by 2026.

Meanwhile, significant concrete results have been achieved. For example, in 2017, the new flood protection standards for primary flood defence systems were embedded in law; the first dyke improvements under these standards are in progress. In 2018, a new IJsselmeer water level ordinance was enacted for the IJsselmeer Region, which enables flexible water level management. During the three dry years - 2018 - 2020 - this measure has already proven its value. The same goes for the sums that the central government and regional authorities have been investing in freshwater supply routes, water retention, and innovations with effect from 2014.

Since 2017, the Delta Programme has comprised a Delta Plan on Spatial Adaptation, supplementary to the Delta Plan on Flood Risk Management and the Delta Plan on Freshwater Supply. In 2021, the so-called Incentive Scheme was introduced, enabling co-funding from the Delta Fund for measures to combat waterlogging and drought and measures aimed at flood impact reduction. Thus, the governments are taking concrete steps to climate-proof the Netherlands and to better prepare our country for waterlogging, drought, heat, and the impact of flooding.

CHAPTER 2

Continued development of the Delta Programme

Melting ice arch, Antarctica, 2018

Climate adaptation is urgent: the Delta Programme taskings turn out to be more extensive and complex than originally assumed, whereas we have less time to respond to climate change. Factoring in major long-term taskings is imperative for all the parties involved: the potentially accelerating rise in sea level, drought and other weather extremes, and extremely high and low river discharges. This is what we need to anticipate in the choices we will be making in the years ahead, and we need to prepare for the choices that could be called for in the years beyond 2050. The fact is that climate-proofing the Netherlands will continue to require attention and effort, even after 2050. The Delta Programme is exploring ways to effectively interconnect the flood risk management, freshwater, and spatial adaptation taskings with other transitions, and is working on an improved system to monitor its progress. The first six-year review of the Delta Programme revealed that these issues call for additional attention.

2.1 Sea Level Rise Knowledge Programme

Over the past year, the Sea Level Rise Knowledge Programme has gained momentum.

Sea Level Rise Knowledge Programme
Recent studies have shown that by 2100, the sea level may have risen by more than the 1 metre that the Delta Programme currently observes as the upper limit. In 2019, the Minister of Infrastructure and Water Management and the Delta Programme Commissioner initiated the Sea Level Rise Knowledge Programme. In the next five years, government bodies, research institutes, businesses, planners, and NGOs will be joining forces within this programme in pursuit of new expertise on the rising sea level and its impact on Flood Risk Management and freshwater availability. The programme is aimed at enhancing our knowledge of the rising sea level; mapping out the tenability and flexibility of the current Delta Decisions and Strategies in scenarios featuring an extreme rise in sea level with the attendant salinisation and high river discharges; and exploring the potential long-term action perspectives. This Knowledge Programme also covers the exploration of the spatial reservations that may be required to keep long-term options open. The annual Delta Programme reports on the progress of the activities conducted under the Sea Level Rise Knowledge Programme. This programme will ultimately generate important decision information for the next review of the Delta Programme in 2026. The Knowledge Programme web page features background information on the various tracks, research reports, and meeting reports.

By now, the global rise in sea level has increased from 2 mm per annum to 4 mm per annum. The differences in sea level rise are considerable and can be attributed to various factors, such as wind influences. As a result, the acceleration is not yet manifest along the Dutch coast. In the knowledge programme, a statistical method has been developed for processing the expected rise in sea level (based on climate change scenarios for the next few decades) into the probability that the acceleration will affect the Dutch coast in the near future. In addition, greater insight has been gained into the relation between ocean warming and Antarctic melting. This will be incorporated into the new climate scenarios that the Royal Netherlands Meteorological Institute will be publishing in 2023.

In consultation with the Delta Programme partners, regional meetings were set up to embark on the analyses of the tenability and flexibility of the existing strategies. Furthermore, for each region, the potential impact of an

extreme rise in sea level has been explored, along with long-term options and their potential interaction with the current and future investment agendas in the fields of sustainable energy, house construction, infrastructure, agriculture, and nature. The regional meetings revealed that the participating parties have a need for practical guidelines and examples in order to take future water taskings into account in their investment agendas (cf. paragraph 6.1, box). In parallel to these regional meetings, thirteen planners presented their ideas on future solutions to experts and Delta Programme participants. Subsequently, in-depth studies were rolled out. More information on the results of the regional meetings is provided in Chapter 6.

The knowledge programme also addresses implementation issues (Track V), which include communication. An important communication activity was the second national Sea Level Rise Knowledge Programme Day on 20 April 2021, during which 200 representatives of government bodies, research institutes, and the water sector were brought up to date regarding its progress. Another vital element of the knowledge programme is participation by NGOs and government bodies. The participation plan - to be completed by the end of 2021 - sets out how the collaboration with NGOs will be substantiated. Within the context of the implementation strategy, governance and transition issues are being explored that are relevant to the timely anticipation of sea level rise. An important short-term question is how local authorities are factoring the uncertainties of the rising sea level into their spatial decisions.

Meanwhile, periodic consultations have been set up with Flanders, aimed at collaboration on studies into the accelerated rise in sea level and at coordinating potential measures.

2.2 Delta Programme Signal Group recommendations

The Delta Programme Signal Group is composed of substantive experts from several research institutes. The Signal Group advises the Delta Programme Commissioner annually on developments that may affect the Delta Programme water taskings or the structure and implementation of the Delta Programme. The advisory report published in 2020 revolves around drought issues (see Background Document A). The Signal Group proposes, inter alia, an exploration of the vulnerability limits of the current water consumption functions, taking into account the aggregate and irreversible effects of successive periods of drought. The Delta Programme Steering Group discussed the report at the end of 2020; it is now being substantiated in the Delta Plan on Freshwater Supply (see paragraph 4.3).

2.3 Connection

To achieve the Delta Programme goals, it is essential to reinforce the interconnection between the flood risk management, freshwater supply, and spatial adaptation taskings, and to seek linkage with other societal taskings and transitions. The developments in the IJsselmeer Region illustrate how closely the Delta Programme taskings are intertwined with the other taskings and transitions: in addition to sea level rise and extreme weather, water level management in this area must also be geared to choices in river management; to new economic developments resulting in additional water consumption; and to interventions in the purview of the natural environment, urbanisation, soil subsidence, shipping, and the energy transition.

Linkage with other societal taskings and transitions is imperative in order to have water play a more directive role in spatial planning, as set down in the National Environmental Vision. This is a precondition for future-proofing solutions and for preventing future vulnerabilities and damage.

In 2021, the Delta Programme Steering Group will be exploring ways to improve interconnection and linkage: what needs to be done to reinforce the interconnection between the Delta Programme taskings and where would linkage with other developments make sense, e.g., with tracks being pursued under the National Environmental

Vision (such as the NOVI areas[4])? Leading in this respect are the statutory goals of the Delta Programme, viz., to be resilient against climate change by 2050.
The exploration must tie in with the context and instruments of the Environment Act and with current insights in intergovernmental collaboration.
The Steering Group has identified three key issues:

- National and regional/local: the two scale levels need one another, but each has its own working methods and decision-making processes. Peat soil subsidence, for example, calls for additional water. At the national level, this must be taken into account when setting down goals, as in the regions, based on their specific water supply.
- Focus and integrality: focus is the strength of the Delta Programme, in terms of both policymaking and implementation (e.g., dyke improvements and freshwater supply measures). The commitment to integrality and linkage must not compromise this strength.
- Long-term and short-term: in the short term, the realisation of measures often entails linkage opportunities (such as options for leisure activities in dyke improvement projects). Choices regarding measures also need to reserve room for future taskings relating to flood risk management, water availability, and spatial adaptation. Another added value of the Delta Programme is: it sketches the long-term perspective that outlines other developments, identifies uncertainties, and reveals new knowledge requirements. The short-term and long-term perspectives can and must enhance each other.

In Delta Programme 2023 it is the intention to present the possibilities to strengthen the connection with other challenges and transitions; and meanwhile start as many actions as possible. The societal partners of the Delta Programme will be involved in the exploration and actions at both the regional and the national levels (via the Physical Environment Consultative Body).

The best way to identify options for improvement and preconditions for linkage is to embark on the process, via the existing administrative platforms, in the new NOVI areas, and via the environmental implementation agendas. The Delta Programme has already established connections with NOVI areas - Zwolle, Groene Hart, and De Peel - and with the cultural heritage taskings (see box). For all the themes and regions covered in this Delta Programme, inspiring examples are presented of specific actions aimed at interconnection and linkage, such as those involving Central Holland (see box, paragraph 6.1) and the area around the major rivers (see paragraph 6.4).

The aim is to set up design studies to visualise all the taskings in an area on a map. One such a design study is the Blue Lens project initiated by the Rijnland District Water Control Board. In this study, spatial perspectives for climate-proofing the region have been developed. At an early stage, the parties working on urbanisation-related transitions and on the peat grassland area invited the parties collaborating under the Delta Programme to contribute ideas and indicate long-term boundaries.

Amsterdam Metropolitan Area

In several regions, parties are already expending concrete efforts aimed at linking other transitions to the Delta Programme, with a view to future-proof investments. In many cases, such efforts have been triggered by the regional meetings of the Sea Level Rise Knowledge Programme. A case in point is collaboration in the Amsterdam Metropolitan Area (MRA). The collaborating parties aspire to develop this area without compromising its water system and its climate-proof lay-out (non-evasion of responsibility). To this end, the entire lifespan of spatial plans and projects is taken into account, and such plans and projects are tested against all the long-term scenarios. Keys to sustainable development are sought in transitions in the four system layers: water, ecology, energy, and mobility. The aim is a metropolitan area whose construction methods - at the house, neighbourhood, and regional levels - will not put the water system under additional pressure. If this is not feasible, the impact on the water system (costs, planning, space) will be explicitly taken into account in the urbanisation business case.

Linkage of water and spatial quality

Projects set out in the Delta Plans on Flood Risk Management, Freshwater Supply, and Spatial Adaptation are in progress all across the Netherlands (see Chapters 3 - 6). These projects hold opportunities for providing added value in terms of the spatial quality of the surrounding area. Several initiatives are fostering capitalisation on such opportunities in the years ahead.

Under the OUR Landscape programme, the central government is joining forces with local and regional partners to protect the values and qualities of our landscapes. The programme is aimed at landscape-inclusive spatial development in rural areas, in accordance with the National Environmental Vision and in line with the motion

[4] The NOVI areas are: Groene Hart, De Peel, South Limburg, Zwolle region, Amsterdam and North Sea canal area, Rotterdam (Port of Rotterdam transition), North Sea Port District, and Groningen. NOVI areas are instruments to which government bodies commit for multiple years - building on existing intergovernmental collaboration processes - in pursuit of the actual collective realisation of the various taskings. These areas feature in the Environmental Agendas being drawn up for each district.

tabled by MPs Dik-Faber and Van Eijs regarding an action plan for enhancing landscape identities in environmental policy. To this end, the central government is developing both regional and nationwide action perspectives[5]. OUR Landscape is one of the implementation programmes of the National Environmental Vision and involves close collaboration with the National Programme for Rural Areas (NPLG). Comprehensive flood risk management policy is one of the focus areas of this programme.

One of the activities initiated under the OUR Landscape programme involves the Action Plan for Landscape-inclusive Environmental Policy, which is aimed at operationalising the landscape-inclusive set-up of several priority policy themes pertaining to the physical environment through inter-ministerial collaboration. The Action Plan focuses on the creation of proper preconditions to ensure that the environmental transitions in each area are carefully substantiated with due attention to landscape quality and without fragmentation. In 2021, a collective picture will be developed of the results of a landscape-inclusive approach and the intended roles of the parties involved, including the central government. This will be effected within the context of the implementation of the National Environmental Vision. OUR Landscape is coordinating its pursuit of a landscape-inclusive approach in spatial planning with the Flood Protection Programme and the Ministry of Infrastructure and Water Management.

De Groot/Bromet motion on spatial quality and the water tasking

With the De Groot/Bromet motion, the House of Representatives requested the government - in the purview of the formation of the new Cabinet - to examine, in collaboration with local and regional governments, how attention to spatial quality can play a more prominent role in the water tasking, and to explore options for promoting this in water policy.

On 2 June, the Minister of Infrastructure and Water Management forwarded the report on this exploration to the House of Representatives[6]. An official consultative group of local and regional governments was involved in the compilation of this report. It features a wide range of good examples and presents twenty options - submitted by experts in the fields of spatial planning and water - for tying the water tasking more closely to attention to spatial quality. Assessing the viability and practicability of these options requires further elaboration. The exploration demonstrates that closer ties between spatial quality and the water tasking will require additional time and capacity investments, or increasing the investment budget. The latter can be achieved by bundling together differently purposed budgets, to a greater extent than is currently the case. Should this not suffice, additional resources will be required for investments in spatial quality. The scope of the resources required is dependent on the ambition. The next steps, if any, will follow from the choices made with regard to the formation of the new Cabinet.

Climate-neutral and circular national infrastructure projects

The Minister of Infrastructure and Water Management intends to implement national infrastructure projects in an entirely climate-neutral and circular manner by 2030. In 2020, this was set down in the strategy entitled Towards climate-neutral and circular national infrastructure projects (KCI Strategy). Thus, the Ministry is substantiating the agreements on climate-neutral and circular infrastructure projects set down in the Climate Agreement. The strategy pertains to, e.g., engineering structures (such as bridges, locks, and pumping stations); coastline maintenance (see paragraph 6.7.3); navigation channel maintenance; construction sites; and construction logistics. The strategy and related other ambitions (such as the Clean Air Agreement) will, therefore, impact the Flood Protection Programme. The strategy is firmly committed to collaboration between public principals, which will be fleshed out in 2021 and 2022.

Linkage with cultural heritage taskings

Flooding, waterlogging, drought, heat, and soil subsidence may affect the cultural heritage, for example, in the Dutch cultural landscape. On the other hand, knowledge of heritage and the landscape can provide insight into the water taskings. Cultural-historical explorations can generate solutions that have proven their efficiency in the past and that provide insight into the formation of the landscape and the underlying soil and water system.

To ensure proper linkage between the water taskings and cultural heritage, the Delta Programme is collaborating with the Cultural Heritage Agency of the Netherlands (RCE[7]). The preservation of cultural heritage, for that matter, is not solely the domain of the RCE: all the governments - both national and regional - bear responsibility in this respect. The RCE is participating in several components of the Delta Programme to contribute expertise and to provide input on solutions. For example, within the Flood Protection Programme, the RCE is participating in the "Building Blocks for Sustainable Dykes and Spatial Quality" working group and in the General Collaboration on Engineering Structures project.

[5] Parliamentary Documents II 2020/21, 34 682, no.68 (in Dutch)

[6] Parliamentary Document 34 682 no. 84 (in Dutch)

[7] The Cultural Heritage Agency of the Netherlands falls under the Ministry of Education, Culture and Science.

To this end, the RCE has developed the Landscape Panorama instrument, which describes the features and structures of the different landscapes in the Netherlands. Regional RCE consultants provide input into dyke improvement projects. The RCE attends the Freshwater working sessions and contributes expertise to the Spatial Adaptation Knowledge Portal. In addition, the RCE provides advice and participates in projects initiated by provinces, municipalities, and regional waterauthorities, such as those being implemented under the so-called Heritage Deals.

National Water System Exploration

By way of the National Water System Exploration, the central government is reviewing ongoing studies in the fields of flood risk management, freshwater supply, spatial adaptation, water quality, and shipping in interconnection. The water system exploration underpins comprehensively considered long-term decisions at the national and regional levels; consequently, it features in the preparations for the review of the Delta Decisions in 2026 and for the next National Water Programme (2028-2033). In addition, the analysis is important with a view to having water consumption play a directive role in the realisation of other taskings. The analysis can be helpful in making spatial choices, for example, in the fields of agriculture, nature, urban development, and sustainable energy supply.

2.4 Progress mapped out

Importance of progress information

The measures set out in the Delta Programme must be completed within the next thirty years, in order to achieve the goals for 2050. The Delta Programme Commissioner bears statutory responsibility for monitoring the progress of the Delta Programme and for providing information on how the programme is contributing to the realisation of the National Water Programme goals. The progress achieved is reflected in, inter alia, the annual Delta Programme. If progress so dictates, the Delta Programme Commissioner provides recommendations for adjustment, following coordination with the Delta Programme Steering Group. The recommendations are forwarded via the official channels to the Minister(s) responsible and the House of Representatives for decision-making within the framework of the budget debate, and to the democratically legitimised regional and local bodies through the regular channels.

Keeping a sharp eye on the progress of the Delta Programme is vital to enable timely adjustments. The power needed to realise the large number of essential measures within thirty years and the flexibility to adapt the pace or the direction to changing circumstances cannot be taken for granted. Also on account of events that could point to an acceleration in climate change, we need to expedite and intensify our efforts in order to achieve the goals set by 2050 (see Delta Programme 2021). The required degree of acceleration and intensification, and the manner in which this can be realised, will differ considerably from one theme to the next, which means that a tailored approach will be in order.

Continued development of Monitoring - Analysing - Acting system

The Delta Programme maps out its progress via the Monitoring - Analysing - Acting system. The first review revealed that further development of the system is essential in order to achieve the following improvements:

- greater insight into interconnection in the implementation of measures relating to the three Delta Programme taskings (flood risk management, freshwater supply, spatial adaptation);
- a transparent and full picture of the output;
- a better perspective of the input-output-outcome-impact relationships, with a focus on improving substantive support in order to enable timely adjustment.

In the purview of the further development of the Monitoring - Analysing - Acting system, the Delta Programme has initiated the Progress track, focused on an improved system for monitoring, adjustment, and reporting. First of all, the improvement is aimed at more efficient monitoring of the output, in order to keep better track of the progress in implementation. To this end, well-structured information on the flood risk management, freshwater supply, and spatial adaptation measures is presented annually. Wherever possible, the existing theme-based monitoring reports are synchronised, and the data collected is analysed in interconnection. The results are presented on an easily accessible dashboard. Furthermore, the Delta Programme is exploring options for providing more insight into the degree to which the efforts are fostering the goals (outcome).

Another aim is to expand the indicator function of the monitoring system. The Signal Group is already engaged in identifying developments in the physical system[8]. Supplementary to their efforts, the Delta Programme intends to develop a working format to keep track of any new insights, experiences, or developments that hamper or, conversely, foster progress in the implementation and scope of measures. Examples include developments in other policy dossiers or implementation programmes resulting in delays or acceleration in the Delta Programme, and technical-substantive and legal opportunities for and obstacles to carrying out the work.

The proposed improved monitoring constitutes a sound basis for enhancing elements of the programme control process. A key aim involves a more accurate interpretation of the progress information and the associated dialogue: are the measures being implemented as scheduled, and do the effects of measures come up to expectations? And also: how can deviations, if any, be explained, and what options are there to adjust the course? A subsequent aim involves reinforcement of the advising-deciding-acting process. In other words: how do we ensure that the right recommendations regarding adjustments end up on the desks of those who are in a position to take decisions and action, taking account of the powers and responsibilities of the government authorities involved?

The continued development of the Delta Programme was set in motion in 2021, involving (inter alia) the Progress track. DP2023 and DP2024 will contain a more concrete elaboration, comprising an improved system for monitoring, adjusting, and reporting on the progress made in the Delta Programme.

[8] The Signal Group uses indicators to monitor developments in the physical domain that are relevant to the Delta Programme. The indicators are divided into four categories: Wetter/Drier, Hotter, Sea Level Rise, and Busier. The indicators for the "Busier" category refer to socio-economic developments such as population trends and changes in land use.

2.5 Participation

Participation is one of the key pillars of the Delta Programme. The ambition is to have governments, businesses, and residents contribute input into the preparation of the plans. The spatial adaptation and freshwater supply taskings also call for efforts on the part of residents and entrepreneurs.

In 2021, the Physical Environment Consultative Body (OFL) produced an advisory report on Delta Programme 2022 (see Background Document B). Furthermore, the OFL is exploring, in collaboration with the Delta Programme, ways in which it can play a more proactive and agendising role. The OFL has offered to conduct an exploratory study into visual aids to support participation in the various phases of the design and decision-making process.

At the sub-programme and regional level, stakeholders and interested parties are offered a wide range of options for early involvement in strategic choices and measures. Examples include the spatial adaptation risk dialogues, the Water Availability processes, the IRM construction site, regional consultative groups, and the planning meetings of the Sea Level Rise Knowledge Programme. The COVID-19 crisis has sparked several initiatives, e.g., by the Flood Protection Programme, to enhance digital participation.

In order to familiarise young people with the Delta Programme and to capitalise on the knowledge and perspectives of young people in the purview of Delta Programme components, the Delta Programme Commissioner organised a meeting with youth dyke wardens and students in May 2021.

2.6 International developments

In many countries, the risk of flooding, drought, waterlogging, salinisation, and water pollution is increasing, as a result of climate change effects such as the rising sea level and more extreme weather. The Netherlands is supporting other countries in the complex and urgent issues that subsequently arise, among other ways through the efforts of the Special Envoy for International Water Affairs. Every year, a wide range of countries submit dozens of requests for information regarding the lessons that the Delta Programme has generated. These are shared via webinars, in a tailored fashion, geared to the culture, the institutions, and the policy of the country concerned.

The Netherlands is also addressing the water taskings in collaboration with neighbouring countries, for example, in the international river commissions for the Rhine, Meuse, and Scheldt. In early 2020, during the international Rhine conference, a new programme was set down for the Rhine: "Rhine 2040. The Rhine and its catchment area: sustainably managed and climate-proof".

Global Commission on Adaptation

On 25 January 2021, the Netherlands organised the Climate Adaptation Summit (CAS 2021). In this online summit, government leaders and other participants discussed ways to speed up and scale up climate adaptation across the globe. To this end, they used the results of the Global Commission on Adaptation (GCA), initiated by the Minister of Infrastructure and Water Management. The Commission presented eight action tracks with proposals for action programmes and partnerships relating to, e.g., water, infrastructure, food, cities, nature-based solutions, and funding. Under the Water Action Track (WAT), the Global Commission on Adaptation intends to mobilise support for speeding up, scaling up, and the funding of worldwide climate resilience in the field of water.

During the Climate Adaptation Summit, the Water Adaptation Community (WAC) was launched. Its primary goals are to facilitate knowledge exchange to foster the worldwide expediting and upscaling of water climate adaptation, and to link water sector networks to networks involved in climate change and adaptation. Efforts are under way for such themes as Resilient Cities and Deltas; Social Inclusivity; and Climate Justice.

The Netherlands is also active in the Infrastructure Action Track (IAT) aimed at promoting climate-proof investments across the globe. Within the IAT, the Stress Test Facility is being developed, a global overview of substantive and process-based experiences with stress tests. The Facility thus fosters mutual learning.

The Ministry of Infrastructure and Water Management is actively following up on the WAT and will present the results in the wake of such major conferences as COP26 at the end of 2021 and the UN Water Conference in 2023. The Dutch approach, developed via the Delta Programme, is providing important building blocks for the follow-up actions of the WAT and the IAT. The Netherlands is sharing this expertise and experience through such publications as the Delta Lighthouse Case Studies, and via international platforms, coalitions, and regional meetings.

European Green Deal

In early 2021, the European Commission presented the European Climate Adaptation Strategy within the context of the Green Deal. The elaboration of this strategy is also of relevance to the Delta Programme. For example, under the European "Horizon Europe" R&D programme, the Commission aims to contribute to closing knowledge gaps regarding climate effects and the resilience of systems to adapt to such effects, in relation to, inter alia, the oceans. Furthermore, the Commission intends to promote regional and cross-border collaboration, and to update and improve the guidelines for national adaptation strategies in collaboration with the member states. The climate adaptation strategy involves, for example, ensuring the availability and sustainability of fresh water, through such measures as broader utilisation of drought management plans, and the promotion of sustainable soil management and land use. Finally, the Commission wants to expand the support for international climate resilience and preparedness.

Comparison of delta country approaches

The Netherlands is collaborating with governments in eight delta countries under the Partners for Water programme, a component of the Netherlands International Water Ambition (NIWA). The spring of 2021 saw the publication of a comparative study into the approaches adopted in Bangladesh and the Netherlands[9]. The study showed that the Delta Plans of both countries tie in well with the OECD Water Governance principles. A recommendation ensuing from the study is to add long-term orientation and risk approach to these principles.

[9] Van Alphen, J., De Heer, J., and Minkman, E. (2021): Strategies for climate change adaptation, lessons learnt from long-term planning in the Netherlands and Bangladesh. Water International.

CHAPTER 3

Flood risk management

Field test involving the use of tidal sand to combat piping, Hedwige polder, May 2021

Giving impetus to the implementation of the Delta Decision on Flood Risk Management is becoming increasingly urgent in order to meet the flood protection targets by 2050. Last year, Delta Programme 2021 made this clear. The dyke improvement projects are going full steam ahead. For more than 600 kilometres of flood defences, explorations or plan elaborations are under way, and the first projects are in progress. The assessment of all the primary flood defences is also continuing at high speed. By 2023, this will generate an up-to-date national picture of our flood protection.

3.1 Progress: implementation of Delta Decision on Flood Risk Management

New indicator for flood risk management policy

Flood risk management policy is aimed at reducing flood risks to an acceptable level by 2050: a basic protection level for every resident and an economic risk in which costs and benefits even out. In 2017, new standards were anchored in law, pertaining to the situation in 2050. Between now and 2050, flood protection is gradually being raised to the tolerable risk level by improving primary dykes that fail to meet the new standards. Since 2020, the Ministry of Infrastructure and Water Management has been reflecting flood protection progress in its budget, based on two indicators reflecting the outcomes: one for the basic protection level and one for economic risk (see Figure 2 and Figure 3).

The indicators were developed on the basis of the calculated economic risk in 2014 (the year in which the new flood risk management policy was enacted) and the number of people living in areas that had not yet achieved the basic protection level. This is the reference situation. The point of departure for determining the reference situation was that all the projects carried out under Flood Protection Programme 2, Room for the River, and Zandmaas/Grensmaas have been completed. A reduction of the economic risk and an improvement of the basic protection level will only be achieved once the dyke improvements under the Flood Protection Programme or the State Flood Defences programme are completed. The values for 2014 have been set at 100%. The development of the flood risk over time is presented vis-à-vis this reference. For the 2022 budget, the risk was calculated in 2021, based on the improvements of primary dykes that have been realised under the Flood Protection Programme up to 2021 (approximately 23 kilometres)[10]. Furthermore, the degree to which the risk will be reduced up to 2026 was calculated on the basis of the dyke improvements expected to be completed in the period up to and including 2025.

In 2021, the economic risk had fallen by some 1% vis-à-vis the reference situation, as only few flood defences have been improved under the Flood Protection Programme. Based on the improvements expected to be realised up to and including 2025, the economic risk will have been reduced by some 9% in 2026 vis-à-vis the reference situation. The number of people living in an area that has not achieved the basic protection level applicable to 2050 is expected to fall by 5% by 2026.

Basic protection level not yet achieved

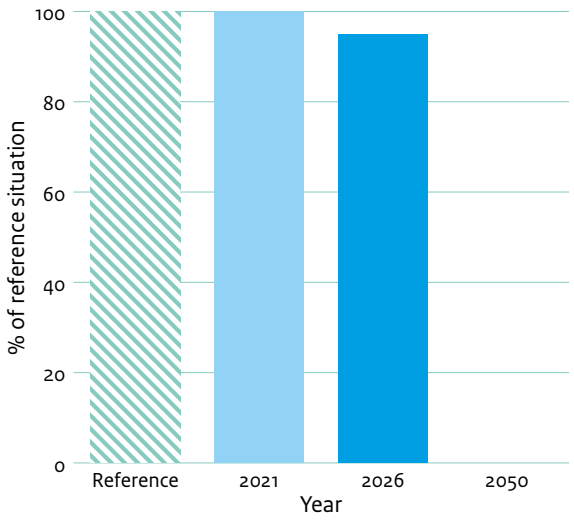


Figure 2 *Indicator for the development in achieving the basic protection level vis-à-vis the reference situation (Source: Rijkswaterstaat)*

[10] According to the fourth quarterly report 2020 of the Flood Protection Programme, measures covering 126 kilometres have been realised up to 2021 (see paragraph 3.4.1). A total of 23 kilometres is of relevance for the calculation of the reduction in the risk level vis-à-vis the reference situation.

Economic risk

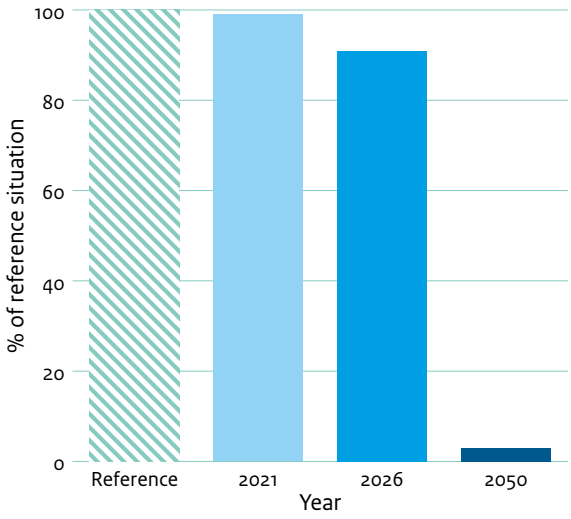


Figure 3 *Indicator for the development in reducing the economic risk vis-à-vis the reference situation (Source: Rijkswaterstaat)*

By 2050, all the flood defence systems must meet the new standards. By then, the basic protection level must have been achieved everywhere, whilst the economic risk must have been reduced to the tolerable economic risk level. Consequently, the figures also show the year 2050.

Evaluation of the Water Act

The Water Act sets out that, by no later than 1 January 2025, the Minister of Infrastructure and Water Management must submit a report to the Senate and the House of Representatives on the effectiveness and the effects of five flood risk management components of the Water Act (Articles 2.2, 2.3, 2.12, 3.9, and 7.23-7.26).

The evaluation ensues from two amendments to the Water Act. The first amendment (in 2014) pertained to the effectiveness and funding of flood protection; it was dictated by the need to effectuate stipulations of the Administrative Agreement on Water. The second amendment (in 2017) concerned the new standards for primary flood defences. This amendment ensued from developments in flood risk management policy and the choice to adopt a risk-based approach with respect to the protection standards.

The amendments to the Water Act are linked to several goals, such as increasing the efficiency and controllability of the Flood Protection Programme, and structural embedding of Flood Protection Programme funding. The evaluation should provide insight into the extent to which the goals associated with the amendments to the Water Act are being achieved or fostered, and reveal whether adjustments or actions are needed.

In Delta Programme 2015, the flood risk management partners (the central government, regional waterauthorities, provinces, and municipalities) agreed to "review every twelve years whether the standards need to be adjusted, if the underlying assumptions have changed materially". This commitment has been anchored in the interim revision of the National Water Plan (2014). This analysis is also covered in the evaluation.

In early 2021, the Ministry of Infrastructure and Water Management embarked on the elaboration of the scope and key questions for the evaluation, in collaboration with the stakeholders. The main stakeholders are: the Association of Dutch Regional Water Authorities, the regional waterauthorities, Rijkswaterstaat, the Flood Protection Programme, the Association of Provincial Authorities, the Association of Netherlands Municipalities, and the Human Environment and Transport Inspectorate. The evaluation is scheduled for 2022 and 2023. The administrative conclusion of the evaluation will commence by early 2024.

On 9 June 2021, the Delta Programme Commissioner, at the request of the Delta Programme Steering Group for the Meuse (SDM), presented an advisory report on the flood protection standards in the Meuse valley. He advises against lowering these standards, as had been suggested in response to the Administrative Order on Flood Protection Standards and Discharge Levels issued by the province of Limburg. However, the Delta Programme Commissioner recommends the exploration, within the existing instruments, of options to minimise the impact of the dykes. The advisory report has been submitted to the Minister of Infrastructure and Water Management as input for the evaluation of the Water Act, and to the Steering Group as the requesting party.

National round of assessments

In 2017, the first national round of assessments of primary dykes and dams commenced. This is the first assessment of the primary flood defence systems under the new standards. The statutory assessment takes place every twelve years, but this first round must be completed within six years.

By now, the managing authorities of the flood defences have gained sufficient experience with and knowledge of the new system and instruments to readily continue their work. In 2020, the Minister of Infrastructure and Water Management, the Chair of the Committee on Flood Defence Systems of the Association of Dutch Regional Water Authorities, and the Delta Programme Commissioner collectively drew up a memorandum urging for continuation of the assessments at full speed.

The Ministry of Infrastructure and Water Management, Rijkswaterstaat, and the Association of Dutch Regional Water Authorities are jointly stepping up their efforts to support, expedite, improve, or adjust the assessment process where needed and wherever possible.

This will enable completion of the round of assessments by 2022, as scheduled, which means that the first Picture of National Security will be available by 2023. These outcomes generate important information for the management and maintenance of the primary flood defences and for essential improvement projects. The schedule of Flood Protection Programme measures will thus become more robust, whilst a better picture will be created of the efforts required to have all the primary flood defences meet the statutory standards by 2050.

The acceleration measures have removed the need for extending the assessment of the primary state flood defences (see paragraph 3.4.3).

Ooijen-Wanssum

The Ooijen-Wanssum area development was completed at the end of 2020. This project involved collaboration between the province of Limburg; the municipalities of Venray and Horst aan de Maas; the Limburg regional waterauthorities; and the Ministry of Infrastructure and Water Management, under provincial leadership. It is a fine example of the integrated and interconnected approach envisaged by Integrated River Management and the Delta Programme. The area development encompasses integral solutions to various regional taskings: flood protection through dyke improvement and increasing river capacity; nature and landscape development; enhancing the liveability of Wanssum; and room for economic development. The exploratory study commenced in 2011 and the first measures were implemented in 2017. The project was successfully completed in 2020, under budget and two years ahead of schedule.

IJsselmeer Closure Dam (Afsluitdijk)

The IJsselmeer Closure Dam Improvement and Renovation project is currently in full swing. The project comprises, inter alia, its improvement over a stretch of more than thirty kilometres; the construction of two pumping stations and two guard locks; and the construction of an opening in the dam to accommodate a fish migration river. These components are scheduled to be completed by no later than 2023.

Two other components of the project have suffered some delay: the construction of new sluices and the renovation of the existing sluices. As the design of the new sluices was based on incomplete data on combinations of wave heights and water levels on the IJsselmeer side of the dam, it needs to be revised. Now that the new sluices will be completed at a later date, it will take longer for additional drainage capacity to become available. This impacts the renovation of the existing sluices: this will now be carried out in phases, in order to continually ensure sufficient drainage capacity during the work. The new schedule factors in that the road must be kept open during the work and that work options are limited during the breeding season and the storm season. As a result, the renovation of the existing sluices will take longer. The work is expected to be completed by 2025.

The final solution substantiates the original goals with respect to flood protection and water drainage, whilst preserving the aesthetics of the original design. Upon completion of the work, the flood protection provided by the IJsselmeer Closure Dam will be ensured for at least fifty years.

At the end of May 2021, the Minister of Infrastructure and Water Management informed the House of Representatives regarding the progress of and developments in the improvement and renovation of the IJsselmeer Closure Dam, and regarding the pertinent financial ramifications.[11]

Moorlag motion

In the Legislative Deliberations on Water of 1 December 2020, MP Moorlag tabled a motion[12] requesting the government to advance and expedite investment projects, and to identify suitable projects in collaboration with regional waterauthorities, provinces, municipalities, and the business community.

Following this motion, the Minister of Infrastructure and Water Management requested Rijkswaterstaat and the local and regional governments to consider a study into the options for expediting infrastructure projects. The general picture is that a large proportion of the work that could be expedited has already largely been carried out.
A complicating factor is the lack of funding and of capacity to expedite work. On the positive side: the Flood Protection Programme is showing a substantial growth in dyke improvement projects that will be entering the realisation phase in the years ahead. This means that the programme's order portfolio will increase. The funds available in the national budget will rise from some EUR 435 million in 2021 to EUR 578 million by 2023. Rather than an acceleration, this involves an increase of work for the hydraulic engineering sector.

[11] Parliamentary Document 35570 A no. 59 (in Dutch)

[12] Parliamentary Documents II, 2019/2020, 35 300 XII, no. 71 (in Dutch)

Crisis management and crisis measures

The Steering Group on Water Crises and Flooding Management (SMWO) is working on a vision document for disaster management during water crises, which will look ahead to 2030. The document is not progressing at the rate hoped for; its presentation has been postponed from 2021 to 2022.

In September 2020, the central government and the Security Regions discussed how to enhance their collaboration during supra-regional and national disasters. The central government and the Security Regions aim to operate as a single crisis organisation during such disasters. The parties have discussed how coordination between the chairs of the Security Regions and the national crisis structure can be substantiated in practical terms, in parallel to the strategy adopted to tackle the COVID-19 crisis. As indicated in the Cabinet point of view regarding the evaluation of the Security Regions Act[13], effective disaster control in a network of partners[14] calls for thorough collective preparation. The recent realisation of the National High Water and Flooding Crisis Plan ties in well with these efforts.

Under the Water and Evacuation (WAVE) programme, the Steering Group on Water Crises and Flooding Management has commissioned the Security Regions to conduct regional and supra-regional impact analyses to underpin evacuation plans. WAVE will be rounded off by the end of 2021, by which time the Security Regions will review how they can embed their mutual collaboration and their collaboration with other parties (such as Rijkswaterstaat).

For dyke ring 48 (the area between the Boven-Rijn, Pannerdensch Canal, and the German border), a pilot study has been launched to explore options for improving the safety of residents. The Ministry of Infrastructure and Water Management, the regional waterauthorities, and the Security Regions are collectively seeking an optimum combination of preventative evacuation (escaping the area) and vertical evacuation (fleeing to a safe place within the area), which will be translated into action perspectives to reduce casualty rates. The results of the pilot study will be available by mid-2021. If the results hold promise, this approach could perhaps also be used in other areas. Furthermore, the results are of relevance to the evaluation of the standards (under the evaluation of the Water Act; see above) and to the implementation of crisis management by the Security Regions.

[13] Parliamentary Document 29 517 no. 198 (in Dutch)

[14] This network comprises the central government (including the Ministry of Defence), the Security Regions, crisis partners (among which providers of vital processes), and other public and private partners.

3.2 Actions for linkage with other taskings and transitions

Integrated River Management (IRM)

Under the Integrated River Management programme, government bodies (Ministries, provinces, regional waterauthorities, and municipalities) are collaborating with interest groups and the Delta Programme Commissioner in pursuit of integrated solutions to various taskings in the area around the major rivers. The taskings pertain to issues ensuing from, e.g., climate change and riverbed erosion, and involve such domains as flood protection; navigability; freshwater supply; drinking water supply; nature; and ecological water quality. The programme is a fine example of linking up flood risk management and freshwater supply taskings with other taskings in the area.

The goal is to preserve the future use of the Rhine and the Meuse for all the river functions, and to provide added societal value to the area around the major rivers. This requires a system-oriented perspective and an integrated approach. The parties are developing a programme under the Environment Act (POW-IRM), comprising a vision document for the rivers extending up to 2050; (system) choices regarding soil level and discharge capacity; and an implementation programme. In parallel, projects are already being carried out in an integrated manner, wherever possible. Paragraph 6.4 provides more information on the progress of the Integrated River Management programme.

Spatial quality

In 2020, the Council of Chief Government Advisors presented an advisory report on the Flood Protection Programme. The crux of their report was that more efficient collaboration between the government bodies responsible will boost the quality of flood risk management efforts. According to the Council, the Room for the River programme has generated inspiring projects that resonate well with the Panorama of the Netherlands perspective for the future. This can be attributed to the fact that enhancing spatial quality constituted the programme's second objective, after improving flood risk management. The Council feels that the Flood Protection Programme is lacking in spatial quality requirements. The central government needs to intensify the linkage of quality and flood protection, and thus maximise the societal yield of the programme. The advisory report has prompted the Minister of Infrastructure and Water Management to expand the motto of "plain and effective" to "efficient, plain, and

effective". The Minister regards the recommendations as support for and encouragement of the course taken, viz. to adopt an optimally integrated approach in the Flood Protection Programme projects. Together with provinces, municipalities, and regional waterauthorities, the Minister aims to build on the good examples that are already manifest and to commit to further collaboration on interconnected spatial taskings. The National Environmental Vision can provide additional impetus to the efficient combination of taskings and transitions in an area.

In order to embed spatial quality in the Flood Protection Programme projects, the local and regional governments will be substantiating their relevant policy responsibilities. The central government is facilitating this under the OUR Landscape programme (see paragraph 2.4).

3.3 Signs and new insights

Flood Protection Expertise Network advisory report on discharge distribution

The Rhine tributaries discharge distribution is covered by the Delta Decision on the Rhine-Meuse Delta. The Ministry of Infrastructure and Water Management has asked the Flood Protection Expertise Network for advice on the future discharge distribution in high water situations and on the existing policy agreements (cf. paragraph 6.3). The report - expected by July 2021 - will constitute input for the design of the alternatives being developed within the context of Integrated River Management (cf. paragraph 6.4).

Flood Protection Expertise Network advisory report on resilience of the flood protection system

In 2019, the Flood Protection Expertise Network - at the behest of the Minister of Infrastructure and Water Management - presented an advisory report on the tenability of the current flood risk management strategy in the event of an accelerated rise in sea level. The report addresses the resilience of the current flood protection system under increased sea level rise, and outlines the required system explorations regarding the tenability and effectiveness of the current system. The recommendations have been taken into account in the set-up of the Sea Level Rise Knowledge Programme (cf. paragraph 2.1).

According to the report, major system changes will not be necessary in the near future (up to approximately 2050). The Flood Protection Expertise Network states that a 1 metre sea level rise can be accommodated, in technical and financial terms, by upscaling the current flood risk management strategy. This will, however, impact the spatial accommodation and the ecology of water systems. In the scenario featuring a sea level rise of up to 2 metres or 20 mm/annum, the continuation of the current flood risk management strategy will entail technical challenges. The required interventions will probably be feasible from a technical and financial perspective, yet they will have a considerable impact in a spatial, ecological, and societal sense. The Flood Protection Expertise Network recommends that this impact should be mapped out and used as the basis for conducting a series of system explorations into the feasibility of alternative strategies, starting with the areas in which current policy will first reach its limits, such as Rhine Estuary-Drechtsteden and Oosterschelde.

The Flood Protection Expertise Network expects that from an economic point of view, the current standards will definitely hold good under a 2 metre sea level rise. Tenability will be at issue if the costs of dyke improvement outpace the economic value in the protected area. The Network expects that in the scenario featuring a maximum sea level rise of 2 metres, the standards will need to be adjusted at several locations in order to keep the risk of casualties at an acceptable level.

Flood Protection Knowledge Agenda

In early 2021, the Ministry of Infrastructure and Water Management updated the Knowledge for Flood Defences programme. This programme is a component of the Ministry's Flood Protection Knowledge Agenda. Over recent years, the Knowledge for Flood Defences programme has generated particular expertise for the (continued) development of the instruments for the assessment and design of primary flood defences. The current statutory assessment instruments have now been sufficiently developed to warrant the accuracy of the ongoing assessments. The focus of the updated knowledge programme is on research in the purview of a more realistic estimate of the flood probability of primary dykes and dams.

3.4 Delta Plan on Flood Risk Management

The Delta Plan on Flood Risk Management comprises all the Delta Programme studies, measures, and provisions - scheduled or to be scheduled - that relate to flood risk management. The diagrams and tables in the Delta Plan set out the progress, schedule, planning, and phasing of the flood protection projects.

The measures are funded from the Delta Fund; regional waterauthorities contribute half the cost of dyke improvements carried out under the Flood Protection Programme. Several projects are co-funded by regional parties, and a few are funded from the Ministry of Infrastructure and Water Management budget. Wherever relevant, the Delta Plan on Flood Risk Management also covers regional measures that are not co-funded by the central government. Sand replenishment along the coast falls under management and maintenance; consequently, it does not feature in the Delta Plan on Flood Risk Management. The scheduled replenishment projects are listed in the Coastline Maintenance Implementation Programme.

3.4.1 Flood Protection Programme

Tables 1 up to and including 8 reflect the Flood Protection Programme schedule for the period 2022-2027.

Progress and scheduling

The Flood Protection Programme is gaining momentum. Improvement projects for more than 600 kilometres of

Year	Realised with realisation phase	Realised without realisation phase	Realised in total
2014	0.2 km	0.2 km	0.4 km
2015	0.9 km	11.6 km	12.5 km
2016	0.9 km	0.3 km	1.2 km
2017	11.0 km	15.8 km	26.8 km
2018	6.0 km	27.3 km	33.2 km
2019	1.9 km	12.2 km	14.1 km
2020	13.9 km	34.6 km	38.3 km
Total	**34.6 km**	**91.5 km**	**126.1 km**

	Prognosis
2021	7.6 km
2022	2.1 km
2023	4.3 km
2024	29.4 km
2025	49.6 km
Total	**93.0 km**

18.6 km Annual average between 2020 and 2024

Basis:

- Schedule
- Request for process amendment
- Schedule for 2021-2026

Figure 4 *Realisation of Flood Protection Programme Source: 4th quarterly report, Flood Protection Programme 2020*

primary flood defences are scheduled to be underway by 2022. More than half of these projects have already entered the plan elaboration or realisation phase, following completion of the explorations. Upon the commencement of the programme, the total length of dyke improvements required up to 2050 was estimated at approximately 1500 kilometres. By now, projects have been scheduled for 767 kilometres.

The first assessments of primary dykes will run until 2023. For dyke stretches that fail to meet the standards, new improvement projects will be incorporated into the programme. In the years ahead, this will provide increasingly greater insight into the scope of the overall programme up to 2050. New projects first undergo an entry test. The entry test was introduced in 2020 to stabilise the programme in terms of scope (dyke kilometres and number of engineering structures), milestones, and costs. Projects that have passed the entry test qualify for scheduling.

In the programme plan, the Flood Protection Programme alliance (Rijkswaterstaat and the regional waterauthorities) set out the ambition of raising their production and having an annual average of 50 kilometres of primary flood defences meet the standards. Several methods exist to have a dyke meet the standards: implementing physical measures such as dyke improvement, or reducing uncertainties regarding the strength of the dyke, for example, by applying new knowledge demonstrating that the primary dyke nonetheless complies with the standard. The average lead time of Flood Protection Programme projects is seven years. The current programme was launched in 2014; the early years mainly saw the completion of minor projects. Larger projects, many of which are more complex, generally feature a longer lead time. Figure 4 presents a prognosis of the completed Flood Protection Programme projects, expressed in the expected increase in the stretch of flood defences that once more meet the standards. With effect from 2026, the ambition of an annual average of 50 kilometres is expected to be realised, thus compensating for the lower production rates in the period 2021 - 2025.

The current estimate of the overall dyke improvement tasking in the Netherlands up to 2050 warrants the expectation that sufficient resources will be available in the Delta Fund to cover the aggregate Flood Protection Programme taskings, if the Delta Fund feeding arrangements set down in the Administrative Agreement on Water will be extended up to and including 2050. The Flood Protection Programme is keeping a close eye on the costs of the overall dyke improvement tasking up to 2050. Chapter 7 addresses the funding of the entire Delta Programme.

The Flood Protection Programme has scheduled a wide range of projects for the twelve years ahead. The expenditure scheduled for 2024 and 2025 will exceed the budget, which may result in a deficit. The regional waterauthorities and the central government have agreed to each stand surety for covering half of a budget deficit, if any.

Knowledge development and innovations

Under the Flood Protection Programme, knowledge and innovation projects are set up. New knowledge and innovations are needed in order to be able to realise the dyke improvements set out in the Flood Protection Programme in a timely manner, at acceptable costs, and with an acceptable impact on society.

Several projects were successfully completed in 2020, such as the General Explorations pertaining to Piping, Macro-stability, and Cables & Pipes. The projects have generated new insights, working methods, and technologies to, e.g., reduce costs and to gear improvement projects to the surrounding landscapes.

In the years ahead, the focus will be on collaboration, the strength of flood defences, and sustainability. The Engineering Structures Collaboration project, for example, should produce a collective strategy for the improvement of 500 engineering structures. This year, a pilot study in the Hedwige polder will produce greater insight into the probability of piping in tidal areas, following a successful test conducted along the Wadden Sea coast in 2020, which resulted in reducing the piping tasking in that area. The Building with Nature project in Natura 2000 areas (Drents Overijsselse Delta regional waterauthorities) shows how flood protection measures can be implemented in Natura 2000 areas.

A point for attention is the upscaling of innovations. The Innovation Accelerator project fosters upscaling by supporting projects, by sharing knowledge, and by rounding off studies wherever necessary. In 2020, the Collective Innovation strategy was endorsed. This sets out three basic principles for upscaling innovations: everyone makes an effort to advance innovations; every project takes account of relevant, (nearly) mature innovations and knowledge as fully-fledged alternatives; and the parties collectively bear the risks, if any, entailed in the large-scale application of innovations.

Sustainability and spatial quality

In 2020, the Flood Protection Programme alliance published the Sustainability and Spatial Quality Programme Strategy, aimed at supporting the transition to sustainable, climate-neutral, and circular dyke improvements through spatial quality (see Figure 5). Via their own policies and via sector-wide covenants, all the Flood Protection Programme alliance partners have committed to ambitions relating to spatial quality and sustainability. The goal is to have

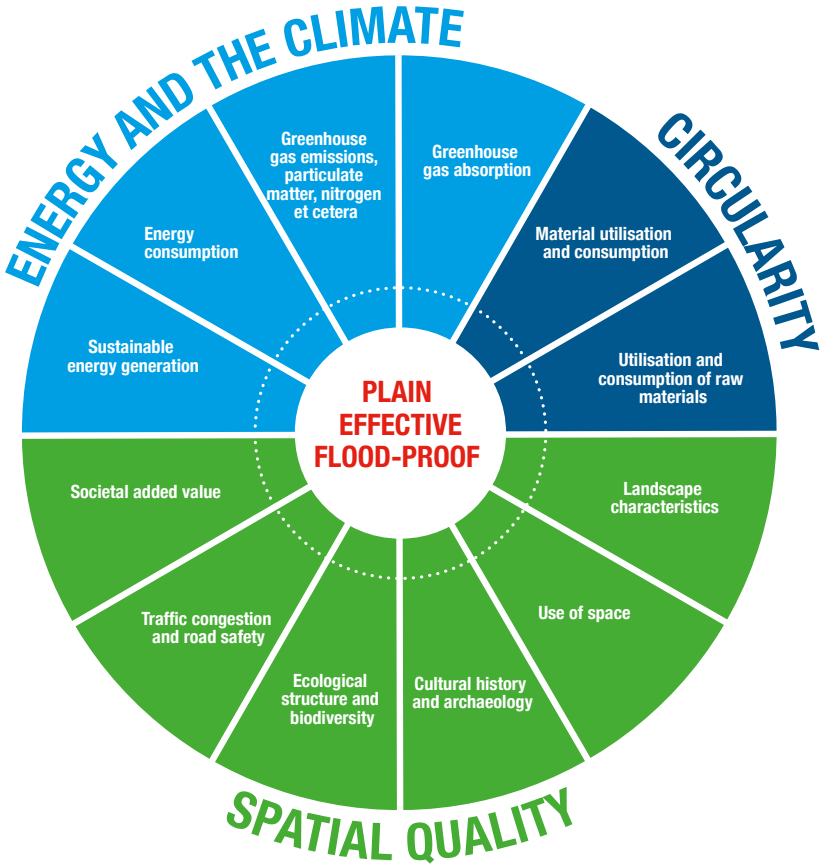


Figure 5 *The sustainability wheel reflecting the three perspectives of the Flood Protection Programme*

sustainability and spatial quality structurally embedded in the Flood Protection Programme projects by 2023, and to have the project ambitions resonate with the goals and requirements of the Environment Act. Furthermore, the partners intend to substantiate, wherever necessary, current developments relating to sustainability in, e.g., the Climate Agreement. This involves a huge tasking. For example, the implementation of the Flood Protection Programme is doubling the CO_2 footprint of the regional waterauthorities. The Flood Protection Programme alliance aims to have sustainability and spatial quality embedded in the dyke improvement strategies by 2023.

In 2020, the extent to which sustainability and spatial quality have been embedded in dyke improvement projects was monitored for the first time. This revealed that in nearly all the projects, sustainability and spatial quality are accommodated in the working processes. How this is achieved differs widely, as does the extent of accommodation. Some project teams elaborate all the sustainability themes in all the process phases, whereas others focus on a specific theme or on a particular phase. The embedding of sustainability and spatial quality has improved vis-à-vis 2019, yet sustainability and spatial quality have not yet secured a structural place in the dyke improvement process. Initial calculations have shown that earth moving accounts for some 80% of the CO_2 footprint of the Flood Protection Programme. One of the keys to lowering its footprint is, consequently, to use local soil wherever possible. This also opens up opportunities in terms of spatial quality, e.g., through a combination with nature development on the floodplains.

Project teams and regional waterauthorities can use the monitoring results to evaluate their own strategies. The Flood Protection Programme alliance is using the results to optimise the activities set out in the Programme Strategy. Insights into sustainability and spatial quality are developing at a fast rate, which is why knowledge sharing is crucial. In early 2021, several LinkedIn groups were set up to this end: the open Sustainability and Spatial Quality Expert Group, and closed groups for the knowledge and innovation projects. The participants of the closed groups are experimenting with collective tool development by way of co-creation. The groups cover the five sustainable projects launched in 2020 and 2021 under the Knowledge and Innovation Agenda:

- Building blocks for sustainable dyke improvements (Rivierenland regional waterauthorities);
- Wolferen-Sprok zero-emission design (Rivierenland regional waterauthorities);

- Sustainable Construction Calculator for the plan elaboration and realisation phases (Rivierenland regional waterauthorities);
- Building with Nature in Natura 2000 areas (Drents Overijsselse Delta regional waterauthorities);
- Grebbe Dyke circular design in the plan elaboration phase (Vallei and Veluwe regional waterauthorities).

In 2021, additional attention will be focused on biodiversity.

Examples of spatial quality in Flood Protection Programme projects

The experience gained over recent years shows that many Flood Protection Programme projects are already fostering spatial quality, especially if spatial quality is actively addressed at an early stage, as is manifest in the following three examples.

The Grebbe Dyke project has been tackled as an area development from the very start, continuously looking for opportunities to link spatial quality to flood protection solutions. This has generated, e.g., a stepped dyke that curbs waves whilst offering a safe bicycle and walking trail on the sea side of the dyke. Furthermore, the dyke now forms part of the Horn Work, an ancient fortress in the Grebbe line of defences, which has been restored under the project.

The Meandering Meuse project has pursued an integrated approach and area development from the start. As a result, the surface area available for nature development has increased considerably. The project is almost CO_2 neutral, by retrieving dyke clay from the area (through nature development) and by sequestering CO_2 in riparian forests. Furthermore, the project generates added value for the landscape, recreational routes, and cultural history, e.g., by restoring elements of the Southern water defence line. As a result of proper arrangement at the administrative level, from the start, the integrated approach has enabled capitalisation of several opportunities and combination of budgets.

In the Gorinchem-Waardenburg dyke improvement project, the regional waterauthorities and the alliance design team were committed to an integrated regional approach. From the start, they opted for collaboration with all the stakeholders in the region, in pursuit of an intervention that would yield maximum quality for the area. The accommodation of the dyke is not a separate element in the regional tasking: the way in which the dyke improvement is realised - the choice of solution strategy - is largely decisive for how the dyke eventually fits in. This approach has resulted in, e.g., connections between the villages and the river. The soil deposited on the inner berm has been extended up to the crest wherever possible. This has created a complete recreational network with connections to the floodplains.

In most cases, the costs of capitalising on linkage opportunities for spatial quality are low vis-à-vis the total project budget. Yet securing sufficient resources can be difficult for the funding party - usually a municipality. Here, too, early exploration of opportunities to take spatial quality into account is important, in order to have more time to arrange funding.

Future dykes

Dykes covered in a wide variety of vegetation species help to boost biodiversity. Furthermore, diverse grass covers require less grass replacement and lower mowing frequencies, which contributes to reducing CO_2 and nitrogen emissions. By seeding dykes with diverse mixtures of grass species, herbs, and flowers, the cover will be more sustainable, more natural, and less susceptible to drought. The Future Dykes innovation project is testing the erosion resilience of various types of diverse grass covers. It also amasses knowledge on the realisation, assessment, maintenance, and cost effectiveness of such sustainable grass covers.

Circular use of sludge in the Wide Green Dyke project

The Eems-Dollard is too muddy: the water contains too much sludge, which hampers nature. Under the ED 2050 Programme, sludge is removed from the Eems-Dollard and repurposed on the land. “Maturing” the sludge in clay maturing plants generates good clay for dyke improvements. Such clay is being used for the Wide Green Dyke along the Dollard. The result is a safe, sustainable, and circular dyke.

Table 1 Knowledge and Innovation Agenda

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	Innovation reserve	■	■	■	■	■	■	■	■	■	■	■	■
	Knowledge and Innovation Programme (KIA)	■	■	■									
33T	GE Engineering structures	■	■	■									
33H	GE Cables & Pipes												
13K	Cuijk - Ravenstein innovation												
13D	Ravenstein - Lith innovation												
33M	JLD Dyke stabiliser (GE Macrostability												
33M	JLD Dyke stabiliser (GE Macrostability) Readjustment and monitoring phase	■	■	■	■								
33Q	Grass on Sand study	■											
33O	Dyke and forelands (GE W)												
33N	Asphalt Cladding Study (Wadden Sea GE)												
33N	Continued monitoring of asphalt degeneration												
28F / 28G	Vijfhuisterdijk piping test (Lontkade)												
33C	GE Wadden Sea												
16M	Geervliet Hekelingen 20-3												
33S	Hedwigepolder piping test	■											
33I	Grass and Clay Cladding Monitoring phase D Wadden Sea GE	■	■	■	■								
33I	Grass and Clay study phase C Wadden Sea GE												
17D	Kerkhovenpolder - Germany pilot (Wide green dyke)	■	■	■	■								
33L	GE Dyke improvement using local soil	■											
19I, 19N, 19P, 19Q	First round, Plan elaboration innovative												
19D	Round 2 Steyl Maashoek innovation	■											
18A	Eemshaven-Delfzijl - Double Dyke												
18A	Eemshaven-Delfzijl - MJVM	■	■	■	■	■	■	■	■	■	■		
18A	Eemshaven-Delfzijl GE Wadden Sea contribution												
21F	Twente Canal- innovative												
22L	Wolferen-Sprok dyke improvement												
22E	Gameren innovation GZB												
33E	GE Macrostability												
33D	GE Piping												
33U	More sustainable and permissible Flood Protection Programme dyke improvements												
33V	Innovation accelerator	■	■	■									
24AG	Zuid-Beveland West, Westerschelde Hansweert - innovation												
25I	Eemdijk-Spakenburg "collapsable dyke" in Oude Haven Spakenburg												
25P	Grebbe dyke innovation V												
33R	GE HEEL	■	■	■									
33G	System elaboration Vecht flood perspective - innovation												

Key: ■ Innovation

Table 2 Schedule of Flood Protection Programme measures, 2022-2027/2033

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
03V	Engineering structures												
03O	Den Oever - Den Helder, incl. connecting sections												
03Y	Durgerdam connection												
03S	Markermeer dyke connection												
03I	North Sea Canal (D31 -D37)												
03E	Wieringermeer category C dyke												
02F	Culemborgse Veer-Beatrix Lock (CUB)												
02I	Irene Locks-Culemborgs Veer												
02E	Salmsteke												
02G	Salmsteke Schoonhoven (SAS)												
02C	Improvement former Cat. C dyke HDSR (GHIJ)												
02H + 02J	Vreeswijk - Jaarsveld												
02B	Gouda Waaier lock												
02D	Wijk bij Duurstede Amerongen (WAM)												
05E	Gouda IJssel dyke (VIJG) track 2												
05G	Gouda IJssel dyke (VIJG) track 4 (GHIJ)												
05F	Spaarndammer dyke engineering structures												
05C	IJssel dyke improvement Gouda Stadsfront Forelands track 3												
06K	Krimpenerwaard Strong IJssel Dykes (KIJK)												
13H	Boxmeer - Cuijk (section)												
13K	Cuijk - Ravenstein												
13D	Ravenstein - Lith												
14E	Moerdijk												
14F	Standhazen Dyke												
34L	Genemuiden-Hasselt												
34R	Zwolle guard lock												
34O	Mastenbroek IJssel												
34P	Mastenbroek Zwarte Meer												
34M	Zwolle urban dykes (15E)												
34AK	Vecht - Stenendijk Hasselt												
15P	Vecht Dalfsen Zwolle												
34U	Zwolle-Olst												
34Q	Mastenbroek Zwarte Water												
34AL +34AM	Vecht Zwartewaterland												
34AR +34AS	Vecht-Oost												
28F / 28G	Koehool- Lauwersmeer												
28P	Linde dyke (former cat. C dyke)												
28A	Schiermonnikoog - Wadden Sea dyke												
	Schiermonnikoog dunes												
28E	Zurich-Koehool												
16M	Geervliet - Hekelingen 20-3												
16E	V3T flow slide												

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
17D	Kerkhoven polder-Germany LRT3												
23AB	Alexanderhaven AB												
60AJ	Roermond sub-track South												
18D	Lauwersmeer/Vierhuizergat												
21I	IJsselpaviljoen Zuthpen												
21AI	Spijk-Westervoort Sub-project 1												
21AI	Spijk-Westervoort Sub-project 2												
22X	Gorinchem-Waardenburg (GoWa)												
22D	Neder-Betuwe												
22AW+BW	Sprok-Sterreschans-Heteren												
22BX	Sprok-Sterreschans-Heteren A15 intersection												
22K	City of Tiel excl. Fluvia												
22AR	Streefkerk Ameide Fort Everdingen (SAFE)												
22Y	Tiel - Waardenburg (TiWa)												
22L	Wolferen-Sprok incl. DTO												
24AE	Zuid-Beveland East, Oosterschelde												
24R	Zuid-Beveland East, Westerschelde												
24AG (4AV-24AM)	Zuid-Beveland West, Westerschelde Hansweert												
24AH + 24AN	Zuid-Beveland West, Westerschelde S2												
24AO	Zuid-Beveland West, Westerschelde S3												
25K	Apeldoorns Canal												
25P	Grebbe dyke												
25L	Northern Randmeer dyke (incl WDOD)												
27E	IJsselmeer dyke												
27G	Oostvaarders dyke												
27D	Zuidermeer dyke/MSMF												
27C	Noordoost polder engineering structures												

Key: (Pre-)Exploration Plan elaboration Realisation Fastlane

Table 3 Administrative Agreement on the Meuse measures

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
60F	Arcen (19J)												
60I	Baarlo (19M)												
60L	Beesel (19P)												
60M	Belfeld (19Q)												
60O	Blerick-Groot Boller (19S)												
60K	Buggenum (19O)												
60E	Heel (19I)												
60N	Kessel (19R)												
60J	Nieuw-Bergen (19N)												
60B	Steyl-Maashoek (19D)												
60D	Thorn (19H)												
60H	Venlo Velden (19L)												
60G	Well (19K)												
60AI	Willem Alexanderhaven C (23C)												

Key: Plan elaboration Realisation

Table 4 Pre-funding

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
03R	Gouwzee & Buiten IJ												
03AA	Katwoude												
03AC	Monnickendam inner city dyke												
03AD	Monnickendam Sea dyke												
03AE	Schellingwoude												
03AB	Volendam (Zuideinde)												
14A	Geertruidenberg/ Amertak												
14D	Willemstad - Noordschans												
60AE	Lob van Gennep												
21E	Grutbroek industrial estate												
21AK	RIDS Fase 1 IJsselkade												
21A	Arnhem Rhine Quay												
24AX	Kop van Ossenisse												
24AK	Sint Annaland												

Key: (Pre-)Exploration Plan elaboration Realisation Payment of (pre-)exploration pre-financing
Payment of plan elaboration pre-financing Payment of realisation pre-financing

Table 5 River widening-dyke improvement exchange grants

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
06K	Hollandse IJssel storm surge barrier failure reduction, from KIJK project	€											
13H	Meandering Meuse, Boxmeer - Cuijk project contribution							€					
13K	Meandering Meuse, Cuijk - Ravenstein project contribution				€								
13D	Meandering Meuse, Ravenstein - Lith project contribution	€											
13H	Oeffelt contribution from Boxmeer - Cuijk							€					
60G	Meandering Meuse, contribution from Round 3 / Well dyke improvement	€											
60G	Oeffelt, contribution from dyke improvement round 3	€											
60AE	Lob van Gennep approx. EUR 8.5 million (contributing projects unknown)												
21AI	IJsselpoort phase 1, dyke stretch 48-1 exchange					€							

Key: € indicates year in which exchange grant will be paid out

Table 6 Multi-Year Programme for Infrastructure, Spatial Planning and Transport

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
60F	MIRT Arcen (19J)												
60I	MIRT Baarlo (19M)												
60D	MIRT Thorn (19H)												
60H	MIRT Venlo Velden (19L)												
60G	MIRT Well (19K)												

Key: Plan elaboration Realisation

Table 7 Rijkswaterstaat

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
80F	IJmuiden Dyke												
	IJmuiden engineering structures												
	Prinses Marijke lock gate												
80L	Marken												
80K	Hollandse IJssel storm surge barrier (gate)												
80G	Vlieland												
	Voorhaven dykes Northern Lek dyke (HDSR administrative agreement)												

Key: Realisation

Table 8 Tentative schedule of dyke improvements

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
03P	Markermeer dyke section (D18)												
03Q	Markermeer dyke section (D22) Schardam												
03A	Krassekeet pumping station												
03L	Den Helder Sea Wall												
03G	Markermeer engineering structures (D18-D22)												
03H	Markermeer engineering structures (D27)												
03W	Markermeer engineering structures (Damsluis D27K3)												
03X	Markermeer engineering structures (Poelsluis pumping station D27K6)												
03D	Vier Noorder Koggen engineering structures, eastern dyke												
03Z	Nieuwe Diep (Den Helder)												
03J	Texel												
06D	Capelle-Zuidplas												
06F	Residual tasking Hollandse IJssel												
	Section 14-2 (scheduling only)												
	36.0 Boxmeer - Elevated Soils dyke extension												
13S	Den Bosch - Heusden												
13P	Lith - 's-Hertogenbosch												
	Section 36 a Keent												
14E	Moerdijk residual tasking												
34N+34AC	Deventer												
34K+34Z	Around Kampen												
28L	Wadden Sea and Lake IJsselmeer engineering structures (third round of assessments)												
	Lemmer - Stavoren dyke												
	Stavoren - IJsselmeer Closure Dam dyke												
	Terschelling dyke												
	17-3 Oostmolen dyke Ring dyke												
	20-2 Den Briel Meuse dyke												
17B	Chemical park-Punt van Reide												
17A	Delfzijl-Chemical park												
17E	Kerkhoven polder-Germany - LBO1												
17C	Punt van Reide - Kerkhoven polder												
	Afferden up to and including Neer												
60S	Blerick (excl. Groot Boller)												
60AA	Claus plant up to and including Voulwames												
60Q	Gennep												
60Z	Meers												
	Northern sector (Ohé and Laak-Stevensweert, Aasterberg, Nattehoven-Roosteren)												
	Roermond												
60R	Venlo												
60AF	Venlo 't Bat												

Code	Project name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	Southern Meuse Valley (Eisden and Sint Pieter)												
	Southern Meuse Valley (Itteren and Borgharen)												
	Southern Meuse Valley (Maastricht)												
	Arnhem - Rheden												
	Doesburg - Doetinchem (zz OIJ)												
	Doesburg - Hackfort channel sub-project 1												
	Doesburg - Hackfort channel sub-project 2												
	Doetichem - Doesburg (nz OIJ)												
	Twente Canal lock - Deventer												
	Spijk-Westervoort Sub-project 3												
	Zutphen - Hackfort channel												
	Westervoort - Doesburg												
	Zutphen - Twente Canal lock												
	Alem												
	Bergsche Maas dyke - Hank (A27)												
	Bergsche Maas dyke												
22BJ	Everdingen - Ravenswaaij												
	Ewijk (A50) - Dreumel												
22BI	Gorinchem Wallen - Hardinxveld-Giessendam (A15)												
	Hank (A27) - Steurgat - Werkendam												
22BL	Hardinxveld-Giessendam (A15) - Kinderdijk												
22BK	Heerewaardense Afsluitdijk												
	Heerewaardense Maas dyke												
	Heteren (A50) - Beusichem												
	Heumen - Niftrik (A50)												
	Kinderdijk - Streefkerk												
	Millingen - Nijmegen												
	Niftrik (A50) - Dreumel												
	Nijmegen - Ewijk												
	Rossum - Bergsche Maas dyke												
	Rossum Wilhelmina lock												
	Ameide lock - Fort Everdingen												
22BT	Streefkerk - Ameide lock												
	Werkendam - Afsluitdijk Andel (Wilhelmina lock)												
24AY	Koopmanshaven Vlissingen												
24AW	Sloehaven up to outer port												
	Section 11-1 (new standard)												
	Section 52-1 (new standard)												
	Section 52-2 (new standard)												
	Section 52a-1 (new standard)												
27F	IJmeerdijk - Almere poort												

Key: (Pre-)Exploration Plan elaboration Realisation Fastlane

3.4.2 Flood Protection Programme 2

The Second Flood Protection Programme mainly comprises projects ensuing from the first assessment (2001) and the second assessment (2007) of the primary flood defences. The final two projects of this programme are under way:

- Eem Dyke and Southern Randmeren Dykes (realisation: 2021);
- Hoorn-Edam-Amsterdam Markermeer Dyke.

Expectations are that 22 kilometres will be completed by 2021. More information is provided in the 19th progress report[15] of the Second Flood Protection Programme.

[15] Parliamentary Document II, 2020/2021, 32698, 55 (in Dutch)

Table 9 Second Flood Protection Programme

Second Flood Protection Programme	2022	2023	2024	2025	2026	>
Budget: a total of EUR 2.551 million, of which EUR 390						
Hoorn-Edam-Amsterdam Markermeer Dyke						

Key: ■ Realisation

3.4.3 State Flood Defences programme

Assessment of the safety of regional and primary state flood defences is currently under way. The assessment reports on the regionals state flood defences have been submitted to the Human Environment and Transport Inspectorate, and the overall safety report will be completed in 2021. The assessments of the primary state flood defences are scheduled to be submitted to the Human Environment and Transport Inspectorate by mid-2022. The need to extend the process until the end of 2022, as envisaged earlier, has thus been removed.

The safety assessments constitute the basis for scheduling improvement measures under the State Flood Defences programme. This is expected to be realised by 2023-2024.

3.4.4 IJsselmeer Closure Dam

The IJsselmeer Closure Dam Improvement and Renovation project is currently in full swing.
Most of the work will be completed by 2022 and 2023. The construction of new sluices and the renovation of the existing sluices have been delayed; this work is expected to be completed by 2025 (see paragraph 3.1).

Table 10 IJsselmeer Closure Dam measures

IJsselmeer Closure Dam	2022	2023	2024	2025	2026	>
Budget: EUR 1,780 million in total, of which EUR 1,665 million still available as from 2021						
IJsselmeer Closure Dam						

Key: ■ Realisation

3.4.5 Foreshore Deposits

Rijkswaterstaat and the Scheldestromen regional waterauthorities rolled out the Foreshores Deposits programme at the end of 2019. The stone deposits at 27 locations along the Oosterschelde and Westerschelde in the province of Zeeland are intended to reinforce the foreshores and thus combat flow slide. Along the Westerschelde, Rijkswaterstaat and the province of Zeeland joined forces in 2020 with respect to the implementation of projects. At locations at which Rijkswaterstaat is reinforcing the foreshores, the province is working on the restoration of floodplain nature, inter alia, near Bath and Ossenisse. At 16 locations, the Rijkswaterstaat deposits will be completed by 2023 (costs: EUR 62.8 million). The Scheldestromen regional waterauthorities will be tackling the other 11 locations in the years up to 2026 (costs: EUR 10.6 million). These locations are in the preparatory phase. The project is expected to commence by the summer of 2021.

3.4.6 Increasing river capacity

The ongoing Integrated River Management programme aims to tackle the taskings related to flood risk management, nature, water quality, navigability, freshwater availability, spatial development, and economic development in an interconnected manner (see paragraph 6.4). Meanwhile, the work on flood protection, involving dyke improvements and river capacity, continues. More information on river capacity projects is provided in the overview of MIRT projects (MIRT Overzicht, in Dutch) and in paragraph 6.4.3.

IJssel Delta phase 3 and Pannerdensch Canal groyne lowering

Along the river Rhine, two projects are being carried out to lower the river water level: IJssel Delta phase 2 and Pannerdensch Canal groyne and bank lowering. IJssel Delta phase 2 comprises, inter alia, improvement of the Drontermeer dyke, removal of the Roggebot sluice, and realisation of a sluice and lock in the Reeve dam, which will result in the achievement of the 41 cm water level reduction near Zwolle. The work is expected to be completed by 2022. The Pannerdensch Canal groyne and bank lowering, involving a water level reduction of 5 cm for the Boven-Rijn, is expected to be completed by 2023.

Rivercapacity and dyke improvement

Meuse

Along the Meuse, seven projects are being carried out in pursuit of a water level reduction, most of which are combined with integral area development: Thorn-Wessem, Baarlo-Hout-Blerick, Arcen, Well, Oeffelt, Lob van Gennep, and Meandering Meuse. For six areas, IRM pilot studies are exploring the options (see paragraph 6.4.3).

Rhine

On 24 October 2020, the Preferential Decision on the IJsselpoort River Climate Park was set down. The project involves collaboration between nine parties: the municipalities of Arnhem, Duiven, Rheden, Westervoort, and Zevenaar; the province of Gelderland; the Rijn and IJssel regional waterauthorities; Natuurmonumenten nature organisation; and the Ministry of Infrastructure and Water Management. The parties are addressing the various taskings in this area in an interconnected manner. The costs of the project amount to EUR 60 million. The project is a fine example of an integrated approach, as envisaged in the Integrated River Management programme (cf. paragraph 6.4.1).

Table 11 Increasing river capacity

Realisation	2022	2023	2024	2025	2026	2027	2028
River Rhine							
IJssel Delta phase 2							
Pannerdensch Canal groyne lowering							
MIRT Explorations							
River Rhine							
IJsselpoort River Climate Park 1st phase							
River Meuse							
Meandering Meuse (incl. Ravenstein-Lith Flood Protection Programme)							
MIRT Oeffelt							
Lob van Gennep							
Alem increasing river capacity							

Key: Plan elaboration Realisation

CHAPTER 4

Freshwater supply

Meandering Essche Stroom brook, Brabant, May 2021

Continuing to supply the Netherlands with sufficient and good-quality fresh water, now and in the future, remains a major challenge. The freshwater supply is not always sufficient to meet the demand. The prolonged periods of drought in 2018, 2019 and spring of 2020 gave us this insight. The combination of more frequent lower river discharges, sea level rise, and soil subsidence is rendering the Netherlands even more prone to water shortages than is currently the case. The Delta Scenarios show that under our current use of land and water management, the probability of water shortages is increasing. The supply of water is becoming increasingly uncertain, whereas, concurrently, the demand for water - both surface water and groundwater - is rising. Without additional measures, the water system will become even more unbalanced.

Ergo, the urgency of measures is considerable. Consequently, the financial resources in phase II of the Delta Plan on Freshwater Supply have been doubled. A total of EUR 800 million is available for an extensive set of measures. The Delta Fund is providing EUR 250 million of this sum; the freshwater supply regions are contributing the remaining EUR 550 million.

4.1 Progress: implementation of Preferential Strategy on Freshwater Supply

In the years ahead, drastic choices will be needed in order to render the Netherlands climate-proof. The physical features of the water and soil system must become directive for the use of space. Spatial planning choices must take more account of water availability. Furthermore, all the water consumers will need to economise on their water use, whilst water retention and distribution will need to be improved considerably. And finally, in some cases, society will have to accept damage, as drought damage cannot always be prevented (see box headed Preferential order in National Environmental Vision and National Water Plan). The impact of climate change is already manifest. Following three consecutive dry years, groundwater levels are falling, in particular in the eastern and southern parts of the Netherlands. This has prompted the Minister of Infrastructure and Water Management to set up a Groundwater Study Group. The Royal Netherlands Meteorological Institute KNMI has observed that the Elevated Sandy Soils are faced with increasingly frequent precipitation shortages. Such a trend has not been observed in the low-lying parts of the country. More than half of the investments relating to phase II of the Delta Plan on Freshwater Supply are earmarked for the sandy soils, in order to improve local water retention.

Low-lying parts of the Netherlands are supplied with fresh water from, in particular, the rivers Rhine and Meuse. Annual Rhine discharges are increasing, but in summer or autumn, discharge levels may be low for a prolonged period of time, as was the case in 2018. This can result in local salinisation of lake IJsselmeer and the western part of the Netherlands; suspension of water intake; a need for alternative water supply for the regional waterauthorities and drinking water plants; and navigation depth restrictions on the rivers Waal and IJssel for the shipping sector.

Elevated parts of the Netherlands depend almost entirely on precipitation for their water supply. Prolonged precipitation shortages reduce the supplementation of groundwater supplies, resulting in falling groundwater levels and soil dehydration. This has an increasing impact on groundwater-dependent functions.

Implementation programme 2015-2021 (Delta Plan phase I)

The first phase of the Delta Plan on Freshwater Supply (2015-2021) saw the implementation or launch of a wide range of measures. Some examples of measures completed in 2020:

- Roode Vaart transfer: at the end of 2020, after fifty years, water once more flowed through the Zevenbergen port to the Mark-Vliet system and to the surrounding polder areas in Brabant.
- Roll-out of the programme strategy on the Elevated Sandy Soils South and East: regional governments and stakeholders are collectively developing detailed measures to improve drought resilience of water consumption and land use.
- Further development of Smart Water Management: inter alia, properly coordinated lines of reasoning have been drawn up.

More information on the completed measures is provided in paragraph 4.4 and Background Document C.

During the implementation of phase I of the Delta Plan on Freshwater Supply, a large proportion of the budget has been invested in the final years. The progress and delay of specific projects is always discussed in the Freshwater Administrative Platform.

Despite the COVID-19 pandemic, the implementation is making headway. The COVID-19 measures have impacted a few projects, such as the water availability processes and stakeholder management in the implementation projects. The freshwater supply regions expect to have completed the regional water availability processes in all the urgent areas by 2021, as scheduled.

Implementation programme 2022-2027 (Delta Plan phase II)

A new implementation programme for 2022-2027 has been drawn up, comprising a set of measures to the amount of EUR 800 million (EUR 250 million of which from the Delta Fund and EUR 550 million from the freshwater supply regions). In order to map out the availability of fresh water in the Netherlands - along with the risk of water shortages - a bottleneck analysis has been conducted, based on the updated Delta Scenarios for 2050 and 2100.
The bottleneck analysis constitutes the basis for the exploration of measures in the second phase of the Delta Plan on Freshwater Supply. Step by step, a Preferential Strategy was developed, including the associated measures for the main water system and all the freshwater supply regions (see paragraph 4.5, Table 13).

All the freshwater supply regions have drawn up regional strategies to underpin the measures in their areas.
The strategies have been endorsed by the regional authorities. The Freshwater Administrative Platform has assessed all the measures set out in the implementation programme on the basis of uniform criteria, and has commissioned a social cost-benefit analysis (SCBA). The SCBA also covered farming and nature. The analysis has shown a positive cost-benefit balance for the vast majority of the proposed measures, vis-à-vis the policy-neutral zero alternative. The overall results of the set of measures are positive as well, both in the current climate and in the "Busy" and "Steam" Delta Scenarios for 2050. At the request of the Ministry of Infrastructure and Water Management, the Netherlands Bureau for Economic Policy Analysis (CPB) has conducted a second-opinion assessment of the SCBA. Its general impression was that the analysis has been performed adequately, within the bounds of possibility.

Smart Water Management

Smart Water Management - one of the research measures in the Delta Plan on Freshwater Supply phase I (2015 -2021) - has proven highly effective during, e.g., the drought of 2018. Smart Water Management involves close regional collaboration between regional waterauthorities and Rijkswaterstaat, aimed at improving cross-territorial operational water management. Measures are being mapped out and implemented. The goal is to optimise utilisation of the available water (system) in order to postpone water shortages and waterlogging for as long as possible or prevent water issues altogether, whilst minimising energy consumption. The main milestone achieved in 2021 involved the formulation of the "Smart Water Management Action Plan 2.0" for phase II of the Delta Plan on Freshwater Supply.

Climate-proof Main Water System Freshwater Supply Strategy

The Climate-proof Main Water System Freshwater Supply Strategy is based on a more efficient use of the water supplied by the rivers Rhine and Meuse, through creating freshwater supply buffers and zones in the main water system. In times of shortage, river water is not distributed according to a standard formula; instead, distribution is tailored to requirements and measurements. In its November 2020 meeting, the Freshwater Administrative Platform decided to utilise the Smart Water Management approach for the further elaboration of the strategy and for its substantiation on a "learning by implementation" basis. The impact on the shipping sector is a factor to be reckoned with.

Policy Platform on Drought

The end of 2019 saw the publication of the final report of the Drought Policy Platform. The essence of this report is the need to review water management, i.e., more efficient retention and storage of fresh water, in order to be able to use the supply in times of water shortage, and in order to optimise groundwater supplementation. The

point of departure is that spatial planning efforts need to take more account of the supply and availability of water. Implementation of the 46 recommendations will enhance the Netherlands' resilience against drought. Most of the recommendations have been taken up by the Delta Plan on Freshwater Supply. Virtually all the recommendations are being implemented as scheduled or have been completed. A key action that is still in the rounding-off phase involves the formulation of regional prioritisation schemes.

Order of preference in National Environmental Vision and National Water Plan

The review of the Delta Programme in 2021 introduced an order of preference for regional water management. The point of departure is that spatial planning efforts must take account of water availability and focus on economising on water consumption. The order of priority is: retention, efficient distribution, and accepting damage. The order of preference for regional water management has also been set down in the National Environmental Vision (NOVI) and in the draft National Water Programme 2022-2027 (NWP). The order, as a national framework for water management and spatial planning, has thus been embedded.

4.2 Actions for linkage with other taskings and transitions

Collaboration with Spatial Adaptation

The Delta Plan on Spatial Adaptation (the Delta Plan on Spatial Adaptation) revolves around rendering the Netherlands climate-proof and water-resilient. Such measures as raising the water level in peat grasslands, greening cities, or disconnecting downspouts from the sewer system impact the demand for fresh water. Consequently, proper coordination and collaboration between the Delta Plan on Spatial Adaptation and the Delta Plan on Freshwater Supply is essential. This was one of the recommendations of the Drought Policy Platform; the first steps to this end have already been taken. Some examples:

- coordination of the knowledge agendas and organisation of a joint knowledge meeting in December 2020. In addition, joint studies have been conducted into urban water requirements and into the insurability of climate risks. The knowledge gained will be disseminated via the klimaatadaptatienederland.nl website (formerly: ruimtelijkeadaptatie.nl).
- administrative coordination, e.g., in joint Steering Group meetings, at the national level and in many regions (such as the Elevated Sandy Soils East and South).
- better coordination between, on the one hand, stress tests and risk dialogues, and on the other, the water availability processes. This is achieved through, e.g., the utilisation of freshwater expertise in the stress tests.

Collaboration with other transition taskings

The Ministry of Agriculture, Nature and Food Quality is working on the Climate Adaptation in Agriculture Action Programme and on Action Lines for Climate Adaptation in Nature. Joining forces - for example, by organising joint regional meetings - enhances the linkage between freshwater availability and other taskings in rural areas, such as nitrogen issues, nature restoration, and the saturation of peat grasslands. In the spring of 2021, the Ministry of Agriculture, Nature and Food Quality set up regional meetings in the freshwater supply regions, in concert with the Ministry of Infrastructure and Water Management and the regional parties, focused on climate adaptation, water issues, agriculture, and nature.

Collaboration with the Ministry of the Interior and Kingdom Relations ensures linkage with the urbanisation and housing tasking; spatial planning policy; and the energy strategies (cf. paragraph 5.4.2.).

The Ministry of Education, Culture and Science is working on the linkage between cultural heritage and the environment, inter alia, by contributing - in concert with several other organisations - to the Heritage Deals. The Cultural Heritage Agency of the Netherlands - which falls under the Ministry of Education, Culture and Science - is working on the integration of cultural heritage and climate adaptation through disseminating and developing knowledge and by giving advice on actual projects. In relevant efforts, the Agency seeks to link up with the Delta Plan on Freshwater Supply. To address the freshwater supply tasking, an option would be to look for locations in the landscape that in the past used to be laid out for water collection. Traditionally wet cultural-historical landscape elements and structures, such as sewage farm systems, wet heather, seedbeds, peat bogs, and marshy forests can help to slow down water drainage and to accommodate peak discharges.

Utilising historic structures

The restoration of seedbeds (longitudinal embankments between two ditches) on estates in Brabant can be of help in tackling the freshwater supply tasking. Several decades ago, parts of these estates were regularly flooded, and the land was used accordingly. The acceleration in brook discharge rates has significantly changed both the regional drainage situation and the use of land. The regional waterauthorities, the province of Noord-Brabant, and several estate owners are exploring ways to utilise historic estate structures - such as seedbeds - in the purview of efficient water management, both for temporary peak storage and for prolonged water retention to combat dehydration.

Linkage with Integrated River Management and regional programmes

The Integrated River Management (IRM) Programme revolves around flood protection, while also addressing such taskings as nature; environmental appeal; navigability; and riverbed erosion. Water availability is a key element in this respect. Riverbed erosion affects water distribution in periods of low river discharges. Its impact on freshwater availability and navigability is taken into full account in the policy decision on riverbed levels. Programmes covering, e.g., the IJsselmeer Region, the Southwest Delta, and Rhine Estuary-Drechtsteden also tend to pursue interconnection between water availability and such taskings as flood protection, the Major Waters Programme Strategy (PAGW), sea level rise, and spatial developments that may affect water requirements (saturation of peat grasslands, construction of data centres).

Sea Level Rise Knowledge Programme

The Sea Level Rise Knowledge Programme is developing knowledge on the tenability and flexibility of the current Delta Decisions and Preferential Strategies in the event of an extreme rise in sea level, and is exploring potential action perspectives (cf. paragraph 2.1). It addresses flood protection, waterlogging, geomorphology, and the impact on water availability - in particular on account of groundwater and estuarian salinisation. An advisory report in the purview of the next six-year review of the Delta Decisions and Preferential Strategies - scheduled for 2027 - is expected by 2025.

4.3 Signs and new insights

Reconsideration of water management

Current water management - predominantly focused on the prevention of waterlogging, on water drainage, and on large-scale groundwater extraction - frequently causes spring and summer water shortages. During the three dry years (2018, 2019, and 2020), this became particularly manifest at the Elevated Sandy Soils, which were faced with substantial water shortages. This has prompted the Drought Policy Platform to conclude that a reconsideration of current water management (in particular, its focus on water drainage and on the prevention of waterlogging) is imperative. The focus should be on increased water retention, on more efficient distribution, and on a more economical use of water.

More space for water

Freshwater supply taskings cannot be addressed in isolation; that is why collaboration with parties outside the water domain must be enhanced. After all, a transition to “increased water retention” calls for more than just the restoration of the natural system. In many cases, land use must also be improved, through more sustainable soil management and/or adjustments in operational farm management - factoring in such other taskings as nitrogen issues and biodiversity. More room must be reserved for water, on a structural basis, to raise groundwater levels and accommodate peak discharges. In terms of organisation, funding, and communication, this poses quite a challenge.

Boundaries of groundwater management

The three dry years and the damage caused to agriculture and nature have demonstrated that groundwater management is reaching or has already exceeded its limits. The provinces and water authorities at the sandy soils have conducted studies into groundwater management. Their interim conclusion is that optimisation measures alone will not suffice; the regions will also need to implement transitions in water consumption and land use (involving a reduction in water requirements). In this respect, linkage is being sought with the Supplementary Strategic Supply processes for drinking water provision. The Water Steering Group has set up a Groundwater Study Group to map out the groundwater policy tasking, in close collaboration with the Delta Programme. This official study group is taking stock of the medium-term and long-term policy taskings relating to groundwater, and exploring which policy taskings require additional efforts. The goal is to develop a set of recommendations to review and fine-tune the groundwater strategy and ambition.

Soil subsidence

Soil subsidence in urban and rural areas is causing damage to infrastructure and buildings, and adding to the risk of waterlogging. Furthermore, subsidence can increase the

risk of flooding, especially because the sea level is rising, and river discharges are increasing. The Climate Agreement and the National Environmental Vision set out agreements on reducing CO_2 emission in peat grasslands via area-based strategies. Combating soil subsidence in peat areas calls for saturation, which will result in an increasing demand for water. Such additional water requirements can foster additional water shortages, e.g., in the IJsselmeer Region (cf. paragraph 6.2.3). The area-based peat grassland strategies and water availability processes call for integrated consideration. The impact of falling groundwater levels and soil subsidence in built-up areas must be integrated into water availability processes and risk dialogues.

Soil subsidence and water requirements

Combating soil subsidence in urban and rural areas is adding to water requirements. The stress tests and risk dialogues conducted by the province of Zuid-Holland and the bottleneck analysis conducted by the West Netherlands freshwater supply region have demonstrated the need for further research into urban water requirements in the purview of greening and keeping foundations wet. Such studies will be conducted in addition to the research into water requirements for combating salinisation and peat oxidation in peat grasslands.

IJsselmeer Region stress test

This past year, it has become clear that the probability of water shortages in the IJsselmeer Region is increasing more sharply than anticipated. The probability of water shortages underpinning the IJsselmeer water level ordinance is once every 50 years. Recent analysis has shown that - without additional measures - the probability of water shortages will increase substantially: to once every 5 years, based on the "Steam" Delta Scenario for 2050.

The probability of water shortages is increasing as a result of a decline in the supply from the river IJssel; increased salt intrusion near the IJsselmeer Closure Dam; and sub-optimal supply of the IJsselmeer buffer as a result of a limited term of expectation. Furthermore, water consumption is growing in order to combat soil subsidence in peat grasslands[16]. Deltares has mapped out the consequences of such developments on the basis of a stress test[17]. This shows that, particularly in the driest periods, large volumes of water are required to keep up the water level in peat grasslands. This is one of the reasons why the IJsselmeer buffer is increasingly insufficient to meet the demand for fresh water. In addition, the effectiveness of freshwater supply measures in the IJsselmeer Region is declining. Particular bottlenecks occur in the peat grasslands in Friesland and Noord-Holland. In the tidal rivers area - comprising peat grasslands in the Groene Hart region - the bottlenecks are not as serious, because of the availability of river water and the expanded Climate-proof Water Supply (KWA).

New policy choices are required to reduce the probability of water shortages in the IJsselmeer Region in the decades ahead. Such choices relate to both policy focused on increasing the freshwater supply and policy focused on preventing an additional increase in the demand for fresh water:

- One way to increase the supply of fresh water is to set down agreements on water distribution in the Integrated River Management programme, which will be drawn up in the years ahead. The Delta Plan on Freshwater Supply is also looking into options for an additional supply route via the Amsterdam-Rijn Canal. Salt intrusion at the IJsselmeer Closure Dam can be combated by implementing measures at the sluices. Phase II of the Delta Plan on Freshwater Supply will embark on such measures.
- The prevention of an additional increase in the demand for fresh water focuses on various water consumers: not only the peat grasslands, but also the agriculture sector (irrigation), data centres, and other economic activity. This calls for spatial considerations.

Implementation capacity under pressure

Regional implementation capacity is under pressure as a result of the large number of taskings that the regions are faced with. The regions need to address such major transitions as the housing tasking, nitrogen issues, the agricultural transition, soil subsidence, and nature restoration. This calls for substantial implementation capacity, which is scarce in the regions - especially in municipalities that are also faced with major socio-economic taskings (cf. paragraph 1.3).

International coordination of low discharge strategy

The annual volume of water entering the Netherlands via the major rivers is more than double the annual precipitation volume: 70 billion cubic metres versus 30 billion cubic metres. Traditionally, the low-lying parts of the Netherlands largely depend on the major rivers for their water supply. International coordination on water management in periods of shortage, with the countries through which these rivers pass, is vitally important. During the Rhine Ministers Conference of February 2020 in Amsterdam, low discharge was added as one of the main themes of the Rhine 2040 programme. Climate and consumption scenarios will be developed for the Rhine basin, as will criteria for the assessment of and solutions to low discharge levels. The goal is to collectively address the impact of low discharge events. The strategy to this end will

[16] Het effect van onderwaterdrainage en passieve peilstijging in veenweidegebieden op knelpunten in de zoetwatervoorziening | Publication | Delta Programme.

[17] Stresstest voor het Deltaprogramma Zoetwater fase II | Publication | Delta Programme.

be elaborated in close collaboration with the Delta Plan on Freshwater Supply. In December 2020, the International Meuse Commission set down a strategy for extremely low discharge levels. This covers such topics as discharge statistics, the impact of low discharge levels, monitoring, action perspectives, and the potential impact of climate change on the trend in low discharge levels.

Insights from the Delta Programme Signal Group

The Signal Group has recommended a study into when current water consumption will reach its limits, factoring in extreme scenarios - such as consecutive dry years. The Delta Programme (Freshwater Supply) is also adopting its recommendation to examine - in collaboration with water authorities and water consumers - to what extent water consumers can adapt their consumption and when the day will come that a change in land use will be inevitable.

Freshwater Supply Knowledge Agenda

The Freshwater Supply Knowledge Agenda annually agendises new knowledge requirements and provides insight into the progress and outcomes of studies and pilot projects that are already under way. In the years ahead, the knowledge agenda will mainly revolve around three questions:

- How can we turn water availability into a directive precondition in spatial developments, and where will we reach our limits?
- How can we reduce dependency on traditional freshwater supply sources?
- How can we substantiate sustainable groundwater management?

By way of the National Water System Exploration, the central government is reviewing ongoing studies in the fields of flood risk management, freshwater supply, spatial adaptation, water quality, and shipping in an interconnected manner (see paragraph 2.1).

4.4 Delta Plan on Freshwater Supply 2015-2021 (phase I)

Water availability

Insight into water availability is a precondition for selecting efficient measures. The dry summers of recent years have added to the need for insight into such issues. All the freshwater supply regions are working on water availability through pilot projects, analyses, and regional processes. This conforms to the recommendation of the Drought Policy Platform to continue the efforts on the elaboration of the Water Availability instrument.
The Freshwater Administrative Platform is coordinating and embedding the elaboration of the Water Availability instrument and the progress in the implementation of the Drought Policy Platform recommendations. The Freshwater Administrative Platform is increasingly focusing on interconnection and collaboration with the regional processes under the Delta Plan on Spatial Adaptation.

Despite the restrictive measures to combat COVID-19 in 2020, the freshwater supply regions expect to have completed the regional processes in all the urgent areas by 2021. At locations at which COVID-19 measures interfered with regional processes, innovative solutions have been pursued. For example, digital field trips were set up to involve interested parties in the Climate-proof Water Supply West-Netherlands freshwater supply project. Via Google Maps, nine locations could be “visited” to obtain information on the latest developments.

Main water system

Most of the measures carried out by Rijkswaterstaat [the executive branch of the Ministry of Infrastructure and Water Management] are on schedule. Three of the ten measures have been completed. The Noordervaart project is the only one affected by delays and additional costs, on account of the unexpectedly wide range of cultural heritage in the subsoil and as a result of developments in the private sector. After careful consideration, based on the criteria developed to this end under the Delta Plan on Freshwater Supply, the Freshwater Administrative Platform has decided to accept both the delays and the additional costs.

The Water Availability instrument for the main water system is being substantiated under the Climate-proof Main Water System Freshwater Supply Strategy (see paragraph 4.1). The efforts being expended within this context are coordinated with other water authorities and with consumers. In addition, Rijkswaterstaat is responsible for the Smart Water Management programme management.

Table 12 Schedule of measures under the Delta Plan on Freshwater Supply 2021-2023

	2021	2022	2023	2024
IJsselmeer Region				
Flexibilisation of IJsselmeer water level:				
MWS: operationalisation of Flexible Water Level Management				
MWS: measures involving Friesland IJsselmeer shores				
MWS: IJsselmeer Region resilient natural shores 1st phase				
MWS: Implementation of IJsselmeer water level ordinance				
Project programme for Northern Region Elevated Soils:				
Natural design of Dwarsdiepgebied				
Climate-proof Drentsche Aa basin				
IJsselmeer Region testing ground:				
Gouden Gronden				
Hunze and Aa's testing ground				
Wetterskip Fryslân testing ground				
Elevated Sandy Soils				
Elevated Sandy Soils Delta Plan implementation programme, Southern Region				
Elevated Sandy Soils Freshwater Supply implementation programme, Eastern Region				
West-Netherlands				
West-Netherlands Climate-proof Water Supply				
Optimisation of lake Brielse Meer water supply, step 1				
Southwest Delta				
Roode Vaart transfer to West-Brabant and Zeeland				
Resilient regional water system measures				
Zeeland Freshwater Supply Climate Pilot testing ground:				
E4 - Wetland - Mild Desalinisation environmental approach & pilot study				
E7 - More fruit with less water				
E13 - Subsoil irrigation				
Additional resources for the Freshwater Supply testing ground				
Area around the major rivers				
MWS: study into longitudinal erosion control dams				
Launch of measures in area south of the major rivers				
Main water system (cf. sections on the regions)				
Water availability in the Main Water System (MWS)				
Smart Water Management (SWM)				
Noordervaart				

Key: Realisation Study Policy development Climate pilots

	2021	2022	2023	2024
Additional Drought Policy Platform measures				
MWS: Salt monitoring and model development Amsterdam-Rijn Canal/North Sea Canal				
MWS: Salt monitoring and model development in lake IJsselmeer				
MWS: Focus on salt West-Netherlands South, additional measuring stations in Rhine-Meuse estuaries				
MWS: Neder-Rijn Lek flow meters for West-Netherlands freshwater buffers				
Support of regional elaboration of IJsselmeer Region prioritisation schemes				
Saltwater mapping 1st phase				
Plus package Eastern Region				
Plus package Southern Region				

Key: Realisation Study Policy development Climate pilots

4.5 Delta Plan on Freshwater Supply 2022-2027 (phase II)

In an intensively concerted effort, the freshwater supply regions and the central government have developed a well-substantiated set of measures for phase II of the Delta Plan on Freshwater Supply (2022-2027). The process involved a consecutive cycle of bottleneck analysis to potential, promising, and eventually preferential measures. In addition to this set of measures, the Delta Plan on Freshwater Supply 2022-2027 (see Background Document D) comprises a summary of this process. The Plan underpins the Delta Fund and regional contributions to be scheduled. The Delta Plan is focused on the freshwater supply measures for the period 2022-2027, and looks ahead to the period 2028-2033 (phase 3).

The Delta Plan 2022-2027 comprises more than 150 measures elaborated in the freshwater supply regions and for the main water system, geared to the national and regional taskings. All the measures have been assessed on the basis of uniform criteria and a social costs-benefits analysis approved by the Netherlands Bureau for Economic Policy Analysis. The regional measures are based on area-based strategies, adopted at the administrative level and featuring optimally quantified goals.
Some examples of typical area-based measures:

Main water system (Rijkswaterstaat):
- implementation of Climate-proof Main Water System Freshwater Supply Strategy (see paragraph 4.1)
- Meuse: measures relating to effective lockage and to buffers
- Rhine: measures relating to climate-proof freshwater supply, such as weirs, lockage losses / salt leakage, and explorations
- Smart Water Management[18] (including information screens)

North-Netherlands:
- agricultural innovation, improving supply, new sources, and buffer capacity
- sandy soils programme (including retention, brook restoration, soil management)

West-Netherlands:
- optimisation of supply routes (Krimpenerwaard, Kromme Rijn, Brielse Meer)
- transition to alternative sources (brackish water, effluent, rainwater storage)
- enhancing local resilience (water savings, flexible water level management, climate buffers)

Southwest Delta:
- innovative farming
- optimisation of water management (supply routes, buffers, alternative sources)

Elevated Sandy Soils South:
- sandy soils programme (including retention, brook restoration, soil management)

Freshwater Supply East:
- sandy soils programme (including retention, brook restoration, soil management)

Area around the major rivers:
- climate-resilient inlets and regional self-sufficiency

Table 13 provides insight into the investments scheduled for the second phase of the Delta Plan on Freshwater Supply, to carry out the measures in the main water system and in the freshwater supply regions. The investments will be

[18] The Smart Water Management (SWM) programme and approach is implemented jointly by Rijkswaterstaat and the regional waterauthorities. As Rijkswaterstaat is applying for funding, managing the budget, and ensuring national coordination, Smart Water Management is listed under the main water system measures.

made by the central government (Delta Fund), regional waterauthorities, provinces, municipalities, drinking water companies, and water consumers. The measures pertaining to the main water system will be funded entirely from the Delta Fund (see Table 13). The regions will be funding 75% of the costs of regional measures; the Delta Fund will compensate a maximum of 25% of the costs. Supra-regional measures and innovative measures qualify for a maximum Delta Fund contribution of 50%. In the Delta Fund, EUR 250 million has been set aside for the second phase of the Delta Plan on Freshwater Supply. The second phase will involve the implementation of measures with an overall scope of some EUR 800 million (including measures still awaiting decision-making), EUR 540 million of which will be funded by the regions.

The total overview of measures is presented in the Delta Plan on Freshwater Supply 2022 - 2027 (Background Document D).

Table 13 Overview of second-phase investments

Freshwater supply regions and main water system	Investment (in millions of EUR)	Delta Fund contribution (in millions of EUR)
Elevated Sandy Soils South	200.0	50.0
Elevated Sandy Soils East	200.0	50.0
North-Netherlands	120.6	31.7
Of which Sandy Soils Programme	*60.0*	*15.0*
West-Netherlands	34.5	15.3
Southwest Delta	85.9	21.0
Area around the major rivers	7.0	1.8
Main water system	54.8	54.8
Risk reserve		11.1
Total as set down in Delta Programme 2022	**702.8**	**235.4**
Non-allocated resources		**14.6**
Total investment from the Delta Fund		**250**[19]

Table 14 Main water system measures

Measure	Delta Fund contribution (in millions of EUR)
Water-saving measures at Meuse sluice complexes	6.9
Enhancement of international collaboration in the purview of water management in Meuse and Rur basins	1.6
Exploratory study into water storage / water buffers along the Meuse	0.2
Continuation of Smart Water Management programme, including development of national information screens[20]	18.3
Integrated exploration of Climate-proof Main Water System Freshwater Supply Strategy (e.g., exploratory study into strategic freshwater buffers / exploration of Amsterdam-Rijn Canal route / study into options for water re-distribution)	3.2
Management of measures to increase flow at Hagestein weir	0.8
Measures to reduce (external) salinisation at sluices near Den Oever (IJsselmeer Closure Dam)	15.4
Flexible use of Driel weir	0.8
Increasing resilience of Twente Canals water supply (by adapting Eefde pumping station)	2.3
Development of a policy support system for the Rhine tributaries, including the salinisation-prone area	1.7
Improvement of monitoring and information provision through realisation of additional measuring stations	1.5
Exploration and plan elaboration of measures to combat salinisation in Gent Terneuzen Chloride Canal	1.4
Measures to reduce salt intrusion at Delfzijl sea locks	1.2
Total	**54.8**

[19] Investments have been rounded off to 1 decimal place, which is why the total does not exactly match the sum of the investments.

[20] The Smart Water Management programme is implemented jointly by Rijkswaterstaat and the regional waterauthorities. As Rijkswaterstaat is applying for funding, managing the budget, and taking care of programme management, the table lists Smart Water Management under the main water system measures.

Freshwater availability

Taskings

- Subsoil salinisation (combined with other taskings)
- Falling groundwater levels and no freshwater supply
- Falling groundwater levels and limited freshwater supply
- Inlet salinisation
- IJsselmeer water buffer volume
- Low water levels and discharge volumes
- No freshwater supply

Strategic choices with corresponding nationwide measures

- Preferential order: adapting land use to water availability; cutting down water consumption; improved water retention; more efficient distribution of water; and acceptance of (residual) damage
- Climate-proof freshwater supply from main water system in combination with smart water management. (Key distribution points in and from the main water system)
- Freshwater section of main water system
- Groundwater supplementation

Essential strategic long-term decisions

- Replacement of Maeslant storm surge barrier
- IJsselmeer Closure Dam drainage by gravity / pumping
- Rhine discharge distribution at high and low water levels

Measures at specific locations

- Expansion of IJsselmeer water stock
- Expansion of West-Netherlands Climate-proof Water Supply
- Optimisation of Brielse Meer buffer
- Enhancing freshwater/saltwater separation at sluices
- Expansion of Noordervaart supply
- Meuse lockage water-saving measures

***Map 1** Freshwater supply policy taskings and measures*

CHAPTER 5

Spatial adaptation

Pavement stones making way for façade gardens, Rotterdam, June 2021

Adaptation to climate change is urgently required and its urgency is increasing as global warming continues. In 2020, the Global Commission on Adaptation (GCA) launched worldwide campaigns to expedite the efforts. The Netherlands has also chosen to accelerate. The Delta Plan on Spatial Adaptation and the National Climate Adaptation Strategy are being implemented in an interconnected manner. Step by step, the municipalities, regional waterauthorities, provinces, and the central government are carrying out the Delta Plan. By now, they have entered the risk dialogue and implementation programme phase.
Many municipalities are already embarking on measures.

5.1 Progress: implementation of Delta Decision on Spatial adaptation

The main track for the implementation of the Delta Decision on Spatial Adaptation runs via the Delta Plan on Spatial Adaptation. Its progress is outlined in paragraph 5.4. The Delta Plan on Spatial Adaptation focuses on the spatial domain. Proper spatial choices in terms of climate-proofing the Netherlands will enable great strides to be made. Key principles to this end have been set down in the National Environmental Vision (see figure 6). Climate adaptation is an important element of the National Environmental Vision: it constitutes the basis for priority no. 1, “Room for climate adaptation and the energy transition”. Climate adaptation is also one of the main messages in the National Water Programme, in which it features in the first key ambition: “A safe and climate-proof delta”. These two programmes set out the central government policies and actions relating to climate adaptation, thus embedding the Delta Programme at the national level. At the regional level, it is embedded in such documents as the provincial and municipal environmental vision documents and the regional water management programmes. The translation of the National Environmental Vision into provincial and municipal environmental visions is expected to give direction to spatial choices pertaining to climate adaptation at these scale levels. A digital meeting on 17 May 2021 - organised by the Association of Netherlands Municipalities and the Ministry of Infrastructure and Water Management - revealed that many municipalities have actively embarked on this topic.

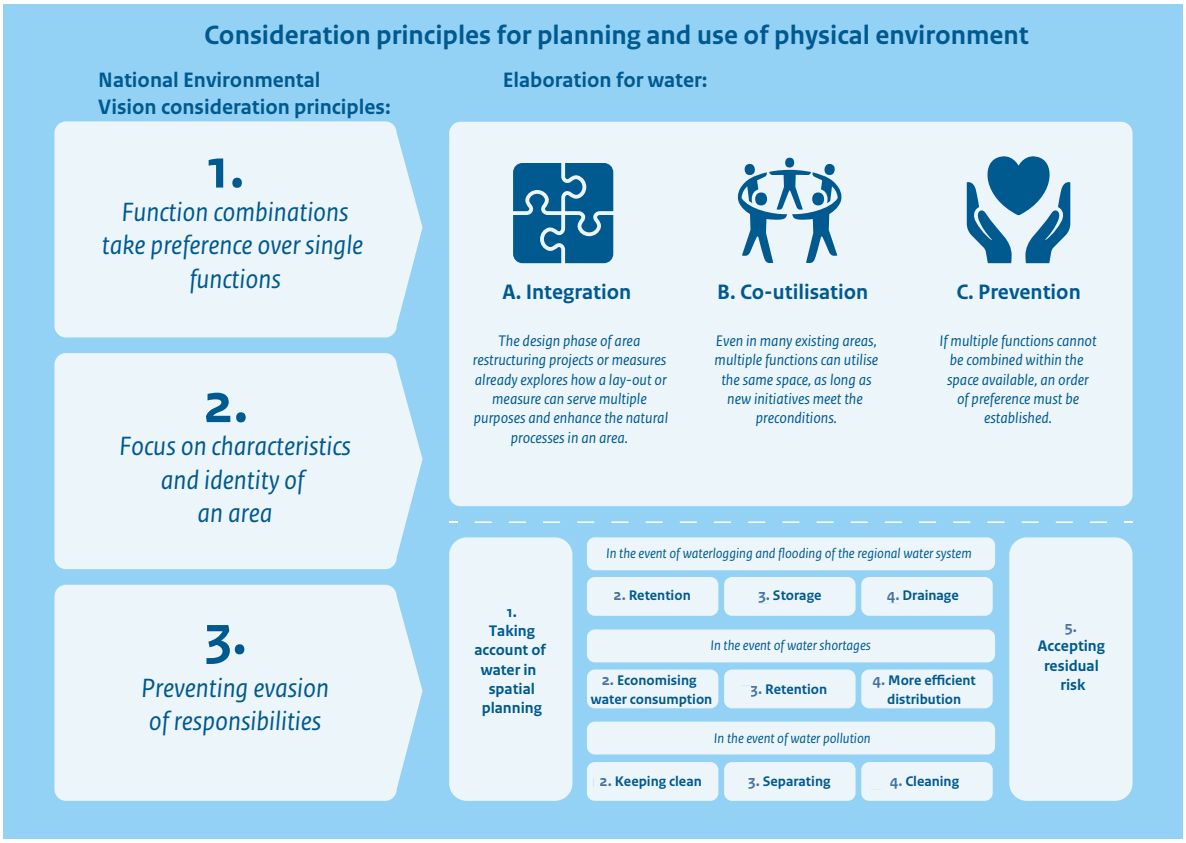


Figure 6 *National Environmental Vision consideration principles for the planning and use of the physical environment, elaborated in terms of water issues. Source: Draft National Water Programme 2022-2027. This infographic may be revised in the purview of the Final National Water Programme, to be published in March 2022.*

Acceleration

The implementation of the Delta Decision on Spatial Adaptation is given impetus by several actions set out in the Delta Plan, such as the introduction of the temporary Incentive Scheme, for which the Minister of Infrastructure and Water Management is setting aside EUR 200 million with effect from 2021, and which is co-funded by the regional governments to the amount of EUR 400 million. Furthermore, increasing attention is being paid to economic sectors other than the water domain, such as the construction, infrastructure, and agriculture sectors, and to collaboration between various public initiatives such as campaigns to green and de-pave gardens. More examples of acceleration are presented in paragraph 5.3 and in the Climate Adaptation Newsletter.

5.2 Actions aimed at linkage with other taskings and transitions

The impact of climate effects in a broad sense is extensively covered in the National Climate Adaptation Strategy. In addition to water-related issues, such effects comprise the impact of heat on public health and the consequences of shifting temperature zones for biodiversity. Specific action programmes are focusing on raising awareness of such effects and on taking climate adaptation measures. The action programmes link up with such important economic sectors as construction, infrastructure, agriculture, and cultural heritage. The implementation of the Delta Plan on Spatial Adaptation fits in well with these efforts, also because since 2020 responsibility for the National Climate Adaptation Strategy and the Delta Plan on Spatial Adaptation has been vested with a single Climate Adaptation team within the Ministry of Infrastructure and Water Management.

Cultural heritage

An example of the use of heritage as a point of departure for climate adaptation is a project in the Kanaleneiland district in Utrecht. Here, green structures constitute the basis for climate-proofing and providing new impetus to the area. The design covers both old landscape structures and the principles (air, light, and space) from the post-war reconstruction era (1940-1965). The Utrecht Architecture Centre AORTA has set up a multi-disciplinary study to identify - by way of a cultural-historical exploration - the district's set-up and qualities, with a view to the climate tasking. Furthermore, the water system has been analysed, and workshops have been organised to develop a roadmap of measures.

Map of climate projects

The Ministry of Infrastructure and Water Management is working on a map of climate projects. This map reflects locations' vulnerabilities to flooding and precipitation, and the efforts required to reduce such vulnerabilities. The information extends up to 2150 and can be used in the purview of location choices and the design of future residential areas - both new construction projects and densification of existing areas. The map can be used to underpin consultations on long-term and climate-proof ways to address the urbanisation tasking.

Climate adaptation in urbanisation strategy for Zwolle region

The Zwolle region is working on an urbanisation strategy to explore whether and how 40,000 to 80,000 new houses can be realised in this area. The 22 municipalities, the provinces involved, and regional waterauthorities in the Zwolle region are collaborating with the Ministry of the Interior and Kingdom Relations and the Ministry of Infrastructure and Water Management to this end. The strategy will bolster the national housing tasking of realising 1 million houses by 2030. An initial analysis has been conducted of the water system and the climate risks in 2050, 2100, and 2150. Thus, the urbanisation strategy is factoring in climate change issues - in terms of both location choices and design principles. The analysis was based on the same method as was used for the national map of climate taskings.

5.3 Signs and new insights

The Delta Plan on Spatial Adaptation is being implemented in 45 Working Regions. Each Working Region has conducted stress tests and is engaging in several risk dialogues in order to develop implementation agendas for the required climate adaptation measures. A monitoring round[21] in early 2021 revealed that conducting internal and external risk dialogues involves a particular lot of work for the municipalities. Regional waterauthorities and provinces play an important part in the development of integrated spatial vision documents in which climate adaptation is linked to other spatial taskings, and operate as partners in the risk dialogues. The seven Spatial Adaptation Regional Consultative Bodies foster coordination with and between the Working Regions, and liaise with the national level. These bodies also collectively elaborate cross-regional themes, such as monitoring and communication regarding impact of the strategy - within the agreements set down in the implementation agendas that are being drafted. The Delta Plan on Spatial Adaptation programme team is supporting this process with expertise, tools, and networks. Collaboration and the exchange of experience should expand regional implementation capacity.

Joint knowledge programme

The knowledge activities of the Delta Plan on Spatial Adaptation, the National Climate Adaptation Strategy, and

[21] See Background Document E

the Delta Plan on Freshwater Supply are accommodated in the Climate Adaptation Knowledge Programme.
This programme comprises three elements:

- development of fundamental system expertise on the consequences and risks of climate change;
- application of expertise in the purview of national policy;
- application of expertise in the purview of local and regional governments, businesses, and residents.

In 2020, the knowledge programme products generated several signs and insights[22]:

- Climate and Water Requirements in Urban Areas: water requirements in urban areas are increasing, not only as a result of climate change, but also due to the essential climate adaptation measures, such as creating more blue and green areas in the city;
- Social Resilience and Climate Adaptation: this exploratory study maps out how climate change is impacting vulnerable people and districts; it outlines the socio-economic conditions for measures; and provides guidelines for a tailored participation strategy;
- New version of the Climate Damage Assessor: the Climate Damage Assessor now also provides insight into risks and costs for the agriculture sector (such as drought damage) and for nature (such as damage caused by combating wildfires); a new infographic visualises all the quantified damage mechanisms;
- New version of Climate-proof Cities Toolbox: the toolbox has been expanded to include, e.g., the effect of measures on perceived temperatures and a calculation of the additional benefits of climate adaptation measures;
- Monitoring Local Climate Resilience: this study has generated a set of climate resilience indicators that have been applied in two case studies (Apeldoorn and Delft), using available data;
- ERA4CS (European Research Area for Climate Services EU programme): the Netherlands is participating in this programme, and Dutch research institutes are involved in ten studies. The interim results have been published on the Climate Adaptation Knowledge Portal website; completion is expected by mid-2021;
- Expertise from the "Large-scale Active Groundwater Level Management in Built-up Areas" study has been elaborated in more detail, in concert with the National Soil Subsidence Knowledge Programme. A fact sheet has been compiled, in consultation with government bodies and private sector parties. The fact sheet involves an update of the available expertise and the experience gained in active groundwater level management during the period 2017-2020.

[22] National Water and Climate Knowledge and Innovation Programme, Climate-proof Cities focus area

5.4 Progress in Delta Plan on Spatial Adaptation

The Delta Plan on Spatial Adaptation comprises seven ambitions that are intended to have the Netherlands climate-proof and water-resilient by 2050.

5.4.1 Progress of stress tests, risk dialogues, and implementation agendas

Work on the first three ambitions - stress tests, risk dialogues, and implementation agendas - is in full swing. A new monitoring map shows the stress tests that have been conducted in the Netherlands.

Risk dialogues and implementation agendas

Regional monitoring through interviews has provided information on the phase status of the Working Regions in early 2021. Nearly all the Working Regions have embarked on risk dialogues and are satisfied with the progress made. On a national scale, however, wide differences in approach can be observed. The risk dialogues raise awareness of climate adaptation among colleagues in other municipal disciplines and among regional partners. Furthermore, they foster collaboration among the parties involved, although their continuity is a point for attention. Pressure of time and a lack of capacity remain particular challenges for smaller and medium-sized governments. In addition, the dialogues call on other skills, such as strategic thinking and communication skills. Another point for attention is collaboration with networks involved in other taskings (such as the energy transition) and with commercial parties, such as developers and businesses. Examples of such collaboration exist - e.g., the Climate-proof Construction covenant of the province of Zuid-Holland, possibly followed by a covenant in the northern provinces - but across the board, public-private collaboration is still in its infancy. The Delta Plan on Spatial Adaptation programme team continues its attempts to encourage such efforts. A growing number of municipalities and Working Regions have set down a climate adaptation implementation agenda.

Spatial strategies and climate adaptation strategies

A milestone in 2020 was the publication of the National Environmental Vision (NOVI; see paragraph 5.1). The Vision gives direction to climate adaptation. Several provinces have already rolled out provincial climate adaptation programmes, for example, the *Weerkrachtig Zuid-Holland* programme in the province of Zuid-Holland (see box) and the *Op weg naar een klimaatbestendig Utrecht* programme in the province of Utrecht. For the entire Noord-Brabant and Limburg area, the collaborating governments have set down the South Netherlands Climate Adaptation Implementation Programme (see box). Several regions have already set down

Figure 7 *The seven ambitions of the Delta Plan on Spatial Adaptation*

or are preparing a Regional Adaptation Strategy. Under the Regional Adaptation Strategy, linkage is sought with the National Environmental Vision and the National Rural Areas Programme. Many municipalities are anchoring climate adaptation policy in existing documents, such as the Municipal Sewerage Plan, the greenery management plan, or terms of reference for new construction and renovation projects. Most of the regional waterauthorities have also developed climate adaptation strategies and incorporated them in programme strategies. In this respect, the regional waterauthorities have focused both on their own tasks and on those of partners.

Weerkrachtig Zuid-Holland provincial strategy

The province of Zuid-Holland has set down its climate adaptation strategy in the Weerkrachtig Zuid-Holland programme. Stress tests have since been conducted and several theme-based collaboration and dialogue coalitions have been set up (among which the Climate-adaptive Construction Covenant and a partnership with housing corporations). Furthermore, guidelines have been published on a range of topics, including: capitalising on opportunities for linkage with the energy transition; new construction projects; management taskings of housing corporations; and 3D subsoil structure. A full overview of the results of the programme is presented in Tussenstand Weerkrachtig Zuid-Holland.

In early 2021, the first Provincial Climate Adaptation Implementation Agenda was published, outlining all the provincial actions, projects, and efforts aimed at rendering Zuid-Holland climate-adaptive and water-resilient. The implementation focuses on, inter alia, infrastructure; the energy transition; innovation; nature and water; the built-up environment; health and safety; procurement policy; and provincial real estate.

Climate-proof Brabant and South Netherlands Implementation Programme

The province of Noord-Brabant has identified Climate-proof Brabant as one of the five main taskings in its environmental vision document. In 2020, this main tasking was elaborated into the Climate Adaptation Vision. Noord-Brabant is tackling climate adaptation via four tracks:

1. climate adaptation as an integral component of all the provincial portfolios, programmes, and projects (Provincial Executive administrative order);
2. a large-scale, area-specific “green-blue” strategy to combat dehydration and waterlogging, in

concert with the partners, in interconnection with the nature taskings and new perspectives for sustainable, climate-proof farming;
3. anchoring climate adaptation in society through awareness campaigns and concrete action by residents, according to the Design Thinking principle: having the abstract concept of climate adaptation tie in with the various target groups' and lifestyles' perceptions of their environment (e.g., the "Coping with extreme weather" impact project);
4. collaboration at the South Netherlands scale level, under provincial direction and supported by, inter alia, knowledge development and exchange (e.g., via the climate portal) and grants.

In early 2021, the South Netherlands Climate Adaptation Implementation Programme was set down for Noord-Brabant and Limburg, comprising thirteen Working Regions. The programme comprises a collective ambition and strategy, a spatial adaptation implementation agenda, and a freshwater supply working plan (Elevated Sandy Soils South). Under the Spatial Adaptation Implementation Agenda, drawing up the implementation agendas in the thirteen Working Regions is combined with the elaboration of themes in the administrative South Netherlands Climate Adaptation Platform (such as monitoring). In the years ahead, the agendas will be fine-tuned and concretised on the basis of dialogues. Development under provincial direction enables interlinkage of taskings relating to coping with extreme weather at various scale levels and in urban and rural areas.

Analysis

The Netherlands Environmental Assessment Agency has requested the Climate Adaptation Services foundation to conduct a qualitative analysis of municipal climate adaptation efforts. The Agency is using the results for its Netherlands Later project which maps out policy options for long-term spatial planning in the Netherlands.

Vital and vulnerable

Vital and vulnerable processes represent a special component of the Delta Programme. Last year, the Delta Programme Commissioner requested additional attention for such processes. The report on the Climate Adaptation City Deal identifies vital and vulnerable functions as one of the upscaling themes. Working visits of the Delta Programme Commissioner to the "drinking water" and "electricity" processes revealed that the topic of climate adaptation is widely embraced; the parties involved are actively working on studies, sharing experience, and taking measures. Netbeheer Nederland [the association of power and gas grid managers in the Netherlands] has set up a "Climate Working Group" to explore and share knowledge on the impact of climate change. Other processes also pay attention to this theme. Background Document F contains a more extensive description of the progress in national vital and vulnerable processes. Since December 2020, the Knowledge Portal has featured a dossier on vital and vulnerable functions. In January 2021, the Spatial Adaptation Steering Group forwarded a letter to the Working Regions requesting attention for collaboration with the Security Regions as a source of information on failure of vital processes.

Provincial networks

Regional accessibility is vulnerable to climate change. The provinces are working together on climate-adaptive risk management of regional infrastructure, coordinated by the province of Overijssel. For example, in 2020 the province of Noord-Holland conducted a climate stress test for provincial roads, and is now drawing up evacuation profiles in concert with the Security Region.
The province of Gelderland has compiled a Climate Impact Atlas of provincial infrastructure, and has anchored climate adaptation in its Track Schedule. In this province, climate adaptation is incorporated into sustainable road construction tender procedures. Drinking water provision must also be climate-proofed. In early 2021, the Exploratory Study into Climate-proof Drinking Water Provision was published, a product of collaboration between the Association of Provincial Authorities, the national association of water companies in the Netherlands Vewin, and the Ministry of Infrastructure and Water Management. In this report, the provinces and drinking water companies present their adaptation strategy to ensure a sufficient supply of drinking water of sufficiently good quality up to 2040, based on additional strategic supplies, water savings, and alternative sources.

Rijkswaterstaat and Prorail

In 2020, Rijkswaterstaat conducted a qualitative stress test for the main water system and completed the bulk of its internal risk dialogues. The stress test of the main waterway network in 2020 focused primarily on the largest threat: low water levels in combination with riverbed erosion in the Rhine and the Meuse. In 2021, this stress test will be continued for the rest of the main waterway network; high water levels and heat will also be covered then. The stress test for the road network had already been completed in 2019; in 2020, the results were used, in combination with the launch of the internal risk dialogue, for an in-depth study of some topics, such as the effects of regional flooding

and drought.The results of the stress tests will be presented in and incorporated into the Rijkswaterstaat Climate Impact Atlas.

In 2021, Rijkswaterstaat will be conducting external risk dialogues on the waterways, roads, and the water system, with partner governments, other network managers, and user interest groups. The goal is to draft the first version of an implementation agenda. Prorail is working on a similar process to develop a climate adaptation implementation agenda. The Ministry of Infrastructure and Water Management is developing an assessment framework aimed at implementing climate adaptation in these state networks.

5.4.2 Capitalising on linkage opportunities

In terms of climate adaptation, an integrated approach is essential, as is capitalising on opportunities for linkage with other spatial developments, and coordinating the scheduling and planning of measures. There are plenty of options for combining strategies and measures pertaining to the various transitions, e.g., water storage in nature reserves, greenery in cities, and reducing heat in built-up environments. Many inspiring examples can be found of successfully linking taskings: in asset management, in the management of public space, in area developments. Many of these developments and taskings converge in regional processes. In many cases, decisions on the physical environment will, eventually, be taken at the municipal or provincial level.[23]

Connecting climate adaptation and the energy transition in Groningen

Paddepoel - a large neighbourhood in the city of Groningen - was built in the 1960s and 1970s. The municipality of Groningen has commissioned WarmteStad to construct a district heating system in this area. Concurrently, three streets are being renovated in order to be able to cope with severe downpours and hot periods. The municipality is thus linking the energy transition to climate adaptation, and also to civic participation, by devising the measures in collaboration with local residents wherever possible.

Connecting climate adaptation and public health in Dordrecht

In the "Dordwijkzone: urban park as a natural climate buffer" implementation pilot, the promotion of public health plays a part in the municipal climate adaptation measures. For example, in the Vogelbuurt neighbourhood, a green corridor will be created between Vogelplein square and the sports park. Subsequently, the authorities will examine whether this corridor is fostering the health of local residents. Another measure is the Overkampweg Parkway, involving the expansion of the line of trees along Overkampweg road with tree species from Overkamp Park. This will create a green, shaded route around the park, which also accommodates a hospital. The authorities will examine whether this increase in greenery is beneficial to the health of hospital patients.

5.4.3 Promotion and facilitation

Implementation project pilots: highlights

Eight pilot studies for implementation projects have received financial grants from the Minister of Infrastructure and Water Management: Meerssen[24], Groningen, Utrecht region, Eindhoven, Horst aan de Maas, Dordrecht, the province of Gelderland, and Enschede. The climate adaptation measures will be realised in the period 2019-2021. Lessons to be learnt will be collected and all the projects will be assessed for effectiveness of the measures and attainment of the intended goals. The lead time of these monitoring processes ranges from short (1 year) to long (10 years). During two knowledge sessions in November 2020, the eight pilot studies exchanged their lessons learnt and new insights. The outcomes have been shared via the Knowledge Portal and in the Climate Adaptation Newsletter.

Temporary Incentive Scheme rolled out

The Climate Adaptation Temporary Incentive Scheme - intended to expedite climate adaptation efforts - came into force on 1 January 2021. The Minister of Infrastructure and Water Management has set aside EUR 200 million to this end. Grants are awarded on the basis of two-thirds co-funding by the Working Regions. In early 2021, regional information meetings were organised to raise awareness of the scheme among the Working Regions[25]. The first grants were issued in May 2021.

[23] Under the Environment Act, such decisions are set down in the Environmental Plan.

[24] Dijkstra motion, Parliamentary Document 35 000-J no. 8 (in Dutch)

[25] The FAQs page on this scheme was updated following these meetings.

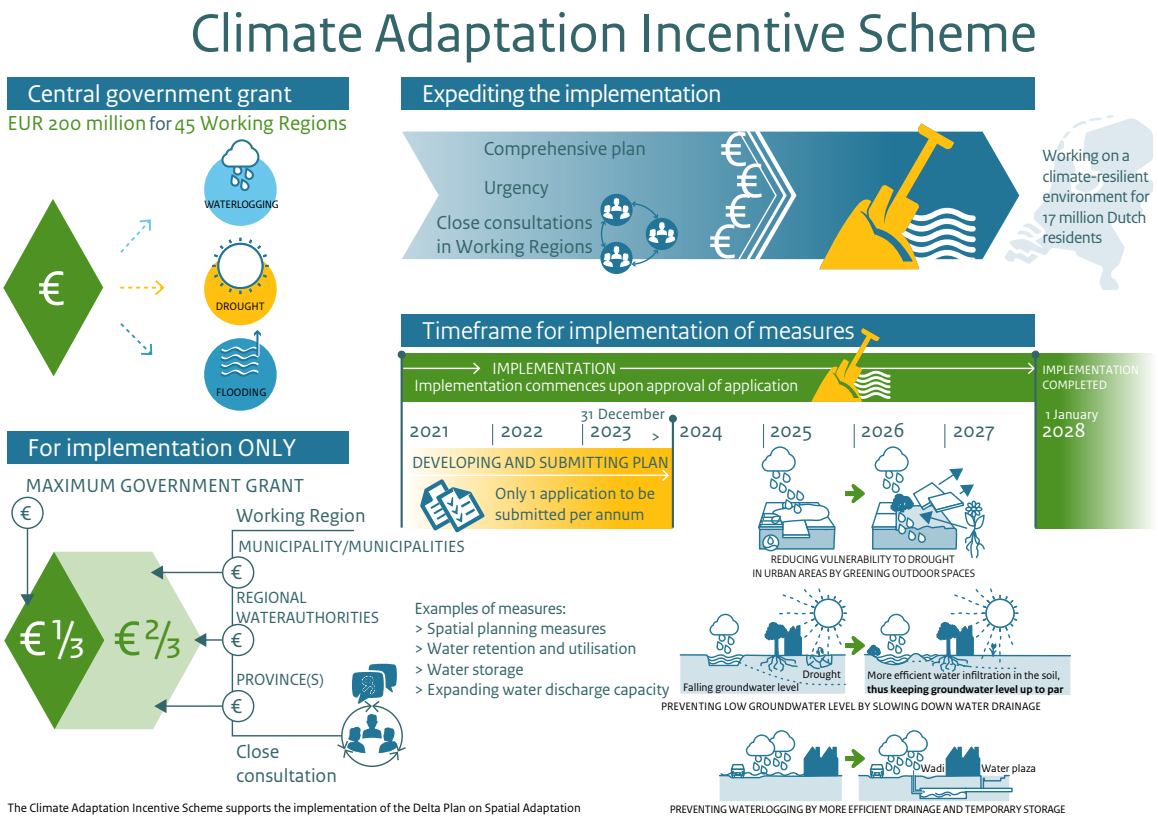


Figure 8 *Infographic on the Climate Adaptation Incentive Scheme*

Financial incentives for private parties

The Financial Incentives Alliance has conducted pilot studies to find out whether financial incentives will induce residents to climate-proof their gardens. Furthermore, municipalities and regional waterauthorities have explored ways to support municipal decision-making processes on the use of financial incentives (ambition 2: conducting risk dialogues). The results have been presented in a report entitled "Financial incentives for climate adaptation - behavioural approach[26]" and in the Beleidsmixer roadmap. The pilot studies have demonstrated, inter alia, that the government is underestimating awareness of financial incentive schemes among residents. Furthermore, the simplicity of an incentive is relevant to its effectiveness, as the pilots have shown.

Exploration of the role of financial institutions in climate adaptation

In 2020, the Together Climate-proof Platform conducted an exploratory study into the role of financial institutions in climate-proofing the physical environment. The study has shown that banks, insurance companies, and investors are taking increasingly more account of the risks of climate change via the services they are providing (financing and insurance) and via their investment decisions.
They are increasingly aware of the fact that climate risks also entail financial risks. Expectations are that, in their communications with clients, financial institutions will focus more on climate risks, whilst also linking the price of their products to such risks.

Association of Netherlands Municipalities support programme

The Administrative Agreement on Climate Adaptation sets out that resources will be available for local and regional governments that have not yet managed to conduct stress tests and risk dialogues or are just embarking on the process. The central government has requested the Association of Netherlands Municipalities to organise this support programme, as many (small) municipalities could use a helping hand. Since 2019, the programme has been rolled out step by step. In 2020, following peer group meetings at the management and administrative levels, thirty municipalities received tailored - regional and national - support, focused both on giving impetus to internal processes and on improving linkage with activities under the Delta Plan on Spatial Adaptation. Some examples

[26] Report: Gedragsaanpak financiële prikkels voor klimaatadaptatieve maatregelen (2020; in Dutch).

of the results generated:

- increased structure, establishing ownership, and the launch of core teams, linking up with sustainability programmes and the Environment Act;
- climate adaptation is increasingly being incorporated into implementation projects, and linkage opportunities in problem areas are being incorporated into implementation programmes;
- broader internal commitment, which has reinforced the position of climate adaptation in spatial projects, and in management and maintenance efforts;
- activity plans foster the realisation of the ambitions set out in the Delta Plan on Spatial Adaptation;
- adjustment of spatial working processes, resulting in increased attention on climate adaptation in built-up areas, at industrial estates, in rural areas, and at development locations.

The knowledge and insights gained are presented in a report. Key challenges for many of these (small) municipalities are a lack of funding; the combination of many new taskings in the physical domain; the complexity of integrated approaches; the skills this requires in the official organisation; and regional collaboration. On 17 May 2021, a digital event concluded the support programme.

Climate Adaptation Learning Environment

In 2021, the Climate Adaptation Learning Environment started its first training courses: "Participation & co-creation", "Organisation and collaboration", "Climate adaptation in existing neighbourhoods", and "Climate-adaptive construction and development". The training courses are intended for pertinent staffs of municipalities, regional waterauthorities, and provinces, but are also open to such other target groups as project developers. The learning environment and the courses are based on interactive learning and provide perspectives for action. Submitting their own case situations enables participants to link the information provided to their own working processes and projects.

Together Climate-proof Platform

The Together Climate-proof Platform is a target group-oriented public-private network of "climate workers". They promote and facilitate climate adaptation efforts through the exchange of practical experience and expertise; by encouraging new strategic cooperatives; and by upscaling success factors. This obviates the need for professionals to continuously re-invent the wheel. In 2020, the climate workers focused on local governments and on several private sectors and theme areas, such as the horticulture sector, industrial estates, and housing corporations. Exploratory studies have been conducted into opportunities for climate adaptation within healthcare organisations and financial institutions.

Climate Adaptation Knowledge Portal

The Climate Adaptation Knowledge Portal[27] is a frequently consulted source of information for all those engaged in climate adaptation. The number of visitors is growing: from close to 20,000 in the first year to more than 90,000 unique visitors in 2020. Some new features on the Knowledge Portal include: a monitoring map showing the stress tests that have been conducted in the Netherlands, and knowledge dossiers providing information on topical issues, such as "greenery in the city". More than one hundred tools are available, whilst the Portal's map of examples - featuring nearly 300 projects - has grown into a showcase for climate adaptation in the Netherlands. Much of the information is also available in English (some 12% of the visitors come from abroad). An overview of what the Climate Adaptation Knowledge Portal has accomplished over the past five years is presented in the Appendix to the Memorandum to the House of Representatives dated 12 May 2021, on the progress of climate adaptation.[28]

Climate Impact Atlas

The Climate Impact Atlas is an important tool for providing insight into a particular area's vulnerabilities to climate change (ambition 1 of the Delta Plan on Spatial Adaptation). Location-specific GIS data for conducting climate stress tests is provided free of charge. In May 2020, a new, updated, and user-friendly website was launched. The maps were comprehensively updated, and new maps were added. A wide group of users has provided input on the development of the maps, and many research institutes have been involved in their design. In addition to governments and other organisations, the Climate Impact Atlas is increasingly serving the knowledge professionals of the future, considering the growing number of helpdesk requests from the education sector. The Ministry of Infrastructure and Water Management intends to facilitate the Climate Impact Atlas and the Knowledge Portal at least until the next review of the Delta Decision on Spatial Adaptation.

Climate Adaptation City Deal

After four years, the Climate Adaptation City Deal was completed at the end of 2020. The Deal involved collaboration between seventeen public and seventeen (semi) private partners and the central government, aimed at achieving a breakthrough in the implementation of climate adaptation in Dutch cities. During the "Road to CAS" event in October 2020, the batons relating to seven upscaling themes were symbolically passed to seven representatives of various organisations. One baton was handed to a signatory of the new Public Space City Deal, one of whose sub-themes is a healthy, climate-resilient, nature-inclusive, and safe

[27] In January 2021, the name of the Knowledge Portal was changed from Spatial Adaptation Knowledge Portal into Climate Adaptation Knowledge Portal.

[28] Parliamentary Document 31710 no. 79 (in Dutch)

environment. The experience, examples, and insights gained during the process have been compiled in a documentary: the Climate Resilient City Explained.
The documentary premiered during the Climate Adaptation Summit (CAS) in January 2021 and will remain available online via the CAS Side Events and via YouTube. A final report is also available.

Events

December 2020 saw the first joint knowledge day on climate adaptation and freshwater supply. The day's programme was attended by more than 300 representatives of the Delta Plan on Spatial Adaptation and the Delta Plan on Freshwater Supply knowledge communities. Spatial adaptation was one of the key issues in the online Delta Congress, featuring sessions on climate-proof house construction; the linkage between climate adaptation and the energy transition; heat; and drought.

Greening gardens

As the Minister of Infrastructure and Water Management sets great store by encouraging residents to set to work with climate adaptation and biodiversity, the Ministry has forged a partnership with a wide group of green organisations active in this field. They are amassing initiatives under the heading of "Green the Netherlands, start in your own backyard". One such an initiative is the "NK Tegelwippen", a de-paving contest that runs from 30 March to 30 September 2021, in which municipalities compete for the largest number of tiles replaced by greenery.

5.4.4 Regulating and embedding

Embedding in municipal and provincial policies

Climate adaptation has not been fully embedded in environmental policy everywhere. In every Working Region, one or two local or regional governments tend to take the lead in this respect. In many Working Regions, climate adaptation is mentioned in the environmental vision documents, but still in a rather abstract manner.

Virtually all the provinces have embedded points of departure for climate adaptation in their policies or are working on this. Such points of departure are embedded in, e.g., specific climate adaptation policy, in environmental vision documents and regulations, or in regular operational management. Examples include: "On the road to a climate-proof Utrecht", South Netherlands Climate Adaptation Implementation Programme (provinces of Noord-Brabant and Limburg), Gelderland Climate Adaptation Policy Framework, and the Climate Adaptation Project Brief (province of Groningen). In the position paper of the Association of Provincial Authorities entitled "Climate-proofing the Netherlands", the provinces have outlined their concerted climate adaptation efforts and indicated what they expect of other partners.

Guidelines for Urban Water Management under the Environment Act

The Environment Act affects the ways in which parties are collaborating on urban water management. What is changing, and what remains the same? The answers to such questions are presented in the Guidelines for Urban Water Management under the Environment Act, published in April 2021. Many local and regional governments are working on environmental vision documents and environment plans that anticipate the new Environment Act. The new Act offers room for a tailored approach, e.g., in the field of climate adaptation. Actions and measures relating to climate adaptation can be set down in a municipal sewerage programme. Such programmes are not mandatory, unlike the current Municipal Sewerage Plan. The Guidelines recommend that municipalities should also elaborate the environmental vision document in a municipal sewerage programme, in addition to an environmental plan.

Climate Adaptation Standards Consultation Committee (OSKA)

Standards play a key role in the design, construction, and maintenance of buildings, infrastructure, and public space. In many cases, climate change has not yet been factored in, as a result of which climate adaptation is not or not properly taken into account in the implementation of plans. The Climate Adaptation Standards Consultation Committee (OSKA) has been set up to promote the incorporation of new insights into climate change in standards. Examples of such standards are norms, guidelines, protocols, checklists, and instructions. Rather than actually developing standards, OSKA initiates their development (see Table 15). OSKA involves collaboration between government bodies, the business community, research institutes and the standardisation organisations CROW, ISSO, NEN, and RIONED. Standards are developed in a three-step process: exploration, action programme, declaration of intent.

OSKA and the standardisation organisations are working on a method to identify existing standards that do not take account of or take insufficient account of climate change. The result is expected by December 2021.

Table 15 Work on standards, mid-2020 to mid-2021

Topic	Exploration	Action phase	Declaration of intent	Theme
Cooling of buildings	Completed in 2020		Signed in April 2021	Heat (stress)
Standard(s) for stress tests	Completed	Launched in March 2021		Heat, drought, waterlogging, flooding
Standards for rainwater collection and drainage	Completed			Waterlogging
Standards for rainwater infiltration measures	Completed	Commenced: action phase links up with Hanze UAS RAAK study		Waterlogging
Standards for measures to combat soil subsidence	Commenced in 2021, focus on light road fill materials			Drought, soil, agriculture
Biodiversity standards for the built-up environment	1st phase completed in April 2021			Waterlogging, biodiversity
Green or climate-adaptive rooftops	Not yet commenced			Heat, waterlogging

5.4.5 Responding to calamities

Division of responsibilities in the event of damage caused by extreme weather

In 2020, an exploratory study was conducted into the division of responsibilities between individual owners, the government, and insurance companies in the event of damage caused by extreme weather. The study covered damage caused by waterlogging, drought, heat, flooding, storm, hail, lightning, and wildfire. In most cases, the owners bear responsibility for damage due to extreme weather. However, several forms of collective care have been developed to reduce individual risks of damage or disruption. With respect to flooding and waterlogging, the government bears most of the responsibility for preventing disruption. It performs such duties through investing in flood defences, in sewerage systems, and in the planning of public space, and via pertinent legislation. When it comes to drought and heat, responsibility is shifted to individual owners. The report also lists which damage resulting from extreme weather is insurable. The study has revealed a need for a more detailed explanation regarding the division of responsibilities. An infographic has been compiled to substantiate this.

Local heat plans

During extreme heat, additional care and attention must be paid to vulnerable groups such as elderly people living alone, sick people, young children, and residents of care facilities. The same goes for athletes and those attending major events. Municipalities are advised to draw up local heat plans - in collaboration with such bodies as the community health service - in order to be properly prepared. However, local heat plans are not yet common. Therefore, the province of Zuid-Holland has, in concert with its three community health services, developed a digital workshop entitled "Heat plan in 1 day" for municipal staff. The workshop is repeated regularly and can also be used for other community health services, provinces, and municipalities.

CHAPTER 6

Progress per region

North Sea Canal ports, Amsterdam, 2018

The Preferential Strategies have been updated following the review of the Delta Programme in 2020. In all the regions, their implementation is continuing full steam ahead. This Chapter reflects the progress.

6.1 Introduction

The following paragraphs outline, region by region, the progress made with respect to the implementation of the Preferential Strategies for the three Delta Programme taskings: flood risk management, freshwater supply, and spatial adaptation. A full overview of the flood risk management and freshwater supply measures scheduled for the years ahead is presented in the pertinent Delta Plans (see paragraphs 3.4 and 4.4).

The box below reflects the progress made regarding the Future-proof Amsterdam-Rijn Canal/North Sea Canal Water System. Within this programme, water authorities and provinces have been collaborating - in interconnection with the Delta Programme - since early 2019 on future-proofing the water system for the Amsterdam-Rijn Canal/North Sea Canal area.

Future-proof Amsterdam-Rijn Canal/North Sea Canal Water System (TB)
The TB process serves two purposes: increasing the resilience of the water infrastructure and exploring how water can play a (co-)directive role in the spatial system at appropriate strategic defining moments. The process maps out promising water infrastructure, including spatial reserves, to keep future options open and visualises the impact of current and future functions on the water system.

Progress
In 2020, the parties explored potential locations for future pumping stations, in order to ensure sufficient drainage capacity to the lake IJsselmeer Region and the river Lek. Furthermore, they mapped out the scope for raising the North Sea Canal and Amsterdam-Rijn Canal calamity level from Normal Amsterdam Water Level (NAP) to NAP +0.20 m. Several other studies are still under way. These studies provide insight into, e.g., the impact of sea level rise on existing drainage and pumping capacities; potential water storage locations; and the effect of spatial planning and climate change on polder water requirements and water drainage.

Actions for linkage with other taskings and transitions
The parties working on the TB process are actively collaborating - on the basis of a network structure - with, inter alia, the Delta Programme (e.g., via the Spatial Adaptation Working Regions), the Sea Level Rise Knowledge Programme; the programme addressing the replacement and renovation of the pumping station and sluice complex near IJmuiden; and the Amsterdam Metropolitan Area (Resilience by Design project). The TB process has generated important input for the urbanisation strategy of the Amsterdam Metropolitan Area, for the environmental vision documents of municipalities and provinces in Noord-Holland and Utrecht, and for the National Water Programme. For the time being, the TB process will continue to work on integration, by tabling the water taskings and the directive role of water in new consultative platforms.

New insights and signs
The Amsterdam-Rijn Canal/North Sea Canal system is reaching its limits in terms of discharge, freshwater availability, and salinisation. Failure of one of the IJmuiden pumps in 2020 demonstrated the vulnerability of the system and the urgency of additional water discharge measures. During the dry summers, the Amsterdam-Rijn Canal was prone to salt intrusion. In the long run, the facilitation of both shipping and freshwater supply functions may create increasingly more challenges in this region. The TB process seeks to map out the effects and potential solutions.

The taskings involved in the spatial planning and use of the Amsterdam-Rijn Canal/North Sea Canal area are considerable, as are the associated interests. All the taskings and interests are competing for the same space. Water management has insufficient leeway to cope with the consequences of climate change and new spatial developments. The TB process is mapping out and agendising effects and solutions, but it is already clear that, particularly in this area, water taskings must be (co-)directive in decisions on the use of space. Climate-proof

solutions are needed, including as many local water retention measures as possible. Furthermore, space must already be reserved now to ensure proper functioning of the water system.

In early 2021, the TB process presented its results at the Central Holland Sea Level Rise regional session organised by the Sea Level Rise Knowledge Programme, as did the Resilience by Design project (Amsterdam Metropolitan Area) and the Amsterdam Sustainable Area Development Programme. The session on long-term water taskings was attended by some 50 representatives of municipalities, regional waterauthorities, provinces (spatial planning and water), Security Regions, the Ministry of Infrastructure and Water Management, World Wildlife Fund, and investors. The participating parties acknowledge the necessity of taking more account of future water taskings in spatial planning decisions, e.g., for housing developments. They have a need for practical guidelines and examples to convert this concept into designs.

6.2 IJsselmeer Region

Three dry summers gave us a great deal of new insights into the demand for fresh water from the IJsselmeer Region. This has once more underscored its importance as the Netherlands' largest freshwater buffer, but it has also become manifest that climate change, developments in the area around the major rivers, and new water requirements are putting pressure on the freshwater buffer. Flood risk management requires more knowledge of the impact of main water system measures on the surrounding regions. The IJsselmeer Region Delta Programme is addressing this.

6.2.1 Progress: implementation of Preferential Strategy for the IJsselmeer Region

Flood risk management

Regional elaboration of Integrated Flood Protection and Level Management Study

The reviewed Delta Decision on the IJsselmeer Region sets out that after 2050, any peaks in the lake water level will be controlled by way of pumping and a moderate rise in water level. This decision is founded on the Integrated Flood Protection and Level Management Study that was completed in 2019. It shows the effects of a potential rise in the water level of lake IJsselmeer after 2050. For the main water system, quantitative data is presented and for the regional water systems, qualitative data. In 2022, the IJsselmeer Region Delta Programme parties will embark on a scenario study to quantify the regional effects of a potential water level rise. Under this study, any changes in the region - such as changes in water discharge - will also be converted into effects for the IJsselmeer Region.

IJsselmeer Closure Dam pumping capacity

The delay in the construction and renovation of the sluices in the IJsselmeer Closure Dam project (see paragraph 3.1) does not entail any negative ramifications for the discharge from the IJsselmeer Region to the Wadden Sea, not even in the near future. In terms of flood risk management in the IJsselmeer Region, a key element in the IJsselmeer Closure Dam project is the addition of pumps to supplement the gravity-driven drainage capacity. The pumps are needed to keep the IJsselmeer winter water levels at their current level, until 2050 as a minimum ("drainage by gravity if possible and pumping if need be"). Originally - as set out in Delta Programme 2015 - the required pumping capacity would be realised gradually, but upon completion of the IJsselmeer Closure Dam project, the full pumping capacity of the drainage and sluice complexes near Den Oever will be available all at once.

Dyke improvement

The dyke improvements around the IJsselmeer Region are on schedule (see Delta Plan on Flood Risk Management, paragraph 3.4). In 2020, the Houtribdijk improvement was completed. The dyke now meets the new flood protection standards and contributes to the flood protection of a large area around lakes IJsselmeer and Markermeer (cf. paragraph 6.2.2).

Sea Level Rise Knowledge Programme

The Sea Level Rise Knowledge Programme is also covering the IJsselmeer Region in its exploration of the tenability of the current Preferential Strategies and of potential adaptation strategies. The knowledge programme focuses its efforts on the main water system and the long-term impact on freshwater availability. The IJsselmeer Region parties are developing knowledge on the regional effects. As the main system and the regional water systems are intertwined, the IJsselmeer Region Delta Programme will be liaising between these knowledge development processes.

Freshwater supply

Water distribution in IJsselmeer Region

The "IJsselmeer Region Water Distribution Framework Document" will be completed by the end of 2021, following an intensive process involving seventeen parties.
The framework document will underpin updated

agreements from 2009 regarding water distribution in the IJsselmeer Region and will thus serve both as a reference book and a scenario for times of drought. The framework document is building on knowledge products of the Smart Water Management programme in the IJsselmeer Region, such as improved data, action perspectives, and the line of reasoning regarding drought. It is substantiating a key recommendation of the Drought Policy Platform. The parties intend to set down the main agreements in a water distribution agreement. The recommendations of the framework document will be used in the IJsselmeer Region Delta Programme, in the Smart Water Management programme, and in the North Netherlands freshwater supply region.

Progress of Delta Plan on Freshwater Supply Phase I measures
In the freshwater supply regions linked to the IJsselmeer Region, the implementation of freshwater supply measures is largely on schedule. Most of the measures have been completed. The regions have drawn up sets of measures for the second phase of the Delta Plan on Freshwater Supply, wherever possible in interconnection with measures relating to water quality. In the elaboration and implementation, the parties are taking maximum advantage of the regional processes and risk dialogues conducted under the Delta Plan on Spatial Adaptation.

Water availability
In the freshwater supply regions, several regional Water Availability processes are under way (see paragraph 4.4). The main water system measures taken by Rijkswaterstaat are set out in Chapter 4.

6.2.2 Actions for linkage with other taskings and transitions

Climate change
Over the course of this century, climate change will be imposing significant additional preconditions on water level management in the IJsselmeer Region. However, climate change is already affecting other taskings, e.g., those relating to urbanisation, the energy transition, nature, ecological water quality, and economic development. Furthermore, such taskings may have a major spatial impact and thus affect both freshwater supply and flood protection. This is adding to the area of tension between space requiring developments and water management in the IJsselmeer Region. The IJsselmeer Region Administrative Platform is considering a spatial analysis within the framework of the Regional Agenda for the IJsselmeer Region, taking the Preferential Strategy as its point of departure, in order to map out this area of tension and to ensure an interconnected approach to spatial taskings.

Energy transition
The energy transition constitutes a major challenge in the IJsselmeer Region. Many parties and perspectives are involved. The IJsselmeer Region Administrative Platform has discussed the Regional Energy Strategies and produced an advisory report, integrating the approach of the Regional Agenda for the IJsselmeer Region. The Platform will continue to address this issue.

Integrated River Management (IRM)
In 2020, the IJsselmeer Region Delta Programme responded - via the IJsselmeer Region Administrative Platform - to the Memorandum on Scope and Level of Detail for the IRM Environmental Impact Assessment (see paragraph 6.4.1). The IJsselmeer Region Administrative Platform proposed that lake IJsselmeer be included as an impact area, in order to ensure that any adverse and beneficial consequences for lake IJsselmeer or the IJsselmeer Region will be considered in administrative decisions. The IRM preferential alternative is scheduled to be completed by 2023, including the consequences of new points of departure for the discharge distribution across the Rhine branches (inter alia, for the supply of water via the river IJssel to lake IJsselmeer).

Dyke improvement combined with other taskings
The recent Houtribdijk improvement project (see paragraph 6.2.1) has been combined with work related to water quality and nature. Along a section of the dyke, wide sandy shores contribute to improving water quality, thus fostering a future-proof ecological system in lake Markermeer. This is the first implementation of this solution in a non-tidal freshwater area. In the years ahead, Rijkswaterstaat and Delft University of Technology will be examining the developments in these shores, in order to widen the scope for the national and international applicability of this innovation. Next to the dyke, the new Trintelzand nature reserve has been created, covering more than 500 hectares.

At the end of 2020, the province of Noord-Holland drew up the Hoorn-Amsterdam Coastal Zone Spatial Quality Ambition Programme, in collaboration with other parties. The organisations are focusing on the integrated improvement of the Markermeer dykes, with added value in terms of spatial quality. They are taking advantage of the dyke improvement project to improve the opportunities for living, working and leisure activities in the area and to enhance nature quality and cultural-historical values. With respect to the cultural-historical values, they are calling on the expertise and the products of the Cultural Heritage Agency of the Netherlands.

Wieringerhoek

Several IJsselmeer Region taskings converge in the Wieringerhoek project, which is carried out under the Major Waters Programme Strategy. The creation of natural transitions is improving the ecological connection between lake IJsselmeer, the additional water storage provisions in polders, and the Wadden Sea. By reducing salt intrusion, the project is also boosting the protection of the freshwater supply in this part of lake IJsselmeer. To this end, a salt model has been developed that also fosters knowledge development in the IJsselmeer Region Delta Programme. The project is exploring linkage opportunities and third-party initiatives relating to energy, nature, climate adaptation, and leisure activities.

Oostvaardersoevers

The Oostvaardersoevers project, initiated under the Major Waters Programme Strategy, will establish a connection between lake Markermeer and the Oostvaardersplassen and Lepelaarplassen lakes. This will generate a future-proof eco system: vital, diverse, and sufficiently resilient to cope with, inter alia, climate change, urbanisation, and an increase in leisure activities. The aim is to link up with innovative hydraulic engineering, in order to enhance the appeal, liveability, and safety of the lake area. In 2021, Rijkswaterstaat has developed a proposal for a preferential alternative, in collaboration with the regional partners.

6.2.3 Signs and new insights

IJsselmeer Region Resilience Joint Fact-finding Process

In 2020, the IJsselmeer Region Resilience Joint Fact-finding Process - prompted by the Drought Policy Platform - generated more insight into freshwater availability via the main water system and via the regional water systems, and into the water requirements of consumers. The interrelationship between water level preservation, water quality, and the reliability of the drinking water supply has been taken into account. The study has identified several bottlenecks. In the current situation (Delta Scenario Current), the freshwater supply is sufficient to meet total water requirements (water quantity). During a period of (extreme) drought, the main water system can meet the total current water needs for one to two months, depending on, inter alia, the benchmark situation and the water demand. In the event of rapid climate change and major socio-economic growth (Delta Scenario Steam 2050), the main water system supply will run short for five to ten years per century, i.e., a shortage of 5% to 25% of the total water demand. This analysis has not factored in the (large) water requirements in the purview of gravity-driven drainage at the IJsselmeer Closure Dam in order to combat salinisation of lake IJsselmeer. In phase II of the Delta Plan on Freshwater Supply, a follow-up study will be conducted into the optimum combat of salinisation in lake IJsselmeer.

New water consumers, increase in freshwater consumption

Recent data shows an increase in the demand for fresh water in the supply region. Water requirements are expected to increase even further. The drought in recent summers has prompted government authorities and freshwater consumers to map out the current water requirements of various functions. This has revealed that new (economic) developments are adding to the demand for water, due to, e.g., increasing irrigation, the growing use of cooling water, and the use of water to combat soil subsidence. Additional new freshwater consumers are data centres and the hydrogen economy, as was concluded in the IJsselmeer Region Resilience Joint Fact-finding Process.

New insights into the freshwater buffer

Three consecutive dry summers have underscored the importance of the freshwater buffer in the IJsselmeer Region, but new insights have also revealed the vulnerability of this buffer:

- In 2020, a study conducted under the Integrated River Management Programme (see paragraph 6.4) showed that in times of low Rhine discharges, the river IJssel is already supplying less fresh water than expected, whilst this supply can continue to decrease if the Waal riverbed continues to erode;
- Experience has taught that in spring, weir management in lakes IJsselmeer and Markermeer can easily be adapted. In summer, timely adaptation of weir management in times of drought is more difficult, as IJssel discharge volumes can only be predicted shortly ahead;
- In times of drought, salt intrusion at the IJsselmeer Closure Dam greatly exceeds expectations; it is increasing even further as a result of lock expansion and sea level rise. Excavation of navigation channels could lead to salt spreading in lake IJsselmeer at a faster pace. Additional gravity-driven drainage may be needed to keep the water sufficiently fresh, but this will add to the water requirements;
- In order to reduce CO_2 emissions in peat areas, as set down in the Climate Agreement, the region is working on strategies involving higher groundwater levels. This would involve an additional claim on the IJsselmeer freshwater buffer. Other new water consumers are also drawing on the freshwater buffer (see above).

Based on these insights, the Delta Plan on Freshwater Supply has conducted a susceptibility analysis / stress test (cf. paragraph 4.3). This has revealed that the probability of water shortages will increase considerably, up to once every five years by 2050, on the basis of the expected climate change. The Delta Decision on the IJsselmeer Region aims to keep the freshwater supply and the freshwater demand in the IJsselmeer Region supply area in balance, in order to ensure that the freshwater supply can continue to meet

water demands, even in periods of drought, after 2050.

The new insights dictate the pursuit of a new balance by adapting both the supply and the demand. Several options are available to this end. For example, the supply can be adapted through the Rhine tributaries riverbed level, which will affect the water distribution (in coordination with the Integrated River Management programme; see paragraph 6.4). The future-proof freshwater supply from the main water system can also open up opportunities, for example by increasing the volumes of water transported to lake Markermeer via the Amsterdam-Rijn Canal. In the years ahead, the IJsselmeer Region Delta Programme will be discussing the options and solutions with the stakeholders involved, in close collaboration with such bodies as the Freshwater Supply Delta Programme, the Regional Agenda for the IJsselmeer Region, and the IRM programme.

The ideas for constructing islands in the IJsselmeer Region - e.g., in the purview of nature, housing, and energy generation - constitute a point for attention. Such islands will compromise the buffer capacity. A follow-up study will address the interaction between spatial developments and the freshwater buffer.

6.3 Rhine-Meuse Delta

The Delta Decision on the Rhine-Meuse Delta pertains to choices in the main water system that will affect the entire Rhine-Meuse Delta: the dyked river Meuse, the Rhine branches, the tidal rivers area up to the coastal river estuaries, and the northern basins of the Southwest Delta.

Flood Protection Expertise Network advisory report on discharge distribution

The distribution of Rhine water across the Rhine branches in times of high water has been set down in policy. Under the Delta Decision on the Rhine-Meuse Delta (Delta Programme 2015; reviewed in Delta Programme 2021), the current policy agreements will remain in force until 2050; the central government will examine whether there is reason to change the discharge distribution after 2050 and keep options open to this end. Delta Programme 2019 set out that from a cost-effectiveness perspective, there is no need to amend policy after 2050; however, it would be wise to keep the option open. In early 2021, the Ministry of Infrastructure and Water Management requested the Flood Protection Expertise Network to provide advice regarding the future discharge distribution and the existing policy agreements.

Several reasons can be adduced for holding the policy agreements to the light. Under the agreements, Lek discharge volumes will not be raised if normative high water discharges increase as a result of climate change. However, following the introduction of the flood risk approach in 2017, there is no single normative discharge level anymore. The entire range of discharge levels is now being considered in the assessment and design of primary flood defences, including discharge levels exceeding the former normative level of 16,000 m^3/s. The question is what this entails for the "Spare the River Lek" policy. Another question is whether the points of departure and considerations underpinning the "Spare the River Lek" policy are still valid in light of the flood risk approach (future-oriented and climate-resilient design).

Finally, a recent study[29] has revealed that under current policy, without additional measures, the control structures regulating the discharge distribution will reach the limits of their regulating capacity in the future. This raises the question as to what additional measures would be possible, including the potential amendment of the the "Spare the River Lek" policy.

The Flood Protection Expertise Network advisory report is expected by July 2021. The report will constitute input for the design of alternatives within the IRM framework: sets of measures to realise the goals of the IRM programme (cf. paragraph 6.4).

[29] Memorandum on options for high water discharge distribution across Rhine branches; Schropp, M., Jansen, T., May 2020.

6.4 Rivers Rhine and Meuse

The first review of the Preferential Strategy for the rivers Rhine and Meuse is being conducted via the Integrated River Management (IRM) programme, which has been set up under the Environment Act. This programme is aimed at addressing the taskings related to flood risk management, nature, water quality, navigability, freshwater availability, and spatial and economic developments in an interconnected manner. IRM can thus be regarded as an example of an integrated delta strategy. Several building blocks were completed in 2020/2021. Meanwhile, the work on flood risk management is continuing, by way of dyke improvements and increasing river capacity.

6.4.1 Working towards a new Preferential Strategy

IRM Declaration of Intent

At the end of 2019, the Integrated River Management Steering Group set down the programme action plan. Following a well-attended start-up meeting in early 2020, the work and participation process continued in digital form.

The Integrated River Management Declaration of Intent was presented at the 2020 Delta Congress. The Declaration has been signed by the Minister of Infrastructure and Water Management, also on behalf of the Minister of Agriculture, Nature and Food Quality and the Minister of the Interior and Kingdom Relations; the Delta Programme Commissioner; and the Chairs of the Rhine and Meuse Delta Programmes. With the Declaration of Intent, they are anchoring their joint ambitions. Regional governments, umbrella organisations, and other stakeholders have been invited to join in order to create a broad collective basis for IRM.

Low water in riverbeds

In times of low water, several sections of the major rivers are too shallow to be navigable, whereas the Climate Agreement and the European Green Deal are committed to shipping as a mode of transport. The central government has set aside EUR 100 million in the Mobility Fund to resolve these riverbed level bottlenecks. Specific projects to this end will be elaborated in interconnection with other taskings in the area around the major rivers.

Building blocks for the reviewed Preferential Strategy

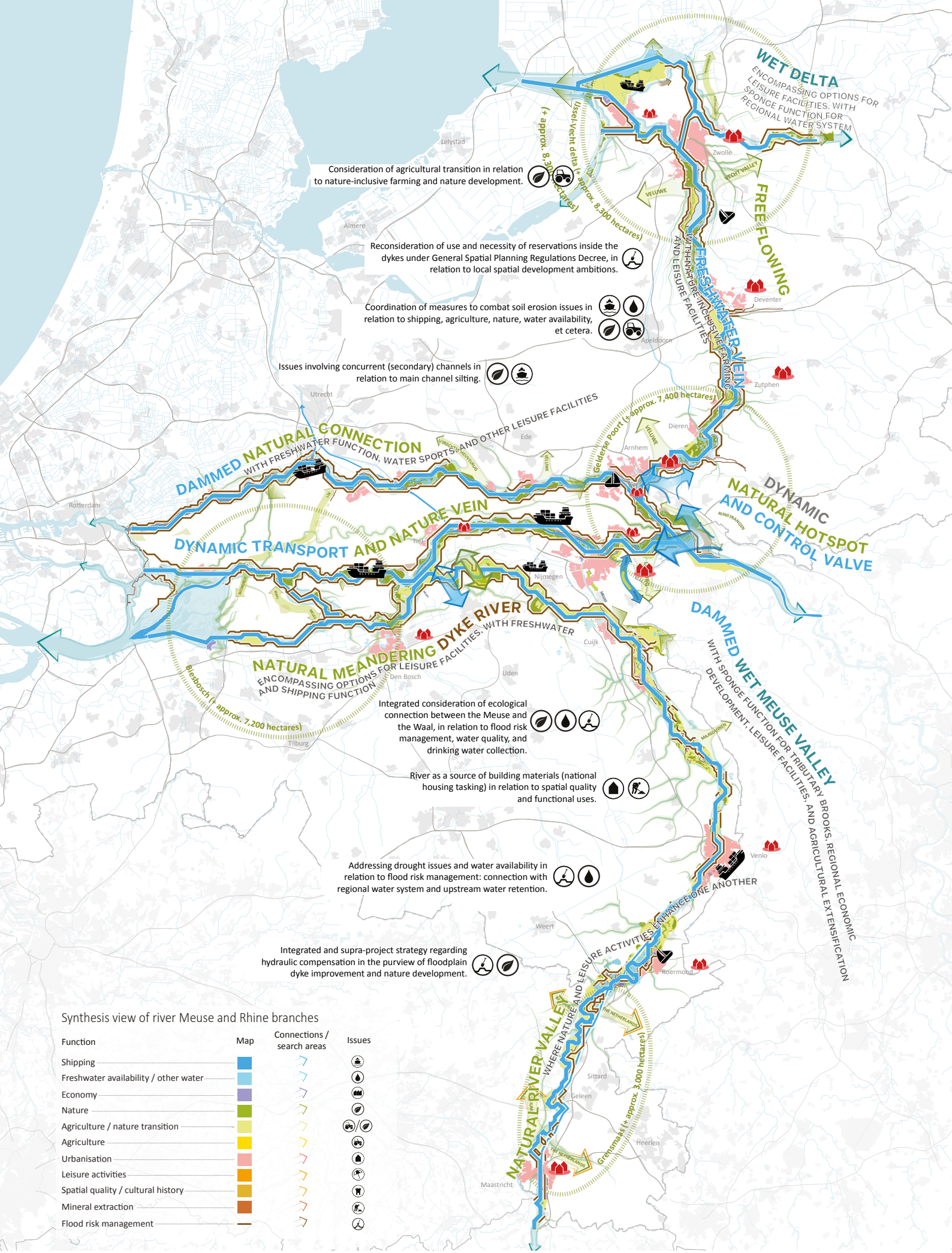
The preferential alternative for the IRM Programme is scheduled to be completed by 2023; this will constitute the reviewed Preferential Strategy for the rivers Rhine and Meuse. In 2020 and 2021, the building blocks became available:

- Memorandum on Scope and Level of Detail of IRM (2020): among other things, the memorandum indicates the need for policy choices regarding the discharge capacities and the riverbed levels of the Rhine branches and the Meuse;
- Rivers in Focus report (2021): the report - based on collective design sessions - features a more equal positioning of functions and issues in and along the rivers;
- Memorandum on Realistic Policy Options (2021): this memorandum indicates the feasibility of the various policy options for riverbed level and discharge capacities;
- System reflection part 1 (2021): this sets out what is needed for the sustainable functioning of the water system in the future;
- Ecological system tasking (2021): this sets out the preconditions for a resilient and ecologically healthy river system.

The parties are currently working on promising alternatives for riverbed levels and discharge capacities. The alternatives will be assessed in 2022 and 2023, within the context of the Environmental Impact Assessment and the social cost-benefit analysis, whereupon the preferential alternative will be selected.

IRM pilot projects

In order to gain experience with an integrated approach and provide a clear picture of the ensuing dilemmas, nine IRM pilot projects were rolled out in 2020: three along the Rhine tributaries and six along the Meuse. The learning objectives of these pilot projects are focused on integration of the goals, sources of funding, and schedules of the parties involved. The experience gained will be taken into account in the development of the IRM Programme. More details on the projects is provided in paragraph 6.4.3.



Map 2 *Focus on the Rivers synthesis map*

6.4.2 Progress in implementation

Rhine flood protection

A full list of the dyke improvement projects scheduled along the river Rhine is provided in the Delta Plan on Flood Risk Management (see paragraph 3.4).

Gorinchem-Waardenburg dyke improvement

The Gorinchem-Waardenburg dyke improvement project is in progress. It involves the complex improvement over a stretch of 23 kilometres that also accommodates several societal planning issues. The design has provided significant input for the development of the design instruments. The Rivierenland regional waterauthorities is sharing the knowledge generated by this project within the Flood Protection Programme. For example, in 2020, the water board published an online learning report on the exploration and plan elaboration phases.

Strong Lek Dyke project

The Strong Lek Dyke project encompasses several sub-projects relating to the improvement of the dyke between Amerongen and Schoonhoven. In 2020, an Innovative Partnership agreement was signed. The sustainability ambitions are high: the aim is to use zero-emission equipment.

Grebbe dyke improvement

The Grebbe dyke improvement project is being carried out within the context of an area development, in which the flood protection goal is substantiated, along with nature goals and ambitions in the fields of leisure activities, cultural history, spatial quality, and sustainability. In the summer of 2020, the partners set down the preferential alternative for the area development. In the plan elaboration phase, the municipalities of Wageningen and Rhenen, the provinces of Gelderland and Utrecht, Rijkswaterstaat, Staatsbosbeheer, and the Het Utrechts Landschap foundation will be elaborating the preferential alternative in more detail, together with the Vallei en Veluwe regional waterauthorities. Special attention will be focused on circularity, e.g., by drawing up the first material passport for a dyke. The plan elaboration is expected to be completed by 2024, whereupon the project will enter the realisation phase.

Dyke improvements of Rijn en IJssel regional waterauthorities

In 2020, the Rijn en IJssel regional waterauthorities set down the preferential alternatives for the Rijnkade and Grutbroek dyke improvement projects. The two projects will enter the realisation phase by 2022. The Westervoort-Loo dyke improvement project has entered the pre-exploration phase. The preferential alternative for the IJsseldijk Apeldoorns Canal dyke improvement project was set down in 2019, featuring two solutions: widening the existing dyke or a sheet pile wall in combination with raising the dyke. The Water Act project plan will be set down in 2021. The project is expected to be completed by 2022.

IJsselpoort River Climate Adaptation Park

In the autumn of 2020, the five municipal councils involved set down the inter-municipal framework vision for the the IJsselpoort River Climate Adaptation Park, and the Minister of Infrastructure and Water Management endorsed the MIRT preferential decision. The plan elaboration is currently under way. The plan encompasses measures in the fields of river capacity, shipping, water quality, nature development, promotion of nature-inclusive farming, re-development of the brickworks plant premises, and development of leisure activities. This will also enhance the spatial quality of the floodplains between Arnhem and Giesbeek. For the plan elaboration, Rijkswaterstaat has taken over the leading role from the province of Gelderland on behalf of the eight collaborating parties. The plan elaboration is expected to be completed by 2023, whereupon realisation will commence.

Meuse flood protection

A full list of the dyke improvement projects scheduled along the river Meuse is provided in the Delta Plan on Flood Risk Management (see paragraph 3.4).

Nieuw Bergen dyke improvement

By mid-2020, administrative support had been garnered regarding the design points of departure for the dyke improvement near Nieuw Bergen. A shorter lifespan (25 rather than 50 years) will reduce the dyke height requirements by 15 cm. The recent insights[30] used as the basis for the calculations have reduced the height by another 20 cm. As a result, several valuable landscape elements can be preserved. The Draft Water Act Project Plan was available for public inspection in early 2021.

Arcen dyke stretch

The Arcen dyke stretch involves several taskings: dyke improvement (Flood Protection Programme), a system measure (MIRT), brook restoration (Water Framework Directive), and enhancing spatial quality. The project is a showcase of innovative participation. In 2020, the Arcen Midden residents collectively plotted the dyke improvement route through their backyards. In 2021, the preferential alternative will be elaborated into an appropriate type of flood defence, in collaboration with the local residents. The route and the preferential alternative for the associated system measure in Arcen Noord have been established in a similar fashion, in concert with local businesses, farmers, and residents. In Arcen Zuid, the castle gardens (open to tourists) are protected, and the dyke has been incorporated into the Maasduinen Natura 2000 area, in concert with the

[30] Grade points of departure, different wind statistics.

Het Limburgs Landschap foundation. The Limburg regional waterauthorities, Rijkswaterstaat, the municipality of Venlo, and the province of Limburg are involved in the project.

Cuijk-Ravenstein dyke stretch

The Flood Protection Programme exploration for the Cuijk-Ravenstein dyke stretch - extending over a length of 21 kilometres - is currently being elaborated. In mid-2020, the regional parties signed a declaration of intent, aimed at properly fitting in the required dyke improvement and at exploring options for linkage with additional regional ambitions, in order to create societal added value. One of the opportunities being explored is floodplain excavation, which can provide added value in terms of increasing river capacity, nature development, and mineral extraction. A point for attention is that the dyke foreland is also important with respect to the piping tasking, which could limit the options for flood plain excavation. Regional parties have also identified several options for enhancing spatial quality, for example, by giving more prominence to ramparts in Grave and by optimising a continuous bicycle route along the river Meuse. Funding is a challenge in this respect. In collaboration with local stakeholders - among which residents, interest groups, terrain managers, four municipalities, provincial authorities, and Rijkswaterstaat - the regional waterauthorities is gradually developing a preferential alternative, to be endorsed by the end of 2022.

Thorn-Wessem dyke stretch

At the end of 2020, the Limburg regional waterauthorities, in coordination with the Minister of Infrastructure and Water Management, set down the preferential alternative for the Thorn-Wessem project. The project comprises dyke improvement, a system measure, and brook restoration. The action plan for the plan elaboration phase was launched in 2021. Once the dyke is safe, the area between Thorn and Wessem will lose its riverbed status, whereupon it will be designated as a long-term development area (see Meuse valley riverbed policy elaboration). This will provide local businesses and residents with more options for development, after years of being left in the dark.

Baarlo-Hout-Blerick area plan

At the end of 2020, the authorities selected a preferential alternative for Baarlo-Hout-Blerick. It involves an area plan elaborating a dyke improvement, a system measure, brook restoration, and the enhancement of local spatial quality. The dyke improvement entered the plan elaboration phase in 2021. Agreements on governance, funding, and division of risks will be set down in an administrative agreement between the parties involved. Local residents and entrepreneurs have actively provided input on the plans. This has garnered wide support, despite the fact that the plans involve the demolition of several houses. Expectations are that the Limburg regional waterauthorities, the Ministry of Infrastructure and Water Management, the province of Limburg, and the municipalities of Venlo and Peel en Maas will finalise the preferential alternative in 2021.

Meandering Meuse

The combined Flood Protection Programme/MIRT Exploration "Meandering Meuse" commenced in 2017 with an integrated plan encompassing dyke improvement, river capacity, and area developments relating to, e.g., nature, cultural heritage, commercial shipping, and leisure activities. The provinces of Gelderland and Noord-Brabant have anchored the plan in an Inter-provincial Framework Vision. In 2020, the realisation of riparian nature - a tasking under the Major Waters Programme Strategy - was added to the plan. In 2021 and 2022, the design, decisions, and permits will be finalised in collaboration with the contractor, in order for the realisation phase to commence by 2023.

In addition to the above projects, the Well, Lob van Gennep, and Oeffelt projects are also making headway.

Limburg policy brief: flood protection standards

Under the Meuse Valley Flood Risk Management Policy Brief, the HKV Agency recommended to consider lowering the standards for 22 dyke stretches in Limburg, on account of the spatial impact, costs, and public support of dyke improvement projects. On 9 June 2021, the Delta Programme Commissioner submitted an advisory report on the standards for primary flood defences in the province of Limburg, underpinned by a wide range of elements for consideration. These elements were set down in consultation with the administrative supervisory group that has been convened in the purview of this advisory procedure. The HKV Agency suggested several scenarios:

- lowering the standards within the primary flood defences system by introducing a new lower category of standards;
- lowering the standards outside the primary flood defences system (which will then become regional flood defences);
- not setting standards for flood defences.

The Delta Programme Commissioner has elaborated how these scenarios would impact the set of elements for consideration. Based on his pertinent assessment and on administrative signs in the administrative supervisory group, the Delta Programme Commissioner recommends leaving the standard values as is and to explore options within the existing set of instruments to minimise the spatial impact of the flood defences.

The Delta Programme Commissioner has identified the following decisive factors for the Limburg situation: the undesirability of a flood frequency increasing to (statistically) 1:30 years; the assessment that introducing a lower category of standards would not remove any spatial consequences; the strong doubts held by the Security Regions regarding the feasibility of a higher evacuation ratio; and the fact that, according to practical experience gained meanwhile by the regional waterauthorities, constructing flood defences to a lower standard would not reduce the costs as significantly as estimated by the HKV Agency. In addition, national-level considerations also played a part, such as policy consistency; the system of national flood protection cost sharing and compensations within and beyond the primary flood defences system; the delay that adjustment of the standards would cause in the dyke improvement tasking; and the impact on the riverbed status.

Maximum local support can be garnered for flood defences that meet the current statutory standards by utilising the options of innovative designs and the optimalisations that are open within the Statutory Assessment Tools and the Statutory Design Tools. The Flood Protection Programme can serve as a source of expertise and experience in this respect, supplemented with regional experience such as been gained under the Programme's Knowledge and Innovation Agenda. Another key notion put forward by the administrative supervisory group is that capitalising on linkage opportunities can foster public support for dyke designs.

The advisory report has been submitted to the Meuse Delta Programme Steering Group as the commissioning party and to the Minister of Infrastructure and Water Management as the Cabinet member bearing system responsibility, to serve as a building block for the evaluation of the Water Act prior to 1 January 2025.

Meuse valley riverbed policy elaboration

Currently, the dykes along the Limburg Meuse still need to be capable of withstanding overtopping during high river discharges. In the future, the overtopping requirements will lapse, once the dykes comply with the new standards set down in the Water Act and system measures have created more room elsewhere in the riverbed. The flood-prone area behind the dykes still has "riverbed" status, according to the Major Rivers Policy Line, which limits its uses. In mid-2020, the Minister of Infrastructure and Water Management, in consultation with the region, set down a policy elaboration specifying when the overtopping requirement and the riverbed status will be dropped[31]. The use of areas that are to provide water storage (some of the system measures) will be regulated by setting down a limited scope for area development. The central government and the region are drawing up an integrated spatial vision document for the entire Meuse valley, in coordination with the Integrated River Management Programme.

[31] Parliamentary Documents II, 2019/2020, 27625, 504

Rhine and Meuse freshwater supply

Phase I and Phase II measures

In the area around the major rivers, the implementation of measures under the first phase of the Delta Plan on Freshwater Supply is on schedule. In 2020, the "Sustainable use of shallow groundwater" climate adaptation pilot mapped out the water requirements, the water supply, and potential water shortages in the region. The regional authorities are using these insights in the purview of regional dialogues on water availability. The climate adaptation pilot has also explored options for using shallow groundwater as an alternative source of fresh water; various stakeholders were involved in this process. The final report was submitted in mid-2021. In 2020, the authorities decided to extend the "water saving measures" grant scheme for farmers until 2023. The grant scheme is an increasing success, in part as a result of the dry summers. For the new planning period, the region is committed to increased self-sufficiency and optimisation of the water supply system.

Water availability

In the dialogue on water availability, the authorities are linking up with ongoing regional processes, such as the Fruit Delta Regional Deal and the Regional Adaptation Strategies. A univocal elaboration of the Water Availability instrument in the area around the major rivers is complex, on account of major system differences (areas with and without supply options) and because the four provinces involved are located in different freshwater supply regions.

In the purview of combating drought in the Rijk van Nijmegen nature reserves, consultations are held with terrain managers in order to develop a collective action perspective.

Rijkswaterstaat is carrying out the Meuse Water Availability process, along with regional water consumers (the industry, energy, drinking water, nature, shipping), the regional waterauthorities, and the provinces. The availability of surface water in the Dutch Meuse catchment area has been mapped out, and measures have been drawn up to reduce the area's vulnerability to water shortages. The parties have selected preferential measures and applied for funding from the Delta Fund. The measures revolve around water buffering - in the main water system, in the region, and by water consumers. In 2021, a pre-exploration into additional retention along the river Meuse in the Netherlands and Flanders aimed at reducing the vulnerability to water shortages. Upon identification of promising locations,

a further exploratory study will be conducted in 2022. Water retention will be achieved through adapting the structure and the use of the existing water reservoirs or through the construction of new reservoirs.

6.4.3 Actions for linkage with other taskings and transitions

River Rhine

In 2020, three projects along the Rhine tributaries were designated as IRM pilot projects, with the aim of learning from the experience gained in the purview of the integrated IRM approach:

- MIRT Study Havikerwaard-Fraterwaard-Olburgerwaard (completed in the spring of 2021): the study has generated an overview of the ambitions, taskings, and initiatives in the fields of nature, water quality, shipping, flood risk management, and short-term and long-term spatial-economic development. One of the recommendations is to explore several solution strategies for the potential IRM taskings related to riverbed level and discharge capacity, and for the taskings under the Major Waters Programme Strategy, in interconnection with the challenges in the area such as dehydration and sustainable use of space for farming.
- Paddenpol: several government authorities are collaborating on a single integrated plan; they are gaining experience in combining taskings and budgets, and setting down joint agreements on integrated flood plain management.
- Werkendam Haven and surrounding area MIRT Study (to be completed by mid-2021): the study is mapping out options for an integrated area-specific approach, combining port expansion with nature development, dyke improvement, development of leisure facilities, and increasing river capacity.

River Meuse

In 2020, six IRM pilot projects along the river Meuse were launched to gain experience of the integrated IRM approach:

- Lowering the Lateraal Canal dam: exploring funding methods, including pre-financing by governments, a “millimetre fund” for entrepreneurs, and projects generating a flood level reduction;
- Maastricht Meuse banks: integrated approach to nautical safety and urban renewal, restructuring, and flood protection; coping with phase differences in the taskings;
- Vierwaarden (Venlo-Horst): restoration of inter-administrative collaboration to map out opportunities for synergy and the integrated river taskings for both banks; collaboration with local residents (initiative groups, citizen participation); exploring opportunities for giving (economic) impetus to villages;
- Alem and Sint-Andries fortress: integrated area development with a widened scope and early involvement of a private party in order to expedite a perspective of funding;
- Consideration of creation of discharge capacity in the land abutment on the Gelderland side of the A2 motorway: connecting flood protection with intersecting infrastructure projects and embedding a total package upon implementation, or at different times;
- Den Bosch, Crèvecoeur flood protection: linking Meuse water taskings (flood risk management, waterlogging, and sea level rise) to water taskings involving the regional system (river discharge, drought, and dehydration), in interconnection with nature and cultural history.

The learning goals of each pilot project are focused on implementation, exploration, or research (see Figure 9).

Locations

1. Meuse banks, Maastricht
2. Lowering Lateraal Canal dam near Roermond
3. Interconnected elaboration north of Venlo
4. Alem and Sint-Andries fortress
5. Creating discharge capacity in land abutment on Gelderland side of A2 motorway
6. Den Bosch Crèvecoeur flood protection
7. Werkendam
8. Havikerwaard, Fraterwaard, and Olburgerwaard
9. Paddenpol dyke relocation

***Figure 9**, IRM pilot projects along the river Meuse and the three categories of learning goals*

6.4.4 Signs and new insights

River Rhine

First results of IRM interim products

The first results of the System Review are available, as are the Memorandum on Realistic Policy Options and the Rivers in Focus report. These IRM interim products reveal that climate change and riverbed erosion have a major impact on the navigability of and the discharge distribution across the Rhine branches during low water. The ecological system tasking is also substantial. Furthermore, all the taskings have a spatial impact on the design of the area around the major rivers. The results of the studies conducted underpin the choice to take integral account of the taskings relating to flood protection, freshwater supply, navigability, ecology, and spatial regional development in working out alternatives for the review of the Preferential Strategy for the rivers within the IRM programme.

International collaboration

In 2019, the Netherlands and North Rhine-Westphalia signed a new joint statement on collaboration in the field of sustainable flood protection. The parties are drawing up a new working programme for the period ahead, using the recommendations from the study conducted:

a. gaining more experience in joint research (including verification of data) and the exchange of expertise on 1) cracking and piping, 2) evacuation, 3) future discharge levels, and 4) a method for risk-based approaches and data availability;
b. continuing and strengthening the cross-border collaboration;
c. developing a collective perspective for the future of cross-border flood protection in the border region.

Lessons taught by IJsselpoort River Climate Adaptation Park

Over recent years, eight parties have drawn up an integrated plan for the IJsselpoort River Climate Adaptation Park (cf. paragraph 6.4.2). They have translated their experience into ten tips for future projects:

1. Keep the point on the horizon in focus.
2. Share your collective story.
3. Ensure that you have your facts straight.
4. Enable everyone to participate.
5. Involve politicians at an early stage.
6. Work on trust.
7. Organise everything efficiently.
8. Put equality first.
9. Involve managing parties at the earliest possible stage.
10. Make a joint business case.

River Meuse

Impact of measures on sediment hydrology

Sediment hydrology is affected by many measures in and along the river, such as the construction of secondary channels, nature-friendly banks, and mineral extraction. As yet, insufficient data is available on the exact impact and on the timescale of their occurrence. Additional research is required to gain more insight. This is being substantiated in the ongoing research programme Rivers2Morrow, which is already focusing on Meuse riverbed morphology.

Meuse water availability under pressure

Analyses conducted in the purview of the Delta Plan on Freshwater Supply have shown increasing pressure on the availability of water for the utility functions in the Meuse system. Periods of drought are increasing in both frequency and duration. Water shortages create bottlenecks for agriculture, nature, industry, the regional water system, shipping depths, and drinking water intakes along the river (also as a result of salinisation). Once Germany ceases its brown coal mining, the water supply to the Meuse via the Rur may decrease. Water retention in the tributary brooks and floodplains is becoming increasingly important. This also opens up opportunities for nature development and ecological connection zones, especially along the Northern Meuse Valley.

Integrated working: synchronising schedules

Synchronising the schedules of measures and initiatives is an important precondition for the integrated consideration of taskings. However, in actual practice, such synchronisation is difficult to achieve. In 2021, the IRM programme will map out policy options for riverbeds and discharge capacities. It is not sure whether the required measures can be combined with measures pertaining to, e.g., nature (Major Waters Programme Strategy), shipping, (drinking) water quality (Water Framework Directive), and economic developments including extraction of raw materials. Synchronisation of schedules is also important for the implementation of the IRM pilot projects.

Consequences of termination of brown coal extraction

By 2030, Germany will close down its brown coal pits and terminate the required large-scale groundwater extraction. It will take several decades for the groundwater to be replenished and the brown coal pits to fill up. Germany is considering using part of the Rur discharge to fill up the pits. This will affect the Netherlands: in times of low water discharge, the river Rur contributes significantly to the Meuse discharge and the Meuse drinking water supply. The provinces of Limburg and Noord-Brabant are exploring the consequences in collaboration with North Rhine-Westphalia and Flanders.

Lessons taught by Meandering Meuse project

Over recent years, collaboration under the Meandering Meuse project has generated an integrated plan (cf. paragraph 6.4.2). Here, shared ownership was found to be the key to success. This has the following advantages:

- approaching the tasking in an integrated manner from the very start, and taking joint control;
- equal relations, well-structured processes, and connecting people;
- comprehensive view of multiple taskings;
- joint exploration of promising amendments to project scope, within the frameworks;
- equality of parties and jointly making strategic choices;
- regional governance;
- early and close involvement of residents/ stakeholders in the design and in transparent choices;
- co-funding, joint financial responsibility for the project and the project organisation;
- independent project organisation (IPM team and project manager) working for all the parties;
- process direction, thinking with the intention of accomplishing things.

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

Following the review of the Preferential Strategy in 2020, the parties involved continued its implementation actively and in concert. Their efforts produced multiple results in 2021. For example, a decision has been taken on the Hollandsche IJssel flood protection. Furthermore, the area-specific adaptation strategies have been elaborated in more detail. Initially, these strategies are focused on the extensive, intensively used floodplains area in the Rhine Estuary-Drechtsteden region. By 2022, ties with other transitions will be strengthened.

6.5.1 Progress: implementation of Preferential Strategy for the Rhine Estuary-Drechtsteden Region

Flood risk management

Flood Protection Programme

The Schieland en de Krimpenerwaard district water control board is responsible for the improvement of the dykes along the Hollandsche IJssel river (KIJK project). In 2020, a study was conducted in collaboration with Rijkswaterstaat, which revealed that flood risk management along the Hollandsche IJssel can be achieved at considerably lower costs by investing in the reliability of the Hollandsche IJssel storm surge barrier. Less radical dyke improvements will subsequently suffice. By no later than 2022, the Flood Protection Programme, the district water control board, and Rijkswaterstaat will set down pertinent administrative agreements in the form of an exchange grant contributing to the dyke improvement. The "probability of not closing" the Hollandsche IJsselkering needs to be amended in the Water Act by way of a proposal by the Minister of Infrastructure and Water Management. Implementation of the storm surge barrier measures will commence by 2022, which will improve the probability of failure from 1:200 (current standard) to 1:1000 or better by 2030. This will save an estimated EUR 47 million - 60 million in the dyke improvement tasking.

Area-specific adaptation strategies for floodplains

In 2020, the Rotterdam Port Authority rounded off the adaptation strategy for the Europoort port area outside the dykes, together with government authorities and local companies. The Maasvlakte strategy is nearing completion. In the years ahead, the parties will elaborate the strategies in more detail.

In 2020, the municipality of Rotterdam compiled guidelines for the development of adaptation strategies for inhabited floodplains, drawing on the experience gained in the port areas outside the dykes. In 2021, adaptation strategies will be developed for two areas, in interconnection with ongoing area development processes such as involving the Rhine and Meuse ports. The Port Authority and the municipalities of Rotterdam and Dordrecht will share the expertise amassed for municipalities and businesses to utilise in the purview of adaptation strategies for other regional floodplains areas.

De Staart shelter and Dordrecht city centre

In 2020, the municipality of Dordrecht and the International Architecture Biennale Rotterdam (IABR) developed a vision document pertaining to the elevated De Staart floodplains area. It sets out how De Staart can serve as a large-scale shelter during a flood, and how this can be combined with sustainable, climate-adaptive area development. The municipality and the Cultural Heritage Agency of the Netherlands have explored how the cultural-historic buildings in the historic city centre can be protected from flooding. They are also considering the long-term situation, as sea level rise and high river discharges are adding to the probability of urban flooding. The study is being conducted under the Horizon2020 project, which focuses on the climate adaptation of cultural history.

Vital and vulnerable

The regional Vital and Vulnerable study group of the Rhine Estuary-Drechtsteden Delta Programme produced a position paper in 2020 which elaborated the requirements, roles, and tasks of regional parties in terms of vital and vulnerable functions. The parties aim to gain more insight into the vulnerability of vital provisions and into the impact of their failure as a result of flooding, waterlogging, drought or heat. Furthermore, they want to be able to assess the need for additional measures. The expertise of the managing authorities - many of which operate on a national scale - is essential in this respect. The impact analyses regarding serious waterlogging and flooding, which are being conducted by the Security Regions, are another important source of information.

Point of concern

As a result of the COVID-19 pandemic, the four Security Regions involved had less time to spend on the disaster control actions set out in the Preferential Strategy (layer 3 of multi-layer flood risk management). For several dyke rings, polder clusters, and regional flood defences, the impact analyses relating to serious waterlogging and flooding have already been completed. However, the formulation of evacuation strategies has suffered some delay; the aim is to have them completed by the end of 2021.

Freshwater supply

The implementation of measures set out for phase I of the Delta Plan on Freshwater Supply in West Netherlands is largely on schedule. The implementation of the capacity expansion of the Climate-proof Water Supply is continuing into 2023 as planned. The optimisation of lake Brielse Meer sustained some delay this past year, as a result of the restrictive measures to combat the spread of the COVID-19 virus; the realisation is scheduled to be completed by 2022.

Regional parties are jointly preparing for the next phase of the Delta Plan on Freshwater Supply. The strategy of the West Netherlands freshwater supply region ties in with the national freshwater supply goal of achieving resilience against freshwater shortages by 2050. The region is factoring in other societal taskings and transitions, such as the saturation of peat grasslands, enhancing water quality, urbanisation, and biodiversity. The strategy that has been set down is focused on several tracks: further optimisation of the supply; transition to utilising the subsoil as an alternative source of fresh water; and enhancing the resilience of the regional water system. The efforts are fostered by the explicit consideration of water availability in spatial planning. Finally, the strategy focuses on closer collaboration and linkage with other taskings, such as exploring opportunities for nature and a regional willingness to invest in a climate-proof main water system.

Spatial adaptation

Information on the implementation of the Delta Plan on Spatial Adaptation is provided in paragraph 5.4.

Alblasserwaard-Vijfheerenlanden

In the Alblasserwaard-Vijfheerenlanden region (A5H), the provinces, municipalities, and the regional waterauthorities are working on a regional climate adaptation strategy. The government authorities have set up climate workshops to discuss topics such as urbanisation and a healthy environment; agriculture and nature; landscape and leisure activities; and vital objects and infrastructure with NGOs, the business community, and local residents. A digital symposium has enabled even more people to contribute ideas. The region aims to become an international climate adaptation showcase and will engage in long-term collaboration based on implementation agendas and actual projects.

6.5.2 Actions for linkage with other taskings and transitions

Spatial development framework for dykes

In 2021, the municipality of Rotterdam and the Hollandse Delta regional waterauthorities will roll out a pilot project involving the formulation of a “spatial development framework for dykes” for the Rotterdam Meuse port. The framework will encompass points of departure for the design of, e.g., the housing developments scheduled to be completed near the dyke in the years ahead. In terms of ensuring long-term flood risk management, several options are available both on the seaward side of the dyke and in the area behind the dyke.

Climate-adaptive construction and flood risk management

Flood risk management is increasingly being addressed in climate adaptation efforts in inland areas. The Zuid-Holland Climate-adaptive Construction Covenant sets clear goals for including flood risk management in new construction projects. The parties associated with the Rhine Estuary-Drechtsteden Delta Programme, along with the Covenant, are exploring ways to realise such goals in actual practice. In the Amstelwijck and Vlijweide new construction projects, the municipality of Dordrecht has translated the covenant goals into performance requirements. For example, in the Amstelwijck project, 60 per cent of the houses must have a dry place for residents to stay in the event of a flood. In the Vlijweide floodplains project, the parties are exploring ways to prevent damage and to make more efficient use of the quality of tidal water.

6.5.3 Signs and new insights

Spatial developments

The first regional session of the Sea Level Rise Knowledge Programme for the Rhine Estuary-Drechtsteden region took place at the end of 2020. The session confirmed the idea that current spatial developments and flood protection investments are co-determinative for long-term flood risk management options. Consequently, it is important to consider ongoing developments and investments in interconnection with the long-term perspective.

The knowledge programme is generating new models to map out the impact of sea level rise on water levels and flood protection taskings involving the main water system. The models for the Rhine Estuary-Drechtsteden region were completed first; the results will be available by the second half of 2021. Furthermore, the knowledge programme is providing more insight into the taskings related to freshwater supply, shipping, industry, the economy, the floodplains area, spatial planning, and ecology, and into the resilience and flexibility of the entire system (including multi-layer flood risk management).

No-regret investments

Under the auspices of the Hollandse Delta regional waterauthorities, a study has been conducted into the impact of sea level rise on investments in floodplains areas and dyke zones in the Rhine Estuary-Drechtsteden region. The researchers have studied several types of investments, including investments in nature reserves, industry, flood protection structures, and infrastructure. This has generated tools for the development of no-regret investments. Municipalities and regional waterauthorities can now provide businesses and investors with information on climate-resilient construction. The study will be completed in 2021.

6.6 Southwest Delta

The implementation of the Preferential Strategy is proceeding well. It revolves around the joint ambition for the Southwest Delta: this is the first delta in the world to be prepared for climate change by 2050, as a result of which residents will be able to continue living, working, and engaging in leisure activities here even after 2050. The year ahead will focus on the follow-up to the Southwest Delta Regional Agenda 2050, on the formulation and implementation of an integrated Knowledge and Innovation Agenda, and on intensification of regional collaboration.

6.6.1 Progress: implementation of Preferential Strategy for the Southwest Delta

Flood risk management

Flood Protection Programme

The Hansweert project is the largest dyke improvement effort in the Southwest Delta. During the plan elaboration in 2019, an InnovationHUB was organised, enabling representatives of government organisations, the business community, educational establishments, and research institutes to discuss views on sustainable, nature-friendly, and circular ways to carry out dyke improvements. Various ideas are being elaborated in the Hansweert project and may also be used in future dyke improvements. The final design is expected by the second quarter of 2021; for the time being, its implementation is scheduled for 2022-2025.

Foreshore deposits

In 2020 and 2021, Rijkswaterstaat will be preserving foreshores at several locations along the Westerschelde and the Oosterschelde. Foreshores are important in terms of dyke stability and thus flood protection. Foreshore projects involve many linkage opportunities. In the Westerschelde, measures are being carried out within the context of the Westerschelde Nature Package, which is intended to foster tidal nature. The Oosterschelde deposits will have an ecological top layer, i.e., crushed stone ridges approx. one metre in height. They bolster biodiversity, constitute good hiding places for lobsters, and hold appeal for divers.

Sand replenishment programme

Sand replenishments near Dishoek were accelerated in the spring of 2020, because storm Ciara had washed away large volumes of sand in February. Consequently, flood protection during the winter period could not be guaranteed. In 2021, coastal sand replenishment is scheduled for Goeree-Noordwest, Schouwen-West, Westkapelle-Zoutelande, and Dishoek-Vlissingen.

Freshwater supply

Progress in implementation of planning period up to 2021

By the end of 2020, a special milestone was achieved in the Roode Vaart Transfer project: for the first time in fifty years, water once more flowed through the Zevenbergen port. The new port connects the Hollandsch Diep river with the Mark-Vliet system. The new connection enables additional freshwater supply to West-Brabant. The opening of the Zevenbergen port enhances liveability in the area and also fosters the improvement of water quality in the Brabant Mark-Vliet system. In 2021-2022, the regional

waterauthorities will realise the inlet structure to admit water from the Hollandsch Diep river.

The tender procedure for the realisation of the Krammer locks innovative freshwater-saltwater separation will commence in 2021. This new system will produce a more effective separation of freshwater and saltwater, generate a 50 per cent energy savings, and cut passage times by 16 minutes per lockage. This is the last element of the package to go into implementation.

The Zeeland Freshwater Supply testing ground is the project that has garnered most commitment among other parties. Farmers and municipalities are involved in virtually all the projects. The Evides Water Company and DOW Chemicals in Terneuzen are taking the lead in one of the measures.

Freshwater supply strategy

In November 2020, the amendment to the freshwater supply strategy was endorsed. This also constitutes the first step in the substantiation of the motion submitted by Stoffer c.s.[32], which has been passed by the House of Representatives. The motion makes a case for the urgent address of salinisation and dehydration issues in the Southwest Delta and argues against salinisation of lake Volkerak-Zoommeer. This has removed the urgency of realising an alternative freshwater supply around lake Volkerrak-Zoommeer. In their administrative consultations of 22 February 2021, the regional authorities indicated their intention to develop different and additional measures, and to submit these to the Freshwater Administrative Platform.

The set of measures for the planning period 2022-2027 comprises the following main categories: continuation of Zeeland Freshwater Supply testing ground; more efficient regional water management; reuse of effluent; realisation of resilient regional water system; and monitoring and modelling. The following additional measures have been proposed:

- Wolphaartsdijk underground water storage;
- Optimisation of freshwater situation in PAN polders in West-Brabant;
- Optimising the use of agricultural waterworks;
- Exploring the use of brackish groundwater for drinking water supply;
- Exploring the use of Brabantse Wal run-off.

Water availability

In the Southwest Delta, the elaboration of the Water Availability instrument varies from one province to the next. The province of Zeeland is mainly composed of areas without any supply options. With respect to the island of Schouwen-Duiveland an exploratory study is being conducted - in collaboration with the municipality and the agriculture sector - into water supply options. The overall strategy covering the entire province of Zeeland is being elaborated under the Zeeland Delta Plan on Freshwater Supply. With respect to the province of Zuid-Holland, the strategy covers the island of Goeree-Overflakkee, where a pilot study has already been conducted at an early stage and where water availability has been integrated meanwhile into the regional process for the Delta Plan on Spatial Adaptation. In Noord-Brabant, the Southwest Delta only spans the level-regulated territory of the Brabantse Delta regional waterauthorities, which has set down the water availability frameworks at the administrative level. This provides consumers with clarity regarding the efforts being expended by the regional waterauthorities in terms of the regional freshwater supply. In some parts, such as the areas bordering on lake Volkerak-Zoommeer, further elaboration is necessary. This is being fleshed out in, e.g., the "Participatory monitoring" process, along with farmers in the polders.

Spatial adaptation

The Zeeland Climate Adaptation Strategy, including its implementation programme, will be endorsed in the second half of 2021. The Strategy is based on the principle of multi-layer flood risk management. Furthermore, it pays attention to vital and vulnerable functions and to the Zeeland Delta Plan on Freshwater Supply. During the risk dialogue process, an awareness campaign was launched: "The climate is changing, Zeeland is changing with it".

The Goeree-Overflakkee Working Region has conducted a risk dialogue and set down the outcomes of the stress test. In early 2021, the grant scheme for climate-adaptive measures was introduced (intended for property owners). The climate adaptation strategy and the implementation agenda are expected to be completed by the summer of 2021.

6.6.2 Actions for linkage with other taskings and transitions

Southwest Delta Regional Agenda 2050

The Southwest Delta Regional Agenda 2050 was endorsed in November 2020 and forwarded to the House of Representatives. The Agenda links the goals of the Delta Programme for the Southwest Delta, the Major Waters Programme Strategy, the regional economy, and the National Environmental Vision into inspiring action perspectives for a climate-resilient delta area. In the years ahead, the action perspectives will be fleshed out in more concrete detail by the working programme of the Southwest Delta Regional Consultative Body.

[32] Parliamentary year 2020-2021, 27625, 521 (in Dutch)

Galgeplaat and surroundings sand replenishment

The Galgeplaat and surroundings sand replenishment is included in the second phase of the Major Waters Programme Strategy (PAGW). Preparations for the plan elaboration commenced in the spring of 2021. This type of replenishment is not only important in terms of the ecology; it also bolsters flood protection: the sand replenishments reduce wave attack on the dykes surrounding the Oosterschelde.

Southwest Delta Vital Countryside Inter-administrative Programme

In the Southwest Delta, the Area Plan of the Vital Countryside Inter-administrative Programme has been endorsed: "Boundless collaboration on a visible and future-proof Southwest Delta". This programme is tackling several taskings in the rural area in an interconnected manner, in the form of breeding grounds: "Sustainable farming", "Freshwater supply", and "Enjoying and experiencing the Delta". In the "Freshwater supply" breeding ground, the taskings - such as freshwater availability and a resilient water system - are being elaborated into an area-specific strategy. In concert with the Southwest Delta Freshwater Supply Coordination Consultative Body, the authorities are exploring what other projects would be useful to carry out under the programme. Within the "Sustainable farming" breeding ground, a sustainable agriculture roadmap is being developed. This ties in with taskings related to water availability, flood risk management, and climate adaptation.

Climate-vigorous Goeree-Overflakkee

On the island of Goeree-Overflakkee, the "Climate-vigorous Goeree-Overflakkee" campaign was launched. The municipality advises and supports local residents in its various sustainability ambitions - climate adaptation, the regional energy strategy, and heat transition vision document - via a single track. The goal of "climate-proof and water-resilient by 2050" has been incorporated into the Climate-vigorous Goeree-Overflakkee participation frameworks. One of the points of departure is: "By 2050, we will be able to cope with the impact of climate change".

Southwest Environment Agenda and Southwest Delta Regional Agenda 2050

In the Southwest Delta, the Southwest Delta Regional Agenda 2050 and the Southwest Environment Agenda both encompass area-specific elaborations of the National Environmental Vision: the Regional Agenda as an inspiration document featuring action perspectives focused on the major waters; the Southwest Environment Agenda as an administrative agenda featuring area-specific taskings, focused on the districts. The Southwest Environment Agenda identifies three areas in Zeeland in which improvement of collaboration between the central government and the regional authorities is most urgent: the North Sea Port District, the Coast and Foredelta, and the rural area. For the province of Zuid-Holland, regional taskings have been identified, such as the northern rim of the delta. The taskings pertaining to these areas expressly tie in with the Delta Programme for the Southwest Delta, especially with respect to flood risk management, freshwater availability, and climate adaptation.

6.6.3 Signs and new insights

Volkerak-Zoommeer up to par

Based on the Deltares report on "Climate resilience of lake Volkerak-Zoommeer water management" (July 2020), the Southwest Delta Regional Consultative Body has concluded that regular water level management and the freshwater supply of lake Volkerak-Zoommeer are climate-resilient up to a sea level rise of 1 metre, subject, however, to the satisfaction of three preconditions:

- Water supply from the Hollandsch Diep river through the Volkerak locks remains 40 m^3/s throughout the year;
- Seepage pressure does not substantially exceed 3 kg/s;
- Operational management of the Innovative Freshwater-Saltwater Separation in the Krammer locks is optimised on a learning by implementation basis.

The Regional Consultative Body will contact the administrative partners to set down agreements on the concrete substantiation of these preconditions.

Smart sediment management

In 2020, the annual knowledge meeting of the Southwest Delta Knowledge Community was focused on "sediment". This meeting was also the final conference of the Smart Sediment Interreg project. The project conclusion is that smart management of sediment released in the Scheldt delta can foster various ecosystem services, in particular nature, biodiversity, and flood risk management.

Freshwater-saltwater

In November 2020, the Southwest Delta Knowledge Community organised an online session focused on the topic of freshwater-saltwater in the Southwest Delta. In the Southwest Delta and particularly in the province of Zeeland a substantial sum has been invested in the development of technologies and models for fresh-saline groundwater analyses. The participants discussed the possibilities and impossibilities of models, the extent to which such models foster knowledge development, and how the results should be interpreted. The final conclusion was that in some cases, "real-life data" would be preferable.

Southwest Delta Integrated Knowledge and Innovation Agenda

In May 2021, the Southwest Delta programme and the Sea Level Rise Knowledge Programme organised an online meeting on the Southwest Delta Integrated Knowledge Agenda and the Sea Level Rise Knowledge Programme. The more than 130 participants ranged from policy-makers and researchers to representatives of the private sector and regional administrators. The meeting saw the introduction of the Integrated Southwest Delta Knowledge and Innovation Agenda, which provides insight into the interconnectivity and connection between the individual knowledge agendas. Furthermore, during the meeting it became clear that choices relating to other areas, including the Rhine Estuary-Drechtsteden region, the area around the major rivers, and Flanders could have a major impact on the water system of the Southwest Delta and thus on the long-term solution strategies. In this respect, clarity is needed as to which choices are made at the national level and which are made at the regional level. The parties intend to organise similar meetings on a regular basis in the years ahead and collectively to expand the knowledge agenda.

Ghent-Terneuzen Canal

The Ghent-Terneuzen Canal is increasingly salinising, whilst the risk of water shortages is growing. This can be attributed to the construction of the new sea lock and a decreasing water supply from Flanders as a result of climate change. Rijkswaterstaat and the Flemish Ministry of Mobility and Public Works are investigating how this situation is impacting the canal and its environs, and exploring action perspectives to mitigate the consequences.

6.7 The Coast

The Coastline Maintenance Implementation Programme was rolled out thirty years ago. Under this programme, the Netherlands is preserving its coastline by way of sand replenishment. Sand replenishment is a key component of the Preferential Strategy for the coast: "flexible where possible, solid where needed". The success of the Coastline Maintenance programme has helped keep coastal flood protection up to par. Linking other spatial ambitions to future flood protection calls for additional attention.

6.7.1 Progress: implementation of Decision on Sand and Preferential Strategy for the Coast

Decision on Sand

In early 2021, Rijkswaterstaat submitted the Coastal Genesis Policy Advisory Report to the Ministry of Infrastructure and Water Management. This report sets out how much sand coastal management and maintenance will require in the long run. The report also addresses the locations and times at which sand is required as well as potential replenishment methods. The policy advisory report is based on the expertise amassed since 2015 in the Coastal Genesis 2.0 programme.

In 2021, the follow-up to Coastal Genesis 2.0 was accommodated in the Sea Level Rise Knowledge Programme (track 2, System Explorations, Sandy Coast). The activities scheduled for the years ahead encompass knowledge development through research and additional monitoring in the Ameland tidal inlet. The knowledge generated will enable anticipation of future developments that affect the sandy system, as well as more effective and more cost-efficient sand replenishment (learning by doing). The years ahead will provide clarity as regards the need for adjusting the scope of the sand replenishments. For the time being, the current scope of 12 million m^3 per annum will suffice.

Preferential Strategy for the Coast

The end of 2020 marked the thirtieth anniversary of the Coastline Maintenance Implementation Programme. This programme schedules the annual sand replenishments along the coast. Working with sand replenishments has amply proved its worth in actual practice: replenishment is an adaptive method that can easily be geared to current coastline developments; it is a relatively cheap way to preserve the coastline and protect the Netherlands against coastal flooding; the replenishments ensure that the coastal foundation keeps pace with the rising sea level; and the flexible protection method opens up opportunities for nature, the landscape, and leisure facilities. The replenishments keep coastal flood risk management up to par and leave room for utility functions in the coastal zone (drinking water, nature, leisure facilities, archaeology). For the time being, sufficient sand is available at extractable depths in the North Sea to continue this policy.

6.7.2 Actions for linkage with other taskings and transitions

Linkage between other ambitions and flood risk management

An important objective of the Preferential Strategy for the Coast is linking the flood risk management tasking to spatial ambitions. At most locations, flood risk

management taskings are being substantiated in an integrated manner. Good examples are the improvement of the Hondsbossche storm surge barrier (Hondsbossche Dunes) and the coastal improvements near Noordwijk (dyke underneath dunes) and Katwijk (dyke combined with car park). Initiators of other spatial ambitions do not always seek to tie in with future flood risk management taskings. This is, however, important, especially if the sea level is found to rise at an accelerated pace. Linkage with other ambitions can keep future options for new flood protection measures open. That is why it would be wise to incorporate linkage in the municipal environmental vision documents.

6.7.3 Signs and new insights

More sustainable coastal projects

The Ministry of Infrastructure and Water Management intends to operate in an entirely climate-neutral and circular fashion by 2030, to which end it has adopted the "Towards climate-neutral and circular state infrastructure projects" strategy (see paragraph 2.4). The ambitions are being substantiated in various ways, e.g., in the Innovations in Coastline Maintenance programme. Maintenance of the Dutch coast produces high CO_2 emissions. That is why Rijkswaterstaat is exploring new ways to reduce the environmental impact of coastline maintenance. To this end, Rijkswaterstaat is entering into innovation partnerships with a select number of companies. At the end of 2020, the first tender of partnerships generated several promising ideas, among which the Sand Windmill and the Sand Wing. The Sand Windmill is composed of an electric, wind energy operated sand extraction machine that transports sand to the replenishment location. This idea has already progressed from initial design to pre-design. The Sand Wing is a seabed construction that whirls up sand and transports it to the coast.

National Coast Day / Sea Level Rise Knowledge Programme regional session

The Sea Level Rise Knowledge Programme regional session for the coastal zone took place on 12 May 2021, in combination with the national Coast Day. Parties bearing responsibilities in the coastal zone were requested to reflect on future water taskings in spatial developments and spatial taskings. After all, such developments usually involve investments of several millions to several billions of euros, with a lifespan of 50 to 100 years. Take, for example, house construction projects. The session revealed that future-proof investments call for more clarity regarding requirements, preconditions, and examples. For example, does the location feature urgent or high-risk areas, and what are the options in terms of spatial reserves and adaptive designs? Stakeholder involvement and participation is essential. It was recommended to the parties to consider setting down in environmental vision documents that in the future, potential water taskings must be taken into account in the preparation of spatial developments.

Satellite measurements

Rijkswaterstaat annually measures the seabed level in the coastal zone; the seabed level further seaward is measured every three years. These measurements constitute the basis for scheduling coastal replenishments. A study is currently being conducted into the use of satellite measurements to determine the seabed level. If this works out, data on seabed level will be available on a more regular basis. This will provide more insight into coastal behaviour and into coastal response to sea level rise, which will enable model improvement and more accurate sand replenishment calculations.

Wide climate-proof dune zone

The costs of future improvements of flood defence systems are lowest if there is sufficient space, since soil and sand will then suffice for the improvement. In addition, there will be more options for multi-functional accommodation. Consequently, wide, climate-proof dyke and dune zones are preferable. This calls for a spatial vision that is actively disseminated and effectively realised.

6.8 Wadden Region / Freshwater supply region North

Several integrated and innovative dyke improvement projects are under way in the Wadden Region. Linkage with other taskings and transitions is being substantiated in, e.g., the integrated flood risk management strategy for the Wadden islands.

6.8.1 Progress: implementation of the Preferential Strategy for the Wadden Region

Flood risk management

Sea Level Rise Knowledge Programme

In the autumn of 2020, the Spring Tide Festival on the island of Terschelling featured a working session on potential strategies to be pursued should the current strategy for the Wadden Region no longer suffice due to a major rise in sea level. The potential strategies are based on the "protecting, keeping pace, and pulling back" principles. The working session has mapped out the main knowledge gaps and dilemmas; this serves as input for the Sea Level Rise Knowledge Programme. The knowledge programme

also covers the follow-up to Coastal Genesis 2.0 (see paragraph 6.7; The Coast), comprising studies into, e.g., future morphological developments in the Wadden Sea. These will utilise the data generated by the monitoring programme for the Sand Replenishment pilot (Ameland Tidal Inlet Ebb-tide Delta). The monitoring programme provides insight into the operation of the sandy coast and the tidal inlets.

Interim results of Clay Maturing Plant

In 2022, a rejected dyke stretch extending over one kilometre will be converted into a Wide Green Dyke, to serve as a model project. The intention is to use local clay for its improvement. Some of this clay will originate from the Kleirijperij clay maturing plant, where dredging sludge from the ports and the Breebaart nature polder is "maturing" into clay. In mid-2020, it was found that the organic matter and salt content in the clay from the maturing plant did not meet the guidelines for dyke clay. The dyke design was adjusted accordingly. A scale model of the Wide Green Dyke was subjected to a Delta Drain Test to determine the minimum thickness of the layer of clay from the maturing plant required to guarantee flood protection. The Delta Drain Test also provides insight into the behaviour and suitability of local sludge for dyke improvements. At the end of 2020, a small 40-metre test dyke was constructed to gain insight into the processability of clay from the maturing plant.

Dyke improvement

The exploratory study for the Koehool-Lauwersmeer project (Flood Protection Programme) along the Frisian Wadden coast is under way. Wherever possible, the dyke improvement is tying in with other taskings, such as those set out in the Major Waters Programme Strategy for the Wadden Sea (natural transitions between the mud flats and the dyke, restoration of underwater nature) and in the Northeast Friesland/Holwerd aan Zee Regional Deal. All the innovative dyke improvement options and linkage opportunities are being taken into consideration. Coordination between the governments involved is taking place within the Wadden Sea Coast Steering Group, under the auspices of the province of Friesland. The exploratory study is expected to be completed by the autumn of 2021; it will generate an integrated preferential alternative for the various sub-tracks and agreements regarding the parties that will be elaborating the various linkage opportunities in the plan study phase. Realisation is expected to commence by 2023.

In mid-2020, plan formation commenced for the Lauwersmeer-Vierhuizergat project (Flood Protection Programme) along the Groningen Wadden coast. An integrated approach has been adopted, addressing nature, leisure facilities, the economy, and road safety. The project is co-funded from the Major Waters Programme Strategy, the Wadden Fund, and the province of Groningen with respect to ecological linkage opportunities: natural transitions between the mud flats and the dyke, and migration options for fish and other species.

In early 2021, the multi-functional use of the Double Dyke between Eemshaven and Delfzijl (2.6 kilometres) was further substantiated under the Eems-Dollard 2050 programme. In the intervening area, agricultural activities have commenced, involving cultivation of potatoes, seaweed, and shrimp. In 2022, a physical connection will be established between the river Eems and the inland area, in order to allow in tidal dynamics. In that same year, the Eems-Dollard 2050 programme will commence the construction of wet areas to create an ecological connection between the Eems estuary and the inland area.

On account of the nitrogen issues, dyke improvement on the island of Vlieland has been postponed from 2022 to 2023. Raising the dyke will not be necessary. The impact of sea level rise can be accommodated by adapting the banks and using larger stones. On the seaward side of the dyke, a verge will be created encompassing a bicycle path and a footpath. Wherever possible, local ecology will be enhanced.

Security Regions impact analyses

The Security Regions are drawing up flood impact analyses under the national WAVE programme. The COVID-19 crisis has caused some delay. The Groningen and Friesland Security Regions have made resources available for hiring temporary external staff to make up arrears. The impact analysis will be completed in 2021; the results will provide input for the evacuation plans to be elaborated in 2022 and for the integrated flood risk management strategy for the Wadden islands.

Collaboration with Regional Administrative Body North

The Wadden Region Consultation Committee and the Regional Administrative Body North are exploring the desirability of integrating the consultation committees in order to continue as a single administrative body. Officials of the parties concerned are elaborating proposals for the future governance structure.

6.8.2 Actions for linkage with other taskings and transitions

Linkage with other taskings is interwoven in the Preferential Strategy for the Wadden Region. The focus is on innovative dykes with added societal value, as is being substantiated by the ongoing dyke improvement projects (see 6.8.1).

Lauwersmeer Coast Manifesto

The Lauwersmeer Coast Manifesto addresses several regional taskings. Climate adaptation is covered in the improvement of the sea dykes, by focusing on mud flat development on the floodplains. Dyke improvement projects also involve opportunities for enhancing the natural environment and opportunities for boosting tourism and the economy. An exploratory study into freshwater-saltwater gradients in lake Lauwersmeer addresses the impact of salinisation in the Lauwersmeer region. The southern part will be kept fresh, thus improving the freshwater situation of the farmlands. The Kollumerwaard Test Farm is exploring options for the cultivation of saline crops.

Wadden Regional Agenda 2050

The Wadden Regional Agenda 2050 sets the course for the protection and development of the Wadden Region. The Regional Agenda focuses on integrated coastal development; the Wadden Region coasts are considered resilient and part of a single continuous coastal zone. The Wadden Regional Agenda 2050 and the Wadden Region Delta Programme have adopted the same guiding principles: involving residents in the design at an early stage; natural development of the Wadden Sea; integrated solutions; adaptive action in a dynamic environment. Coastal development and dyke improvement are linked wherever possible. Other taskings in the Regional Agenda include: increased waterlogging from the drainage pool; increased salt intrusion; prolonged periods of drought; and temperature rise. A periodically updated Implementation Programme to the Wadden Regional Agenda 2050 is elaborating ways to substantiate collaboration with, e.g., the Wadden Region Delta Programme. The first Implementation Programme is expected to be presented by the end of 2021.

6.8.3 Signs and new insights

Climate-adaptive action testing ground

In early 2021, Groningen hosted the Climate Adaptation Week, parallel to the Climate Adaptation Summit. The participants in the On the way to the Wadden Adaptation Action seminar made a widely supported appeal to the central government and the Delta Programme Commissioner to use the Wadden Region as a testing ground for climate-adaptive action. The focus must be on converting the battle for scarce space from competing into combining: opting for integrated solutions serving multiple purposes. Furthermore, an appeal was made to decompartmentalise financial resources and to widen the allocation scope of the Flood Protection Programme resources to, e.g., safety, the regional economy, nature, and regional identity.

Clay underneath grass cover

In 2020, the Noorderzijlvest regional waterauthorities conducted tests aimed at a more accurate determination of the strength of clay underneath grass covers. The tests revealed that clay is actually stronger than originally assumed. This reduces the flood protection tasking and the need for hard covers, which cuts the costs of dyke improvements. Furthermore, preservation of the grass cover fosters the quality of the environment and renders the dyke more sustainable and expandable. By mid-2021, the Wetterskip Fryslân regional waterauthorities will have the results of similar tests in Friesland.

Integrated flood risk management strategy

By mid-2021, the Wadden islands will embark on a concerted process of drawing up an integrated flood risk management strategy for each of the Wadden islands. The islands intend to involve, inter alia, Rijkswaterstaat, the province(s), the Security Region and the regional waterauthorities(s) in this process. The integrated strategies will address flood risk management (primary flood defences with sand replenishment, dynamic coastal maintenance, mud flat development, innovative dyke concepts); climate-adaptive and water-resilient spatial planning; and disaster control. Long-term coastal maintenance will also be covered. The process will commence with an analysis of existing and expected bottlenecks for each island, based on the stress tests and impact analyses. This will generate, e.g., an overview of vulnerable vital functions in the areas inside and outside the dykes. With this information, the parties will be elaborating no-regret policies and adaptive plans to tackle problems as they arise. Examples include conditions for the construction of electricity stations on floodplains and a climate assessment for zoning plans/environmental plans.

6.9 Elevated Sandy Soils

On the Elevated Sandy Soils, every drop counts. The Elevated Sandy Soils East and South regions have devised a set of stringent measures to tackle drought. The emphasis is on water retention in the soil. The North Netherlands freshwater supply region has completed a set of measures to be implemented in the second phase, covering the sandy soils in the northern part of Drenthe and the adjoining sandy soils in Groningen and Friesland.

6.9.1 Progress: implementation of the Preferential Strategy for the Elevated Sandy Soils

Phase I measures

Elevated Sandy Soils East

In 2020, a wide range of measures and projects was realised. The provinces mainly focused on improving freshwater supply in the purview of nature, such as the Deldernerbroek nature reserve. The regional waterauthorities directed their efforts primarily to restructuring brook valleys such as the Buurserbeek brook, to water retention in the Aaltense Goor nature reserve, and to the completion of innovative projects such as the Wilp Water Plant pilot. Municipal measures mainly involve disconnection of paved surfaces from the sewer systems and the realisation of green-blue structures in urban areas. An example is the Urban Brook in Enschede. Nature organisations are addressing, inter alia, the conversion of coniferous woods into deciduous woods (as has been done at Lonnekerberg), water preservation through resilient planning of brook valleys (as in the Ootmaanlanden area), and water retention through shallowing ditches. An overview of the progress made in the Elevated Sandy Soils East projects is provided on a new website.

Elevated Sandy Soils South

The main pillars for freshwater supply measures implemented by regional waterauthorities in the southern part of the Netherlands are resilient planning of brook valleys; the implementation of the Desired Groundwater and Surface Water Regime (GGOR); restoration of wet pearls of nature; and optimising the water supply. In 2020, the Aa and Maas regional waterauthorities completed the GGOR Biezenloop project. Other projects - GGOR Goorloop - Snelle Loop; Snelle Loop brook restoration; and Optimisation of system and chain measuring grids and data management - are under way. Furthermore, the Climate-active Built-up Areas Incentive Scheme has been expanded. The De Dommel regional waterauthorities carried out the Oude Strijper Aa, Kleine Beerze, and Essche Stroom projects in 2020, involving the resilient planning of brook valleys using grounds outside the nature network. A grant scheme is providing additional impetus to specific municipal water preservation projects. The Brabantse Delta regional waterauthorities is working on the restructuring of the Mark valley, upstream from the city of Breda. Furthermore, several “always good” measures have been taken, such as weir automatization to enable increased (upstream) water preservation. In 2020, the Limburg regional waterauthorities worked on a programme to optimise water levels through dynamic water level management, with more efficient regulation in the water system. The Loobeek, Venrays Broek, and Spurkt brook restoration projects and the Kanjel and Gelei restructuring projects are in progress. In Zuid-Limburg, rainwater buffers have been expanded and measures have been taken aimed at creating a climate-adaptive water system for buildings and infrastructure. In Gulpen, the Centre Plan was completed under the resilient redevelopment of the Gulp brook valley, by adjusting the flow profile. The Oude Geulmeander has been fully completed.

Additional Delta Fund incentive

In 2019, the East and South regions each received an additional incentive of EUR 2 million from the Delta Fund. This sum is primarily being spent on green-blue structures in urban areas, and in the South region also on water preservation at farms. Examples of projects completed in the East region are: Crescent Park in Harderwijk; a cistern in Apeldoorn; the City Green in Oldenzaal; and a blue vein and green lay-out for the Didam City Centre Plan. Examples in the South region include: De Waterpoort (Den Bosch); Gentiaan ditch (Son en Breugel); the Continue to Water Well project (Southern Agriculture and Horticulture Organization and regional waterauthorities); and urban water projects (Weert, Heerlen, Beek, Nederweert, and Sittard-Geleen). In addition, the two regions are jointly investing in drought studies.

Phase II measures

Freshwater supply strategy

In 2020, the Elevated Sandy Soils East and South freshwater supply regions compiled - in collaboration with the spatial adaptation Working Regions - an “ambition and strategy document” for phase II of the Delta Plan on Freshwater Supply. A transition in the current water system is needed in order to ensure a better balance between the supply of and demand for water. The emphasis must be on water retention in the soil rather than on water drainage. Spatial planning measures are also needed in order to boost water availability.

In a transition to a system involving water retention in the groundwater system, management of groundwater supplies

and groundwater levels is essential. Consequently, a major proportion of the new measures is aimed at supplementing groundwater stocks.

Phase II measures

The measures intended to be implemented during the period 2022-2027 have been accommodated in working programmes for the East and South regions, and in the North Netherlands Sandy Soils programme[33] (cf. Programme Strategy). Water system adaptation is achieved in various ways: taking physical measures in the main water system (brooks, canals, and other main waterways), measures in the tertiary water system (minor watercourses, ditches, and trenches), and the construction of infiltration provisions to collect water and have it absorbed by the soil, in both rural and urban areas. More efficient utilisation of water can be achieved through water-saving "watering systems", by improving the soil structure, and by reuse of water. In some cases, land use must be adapted. Pertinent options will be explored in a collective regional process. The regional measures are cost-effective, according to the social cost-benefit analysis (SCBA).

Programme Strategy

The realisation of the ambitions for a climate-resilient Elevated Sandy Soils region by 2050 calls for interconnected and specific measures. The Programme Strategy involves collaboration between a wide range of partners in the regions: provinces, regional waterauthorities, municipalities, nature organisations, farmers, and drinking water companies. Each partner is taking measures that resonate with its own role and responsibilities.

The Programme Strategy is divided into six-year planning periods, following the Delta Programme rhythm. For each planning period, a working programme is drawn up, in consultation with the governments and NGOs concerned. This sets out the intended investments, linked to the relevant types of measures, along with an indication of the scope (surface area/length/number). In 2021, the working programmes of the regions were endorsed. The actual measures will be developed and implemented in an area-specific manner. Should projects scheduled for a particular planning period suffer an unexpected delay, projects from a future planning period may be advanced to an earlier date. This will keep up the pace.

Elevated Sandy Soils East measures

On 3 December 2020, the Regional Consultation Committee endorsed the set of measures for phase II. The measures will give freshwater availability a maximum and structural boost, whilst concurrently enabling all those involved to participate. The following measures have been selected:

- flexible water level management in the main water system controlled by the regional water authorities;
- brook restoration and re-profiling of registered watercourses;
- controllable and underwater drainage;
- reducing local dehydration and water drainage;
- disconnecting paved surfaces from the sewer system and redirecting rainwater to storage or infiltration facilities;
- improving soil structure;
- targeted watering systems;
- company-specific incentive plans;
- adapting land use: converting function into space for water;
- converting coniferous woods into heathland or deciduous woods.

Elevated Sandy Soils South measures

In the period 2022-2027, the focus will be on supplementing groundwater stocks by implementing three categories of measures: efficient water consumption; a resilient water system; and spatial adaptation. The measures aimed at adapting the water system predominantly involve physical measures in the main water system, tertiary waterways, and infiltration provisions. More efficient water consumption is achieved through water-saving "watering systems", enhancing the soil structure, and reuse of water. In some cases, adaptation of the water system and of water consumption calls for changes in land use. Options to this end will be explored in a collective regional process.
All the parties involved in the Delta Plan for the Elevated Sandy Soils have mapped out the type and scope of the measures they aim to implement during the period 2022-2027. The East, South, and North regions are conforming to the same system and types of measures in this respect.

On the initiative of the French EPAMA organisation and the Aa en Maas regional waterauthorities, several parties in the international Meuse catchment area are joining forces to set up an Interreg project focused on climate adaptation.
The project needs to comprise cross-border projects specifically addressing low discharge issues. The following Dutch parties are involved: the Regional Consultation Committee for the Meuse, the Ministry of Infrastructure and Water Management, Rijkswaterstaat, and several drinking water companies.

Elevated Sandy Soils North measures

In the purview of Phase II, the North Netherlands freshwater supply region has rolled out a programme for the sandy soils in the northern part of Drenthe and the adjoining sandy soils in Groningen and Friesland. The points of departure underpinning the programme are identical to those for the East and South regions: a programme strategy to achieve climate resilience by 2050. A transition in the

[33] The North Netherlands Sandy Soils programme is a component of the programme of measures for the North Netherlands freshwater supply region.

current water system is needed in order to ensure a better balance between the supply of and demand for water. The emphasis must be on water retention in the soil rather than on water drainage. Spatial planning measures are also needed in order to boost water availability.

In 2020, the North regions compiled a set of measures on the basis of a survey, following the same method as the East and South regions. The survey resulted in an identical list of proposed customised measures. Similar to the East and South regions, the North region features collaboration between a wide range of partners: provinces, regional waterauthorities, municipalities, and farmers. Each partner is taking measures that resonate with its role and responsibilities.
The following measures have been selected:

- brook restoration and re-profiling of registered watercourses;
- controllable and underwater drainage;
- reducing local dehydration and water drainage;
- redevelopment of urban areas;
- improving soil structure;
- targeted watering systems;
- company-specific incentive plans;
- adapting land use: converting function into space for water;
- area-specific action in concert with all the stakeholders, aimed at freshwater retention and/or water saving.

Water availability
In 2021, the Elevated Sandy Soils will present a comprehensive perspective of water availability.

6.9.2 Actions for linkage with other taskings and transitions

The East and South regions have adopted an area-specific approach in their realisation of freshwater supply taskings. Measures are almost always being implemented in combination with measures relating to other taskings.

Linkage with the Delta Plan for Agricultural Water Management

In the field of agriculture, the Delta Plan on Freshwater Supply seeks to link up with the Delta Plan for Agricultural Water Management. Examples of projects: Fertile Cycle; Farmers for Drinking Water 2.0;'t Klooster Agenda; and an Underwater Drainage pilot. Within this framework, several farmers have already taken measures on their land, such as level-driven drainage and improving the soil structure.

More space for water

The long-term schedule up to 2050 focuses increasing attention on creating more space for water. Rendering water systems resilient calls for shifts in the use of land. As yet, water management is predominantly subservient to the utility functions. The point of departure for a future-proof freshwater supply is that local water availability is taken into account in the allocation of water-requiring functions to an area.

Priority areas

Priority areas have been designated in the working programmes of the East and South regions (see Background Document D). A major proportion of the intended freshwater supply measures will be implemented in these areas, via area-specific and integrated projects, taking account of other taskings and transitions such as biodiversity, circular farming, and climate adaptation. The regional Environmental Agenda South is also focusing on the priority areas set down in the Elevated Sandy Soils Working Plan 2022-2027 (South region). This Agenda addresses taskings in the water domain: water availability and drought.

On the advice of the Drought Policy Platform, the Rhine-East Regional Consultation Committee has set down a collective groundwater agenda, comprising five recommendations for sustainable groundwater stock management. The agenda constitutes the basis for a comprehensive administrative debate on the implementation of measures to boost water availability and the resilience of the water systems. In the South region, the groundwater agenda is being addressed by the two provinces, in consultation with the other governments and NGOs involved. In the province of Noord-Brabant, the Broad Administrative Soil Consultation Body has been established to coordinate the efforts.

6.9.3 Signs and new insights

Implementation in a fix

In the years ahead, a wide range of taskings and transitions will be incorporated into area-specific processes and implementation programmes: nitrogen issues, climate adaptation, the energy transition, and the forest strategy. This could cause bottlenecks in the regional implementation capacity. The regional authorities and the central government must collectively seek solutions in order to prevent stagnation of implementation efforts. Such solutions will involve, inter alia, adequate - administrative - regional-level partnerships, sufficient implementation capacity, and an appropriate combination of instruments.

Radical transition needed

The "Drought in the sandy areas of South, Central, and East Netherlands" study confirms that in the long run, optimising the water system will not suffice for the Elevated Sandy Soils: a radical transition is essential. Consequently, the Elevated Sandy Soils are committed to groundwater stock management.

Creating space

On a structural basis, more room must be reserved for water in order to enable raising groundwater levels and coping with peak discharges. This poses a major challenge in terms of organisation, funding, administration, and communication. The challenge cannot be addressed through water domain measures only; in many cases, other taskings or transitions in urban and rural areas are directive for the short-term implementation. Part of the space required is made available through land acquisition. For a substantial proportion, space needs to be created through multi-functional use of space. These issues are high on the regional agendas. Wherever necessary, pertinent consultations will be held with national parties.

New research programme

The Lumbricus research programme has generated information on climate-resilient soil and water systems in the purview of phase II of the Delta Plan on Freshwater Supply. This has provided more clarity as regards how soil quality improvement and climate-adaptive drainage can foster the freshwater supply. As not all of the questions have been answered yet, the same parties have set up the KLIMAP (climate adaptation in practice) research programme. In terms of set-up, this programme is similar to Lumbricus. It comprises several tracks: testing grounds, future explorations, and adaptation routes.

CHAPTER 7

Delta Fund

New wooden pile dyke, Eemmeer lake, May 2021

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 regional water system measures being implemented by provinces, regional waterauthorities or municipalities. Such measures are not funded from the Delta Fund. The Delta Fund also covers expenditure that does not fall under the Delta Programme, such as expenditure related to Management, Maintenance, and Replacement (Item 3) and the expenditure pertaining to Rijkswaterstaat overhead costs associated with the Delta Fund goals.

The paragraphs below outline the developments in the Delta Fund, the resources contributed by the other Delta Programme partners, the financial taskings of the Delta Programme up to 2050, and the conclusions of the Delta Programme Commissioner regarding the financial security of the Delta Programme.

7.1 Developments in the Delta Fund

Delta Fund budgets

For the period 2022-2035, a sum of some 19 billion euros will be available in the Delta Fund, which brings the annual budget to an average of nearly 1.4 billion euros. This is evident from Table 16, which reflects the itemised and total Delta Fund budgets for the budget year 2022 and for the period 2022-2035. Figure 10 reflects the itemised development in the budgets for the years up to and including 2035.

In accordance with the structure agreed upon, this budget covers the Delta Fund as extended by another year, i.e., up to and including 2035. After deduction of ongoing commitments (primarily involving management, maintenance and replacement, Rijkswaterstaat network expenses, and the central government contribution to the Flood Protection Programme), this generates new scope for investment. Some of this scope for investment will be directly allocated to ongoing reserves.

Tabel 16: Delta Fund budgets in 2022 and overall, based on the Draft Budget for 2022 (in millions of euros)

		2022	Overall (2022-2035)
Item 1	Flood risk management investments	568.4	6,449.3
Item 2	Freshwater supply investments	63.0	269.2
Item 3	Management, Maintenance, Replacement	232.3	3,055.8
Item 4	Experimentation	21.8	975.4
Item 5	Network-related costs and other expenditure	339.4	7,511.4
	of which non-allocated budget available for investment	*3.5*	*1,053.5*
	of which reserves	*15.3*	*2,065.6*
Item 6	Contribution from other national budgets	-	-
Item 7	Water quality investments	103.5	914.7
Total Delta Fund expenditure		**1,328.4**	**19,175.8**
Average annual expenditure			1,369.7

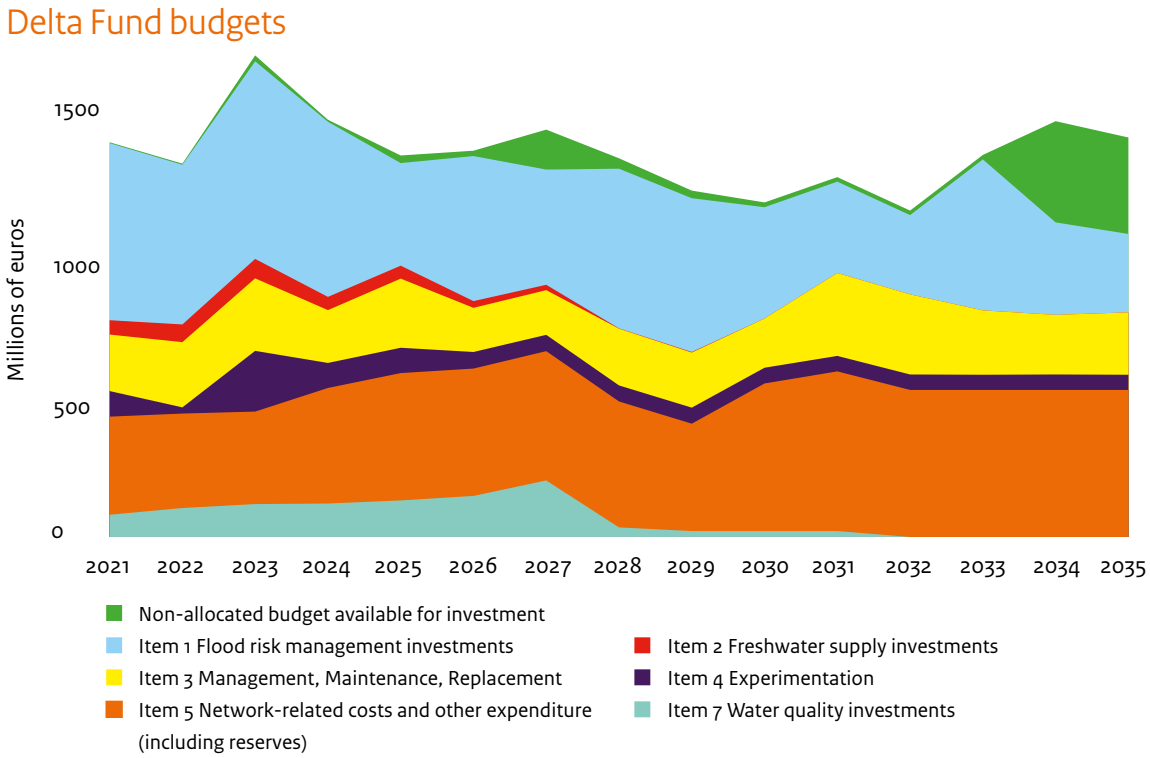


Figure 10 *Delta Fund budgets, itemised and total, based on the Draft Budget for 2022*

On balance, 0.3 billion euros will be available in 2035 for water-related priority policy taskings. In the years ahead, these investment funds will be allocated in an adaptive manner, based on ongoing processes such as the assessment of primary flood defences, the Integrated River Management programme, the Delta Plan on Freshwater Supply, and the Delta Strategy regarding Water Quality and Freshwater Supply. In the period 2020-2035, the non-allocated budget available for investment will total 872 million euros. The largest share of this non-allocated budget will be available with effect from 2034, as reflected in Figure 10. The scope for investment includes risk reserves to a total of some 724 million euros. In the Delta Fund budget for 2022, the Climate Adaptation Incentive Scheme, for which a sum of 200 million euros from the Delta Fund has been set aside, has been transferred from the policy reserves to budget item 2.02 (Freshwater supply investments).

Policy reserves

Item 5 of the Delta Fund encompasses reserves for foreseen future expenditure relating to programmes and projects for which an Initial Decision is still pending, in some cases, subject to co-funding by other parties. The Draft Budget 2022 of the Delta Fund features the following reserves that are relevant to the Delta Programme:

- Regional flood defences managed by the central government, 192 million euros. Within the non-allocated budget available for investments, a sum has been set aside to have the regional flood defences managed by the central government meet the standards set out in the Water Decree.
- Integrated River Management (IRM), 686 million euros and after 2035, 80 million euros annually up to and including 2050. Under this programme, the river-related central government taskings, such as flood risk management, shipping, water quality, water quantity, riverbed situation, and vegetation management are addressed in an interconnected manner in order to achieve synergy in terms of planning and implementation. Furthermore, such taskings are being linked to urgent regional taskings wherever this would foster synergy. Under the Integrated River Management programme, the central government and the regional authorities are developing further policy to substantiate the Preferential Strategy for river flood protection, as stipulated in the National Water Plan 2016-2021. This is also substantiating the review of the Preferential Strategy for the Rivers, as outlined in Delta Programme 2021.
- Freshwater supply, 561 million euros. For the second set of Freshwater Supply measures, a sum of 250 million euros has been set aside for the period 2022-2027. This will be used to continue the policy (follow-up to the first set of Freshwater Supply measures) being pursued to prevent damage caused by drought and salinisation. The droughts in 2018, 2019, and 2020 have shown that we need to step up our efforts to prevent such problems as experienced by the Elevated Sandy Soils and the IJsselmeer Region. To this end, with effect from 2028, an annual sum of 42 million euros will be set aside in

the Delta Fund, totalling 336 million euros in the period 2028-2035. Subsequently, 42 million euros will be added to the reserve annually, in the expectation that this issue will continue to need addressing.

- Major Waters Programme Strategy (PAGW), 515 million euros. This will be spent on the preservation and enhancement of nature and water quality, with a focus on future-proof major waters featuring high-grade nature that combines well with a powerful economy. The Major Waters Programme Strategy covers the period up to 2050 inclusive. For the taskings relating to the periods 2030-2040 and 2041-2050, annual sums of 85.8 million euros and 66 million euros will be added to the policy reserves to fund the urgent taskings and measures to sustain a resilient ecological network.
- Research, 22 million euros. These resources have been compiled into a research reserve, earmarked for research in the purview of the comprehensive water tasking. The studies will address such issues as flood risk management, rivers, water quality improvement, and water quantity (freshwater supply). This reserve can be used in subsequent years, once the research taskings and their funding have been elaborated in more detail. A sum of 2 million euros will be added to the policy reserve annually.
- Spatial Adaptation Knowledge Programme, 14 million euros. In addition to resources for the implementation of measures, resources are also required for gathering and sharing knowledge in the purview of the Delta Plan on Spatial Adaptation, as the preparations for the Climate Adaptation Incentive Scheme have demonstrated. Funding is needed for, e.g., further research into the risks of climate change; research to substantiate measures; the development of a monitoring system; communication; maintenance of the Spatial Adaptation Knowledge Portal ruimtelijkeadaptatie.nl; the Climate Impact Atlas; and the Together Climate-proof Platform.
- Statutory Assessment Tools 2035, 25 million euros. Managers of primary flood defence systems (regional waterauthorities and the central government) have a statutory duty to report to the Minister on the hydraulic condition of these flood defences, as a minimum every twelve years. Further regulations regarding the assessment of the flood defences are set down by Ministerial Order. Such regulations are referred to as the "Statutory Assessment Tools". The scope of this programme encompasses software and the further development of software; technical guidelines; regulations; procedures; support; management; and maintenance. The reserve is intended to cover the required annual costs of this programme, totalling 2 million euros per annum in the period 2024-2035.
- National Groundwater Reserves Knowledge Base, 2.7 million euros. The Subsoil Framework Vision sets out that the central government is to designate National Groundwater Reserves and to provide a protection regime. The three-dimensional demarcation and protection of the National Groundwater Reserves requires several steps: mapping existing data; expanding and updating data; coordination and communication with stakeholders; recording mapping data in the Basic Subsoil Register; setting down the protection regime; maintenance and updating data.

7.2 The financial security of the Delta Programme

The Delta Fund constitutes one of the financial foundations of the Delta Programme. It provides the resources for the future flood protection of our country and for securing a sufficient supply of fresh water. Assuming an annual extrapolation by 1.4 billion euros, the Delta Fund will have some 21 billion euros available for the implementation of the Delta Programme in the period 2036-2050. A proportion of these resources will be available for projects that are considered to be covered by the Delta Programme, but not the entire sum. The Delta Fund also covers government expenditure that falls beyond the scope of the Delta Programme, such as the costs of management and maintenance of the main water system (Item 3), and network-related costs and other expenditure (a major proportion of Item 5).

The tentative extrapolation in Figure 11 is based on the year 2035. In this respect, the Delta Programme Commissioner has assumed that the regional waterauthorities will continue the series earmarked for new flood protection measures after 2028, in accordance with the agreements between the central government and the regional waterauthorities, as anchored in the Water Act. The extrapolation shows that out of the approx. 1.4 billion euros going around annually in the Delta Fund in the period 2036-2050, an annual sum of approx. 0.7 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, an annual sum of approx. 0.7 billion euros will thus be available in the period 2036-2050; this involves the budget for the series available / earmarked for new flood protection measures by the regional waterauthorities (Items 1 and 2) and the reserves relevant to the Delta Programme (Item 5). The investment budget available in the period 2036-2050 would thus total approx. 12 billion euros. In the period from 2015 up to and including 2035, approx. 13.4 billion euros will be available for the Delta Programme, based on realised and estimated budgets.

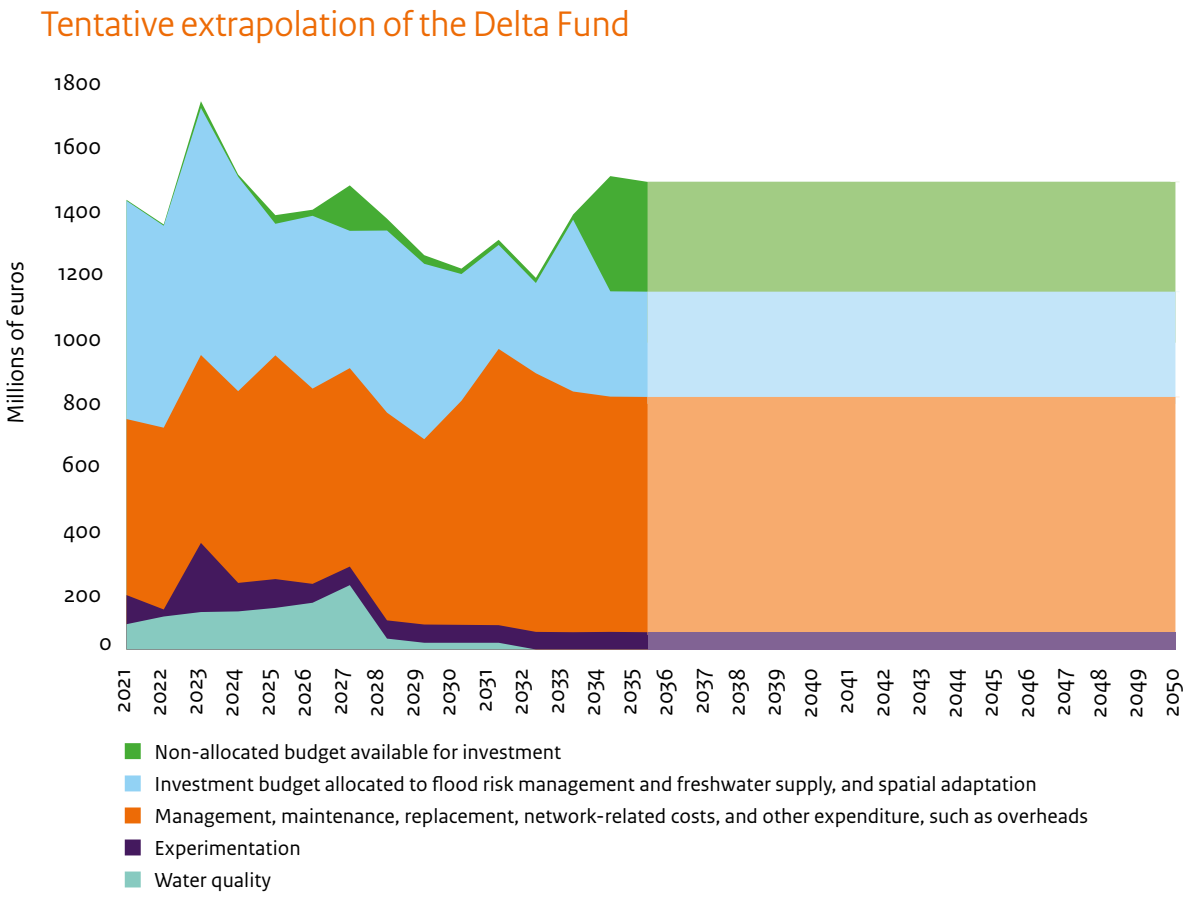


Figure 11 *Tentative extrapolation of the Delta Fund*

This means that, from the roll-out of the Delta Programme up to 2050 inclusive, a total sum of some 25.4 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 regional waterauthorities, such as the provinces and municipalities, are expected to provide.

The Delta Programme tasking relating to the period 2015 - 2050 was reviewed in Delta Programme 2021 and estimated at 25.9 billion euros (price level 2020). In line with wage and price adjustments, the budgets have been adapted to price level 2021. Consequently, a proper comparison between the tasking and the budgets requires annual adjustment of the tasking for inflation, as explained in Delta Programme 2021. Adjusted to price level 2021, the costs entailed in the Delta Programme taskings are estimated to total 26.0 billion euros[34]. With a tentative budget of 25.4 billion euros and an indexed cost estimate of 26.0 billion euros, the Delta Programme features a budgetary tension (deficit) of an estimated 0.6 billion euros.

Based on the tentative extrapolation of the Delta Fund up to 2050 inclusive and the reviewed estimate of the total costs of the Delta Programme, the Delta Programme Commissioner has come to the provisional conclusion that the taskings and the funds available are sufficiently balanced.

However, the budgetary situation is still a cause for some concern, as the budget offers little leeway to accommodate unforeseen developments or setbacks. Furthermore, bodies such as the IPCC have been sounding the alert about an acceleration in climate change and the new, heavier taskings that this will generate. Following the droughts of 2018 and 2019, such concern is particularly fuelled by this summer's flooding and waterlogging in the province of Limburg. According to the Delta Programme Commissioner, additional funding is also required for the management and maintenance of (wet) infrastructure, but against this backdrop, this should not compromise the non-allocated budget available for investment which is essential for the implementation of the Delta Programme. In her letters

[34] The inflation correction of the Delta Programme cost estimate is based on the compound index used by Rijkswaterstaat. For the period from 1 January 2020 to 1 January 2021, it amounts to 0.2%. This rather low rate can be explained by the sharp fall in several components of this "basket" during the global situation (particularly fuel, gravel, and road construction bitumen). From November 2020, prices of these volatile construction materials have been rising considerably, but this rise is not yet manifest in index year 2020.

dated 17 December 2020 and 10 June 2021, the Minister of Infrastructure and Water Management left the solution to the tentative budget deficits for the year 2024 and beyond up to the new Cabinet.

In short, the financial security of the Delta Programme up to 2050 is currently up to par, provided that the solution to the preservation deficits will not compromise the non-allocated budget available for investment. This conclusion has not yet factored in the consideration that climate change may develop at a pace that could dictate acceleration and upscaling of the measures.

7.3 Resources from other partners

In addition to the central government, the regional waterauthorities, the provinces, and the municipalities are also investing in the Delta Programme taskings. Along with the central government, they are co-funding measures set out in the Delta Plans on Flood Risk Management, Spatial Adaptation, and Freshwater Supply. The Ministry of Education, Culture and Science is matching water project investments under the Heritage Deal (budget via "Heritage Counts" policy).

The Spatial Adaptation Working Regions, involving collaboration between regional waterauthorities, provinces, and municipalities, are co-funding two-thirds of the costs of measures they are submitting for grants from the Climate Adaptation Incentive Scheme (up to a maximum of the sum set down for each Working Region on the basis of a formula).

Regional waterauthorities

Investments

The regional waterauthorities are investing in measures for the regional water system and contributing half (approx. 6 billion euros out of the approx. 12 billion euros for 2015-2050) of the Flood Protection Programme funding.

Regional waterauthorities keep flood defences up to par; they manage watercourses and pumping stations; they operate tens of thousands of minor hydraulic engineering structures; and take a wide range of planning measures in order to ensure a continuous and sufficient (not too much, not too little) supply of good-quality water. In addition, regional waterauthorities operate wastewater purification plants to purify water discharged by businesses and households.

As a result of climate change, the rising sea level, soil subsidence, urbanisation, salinisation, stricter environmental standards, the necessary energy transition, and the closure of (raw material) cycles, this infrastructure calls for substantial investments on the part of the regional waterauthorities. The regional waterauthorities' investment agendas for the years ahead show that they will collectively be investing an annual average of 1.8 billion euros in the period 2021-2024 (see Figure 12). Figure 13 reflects how this sum is distributed across the tasks for each regional waterauthorities.

Estimated annual investment expenditure of the regional waterauthorities, 2021-2024

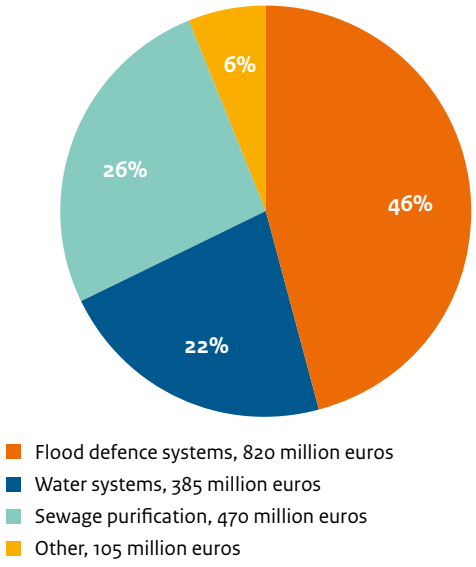


Figure 12 *Average annual investment expenditure of the regional waterauthorities in the period 2021-2024, by task*
Source: Association of Dutch Regional Water Authorities, July 2021

Flood Protection Programme

Investments in flood defence systems account for the largest share in the overall regional waterauthorities investment volumes (see Figure 12). The bulk of the investments go to the primary flood defences. In 2011, the regional waterauthorities joined the Flood Protection Programme, whereupon funding of the improvement of primary flood defences became the shared responsibility of the regional waterauthorities and the central government. Since 2014, investments by the regional waterauthorities and the central government have been on a par. Their contributions are booked as revenue in the Delta Fund and have been incorporated into Figure 10. With effect from 2016, the sums have been subject to annual indexation.

Estimated overall investment expenditure of the regional waterauthorities, 2021-2024

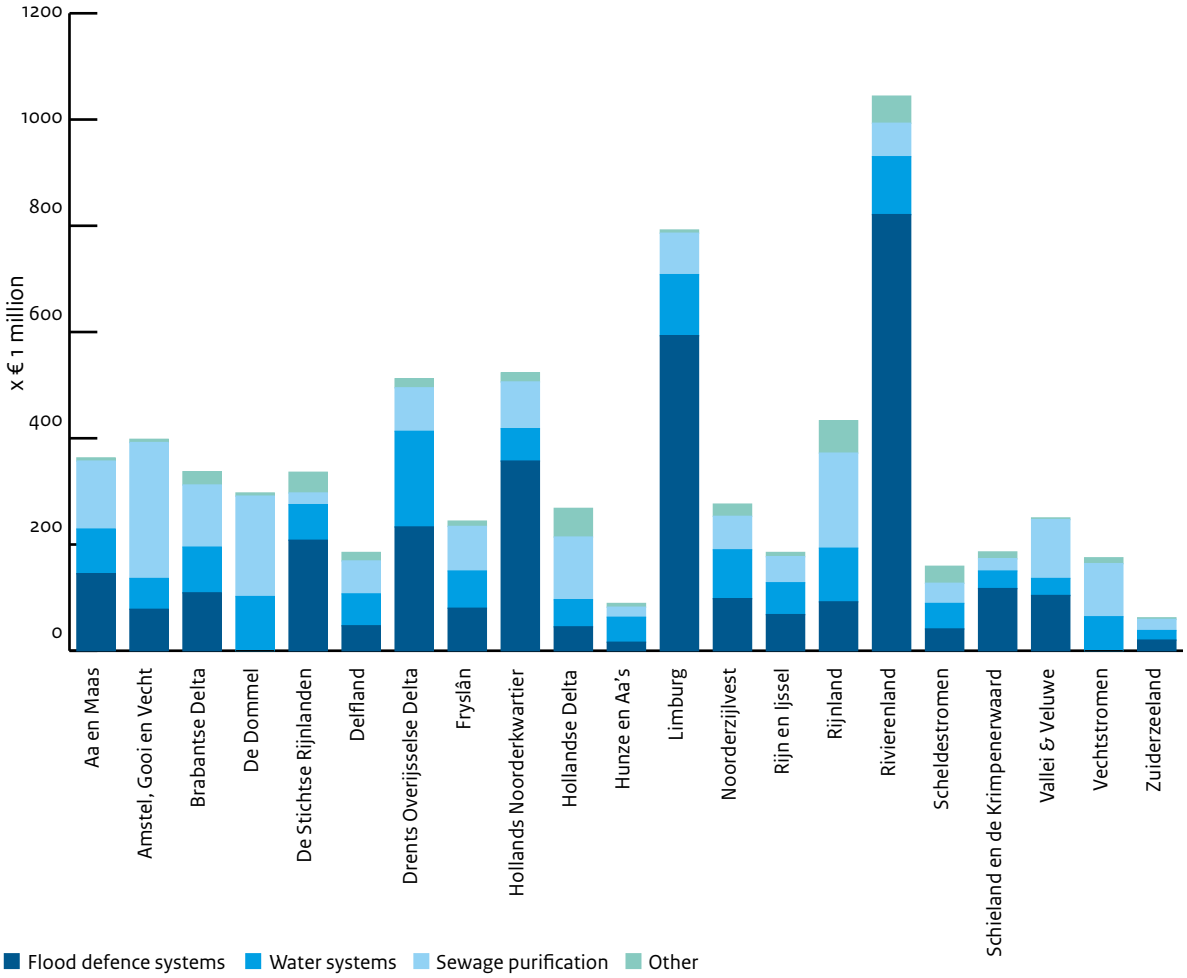


Figure 13 *Intended total investment expenditure in the period 2021-2024, by regional waterauthorities and by task*
Source: Association of Dutch Regional Water Authorities, July 2021

Provinces

The provinces are contributing to the Delta Programme in various ways: by allocating staff to the various programme teams or within their own organisations, by co-funding sub-programmes, or by contributing to research or the implementation of measures. The provincial efforts are mainly focused on linking the various regional taskings to the Delta Programme taskings, e.g., by adopting an integrated approach to agriculture, nature, and freshwater supply issues, or by connecting dyke improvement to the enhancement of environmental quality.
The scope of their efforts - in terms of staffing and funding - differs from one region to the next and is related to the provincial interests in the region concerned. Concrete examples are provided in Chapters 3 to 6 inclusive.

In flood risk management projects, the provinces are investing in linkage opportunities and area developments that foster the spatial development and the spatial quality of the area concerned.

The provinces play a coordinating role in the Water Availability process. Several provinces have initiated regional processes in collaboration with regional waterauthorities and farmers (Dutch Federation of Agriculture and Horticulture LTO). Water availability and water quality are addressed in an interconnected manner within groundwater protection areas and in the so-called regional drinking water dossiers and the associated implementation programmes[35]. Furthermore, some provinces have invested in the Spaarwater climate adaptation pilot. At several locations, this pilot has explored ways to improve the freshwater supply to farmland. Other

[35] See, e.g., Rhine Delta Water Collection River Dossier. River dossiers describe the rivers Rhine and Meuse as sources for the drinking water supply and outline the tasking involved in securing this source.

ongoing programmes are focused on brook restoration measures, water preservation on sandy soils, studies into the optimisation of water systems, and future-proofing public drinking water provisions, such as the review of protection policy. Under the Drought Policy Platform, the provinces have contributed to the substantiation of the policy recommendations regarding groundwater and vulnerable nature; they are currently engaged in the implementation of these recommendations.

In terms of spatial adaptation, the provincial forte mainly lies in connecting climate adaptation to major spatial taskings, such as housing, the energy transition, and regional spatial planning. In Working Regions and freshwater supply regions, the provinces are conducting (regional) stress tests, along with regional partners, to map out spatial adaptation taskings. Agreements on the measures required are made via risk dialogues. The outcomes are set down in implementation programmes (see concrete examples in Chapter 5). In the years ahead, the provinces - along with municipalities, regional waterauthorities, and the central government - will give additional impetus to climate adaptation efforts and the implementation of measures, as stipulated by the Administrative Agreement on Climate Adaptation.

Municipalities

Municipalities are addressing climate change in several capacities. In their capacity of policymaker and regulator, municipalities bear responsibility for, e.g., embedding climate adaptation in the municipal environmental vision documents, (sector) programmes, and environmental plans. In addition, they set down regulations for rainwater and groundwater drainage in sewer plans. Rainwater is increasingly stored or drained above ground, for example, via wadis, green areas, and roads structured for that purpose. In their capacity of owner, many municipalities are investing in climate-proofing societal real estate (such as schools) and public areas, for example, by introducing height differences or by creating more greenery and open water. Furthermore, many municipalities are adopting an initiating role, by taking the lead in new initiatives involving multiple parties, such as corporations and regional waterauthorities. In such efforts, they can also act as co-financier to give impetus to initiatives and keep the process going. At the Working Region level, municipalities and regional partners are mapping out spatial adaptation taskings on the basis of (regional) stress tests and setting down agreements on the measures required via risk dialogues.

The Municipal Water Tasks Monitor shows that in 2021, municipal revenue earmarked for urban water management totalled 1.678 billion euros. Approx. one-third of the expenditure goes to the repayment of loans for facilities constructed earlier and the interest on such loans. Slightly less than half is earmarked for the management of the sewerage systems and other wastewater, groundwater, and rainwater provisions. The remaining part is used to pay for investments straight from the taxes levied or to save for future replacement taskings.

Overview of Background Documents and maps

Historic houses on the Leuvehaven and the Korte Geldersekade, Dordrecht, April 2021

Overview of Background Documents and maps

Background Document A
Delta Programme Signal Group Advisory Report 2020

Background Document B
Physical Environment Consultative Body advisory report and response by the Delta Programme Commissioner

Background Document C
Progress report: Working on freshwater supply in the Delta - Looking back on 2020 and looking ahead to 2021-2022

Background Document D
Delta Plan on Freshwater Supply 2022-2027

Background Document E
Spatial adaptation monitoring report

Background Document F
Progress report on National Vital and Vulnerable Functions Strategy

Background Document G
Report "Water-based"

The background documents to Delta Programme 2022 can also be downloaded via
https://www.deltaprogramma.nl/deltaprogramma/publicaties-per-deltaprogramma

Maps
Map 1 Freshwater supply policy taskings and measures
Map 2 Focus on the Rivers synthesis map

Colophon

Delta Programme 2021 is a publication of the Ministry of Infrastructure and Water Management, the Ministry of Agriculture, Nature and Food Quality, and the Ministry of the Interior and Kingdom Relations.

Compilation
Delta Programme Commissioner's staff

Draft, design, production
Delta3, The Hague

Coordination and supervision
Delta3, The Hague

Text editing
Renske Postma (Met Andere Woorden)
Ria de Wit (Helder en Duidelijk)

Photography
- Floating houses near Buiksloterham, Amsterdam, July 2021: Remco Remeijer
- Glass flood defence in flood-prone village of Neer, Limburg, July 2021: Jos van Alphen
- Melting ice arch, Antarctica, 2018: Arnoud Apituley/KNMI
- Field test involving the use of tidal sand to combat piping, Hedwige polder, May 2021: Louis Meulstee
- Meandering Essche Stroom brook, Brabant, May 2021: Jos van Alphen
- Pavement stones making way for façade gardens, Rotterdam, June 2021: Tineke Dijkstra
- North Sea Canal ports, Amsterdam, 2018: Port of Amsterdam
- New wooden pile dyke, Eemmeer lake, May 2021: Vallei en Veluwe regional waterauthorities
- Historic houses on the Leuvehaven and the Korte Geldersekade, Dordrecht, April 2021: Tineke Dijkstra

Map

1	Freshwater supply policy taskings and measures	MUST
2	Focus on the Rivers synthesis map	Defacto

The Netherlands is a low-lying country with an abundance of water. The national Delta Programme is in place to protect the Netherlands from flooding, to ensure a sufficient supply of fresh water, and to contribute to rendering the Netherlands climate-proof and water-resilient. The national Delta Programme website outlines the progress being made in the execution of the work on our delta.

The national Delta Programme involves concerted efforts by the central government, the provinces, municipalities, and regional waterauthorities, with active participation from research institutes, NGOs, residents, and businesses.

WWW.DELTAPROGRAMMA.NL

NATIONAL DELTA PROGRAMME

GIVING IT OUR ALL FOR A SAFE AND LIVEABLE DELTA

This is a publication of the:

Ministry of Infrastructure and Water Management
Ministry of Agriculture, Nature and Food Quality
Ministry of the Interior and Kingdom Relations

September 2021