



Delta Programme 2012

# Working on the delta

Acting today,  
preparing for tomorrow





The Delta Programme is a nationwide programme. The national government, provinces, municipalities and regional water boards work together with input from social organizations and the business community. The objective is to protect the Netherlands from flooding and to ensure adequate supplies of freshwater for generations ahead.

### Three generic sub-programmes with nationwide coverage:

Safety

Freshwater

New urban developments and restructuring

### Six area-based sub-programmes:

-  Rhine Estuary-Drechtsteden
-  Southwest Delta
-  IJsselmeer region
-  Rivers
-  Coast
-  Wadden region



This map shows the locations, waterways and bodies of water, engineering structures and projects referred to in the Delta Programme.



*Safety*



*Freshwater*



*New urban developments and restructuring*



*Coast*



*Rhine Estuary-Drechtsteden*



*Southwest Delta*



*Rivers*



*IJsselmeer region*



*Wadden region*

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*Photo page 2-3:  
The Meuse at Venlo with flexible high water barriers.  
Peel & Maasvallei water board has positioned  
aluminium slabs to hold back flooding.*

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# 1 Introductory summary

**The national Delta Programme stands for a safe and attractive Netherlands, now and tomorrow. The Delta Programme takes a dynamic and down-to-earth approach to protecting this country from flooding while keeping the supply of freshwater on track. DP2012, the second report of the Delta Programme, came about under the direction and at the suggestion of the Delta Commissioner. National government, the regions, social organizations and the business community were all jointly involved. The DP2012 has been adopted by the Dutch Cabinet. Last year, the first report on the Delta Programme (DP2011) dealt with the approach to work to be carried out in the period up to 2015. This year's report studies and analyses tasking around flood risk management and freshwater supplies. The resulting findings and conclusions make up the core of DP2012.**

Every year, a progress report on the work on the delta is adopted in the Delta Programme, along with the national budget. Plans for necessary measures and provisions form part of this<sup>2</sup>. Up to 2015, alongside ongoing programmes and projects<sup>3</sup>, the emphasis of the Delta Programme will lie on preparation of the Delta Decisions. These political decisions determine the future of the Dutch delta. They provide direction for the work as from 2015: 'the Delta Works of the future'. They follow on from the current implementation programmes and projects. In this way the Delta Programme develops as an increasingly specific programme for flood risk management and freshwater supplies.

Protection against water is an existential and hence unifying topic. With the Delta Programme we aim to avoid what happened in this country last century<sup>4</sup> and in recent years in other countries: severe flooding and major damage due to drought. There has been large scale flooding in countries including France, the United Kingdom, Poland, and further afield in

Australia, Brazil, Pakistan, the United States, and many more. Severe droughts occurred in places including Spain, Greece, southeast England, and increasingly, far away in countries such as Japan and Australia. Avoiding a disaster requires a special approach such as the Delta Programme. Indeed, almost 60% of the Netherlands is vulnerable to flooding; and most people live precisely in the lowest-lying areas – which also house a large part of economic activity.

When it comes to water, the Netherlands is a world leader. The country combines expertise amassed over centuries with new knowledge and innovative techniques. Our water sector is a leader. The national Delta Programme forms a significant impulse in building on this authoritative position. It offers chances to test innovations at home, which can then be exported. Not for nothing is 'Water' designated as leading sector in the Netherlands.

Considerable effort is being devoted to compliance with current, statutory flood protection standards. Work is not yet complete but much has already been achieved, as was apparent during the last high water season, thanks to the Room for the River and Meuse Works programmes. Results were also achieved in reinforcing the weak links along the coast. Even so, there is still plenty to do, as will be clear from the findings of the recently completed third Safety Assessment which covered existing primary flood defence systems. Meanwhile, flood protection standards will be updated in order to realize a level of protection which – where necessary – improves on the current situation in terms of population numbers and increased economic value behind the dykes.

While there was still a high water situation in the region of the major rivers in January 2011, a few months later we were confronted with the issues of drought and low river discharges followed by a wet summer. Spring 2011 was exceptionally hot and dry across Western Europe. April in the Netherlands was the hottest since readings began in 1706. The first week of May showed a greater shortfall in rain than in the extreme drought of 1976. The water managers did what they could within the limits of the current system, by deploying alternative water distribution

1 Decision to institute the office of Delta Commissioner, Government Gazette 2010 No. 1574 – 1 February 2010; also draft 32 304 "Delta Act Flood risk management and Freshwater Supplies".

2 The draft Delta Act determines that the first six annual Delta Programmes will be as detailed as is reasonably possible in setting out such measures and provisions as are to be implemented, and the resources required. In the ensuing period, there is to be an indicative description of the required measures, provisions and resources, for twelve consecutive years.

3 For example: Room for the River, Meuse Works, Flood Protection Programme -2 and Weak Links on the Coast.

4 See DP2011, p. 26.

and adapted water levels. July was very wet with twice the national average level of precipitation - with substantial regional differences. On the basis of national averages heavy rain meant a drastic reduction in precipitation shortfall to a normal level for July.

2011 showed the importance of getting Dutch flood risk management and freshwater supplies in order. We need to adjust to changes which are already being measured: subsidence and the rise in sea level as well as changes which have been partially measured and anticipated: more marked peaks and minima in discharges of river water and rain, dry summers, salinization of parts of the country and spatial and economic developments. The Delta Programme works to this end jointly with government, provinces, regional water boards and municipalities. The approach is down-to-earth, with clear planning and intensive interaction with social organizations and the business community.

There is uncertainty around the precise impact of climate change during the next several decades and it is hard to predict the effects accurately for between fifty and a hundred years ahead. The same applies to spatial and economic developments. A down-to-earth and realistic stance is needed here. It would be wise to keep the options open for measures which are not needed as yet. It would also be advisable to operate strategies offering chances to switch to other strategies or to carry out measures in such a way as to enable later expansion or adjustment. This down-to-earth approach within the Delta Programme is called 'adaptive delta management'. It is about doing what is necessary, neither too much nor too little, without ruling out future options.

The water system features so-called 'tipping points' after which the current system ceases to meet requirements<sup>5</sup>. Timely, pro-active responses and careful preparation for possible major interventions are also part of adaptive delta management. Adaptive delta management and the continuity of the Delta Programme can prevent tardy or mis-investments. It links short-term issues and related investment.

The Delta Programme is an integral programme. Living and working in a safe delta cannot be taken for granted. A densely populated and prosperous country like the Netherlands needs to constantly invest to prevent increasing vulnerability. The tasking around

water - safety and freshwater - is central here, as evidenced by the motion submitted by the Member of Parliament Anne-Wil Lucas and others<sup>6</sup>. The approach seeks to actively establish linkage with other ambitions on the side of government, provinces, regional water boards and municipalities - but also the social organizations and businesses - in other policy fields such as the economy, natural environment and spatial development. This is a prerequisite for seeking smart combinations and synergy. However, this cannot be allowed to decelerate work on the tasks. The experience gained with the river programmes is relevant here.

A consistent approach to the Delta Programme is essential for broad-based conclusions. The inter-connectivity in our water system is a given, but a cohesive approach to finding solutions is a choice. With the Delta Programme we are making this choice for a cohesive approach. To take an example, this year regional and national analyses give us a sharp insight into the issue of freshwater and drought in the framework of the programme. No such comprehensive picture of the constraints would have been possible without the Delta Programme. Hence, the findings form an accepted basis for the future. The same applies to flood risk management: the Administrative Agreement on Water agreed on setting up a cohesive flood risk management programme within the Delta Programme. The completed studies into updating flood protection standards - which are due this year - are relevant in this context.

The chosen methodology enables broad-based acceptance of the facts. Broad-based solutions are arrived at and parties understand the choices to be made.

### Relevant developments

The present Dutch government dates from October 2010. There have been shifts in emphasis and shifts in policy principles that are relevant to the Delta Programme. Important aspects are decentralization of spatial policy and policy on the natural environment. Limited financial scope requires prioritization. Safety comes first. Sufficient fresh water is economically, socially and ecologically important.

The draft National Policy Strategy for Infrastructure and Spatial Planning (2011) designates space for flood risk management, sustainable freshwater supplies and climate-proof urban (re)development as nationally

<sup>5</sup> DP 2011, p. 36-37.

<sup>6</sup> Parliamentary paper 32 500 A, No. 44.

important policy areas. The Delta Programme is clearly positioned as the programme where three generic and six regional sub-programmes solutions for these water tasks come about, for the short- and long-terms. The Delta Programme approaches to tasking around safety and freshwater supplies are detailed interactively with the spatial ambitions of national government, the provinces, regional water boards and municipalities. The 'Delta on the Move – building blocks for climate-proof Netherlands' study from the Netherlands Environmental Assessment Agency (PBL) is published simultaneously with this Delta Programme. The study comprises a review of possible paths to solutions which, next year, will be involved in the work of the sub-programmes.

An Administrative Agreement on Water was concluded on 23 May of this year. Regional water boards became co-financiers for the construction and improvement of primary flood defence systems managed by the regional water boards. The Administrative Agreement focuses on cooperation in the Delta Programme under the direction of the Delta Commissioner. All partners involved are committed to the objectives of the Delta Programme, namely to set about water tasking and an active quest for opportunities for linkage with national and international ambitions. The second Flood Protection Programme is being completed and a cohesive flood risk management programme is being prepared for 2014.

The Administrative Agreement on Water and updating of spatial policy clearly designate the responsible parties. For example, the national government is responsible for national interests including flood risk management and the main water system. The provinces act as area-director, organize spatial planning and set out frameworks for the regional water system. The regional water boards supervise regional and the majority of primary defence systems as well as ensuring water of adequate quality in the regional water systems. The municipalities supervise the public areas within their duty of care under the Water Act and are the initial point of contact in the event of flooding. These and many other topics come together in the Delta Programme. The clarity created by the transparent division of responsibility reinforces the roles of the partners in the Delta Programme and with it the concerted action which gains form and substance under the leadership of the Delta Commissioner.

The core of the 'Faster & Better' recommendation by the Committee for Faster Decision-making Infra-

structural Projects is basic to activities within the Delta Programme. There is clarity on timing of decisions, participation is broad-based, works progress from broad to fine, with clear planning observed by all. All of this is detailed in the administrative planning of the Delta Programme, up to 2015. As set out in the government's Coalition Agreement all implementation-oriented activities started-up are subject to the rules and practices in the Multi-year Programme for Infrastructure, Spatial Planning and Transport (MIRT) including related assistance. These have been adjusted in line with 'Faster & Better'. Hence, we are in line with the motion submitted by Anne-Wil Lucas and others<sup>7</sup>. The MIRT studies currently underway within sub-programmes will ensure results from joint, factual studies in such a way as to be directly deployable for possible, follow-up steps within the MIRT.

The recommendations for the realization of the Top Sector Water were announced in June 2011<sup>8</sup>. This featured seven distinct focal points offering special opportunities to reinforce the position of the Netherlands within the water sector. Four of these seven spearpoints relate directly to the Delta Programme. The Delta Programme offers a wide range of chances for innovative solutions – with the Delta Commissioner in a booster role.

## Key conclusions DP2012

The Delta Programme is bearing fruit. A meaningful infrastructure has come about for systematic, collaborative work on the Dutch delta. There is readiness for collaboration and recognition for the approach. The consistent factual studies lead to well-founded results. The approach conforms with the principals of Faster & Better and this works toward well-based decision-making. An external evaluation<sup>9</sup> has confirmed the value of the organization and approach and has led to meaningful recommendations to make the organization even more effective. These recommendations have been taken on board. The previous Delta Programme announced that the Delta Commissioner would substantiate realization of Delta Decisions. The content of the Delta Decisions has been clarified and the preparatory process detailed<sup>10</sup>. This benefits the administrative partners.

7 Parliamentary paper 32 500 A, No. 45.

8 "Water verdient het" (Water deserves it), advice Top Sector Water.

9 Announced in DP2011 (p. 5, p. 47). See appendix E.

10 See 2.1 and appendix E on attached DVD.

By now, there is a meaningful picture of the constraints and tasks to be dealt with by the Delta Programme<sup>11</sup>. The next several years will see further, even more focused analysis and ongoing assessment of tasking. This will lead to the right decision-paths and help enable the right Delta Decisions. A number of interim conclusions have been taken in the DP2012, based on these analyses: these are important to illustrate possible solutions in the next stage:

### Safety

- **Flood risk management programme** As announced in the Administrative Agreement on Water, the flood risk management programme will be presented in 2014. The basis for development of strategy includes multi-layer flood risk management<sup>12</sup>. Primarily this deals with solutions aimed at flood prevention, but also possible supporting measures from the spatial development and disaster management angles. Studies around revision of flood protection standards, which are due this year, are relevant to the safety strategies in these areas; the same applies to the conclusions of the third Safety Assessment on primary flood defence systems.
- **Multi-functional flood defence systems** Multi-functional deployment of flood defence systems is – linked to the integral character of the Delta Programme – an interesting option. This is certainly the case for urban areas where space is in short supply, and near ‘delta dykes’. The review of applicability for delta dykes which is due in late 2011 offers handles for this, with the proviso that the safety of flood defence systems is not compromised. This will make it possible to move forward – with private sector involvement as an option.
- **Natural flood risk management measures** Natural flood risk management measures can be cost-effective and deliver added value, as is apparent from the study by Ecoshape<sup>13</sup>. Where possible they will be developed as alternatives within the Delta Programme. This will be implemented by the water managers where feasible and effective. Whether changes to design and review instruments are required will be reviewed.
- **Maeslant barrier** The Maeslant barrier in the Nieuwe Waterweg plays an important role in protecting the west of the country from the sea and this will continue for the next several decades. Possible improvement to the safety of this flood defence system will be reviewed.

- **Storm surge duration** Storm surge duration is an important boundary condition for preliminary analyses for the Delta Decision on the Rhine-Meuse delta. Current storm surge duration is 29 hours, as per the statutory review instrument enacted in 2006. International studies show the need to consider an adjusted storm surge duration. To this end, in anticipation of an official adoption the analyses and studies in the Delta Programme take 35 hours as storm surge duration, in addition to the current one.
- **Coastal expansion** Studies conducted within the sub-programme Coast have contextualized the feasibility of large scale coastal expansion. The recently released National Coastal Framework<sup>14</sup> concludes that large scale coastal expansion is not mandatory for flood protection – at least not for the next 50 years. Annual sand replenishment will keep the coast in order. Therefore large-scale coastal expansion will no longer be part of the sub-programme. However, the provinces can develop spatial planning proposals for coastal towns.

### Freshwater supplies

- **Freshwater supplies** For the first time there is now a broad-based national and regional analysis of constraints for freshwater supplies. The current water system with its management and policy appears to be reaching its outer limits. The periods of drought in 2011, and in 2003, show this a practical rather than a theoretical issue. In the long term, with an eye to the greatest possible levels of damage limitation, there will be a greater focus on system flexibility (e.g. temporary increase of the water level or alternative water supplies). Policy now focuses on incidental periods of drought. The frequency and severity of low water interludes and drought could increase apace with climate change. What is rare today could be increasingly frequent, so that the longer term requires a fundamentally different approach and a review of policy. This requires formulation of aims for socially sustainable and economically effective freshwater supplies. This will be prioritized. Solutions around freshwater supplies can be weighed-up and determined per area. The future availability of freshwater in this country’s international river basins is an important item for consideration. This will be on the agenda at the Rhine and Meuse international river basin commissions, together with necessary linkage with the approach to the problems of high water and drought.

<sup>11</sup> See 2.3 and 2.4.

<sup>12</sup> As described in the National Water Plan.

<sup>13</sup> See attached DVD.

<sup>14</sup> See attached DVD.

- **IJsselmeer** At present fresh water reserves in the IJsselmeer are sufficient to meet demand for current functions and the current area covered, for an extremely dry year – something that occurs on average once in 100 years. Hence, there is no necessity for the imminent decision on the water level ordinance of the IJsselmeer, as announced in the National Water Plan.

In the long term what is mainly needed is greater flexibility in the water system in order to increase available water reserves when required, while not ruling out future options. Long-term choices for water level management in the IJsselmeer Region must be based on safety tasking for the area and on still to be determined aims around freshwater supplies. The focus also covers solution-variants other than a 1.5 meter increase in the water level for the IJsselmeer in terms of supply, water reserves in and outside the IJsselmeer Region, as well the ability to impact on water use.

- **The west of the Netherlands** In the area subject to salinization due to salt water intrusion via estuaries, the period during which water from the main system cannot be let in during dry years could increase considerably. In particular this relates to the Gouda intake and to a lesser extent the Bernisse intake.
- **High ground and the southwest Delta** Even in an average year areas without any external supplies of water can face constraints around moisture deficiency in the soil, a drop in the groundwater level and/or ongoing receding levels in the regional water system.
- **River region** Average years already see constraints occurring in areas dependent on supplies of river water – this involves maintaining water levels, quality, and intakes for the regional system.

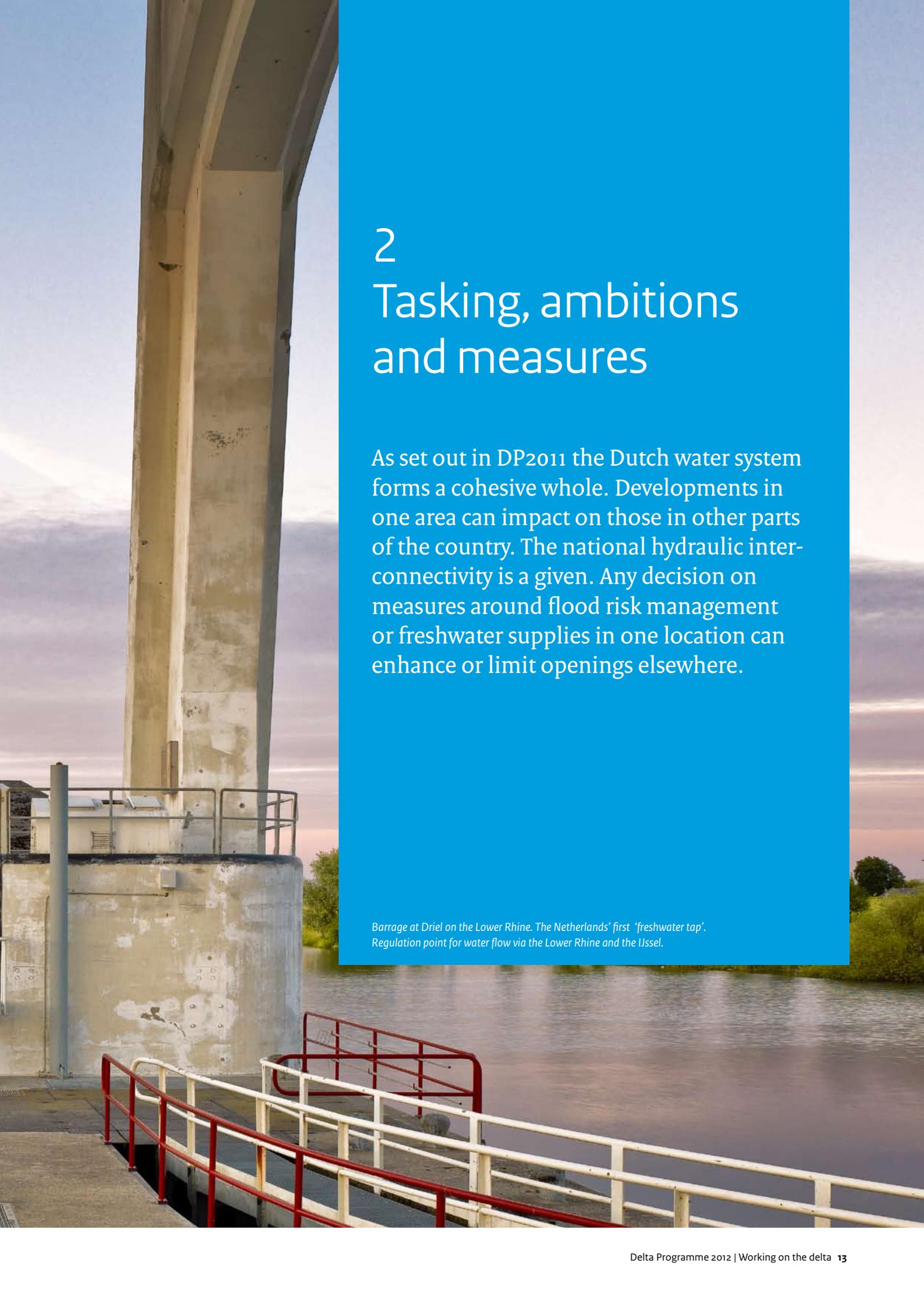
Adequate financial resources are essential for continued investment in a robust, safe delta. Under the Administrative Water Agreement the regional water boards also make a structural contribution to financing tasks around the Flood Protection Programme and hence to flood risk management tasking in the Delta Programme. The Delta Fund will start up as an investment fund as soon as the Delta Act comes into force. The Delta Fund, which includes structural funding for the Delta Programme, will be highly significant for the credible and timely success of large-scale water tasks during the next several decades.

Flood risk management/freshwater is a complex area and forms a linked issue with spatial planning. Indeed, the approach here is also linked. 2011 will see the development of a draft national policy framework for new urban development and the restructuring of built-up areas. Late 2011 is also expected to bring a position on updating of flood protection standards. Early 2012 will bring greater detail and depth on the constraints around freshwater supplies. An initial impulse for the national objectives for freshwater supplies should also be available by then. The interim results will be detailed via the area-based sub-programmes.

Knowledge provides an essential basis in the current stage of the Delta Programme. A uniform methodology has been developed based on other Delta instruments (uniform calculation models) and delta scenarios (uniform forward outlooks). The delta scenarios combine the KNMI-2006 climate scenarios and the socio-economic scenarios which also date from 2006 (to be updated in 2013). The basis of the evaluation method has been determined and the knowledge issues for the Delta Programme have been brought into focus. Adaptive delta management has been successfully detailed for several case-studies and the politico-administrative, financial and legal aspects have been put into focus. Development of the Top Sector Water impacts on innovation within the sector and hence also within the Delta Programme. Encouragement is given for the early involvement of market-based knowledge and experience; the next several years will make it increasingly clear where specific points of contact arise here for the Delta Programme.

Central next year will be the development of potential strategies (DP2013). These will be detailed in preferential strategies in DP2014 and as proposals for Delta Decisions in DP2015. Interim conclusions will be drawn, where possible and necessary, and this will provide direction.





## 2 Tasking, ambitions and measures

As set out in DP2011 the Dutch water system forms a cohesive whole. Developments in one area can impact on those in other parts of the country. The national hydraulic inter-connectivity is a given. Any decision on measures around flood risk management or freshwater supplies in one location can enhance or limit openings elsewhere.

*Barrage at Driel on the Lower Rhine. The Netherlands' first 'freshwater tap'.  
Regulation point for water flow via the Lower Rhine and the IJssel.*

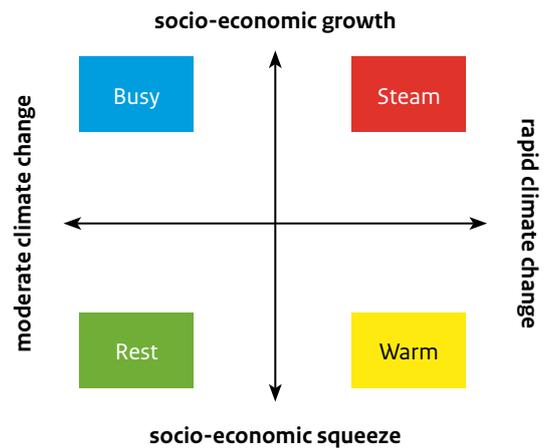
### Interconnectivity in decision making is enabled via Delta Decisions

The five Delta Decisions covering Flood risk management, Freshwater strategy, Spatial adaptation, the Rhine-Meuse delta and Water level management IJsselmeer Region determine and are directional for work to be carried out as from 2015. Section 2.1 sets out the various connective formulas and provides details of the Delta Decisions.

Alongside activities in the current implementation programmes<sup>15</sup> the past year saw tasking from nine Delta Programme sub-programmes charted out in a joint fact-finding study. The review examined what is needed, now and in the future, for continued compliance with objectives under (e.g.) the National Water Plan and regional plans. The so-called delta scenarios were deployed as basis in analysing tasks. These scenarios combine the existing KNMI-2006 climate scenarios and socio-economic scenarios from the collaborating planning bureaus (WLO scenarios, 2006) (figures 1 and 3.1).

A decision making process has been designed<sup>16</sup> to enable a set of cohesive Delta Decisions for the sub-programmes over the next several years. This DP2012 comprises analyses of tasking for safety and freshwater in the short, medium and long terms. In the previous stage the plans of approach for the sub-programmes in the period up to 2015 were incorporated in DP2011. Reviewing possible solution-paths will be central in DP2013, based on tasking analysis. These

Figure 1 Delta scenarios profiles

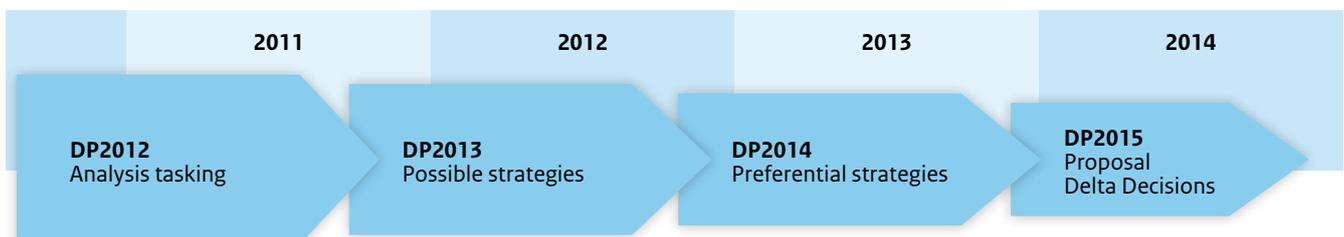


solution-paths will then be detailed in preferential strategies in DP2014; finally, they will lead to proposals for the Delta Decisions in DP2015. Interim conclusions will be drawn, where possible and necessary, and this will provide direction. The initial conclusions based on analysis of the generic and regional tasking are set out in 2.3 and 2.4.

<sup>15</sup> See 2.2

<sup>16</sup> See figure 2 and appendix F on attached DVD.

Figure 2 Process Delta Programme up to 2015



## 2.1 Interconnectivity

The Delta Decisions are central in realizing meaningful interconnectivity between tasks (priority), ambitions (linkage where possible) and measures (implementation) and meaningfully incorporating this in decision making. Various forms of interconnectivity are involved here: in terms of measures and provisions for water management as described in DP2011, in tasking, with ambitions, in terms of time, and in decision making.

### Interconnectivity in tasking

Tasking and measures around both flood risk management and freshwater supplies show strong mutual linkage via the defence systems (dykes, dunes and dams) and water level management (for rivers, lakes, canals, etc.). Hence, defence systems are deployed to ensure the safety of the Dutch delta. Meanwhile, to take an example, it might be necessary to increase reserves in lakes including the IJsselmeer to ensure adequate water supplies. This can lead to higher water levels whereby safety considerations will require flood defence systems to be adjusted apace. In the lowest lying parts of the country water level management is also important for the stability of regional defence systems such as peat dykes, to ensure the stability of foundations in built-up areas and for the rate of subsidence. Water level management in the regional water system combats soil compaction and settling.

Strong interconnectivity also exists between tasking and measures for safety and freshwater supplies on one side and the spatial planning of this country on the other. Hence spatial planning can contribute to water supplies by storing and retaining water, using buffers. The way building is organized in given areas can limit the impact of flooding (for example preventing vital infrastructure 'going down') and thus contributing to safety. Local deployment of delta dykes can also increase safety and climate-proofing while limiting effects of flooding. When (re)developing of areas it can also make sense to reserve space for possible measures needed in the future.

Hence it is essential to have nationwide strategies and a cohesive approach to tasking around safety, water supplies and the role of spatial planning. This takes place within the relevant Delta Decisions. The three generic programmes set out the objectives, standards and frameworks. In the Rhine-Meuse delta and IJsselmeer Region there is evident interconnectivity between the complex issues of safety, freshwater and spatial planning. These are essential areas in the Dutch delta for safety and freshwater supplies. This

demands area-specific Delta Decisions whereby the proposals are developed in conjunction with the generic Delta Decisions.

Water tasking cannot be viewed in isolation from social, economic and ecological developments. The Delta Programme is of far-reaching significance for the utilization and habitability of the Netherlands. Linkage of economic and ecological developments with ambitions can be important in realizing tasking on schedule. To this end the tasking and ambitions are clustered in an integral, area-based approach, whereby tasking leads. Optimal use of resilience in systems can lead to cost-efficient solutions. And, linking use of space to the necessary measures can reinforce the economic basis for linkage with ambitions.

### Interconnectivity in time

The interconnectivity of the Delta Decisions includes timing, in addition to content. It is a matter of keeping the Dutch delta habitable, now and in the future. It is no secret that if things go wrong with the flood defences, they go badly wrong. The low-lying part of the Netherlands is also its economic heart and home to a population running into many millions. Drought – also extreme drought – with a shortfall in water can harm the economy including the Top Sectors Greenports and Industry, as well as the natural environment. To this end the basics must be maintained and the country needs to remain alert for future climate change. There needs to be clarity around the Delta Decisions – the main choices for the future – in order to link-up the short and long terms.

The current implementation programmes work towards achieving order around flood risk management today. The Delta Decisions prepare us for the future. The current programmes will be rounded off between 2015 and 2020 at which time the Delta Decisions will be the order of the day. This will spell opportunities for the explicit linking of short and long-term aspects of the implementation programmes to be started up at that time – and to take work on the delta forwards in a judicious manner.

Short-term plans in areas such as new urban development and restructuring or indeed the replacement or improvement of infrastructure around water management and defence systems can be assessed and optimized in the light of the main long-term choices. The Delta Decisions give direction on the approach to tasking while providing clarity

around linkage of ambitions. At the same time preparing and implementing measures is time-consuming. The sooner the main choices are known the sooner a start can be made on them. Given that implementation of the Delta plan in the wake of the 1953 disaster took between 40 and 50 years one needs to take a timespan of several decades into account.

Meanwhile there is uncertainty around the degrees of socio-economic development and climate change. Ambitions and wishes can shift. Above all, dealing with uncertainties requires ongoing flexibility until tipping points in the water system and (major) interventions are required. Hence, adaptive delta management, meaning neither too early or too late, too much or too little, while facing up to major measures before the tipping point is reached.

#### **Interconnectivity in generating decisions: Delta Decisions**

The process of the Delta Programme has been organized to develop broad-based proposals for Delta Decisions, in collaboration with all parties involved. On this basis, as from 2015 there will be a good foundation for generating decisions and the further implementation of measures and provisions required for flood risk management and freshwater supplies up to 2050, with a forward view to 2100. This is essential in anticipating and being well prepared for a subsequent disaster.

Delta Decisions are sequenced. Proposals for frameworks from the angles of flood risk management, freshwater strategy and spatial adaptation are detailed by area. This generic/area-based interaction yields a single cohesive proposal for the Delta Decisions. Sequencing between sub-programmes and interaction between Delta Decisions and sub-programmes is reflected in administrative planning<sup>17</sup>.

DP2011 announced and briefly set out the five Delta Decisions. Content has further developed, partly based on analyses of the sub-programmes, and so here follows the specific description of the Delta Decisions. The following proposals foreseen for 2014 will be incorporated in DP2015:

#### **Delta Decision Flood risk management Updating flood protection standards and development of area-based strategies for flood protection**

This Delta Decision comprises a proposal for updating flood protection standards together with area-based strategies for Flood risk management tasking.

The updating of flood protection standards indicates:

- Where and how flood protection standards will be adjusted.
- The process to statutory embedded standards in 2017.

The area-based strategies provide insights into promising combinations of measures (delta) dykes, river-widening and/or spatial development measures including natural safety measures (“Building with nature”), adaptive construction and organization], insights into financial requirements, chances for spatial adjustment, social base, planning and feasibility of implementation.

The area-based strategies require insights into overall tasking on flood risk management by area. Interfaces between areas are also relevant here, for example up- and downstream. The Delta Decision on flood risk management provides a significant base for the comprehensive flood risk management programme as announced in the Administrative Agreement on Water. A flood risk management programme will be proposed at the same time as the proposal for the Delta Decision in 2014. This programme will comprise a comprehensive package of measures and provisions – providing appropriate answers around tasks resulting from the third Safety Assessment of primary flood defences, new technical insights, anticipating potential future changes in sea level, river discharges and subsidence, and possible updating of current standards. The Delta Decision and flood risk management programme explicitly link the short and long terms. The programme follows on from the current implementation programmes.

<sup>17</sup> See appendix E on attached DVD.

### **Delta Decision Freshwater strategy** Strategy for sustainable and economically effective freshwater supplies in the Netherlands

The proposal for this Delta Decision comprises a strategy for sustainable, national freshwater supplies which is effective in economic terms, plus a linked package of measures. With an eye to a judicious approach to drought and low water levels, linkage at a national scale and fine-tuning with freshwater management in the Rhine-Meuse delta and the IJsselmeer Region is also important here.

Strategy for sustainable freshwater supplies:

- Provides insights into supply of and demand for freshwater and water security.
- Makes statements on potential for water savings, optimal water distribution and future service levels in relation to functions and their impact on these functions.
- Clarifies the division of responsibilities between government, market and user.

The implementation of measures, including their budgeting and financing, is set out in a linked package of measures. These measures are at international, national and regional levels, and per water user. This may involve infrastructural/spatial development measures, and legal, spatial and economic instruments such as pricing.

### **Delta Decision Spatial adaptation** National policy framework new urban developments and restructuring and recommendations around flooding and heat stress

This Delta Decision concerns a national policy framework for development of built-up areas. The policy framework aims to shed clarity on the deployment of spatial organization and financial instruments, thus enabling meaningful spatial assessment locally and/or regionally. Cost and problem shifting need to be avoided, now and in the future.

The proposal for this Delta Decision yields a strategy – with generic and area-based prerequisites and instruments – on means and conditions for robust development in built-up areas in the Netherlands. With an eye to flood risk management and flooding the strategy focuses on a number of issues around water, subsoil and climate change. The policy will at least cover the topics of the built-up area in- and outside the dykes as well as in, on and around water defence systems and reserved areas from the angle of flood risk management and pluvial flooding.

With the built-up area within the dykes the proposal looks at ways for spatial assessments to take account of the safety demands, at avoiding social disruption and protecting vital and vulnerable functions.

With the built-up area outside the dykes the issue is in how far the current policy is adequate in regard to flood risk management and what spatial prerequisites would be required to prevent economic and environmental damage and, as far as possible, social disruption.

In, on and around the flood defence systems and reserved areas it is important to consider ways to combine integral area-development and construction of flood defence systems and reserved areas with hydraulic demands of safety, management and maintenance of flood defence systems.

Pluvial flooding looks at the interface between, for example, urban compression and coping with water and changing levels in peak rainfall. This is with an eye to the task of restructuring currently confronting the Netherlands. The search is on for a long-term strategy aimed at cost effectiveness and the development of economic and other added value. This specific approach focuses on a more robust and flexible set-up for the built-up area.

### **Delta Decision Rhine-Meuse delta** Strategy for flood protection in this crucial transitional delta area, together with solutions for freshwater supplies

The Rhine-Meuse delta is the location of the major rivers, Rhine Estuary-Drechtsteden and the southwest delta. This is a key transitional area in the Dutch delta. River and sea come together here, and there is a wide range of interests requiring protection – both in terms of population and economic activity. The proposal for the Delta Decision comprises one or more strategies to ensure flood protection and sustainable freshwater supplies up to 2050 followed by a forward view to 2100.

## 2.2 Ongoing implementation programmes

Strategy or strategies:

- Are synergized with the desired, future-proof socio-economic, ecological and linked spatial developments in the Rhine-Meuse delta.
- Provide insights into decisions to be taken, and within expected time-frames.
- Make statements on investments which in the context of the strategy/strategies are already viewed as necessary/no-regretters, so that they can be taken up within the MIRT – in the short or long term.
- Comprise a set of substantive and process-led agreements between the national government and the regions concerning generation of decisions on the way to 2050, based on adaptive management, in any event including future follow-up decisions.

### **Delta Decision Water level management IJsselmeer Region** Strategy for water reserves in this lake in view of freshwater supplies and flood risk management

The proposal for the Delta Decision IJsselmeer area comprises a strategy for water level management in the IJsselmeer area for the period 2015-2050 with a forward view to 2100.

The strategy is:

- Linked to safety tasking for the area, in the short and long term.
- Linked to the role of the IJsselmeer in nationwide freshwater strategy for the same period.

This strategy is the basis for elaborating measures required and linked with water level management during this period.

The ongoing implementation programmes form part of the Delta Programme while retaining an own management, organization and financing. A brief situation overview is set out below. For a comprehensive situation report see the MIRT Projects book 2012.

As the ongoing implementation programmes form part of the Delta Programme, and given the potential for short and long-term linkage, it is important to increasingly steer towards the ongoing implementation programmes vis-à-vis the long term. At such time as the Delta Act has come into force the Delta Programme's annual report will deal more comprehensively with the ongoing implementation programmes and their progress.

Alongside implementation programmes for safety, as set out below, there are also a number of regional implementation programmes that contribute to the aims of the Delta Programme. These include programmes to improve regional flood defence systems, diminishing flooding by setting standards in response to the National Administrative Water Agreement, and better positioning of water in spatial organization as under the Action programme Water and Space.

### **Flood Protection Programme**

Roughly speaking, half of the dyke reinforcement projects under Flood Protection Programme 2 (HWBP2) are expected to be ready and in compliance with standards in late 2011. This puts realization behind schedule compared with the original 2006 plans. This is mainly due to delays of a number of (complex) projects in the planning stage. The original target date of 2015 will not be met. The letter to parliament dated 2 July 2010 abandoned this deadline and stated that the programme would be extended to 2017.

On 22 March 2011 parliament designated the HWBP2 as a Major Project. And with the signature of the Administrative Agreement Water the HWBP2 is fully covered financially. Starting in 2014 the regional water boards will participate for 50 percent in the costs of the improvement projects.

### **IJsselmeer Closure Dam**

In 2006 the IJsselmeer Closure Dam failed inspection based on current statutory flood protection standards. In 2011 the government intends to reach a decision on the future reinforcement and multi-functional configuration of the IJsselmeer Closure Dam. As set out in the MIRT rules this

will be realized via a preferential decision in the form of a structure vision. Fine-tuning is underway with the sub-programmes IJsselmeer Region and Wadden Region.

### **Weak Links Coast**

Three of the eight prioritized weak links along the coast have been reinforced, namely Noordwijk, Flauwe Werk and the Walcheren Coast. Three are in the implementation stage, namely Scheveningen, Delflandse Coast and the west of Zeeland Flanders. The two priority weak links in Noord-Holland are still at the planning stage, namely Hondsbossche and Pettemer seawalls, and the Kop van Noord-Holland. In August 2010 the infrastructure and environment minister (I&E) reached a decision on costs for the financial prerequisites for reinforcement. An amount of €250 million was made available for reinforcement and additional coastal maintenance in these two weak links, over the course of the next 20 years. The regional water board and the province are currently detailing a less elaborate plan and realization is aimed at 2013.

### **Room for the River**

The Key Planning Decision (PKB) features a linked package of 39 measures called Room for the River. This is designed for the Rhine tributaries and is necessary to meet the 2015 target for the statutory level of protection for a river discharge of 16,000 m<sup>3</sup>/s at Lobith. The second objective is to enhance spatial quality in the river region. Where necessary adjustments are being made to the sub-programme Rivers. Parliament receives twice-yearly progress reports on the Room for the River Programme, the latest being in April 2011 (VGR17 covering the period 1 July 2010–31 December 2010). This reported that a project decision (SNIP3) had been reached on nine measures. This represents a SNIP-3 decision on 44 percent of the PKB budget for the realization stage. A start was also reported on implementation of an external, interim evaluation of the PKB Room for the River, as also included in the PKB. This evaluation related both to programme progress and the manner of implementation. The results of the interim evaluation will be ready after the summer and will be submitted to parliament together with VGR18 in October 2011.

### **Meuse Projects**

Meuse Projects comprises 52 sub-projects in the Zandmaas and Grensmaas project areas. The aims are flood protection, realizing objectives around the natural environment, and mining. Once Meuse Projects is complete there will only be complementary task of bringing the entire Meuse Valley Region in line with the agreed level of safety. A dedicated programme will be designed for this. Implementation is behind schedule due to a downturn in the sand and gravel market. The contractors involved have been obliged to jointly seek solutions with government to bridge the low profitability period. Sub-projects also confronted delays for archaeological surveys or possible unexploded ordinance dating from the Second World War – both of which were unforeseen. Implementation of new government policy on development of the natural environment may require adjustment to several projects in Meuse Projects. Completion of Meuse Projects is expected no later than 2020.

### **Repairs on stone-cladding Oosterschelde and Westerschelde**

This project is in the realization stage and completion is planned for 2015.

### **Sand replenishment and the Sand Motor (Delta Dune)**

Sand replenishment is carried out as part of an annual programme directed via Rijkswaterstaat. The Sand Motor Delflandse coast pilot scheme experiments with a new approach to large-scale distribution making optimal use of the natural spread of sediment. This is potentially more efficient and is more favourable from the ecological angle while also exploiting potential for development of the natural environment and recreation. “Rainbowing” started in March 2011. The embankment was realized in 2011 and installation will be complete in 2012.

## 2.3 Generic sub-programmes

This paragraph sets out the main points of the situation around the analyses of the generic sub-programmes; where relevant it provides a brief summary of the given MIRT study, in the form of a chart. See appendix A on the attached DVD for an extended summary. The complete analysis is on [www.delta-programma.nl](http://www.delta-programma.nl). During the period up to 2014 the analyses will be checked annually for continued accuracy of the principles for strategic solutions and Delta Decisions. These delta scenarios (see 3.1) form the basis of tasking and strategies. The progress of sub-programmes vis-à-vis DP2011<sup>18</sup> is summarised and incorporated in appendix B on the attached DVD.

### Safety

Current safety tasking is dealt with in the ongoing implementation programmes Room for the River, Meuse Project, the future of the IJsselmeer Dam, Flood Protection programmes 1 and 2 and Weak Links Coast.

The sub-programme Safety collaborates with other sub-programmes towards the Flood risk management Delta Decision (see 2.1).

Medium to long-term safety tasking comprises three elements:

1. Tasking resulting from the conclusions of the Safety Assessment of Primary Flood Defences, and new technical insights. In the short term this relates to the findings of the Third Safety Assessment.
2. Tasking following on from the rise in sea level, soil subsidence and possible shifts in river discharges.
3. Possible tasking following on from updating of the flood protection standards.

Under the Water Act managers of primary defence systems are required to carry out a review of these systems every six years. This year the National Review Report will be submitted to parliament. This incorporated the findings of the third Review. On the subject of primary defence systems review the Administrative Agreement on Water states the aim of reducing frequency to once in 12 years and making this a continuous process. A proposal to this end will be jointly

detailed by government and the regional water boards before 1 November 2011. The start of the fourth review round will be delayed until such time as there is clarity on updating of standards and related review and design tools. However, the third round review will be extended in the case of flood defence systems where the National Review Report was unable to issue an opinion.

Using the delta scenarios as a basis the area-based sub-programmes have illustrated future safety tasking due to rises in sea level, subsidence and possible changes in river discharges. The rise in sea level generates additional tasking along the coast and in transitional areas. Tasking for the latter is boosted by possible changes in river discharges. Self-evidently these generate additional tasking in the area of the major rivers.

Over the course of the next several decades the aim of updating flood protection standards will be to realize a level of protection meshing better with the current protection structure in terms of increased population and economic value behind the dykes. This could mainly unfold in the areas where there has been a strong increase in population and economic value behind the dykes since the 1960s. The Second Delta Committee has proposed raising safety in the ring of dykes in the Netherlands by a factor of 10. The findings of the casualty analysis which has already been announced, and the study around social and economic damage (Social Cost/Benefit Analysis) will enable better-founded and accentuated statements. A position on updating flood protection standards is expected after the completion of the Casualty and Social Cost/Benefit Analysis in late 2011.

Maps 1a and 1b shows current and future tasking for safety, insofar as this is known.

During 2012-2014 the Delta Programme directed by the Delta Commissioner will detail flood risk management tasking by area into cohesive safety strategies and a flood risk management programme. To this end an administrative process design will be produced jointly with the governmental bodies involved. In the period up to 2014 this will generate insights into the strategies, measures, financing required and its distribution, opportunities for spatial positioning, social base and feasibility of the flood risk management programme. 2014 will see a definite proposal on updating flood risk standards, as part of the Delta Decision Flood risk management .

<sup>18</sup> See DP2011 p. 71.

**Map 1a Safety**  
Current situation



**Key to symbols**

— primary flood defence systems

Legal standards primary flood defence systems:

- exceedance frequency 1: 250 (Meuse dykes)
- exceedance frequency 1: 1.250
- exceedance frequency 1: 2.000
- exceedance frequency 1: 4.000
- exceedance frequency 1: 10.000

- high ground
- dunes
- area outside the dykes
- major rivers
- ⇨ design river discharge
- highly urbanized areas

Current projects Flood risk management:

- Room for the River project
- Meuse projects

Flood protection programme:

- improvement dyke section
- ▲ improvement dyke, dune, dam or engineering structure
- weak links along the coast
- Stone Cladding Zeeland project

NB: excluding projects that may result from Third Safety Assessment Flood Defences

With a view to the progress of the sub-programme Safety and the Delta Decisions, the Delta Commissioner recommends to the government that as soon as the aforementioned Delta studies around updating flood protection standards are complete, validated and adopted, government should make these available for the development of area-based strategies. Flood risk management Right from the start of the Delta Programme the updating of standards has formed a significant part of the Delta Decision Flood risk management whereby it is of great importance to the comprehensive flood risk management programme due for initial delivery in 2014, in line with agreements to this end under the Administrative Agreement on Water. Hence, a decision in principle on 2011 standards was announced in the Delta Programme 2011<sup>19</sup>. Decentral administrators involved in the Delta Programme fulfil an important function in formulating regional strategies to be met by flood risk management. They need relevant information around updating standards, and clear frameworks for the formulation of regional strategies. The government sets store by a careful process around this complex issue. With this in mind the analyses were preceded by an expert quality assurance phase whose findings can be deployed within the Delta Programme to enable frameworks to detail area-based strategies.

Realization of flood risk management tasking meshes with the principle of multi-level safety in the National Water Plan. Flood prevention remains the main base of the safety strategy (first layer). Spatial organization (second layer) and disaster management (third layer) can supplement the combination with preventative measures and generate alternative strategies. The significance of spatial organization (2nd layer) around safety is examined in the sub-programme New Urban Developments and Restructuring in terms of its contribution to development of safety strategies. Disaster management is coordinated by the security and justice minister and does not form part of the Delta Commissioner's tasking package. To ensure meaningful safety strategies where the third layer can also play a role the Delta Commissioner will see to effective fine-tuning with the security and justice ministry.

The area-based approach of multi-layer flood risk management will be jointly detailed by the national

government and regions in the form of six area pilot schemes, two of which are briefly outlined below.

#### *Area pilot schemes multi-layer flood risk management*

This area pilot scheme aims, jointly with the parties involved, to review ways of bringing together the various chances and impact-reducing measures to mutually contribute to flood risk management. This is done with a number of area-strategies including compartmentalization, delta dykes, more stringent standards, diversion dams behind the dykes and the controlled channelling of water through the area, altered or water-resistant buildings, focused policy in spatial planning, and potential for evacuation. Dyke ring 43 (Tieler- and Culemborgerwaarden) is one of the area pilot schemes showing that over and above additional or as replacement for current flood risk management policy (first layer) effective measures are feasible to strongly reduce casualties and economic and other damage. The area pilot for dyke ring 36 (Land van Heusden/De Maaskant) shows that the concept of multi-layer flood risk management forms a means for relevant government bodies to reach shared choices, and in particular that the first and third layers appear effective for flood risk management.

The PBL-study<sup>20</sup> shows that input from the delta dykes can make a significant contribution to lessening the impact of flooding and in enhancing climate-proofing in the Netherlands. 2011 will bring further findings from the feasibility study on the Dutch delta dykes.

When developing safety strategies the area-based programmes in the follow-up process will deploy these findings to examine a more (cost) effective contribution by delta dykes in their area to the desired level of safety.

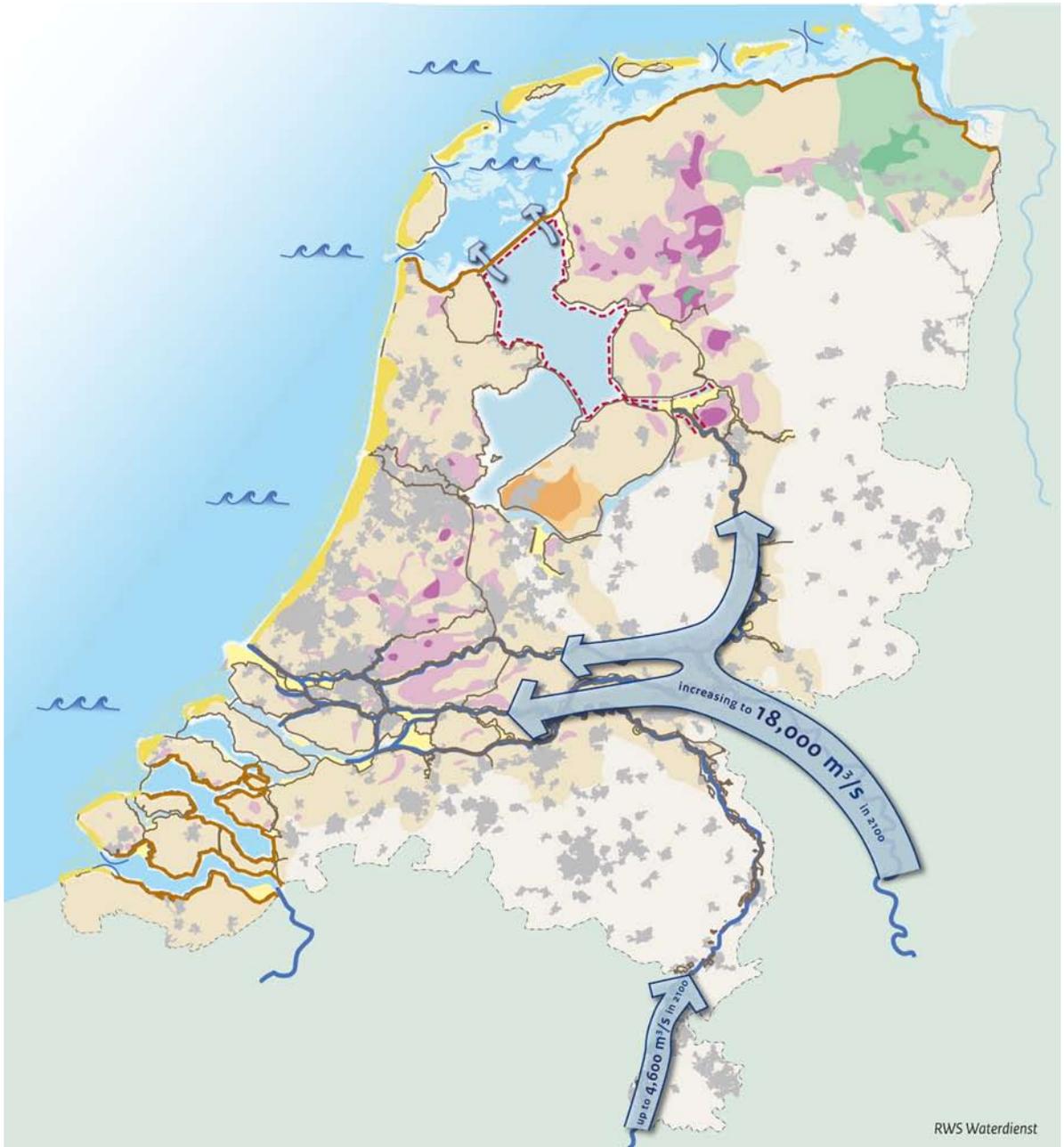
By making delta dykes exceptionally wide the water-defence function can eventually be combined with other practical functions. Multiple use of space also plays a role in regular flood defence systems, particularly in urban areas where space is at a premium. Following the Delta Commissioner highlighting this in DP2011 a study was launched into multi-functional deployment of regular flood defence systems<sup>21</sup>.

<sup>19</sup> See DP2011, p.57.

<sup>20</sup> Netherlands Environmental Assessment Agency, Een delta in beweging – bouwstenen voor een klimaatbestendig Nederland. (a delta on the move – building blocks for a climate-proof Netherlands)

<sup>21</sup> See appendix C on the attached DVD.

**Map 1b Safety 2050**  
Climate scenarios Warm and Steam



**Key to symbols**

- primary flood defence systems
- area within dyke rings
- dunes
- area outside the dykes
- major rivers
- highly urbanized areas

**Effects climate change:**

- ☞ increasing peak discharge Rhine/Meuse
- ☞ rise in sea level (35 cm in 2050)

**Expected soil subsidence (within dyke rings):**

- 20-40 cm (main cause peat oxidation)
- 40-60 cm (main cause peat oxidation)
- 20-60 cm (main cause gas field development)
- > 60 cm (main cause gas field development)
- 20-40 cm (main cause compaction of clay deposits)
- > 40 cm (main cause compaction of clay deposits)

**Tasks supplementary to completion current and follow-up programmes within framework of regular assessment flood defence systems:**

- ☞ gravity drainage IJsselmeer no longer possible with > 30 cm rise in sea level
- potential safety task as a result of Delta Decision IJsselmeer Region
- ☞ increased erosion island headlands
- ☞ maintaining coastal foundation with rising sea level
- ☞ maintaining sea dyke with rising sea level

This showed that – not forgetting anti-flooding factors – building directly on or adjacent to flood defence systems is already legally acceptable and that it is possible to proceed along these lines.

The flood risk management risks, roles and responsibilities have already been brought into focus as far as the area outside the dykes is concerned. Following discussion with other governmental bodies, it is intended that the state secretary for infrastructure and the environment (I&E) will use this as a basis for a decision, at the end of 2011, on the course to be taken with the generic policy for areas outside the dykes. Among other purposes this will serve as input for the sub-programme New Urban Developments and Restructuring and the area-based sub-programmes.

The Ecoshape consortium, which is a collaborative body comprising the business community, knowledge institutions and government bodies, has been requested by the Delta Commissioner to conduct a study into the potential of natural flood risk management measures (building with nature). The study shows that – given a suitable situation – this type of solution can be more cost effective and deliver added value through a combination of nature and safety<sup>22</sup>. This conclusion is confirmed by defence system managers at the regional water boards.

The Delta Commissioner recommends that, where meaningful and effective, natural flood risk management measures should be devised and deployed as alternative measures to counter flooding and that, e.g., the maintenance and management of the foreland should be involved here. Management and maintenance responsibilities need to be set out unambiguously. To this end, the design and review tools must enable such measures. The government will examine in how far the environmentally friendly flood risk management measures slot in with the review/design instruments or whether adjustments will be called for.

## New Urban Developments and Restructuring

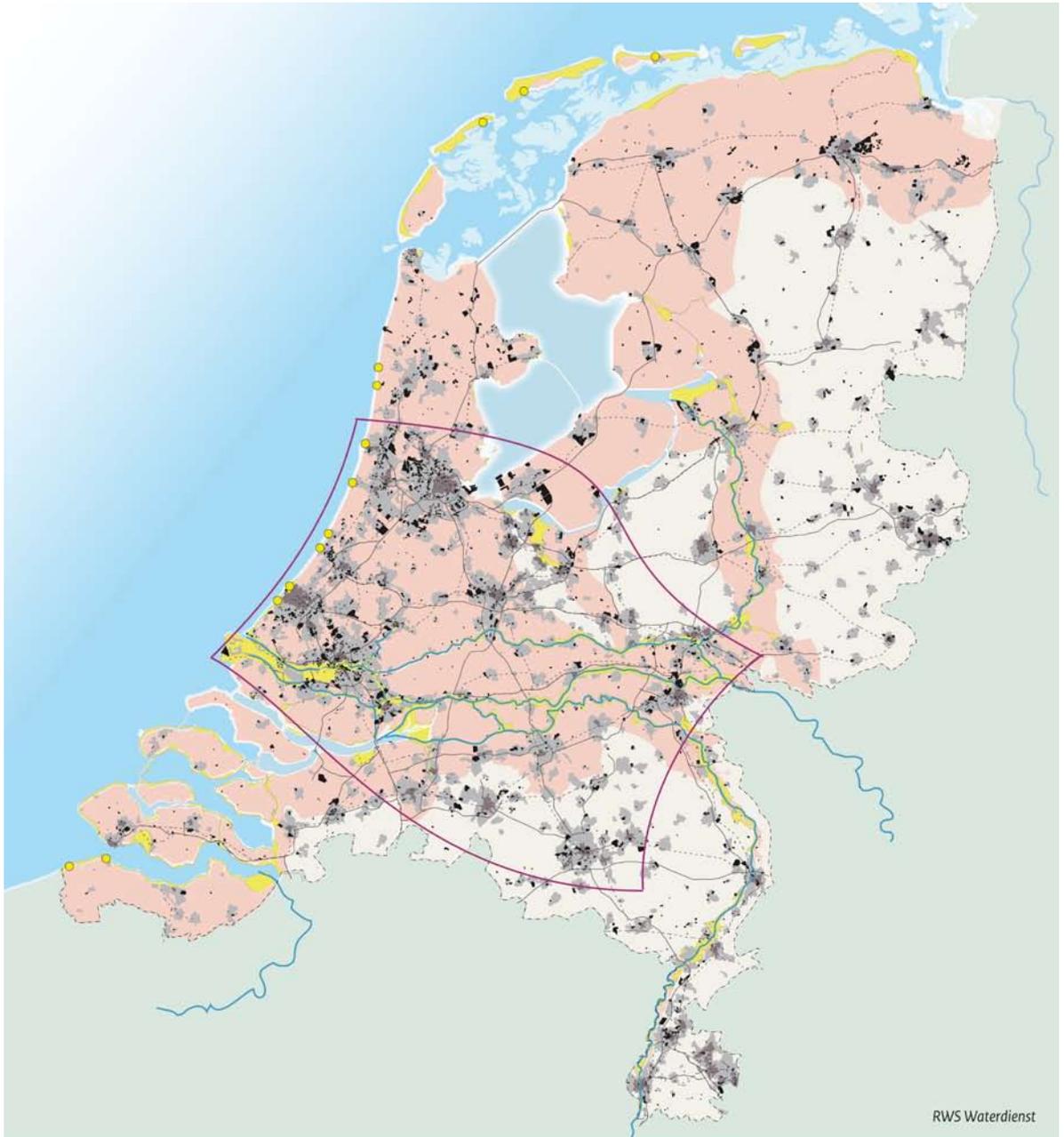
Risks of flooding, pluvial flooding, salinization, subsidence, desiccation, and the effects of extremes of temperature will all need to be taken more into account in the organization and replanning of this country. The next several years will bring considerable new urban development – more due to expansion in existing areas than new expansion locations – particularly in the Randstad. Depending on urbanization and possible climate change there will be increased tasking to contain the effects of flooding, urban water supplies, pluvial flooding, and heat-stress. A wide range of potential measures is available at the urban level - buildings, streets, neighbourhoods, the town or city as a whole. The best route to making an urban area climate-proof is to link-up with autonomous developments (footnote 20). The configuration and positioning of the soil mean that most tasking here will be in the west of the country. Maps 2a and 2b shows tasking around new urban development and restructuring.

When (re)developing built-up areas flood-damage limitation can be realized by taking account of situations that might occur with a dyke collapse, notwithstanding all the countermeasures. The scale of damage and casualties can be limited by a meaningful choice of locations, alterations to buildings, neighbourhoods and infrastructure, and creating evacuation routes. This applies in particular to vital objects and vulnerable functions such as hospitals and power supplies. Detailing the second layer of multi-layer flood risk management as linked to the first and third layers, represents a significant part of this sub-programme.

The sub-programme New Urban Development and Restructuring also looks at spatial instruments for deployment and meaningful involvement in considerations for (re)development of the area outside the dykes. This would enable a future-proof and sustainable spatial organization providing scope for construction tasking in this country. Meanwhile, caution will be exercised in seeking to formulate new rules for construction projects. Linkage between the areas outside the dykes and the main water system need to be borne in mind here. An estimated 115,000 people live in the area outside the dykes, some 64,000 in the Rhine estuary-Drechtsteden area. This total is expected to increase in the future.

<sup>22</sup> The entire report is available on the attached DVD

**Map 2a New urban developments and restructuring**  
 Current situation



**Key to symbols**

- urban area
- urban area, pre-war centre (particularly susceptible to pluvial flooding)
- area susceptible to flooding (area within dyke rings)
- area outside the dykes
- coastal towns with built-up areas outside the dykes
- main infrastructure
- area with major pressure on space
- urbanization up to 2015 (source: hard plans from the 'Nieuwe Kaart van Nederland')

There is major pressure on space in the urban areas around the flood defence systems. Multi-functional flood defence systems offer interesting potential, with the business community playing an important role as partner and possible joint source of finance.

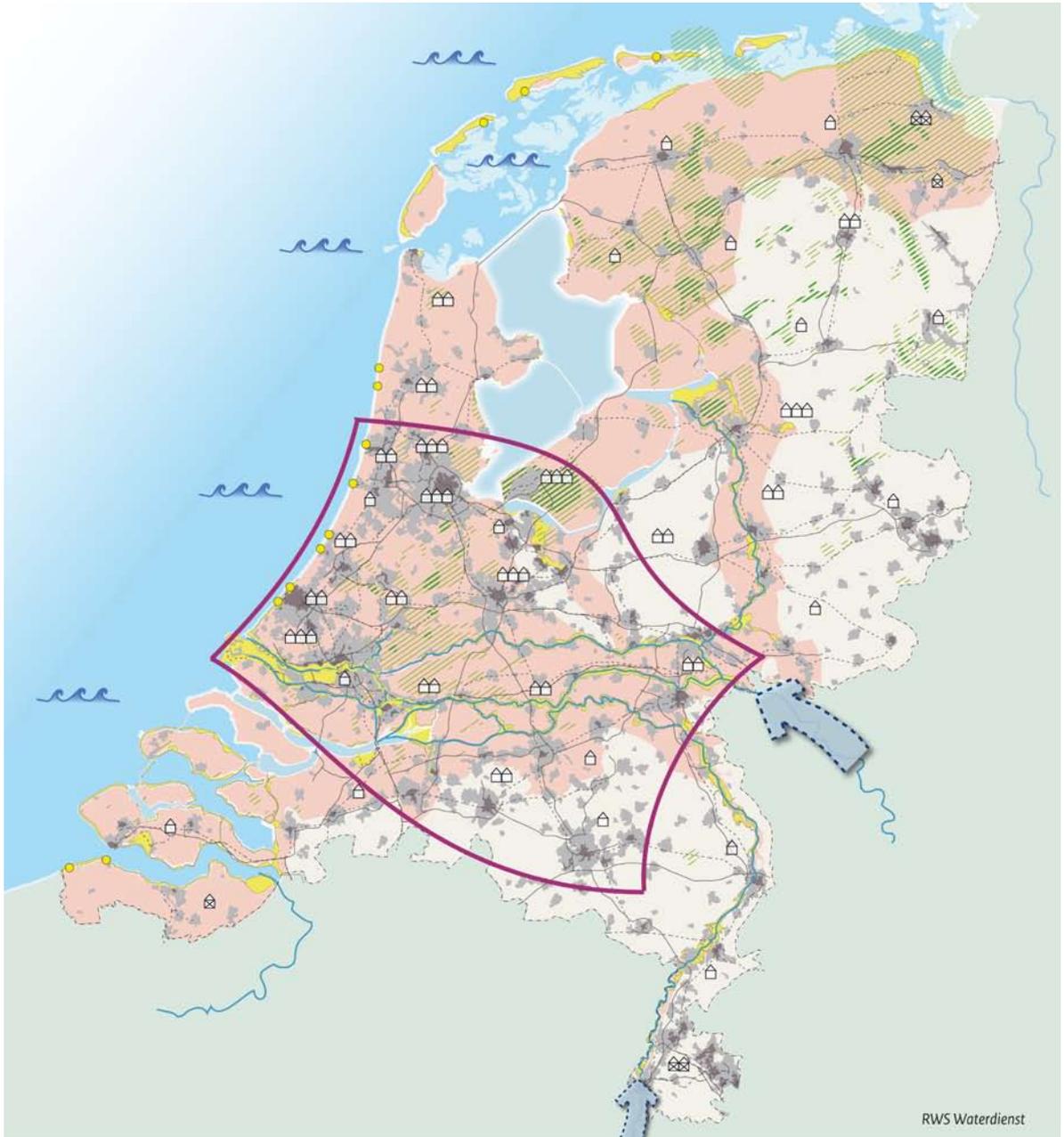
It is already so that 90 percent of municipalities suffer from problems due to excessive rainfall at some time or other. This is usually concentrated around a number of vulnerable – often low-lying – locations and streets. This problem will rise apace with climate change. The water managers have made agreements on combating inundation and there is no shortage of good examples. Helped by a structural approach there are good chances of achieving much more around the good integration of the water function in built-up areas while taking account of long-term developments. A good example of this is storing water reserves in a parking facility in Rotterdam. A flexible and water-robust design limits the nuisance factor, avoids damage to the foundations of buildings and reduces heat-stress in the city – all effects benefiting the quality of life there.

The likelihood of a successful approach is increased by linking water tasks with other social issues.

## MIRT Study ‘Delta Programme New Urban Development and Restructuring’

Name	Reason and objective	Planning	Parties involved
Delta Programme New Urban Development and Reconstruction	Development of a national policy framework for development of built-up areas	2011 Draft Policy Framework  2014 policy framework (input for Delta Decision Spatial adaptation)	I&E, EA&I, provinces, municipalities and regional water boards, social organizations, Delta Commissioner.

**Map 2b New urban developments and restructuring 2050**  
Climate scenarios Warm and Steam



**Key to symbols**

- urban area
- urban area, pre-war centre (particularly susceptible to pluvial flooding and heat stress)
- area susceptible to flooding (within dyke rings)
- area outside the dykes
- coastal towns with built-up areas outside the dykes
- ⋯ main infrastructure

**Effects climate change:**

- ➔ increased peak discharge Rhine/Meuse, decreased summer discharge
- 🌊 rise in sea level (max. 35 cm in 2050)
- ☁ decrease rain in summer (19%)
- ☁ increase in winter (14%)

**Expected subsidence (peat oxidation / compaction clay deposits / gas field development):**

- ▨ up to 40 cm
- ▨ > 40 cm

- ⬡ area with increasing pressure on space

% growth/decrease households per COROP region (prognosis up to 2040, according to WLO scenario TM)\*:

- 🏠 > 20% growth
- 🏠 10 - 20% growth
- 🏠 0 - 10% growth
- 🏠 0 - 10% decrease
- 🏠 > 10% decrease

\* In several regions a lower growth scenario could mean a turnaround from moderate population growth under the TM scenario into a decline in population.

## Freshwater

The analysis of constraints shows that the current water system, management and policy around freshwater supplies are almost stretched to the full. There is an imminent need to seek greater flexibility in the water system. This could include keeping additional reserves of freshwater in the six winter months, using extra supply routes and optimizing use. In the future we may quite possibly confront extremes, all with frequency increasing apace. The current incident-driven policy on drought, in the form of the water distribution priority sequence (figure 5) will need to be deployed more often in future, whereas the instrument is not designed to that end. All of this calls for a reappraisal of current policy and its starting points: alongside constraint avoidance this must also focus on making the best of opportunities, as in agriculture, which go hand-in-hand with the country's unique delta position.

The first ever, broad-based quantitative and qualitative analysis of constraints has been conducted around the question of supply and demand for freshwater in the Netherlands, covering both the current situation and the four delta scenarios.

This analysis of constraints is the first step in a process towards the Delta Decision on Freshwater Strategy in 2014. It came about via a joint factual study – ensuring a good basis for the next stages of the Delta Programme.

Maps 3a and 3b show the current and future situations for freshwater supplies.

Availability of freshwater has always been taken more or less for granted in the Netherlands. This reflects the fact that there is an almost invariable annual surplus rainfall while the major rivers discharge far more water than actually used. This is why even in dry years, freshwater is still discharged into the sea via the Nieuwe Waterweg in order to limit the encroachment of salt water. Rainfall, however, is not always available at the right time of the year, and in the six months of winter is channelled away as surplus to requirements. Meanwhile, in summer, when water is required, there may be a substantial lack of rain.

Moreover, it is not possible to channel water from the major rivers to every location where it is called for. This generates potential constraints locally or in larger areas. In the current situation this already occurs in dry years. In spring 2011 the discharge from the major rivers was already lower and the precipitation shortfall higher than in May 1976 – an extremely dry year.

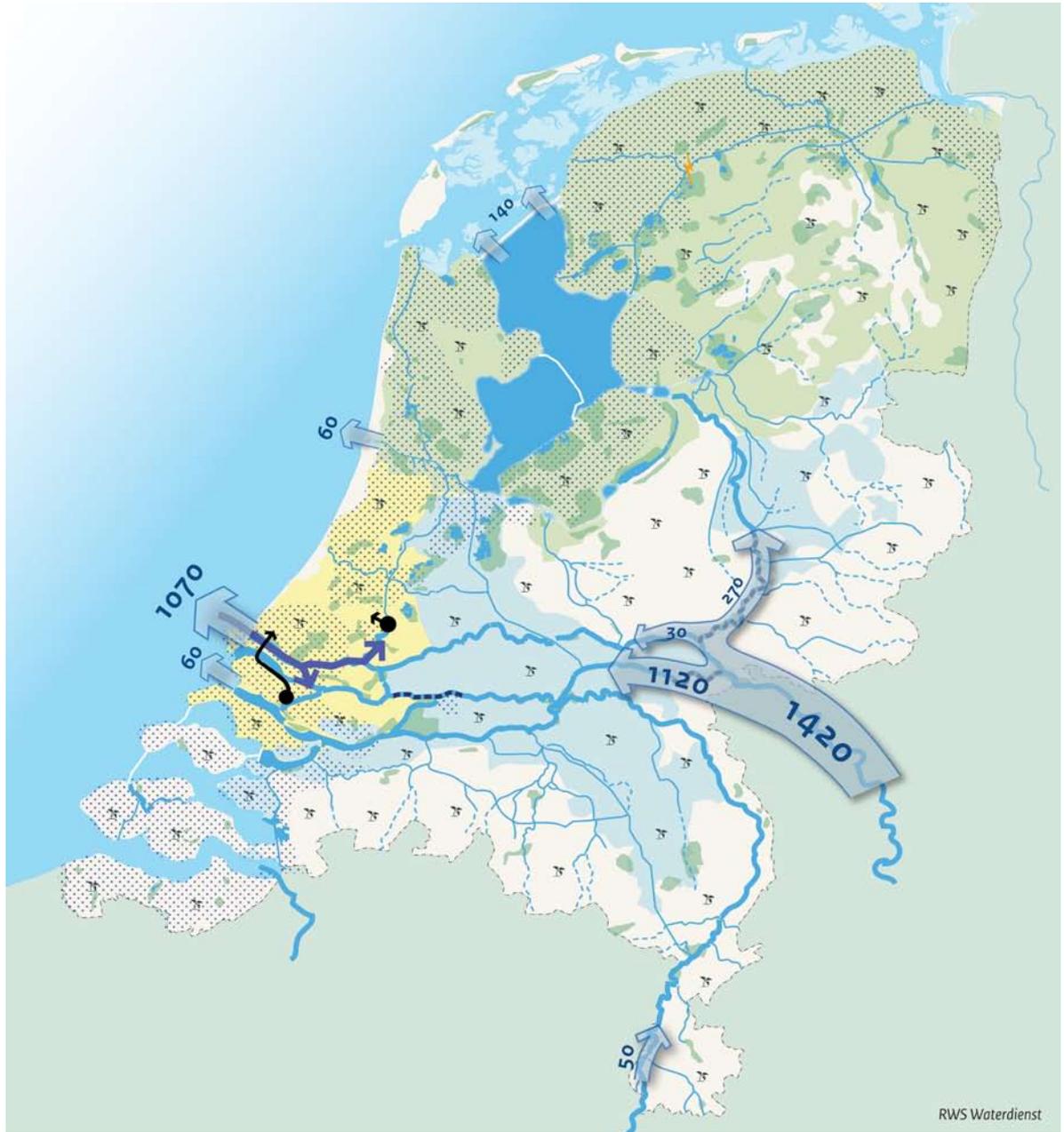
**Figure 3** The water distribution priority sequence deployed for incidental droughts

Category 1 Safety and avoidance of irreversible damage	Category 2 Utility services	Category 3 Small scale high grade use	Category 4 Other interests (economic considerations, also for nature)
<ol style="list-style-type: none"> <li>1 Stability Flood defences</li> <li>2 Settling and oxidation (peat and moorland)</li> <li>3 Nature (linked to soil composition)</li> </ol>	<ol style="list-style-type: none"> <li>1 Drinking water supplies</li> <li>2 Energy supplies</li> </ol>	<ul style="list-style-type: none"> <li>• Temporary irrigation capital-intensive crops</li> <li>• Process water</li> </ul>	<ul style="list-style-type: none"> <li>• Shipping</li> <li>• Agriculture</li> <li>• Nature (so long as no irreversible damage occurs)</li> <li>• Industry</li> <li>• Water-recreation</li> <li>• Lake/river fisheries</li> </ul>
<p>takes precedence → takes precedence → takes precedence →</p>			

Categories 1 and 2 have orders of priority. Categories 3 and 4 have mutual prioritization aimed at minimizing economic and social damage.

**Map 3a Freshwater**

Current situation, dry year (once every ten years)



RWS Waterdienst

**Key to symbols**

- main water infrastructure
- large body of surface water
- salt water (sea)
- areas susceptible to salinization
- salt intrusion
- major inlet
- water flows driest decade in six-month summer period (m³/s)

**Cause of bottlenecks:**

- 1. insufficient supply from river
- 2. excess demand on water buffer IJsselmeer
- 3. inlets become salinized
- 4. no water supply possible

**Bottlenecks:**

- drought damage agriculture
- nature susceptible to drought / salinization
- creeks drying up temporarily
- low river levels disrupt shipping
- potential shortage of cooling water for power plants

- Average water demand (m³/s) in the Netherlands in terms of:
  - level management (55%)
  - flushing (33%)
  - irrigation (12%)

The main causes of constraints in freshwater supplies are:

1. Transport of water supplies is not possible (free-draining elevated sandy ground; part of the southwest estuary area).
2. A shortfall on water available from rivers and canals.
3. Excess demand on reserves, or reserves exhausted (IJsselmeer).
4. Accelerated salinization of intake points (below the major rivers: Gouda and Bernisse).

To date, the frequency of these constraints has been acceptable in policy terms. Hence, there is no policy in place for structural water shortages, only for incidental dry periods – for which there is the water distribution priority sequence. Hence, there is policy for the situation involving a temporary shortfall in water available because of long periods of dry weather nationwide or in some areas, or because of extremely low river discharges caused by extended dry periods across northwest Europe. This policy aims for adequate water supplies – also in extremely dry years – for safety, utilities and to prevent irreversible damage. Even so, complete avoidance of damage due to dry periods is impossible. See table 1 for an illustration of drought damage.

Socio-economic developments and climate change could mean increased demand for water while supplies decline in

spring and summer. Demand for water is very likely to rise in three of the four scenarios<sup>23</sup> which have been studied, while supplies will decrease strongly in two of the four scenarios<sup>24</sup>. This means that constraints will increase in three of the four scenarios.

The west of the Netherlands undergoes external salinization: encroachment by salt water from estuaries. In this area the studies of the scenarios show a strong rise in the period of time during which zero fresh water can be admitted from the main water system in dry years. This applies in particular to the Gouda intake serving the west of the country, and to a lesser degree to the intake at Bernisse for the industrial cluster around the Rhine estuary and water supply for Delfland.

In areas dependent on the supply of river water, average years will already see constraints arising around water level management, water quality and the intake of water for the regional system with rapid climate change<sup>25</sup>.

Areas which do not have external water supplies (elevated sandy areas and part of the southwest Delta) will see constraints due to a lack of moisture in the soil, lowering of the water table and/or increased drying out of the regional water system under the hot and dry scenarios, in average years.

For the IJsselmeer Region rapid climate change scenarios do show adequate water supplies in 2050 – sufficient to meet water demand for current functions, during a dry year (averaging one in 10) in the area served today. However, this does require adjustment to current water level management to ensure a more flexible system (see 2.4 IJsselmeer Region) and better use of available reserves. The analyses still show a wide bandwidth whereby in an extremely dry year (1/100 years)<sup>26</sup> the IJsselmeer Region could suffer a major water shortage in 2050. Today's incidental constraints would then become structural and dry years could occur much more often.

**Table 1 Illustration of the economic impact of water shortage on agriculture and inland shipping.** Based on the Netherlands Drought Study and Drought Study 2, in the current situation. Frequency may increase due to climate change (by a maximum factor of 5; in scenario Steam). Over the next several years the figures will be further studied in the sub-programme Freshwater.

Degree of drought	Damage to agriculture in mln €	Extra costs shipping in mln €
Dry year (average once in 10 years)	700	100
Extremely dry year (average once in 100 years; e.g. 1976)	1800	500
Annual expectation	350	90

<sup>23</sup> Delta scenarios Busy, Steam and Warm.

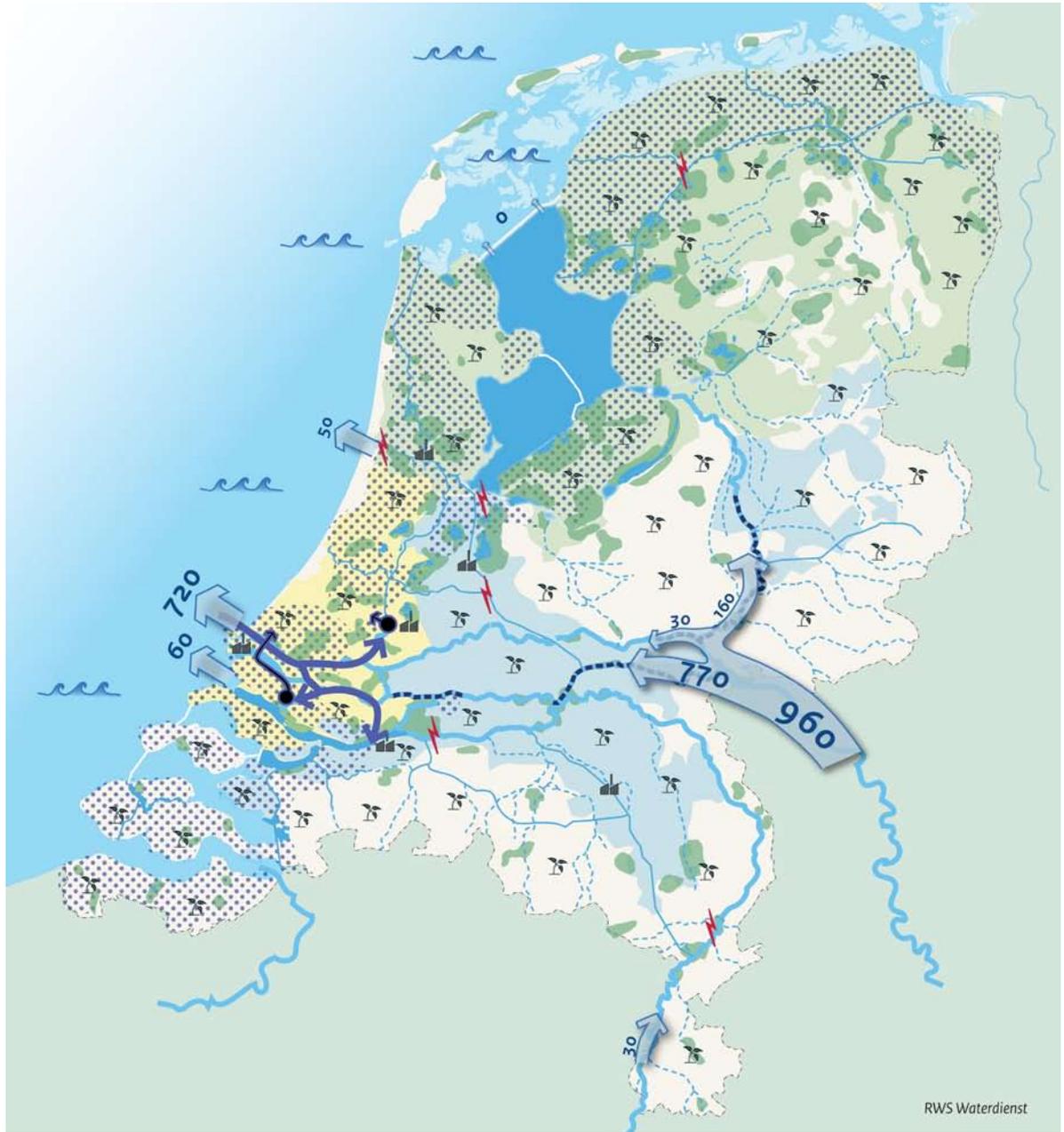
<sup>24</sup> Delta scenarios Steam and Warm.

<sup>25</sup> Delta scenarios Warm and Steam.

<sup>26</sup> 1976 was an extremely dry year.

**Map 3b Freshwater 2050**

Climate scenarios Warm and Steam, dry year (once every ten years)



RWS Waterdienst

**Key to symbols**

- main water infrastructure
- large body of surface water
- salt water (sea)
- water flows driest decade in six-month summer period (m³/s)

- Average water demand (m³/s) in the Netherlands in terms of:
  - level management (59%)
  - flushing (26%)
  - irrigation (14%)

- Effects climate change:**
- decreased average summer discharge Rhine/Meuse (extreme low levels more frequent)
  - rise in sea level (max. 35cm in 2050)
  - decreased summer rainfall (19%)
  - increased summer evaporation (15%)

- increased salt intrusion
- increased salinization
- main inlets under pressure more often

- Cause of bottlenecks:**
1. insufficient supply from river
  2. excess demand on water buffer IJsselmeer
  3. inlets become salinized
  4. no water supply possible

- Bottlenecks:**
- increased drought damage agriculture
  - decreased current nature assets (dessication / salinization)
  - creeks drying up temporarily
  - low river levels disrupt shipping
  - cooling water quantity for power plants more frequently under pressure
  - bottleneck industrial thermal discharges

When they do arise constraints harm the economy as shown in the example in table 1. This may include crop damage, restrictions on industry and reduction of shipping on canals and rivers. At the same time it can also jeopardize utilities and safety, or bring irreversible damage, such as the settling of peat and the natural environment. It is fair to call this social damage. With this in mind studies also looked at the nature of the expected constraints.

With rapid climate change and continuance of current policy and management, a dry year, which occurs on average once in a decade, could impose pressure on uninterrupted supplies of power and drinking water across most of the country. This could jeopardize the safety of regional flood defence systems (stability peat- and other dykes), whereby irreversible damage would not always be preventable. Uninterrupted drinking water supplies in the IJsselmeer Region could be pressured due to deteriorating water quality. In the IJsselmeer Region inability to ensure safety or to prevent irreversible damage (to the natural environment) will only be factors during an extremely dry year, which occurs on average once in 100 years.

The constraints noted will be dealt with in more depth and detail in stage 2 of the analysis of constraints (end 2011). Meanwhile, freshwater tasking will be quantified per region in m<sup>3</sup> water, and possible solution-paths with relevant measures will be shown on this basis. In focusing the analysis of constraints the possibility must also be borne in

mind that countries upstream will use and retain more river water, as they also face increased water demand and shortages. Other factors considered will be adaptation to climate change, exploiting chances and possible technological developments around water utilization functions. These developments can have a major impact on the scope of the constraints identified.

The sub-programme Freshwater will focus on measures and provisions that make the water system more flexible to find solutions on the short term. Potential measures will be assessed for feasibility and short-term impact:

- Flexible water level management in storage of water during the winter six months – both for surface water and groundwater – for use in the summer six months.
- Creation of water supply for important, currently vulnerable, water supply routes such as the Hollandsche IJssel which is subject to rapid salinization.
- Deployment of temporary pumping units (emergency pumps) to move water from A to B
- Small-scale water storage, level-linked drainage and other small-scale, operational measures to optimize water use.

At the same time a more fundamental approach is needed in the longer term. Indeed, the water system and management of a policy around freshwater supplies will be at their outer limits in the event of climate change and/or increased demand for water. Current policy objectives focus on incidental drought – which could become structural in

## MIRT Study ‘Delta Programme Freshwater’

Name	Reason and objective	Planning	Parties involved
Delta Programme Freshwater	Increasing system flexibility and development of a strategy for sustainable, long-term, freshwater supplies with a linked package of measures.	<p>2012 Potential strategies freshwater supplies</p> <p>2013 Promising strategies for freshwater supplies</p> <p>2014 Preferential strategy (input for Delta Decision Freshwater strategy)</p>	I&E, EA&I, provinces, municipalities and regional water boards, social organizations, Delta Commissioner.

the future. The sub-programme Freshwater also looks at system flexibility and efficiency, as well as the more efficient use of water. The questions to be asked here are: What damage will be inevitable? What damage or constraints are still acceptable? How much water will be supplied in due course and at what price? What are the user's responsibilities?

Partly based on recommendations by the Delta Commissioner the challenge lies in prioritization of objectives around socially sustainable and economically effective freshwater supplies while seeking strategies to realize these. Government has accepted the recommendations of the Delta Commissioner and will detail these in the next stage of the programme.

Alongside increasing water reserves, seeking strategies and related measures will deliberately examine demand for water from the user-side. Also included will be agreements on quantity and quality with neighbouring countries (see section 3.5). Water volumes (m<sup>3</sup>) will be the starting-point. One possible solution being studied for feasibility is a structural increase of the level of the IJsselmeer (see section 2.4); this would be set off against other solution-paths and is dependent on the yet to be determined objective. Regional self-supply is also being examined as a possible solution-path. The PBL report (footnote 20) established links between measures in the IJsselmeer and the approach to salinization in the Nieuwe Waterweg. This solution-path will be further detailed as part of strategy development.

This fundamental approach steers development towards sustainable freshwater supplies. This approach anticipates future developments and enables exploitation of chances in – for example – sustainable agricultural development and innovative dyke reinforcement. Cooperation and fine-tuning with the regions, utilization functions and Delta sub-programmes will be essential in the stages ahead.

## 2.4 Area-based sub-programmes

This paragraph describes the main aspects of the position of the analyses around the area-based sub-programmes. Current and possible future safety and water supply tasking and progress regarding DP2011<sup>27</sup> are covered briefly per sub-programme, and there is a look ahead to possible strategies. Treatment of each sub-programme closes with a table giving a brief summary of the relevant MIRT study.

Appendix A on the attached DVD sets out the tasking of the area-based sub-programmes in more detail. The analyses have been established by the administrative steering groups at regional and national levels. The analysis will be reviewed again annually up to 2014, to ascertain whether the starting points are still valid for the solution-paths and Delta Decisions.

### IJsselmeer Region

The IJsselmeer Region forms an essential part of Dutch water management. Not only has the IJsselmeer Dam substantially improved safety across the entire area but it has enabled land reclamation and generated major freshwater reserves for a significant part of the country. The IJsselmeer Region is valuable in both ecological and cultural-historical terms; multiple uses/activities include nature, recreation and shipping. Management of the IJsselmeer is structured in such a way as to do justice to every function; however, it was not designed for a flexible water system.

#### Safety tasking

The water system is currently approaching its outer limits for reasons including rising sea levels over the past several decades and increased pressure on space. It does not operate as well as it should. Hence, the IJsselmeer Dam does not meet flood protection standards and maintaining the winter levels is not always feasible. The IJsselmeer Dam will be reinforced, as will all dykes that do not comply with safety. ESA (extra drainage capacity IJsselmeer Dam) ensures additional extra drainage capacity, to cope with a rise in sea level of up to 25 cm. Any additional rise in sea level will mean either pumping water from the IJsselmeer to the Wadden Sea or allowing the IJsselmeer to rise apace with sea level.

In the short-term the conclusions of the Third Safety Assessment Primary Flood Defence systems could involve additional costs. The possible updating of flood protection standards could also impact on safety tasking.

#### Freshwater tasking

Freshwater reserves in the IJsselmeer are now sufficient to meet demand for freshwater for the current functions and supply area, during an extremely dry year – which occurs on average once in 100 years. Hence, in the short term there is no need for a new IJsselmeer water level ordinance such as announced in the National Water Plan.

There is still great uncertainty around the pace of climate change. With rapid climate change<sup>28</sup> in 2050 current freshwater reserves would still be sufficient to meet demand from today's IJsselmeer Region in a dry year, which occurs on average once every ten years. To this end however, the water system would need to be more flexible. Current water level management with fixed summer and winter target levels needs to be replaced by more flexible management whereby the level can be increased when needed and drop in periods of heavy water consumption. This will allow freshwater reserves to increase whereby these can be used as required. With rapid climate change in a dry year the intake for drinking water at Andijk may be hampered by salinization. However, given an extremely dry year and rapid climate change, 2050 could bring a substantial water shortage. As 2100 approaches the shortages could become more extreme and more frequent. In contrast, with less rapid climate change<sup>29</sup> in an average year there could still be adequate water supplies. Objectives around freshwater supplies must clearly show the extremes for which we are preparing (see para. 2.3).

#### Preview of potential strategies

Adaptation of water level management is one solution-path that arises both for the approach to flood risk management and for freshwater tasking. The task of the Delta Programme IJsselmeer Area is, jointly with the partners, to review all possible solution-paths or combinations of these. To this end the first stage of the programme saw joint studies and reviews on the impact of various water level regimes, i.e. increase the level, lower the level, and maintain the present level.

<sup>27</sup> Also see appendix B on the attached DVD.

<sup>28</sup> Delta scenarios Warm and Steam.

<sup>29</sup> Delta scenarios Rest and Busy.

This generated several insights:

- The current configuration of the IJsselmeer Region is not very flexible. Minor changes in water level can have major consequences for safety, water management, utilization functions and the natural environment. There may also be a severe impact on such issues as cultural-historical values, spatial development, accessibility and the investment outlook. Large changes in water levels would demand major investment.
- A decision to pump water out of the IJsselmeer to the Wadden Sea (and maintain the present level) could solve safety tasking; however, the possibility of increasing freshwater reserves would be limited to a wider variation of the summer water level.
- A decision to have the level of the IJsselmeer rise apace with the sea would generate a major (safety) task right along the banks of the IJsselmeer. The IJssel-Vecht delta is particularly vulnerable to shifts in water level. In the event of a rapid increase in sea level and climate change, rising apace with the sea would yield a maximum of 720 million m<sup>3</sup> of additional water reserves in 2100.
- Apart from the rising-apace formula, freshwater reserves can be increased through greater variation in summer water levels. A combination of the two would yield the largest freshwater reserves.
- In the longer term changes in water level management offer both chances and threats for regional developments.

It is safe to conclude that the main short-term need is for greater flexibility in the water system in order to increase freshwater reserves as required, while not ruling out future options. Choices for long-term water level management in the IJsselmeer Region need to be based both on safety tasking and further to be detailed objectives for freshwater supplies.

The Delta Commissioner recommends that the structural 1.5 metre increase in the level of the IJsselmeer as proposed by the second Delta Committee should not, at this time, be taken as central in seeking a solution. Instead, he also calls for other variants on the solution to be brought into focus for supply, water reserves in dry periods in-and-outside the IJsselmeer Region, and around demand from the area served. The PBL recommendation (footnote 20) on linkage with the Nieuwe Waterweg will be used here.

The government underwrites the thrust of the Delta Commissioner's recommendations and the commitment to greater flexibility. If the results of the next stage of the Freshwater sub-programme (more detailed analysis of constraints and development of a first set of strategies) so merit, increasing the level to 1.5 metres might come back into focus.

## MIRT Study 'Delta Programme IJsselmeer Region'

Name	Reason and objective	Planning	Parties involved
Delta Programme IJsselmeer Region	With an eye to climate change and changing demand for freshwater – develop a strategy for water level management of the IJsselmeer from 2015-2100.	2012 Potential strategies 2013 Promising Strategies 2014 Preferential strategy (input for Delta Decision Flood risk management and Water level management IJsselmeer Region)	I&E, EA&I, provinces, municipalities and regional water boards, social organizations, Delta Commissioner.

## Rhine Estuary-Drechtsteden

The Rhine Estuary-Drechtsteden area is highly urbanized and with activities including the port has a very significant economic value on a national scale. Space is at a premium in the area which has a population of some 1.6 million of which 64,000 outside the dykes. Rhine Estuary-Drechtsteden is the central area in the delta where sea and river come together and where safety (from the angles of the sea and rivers) and freshwater supplies (drought, low-water, and salinization) are both on the agenda.

### Safety tasking

Under the current system flood risk management in the Rhine Estuary-Drechtsteden area is ensured by a combination of flood defence systems backed by dykes and river-widening. Without the Maeslant and the Hartel flood defence systems the dykes would need to be higher, by 0.5m in Dordrecht and as much as 1.2m in Rotterdam. In this region the area outside the dykes is used intensively for housing and work. These are relatively elevated areas and are also protected when the storm surge barriers are closed.

The findings of the third Review of Primary Defence Systems are expected to lead to tasking around reinforcement of the current system in the Rhine Estuary-Drechtsteden area. Climate change and subsidence are creating a second regional safety task. Working on the basis of the Steam-scenario, in 2050 just over 30% of the dykes would be sub-standard, rising to 50% in 2100.

The last several decades have seen a substantial rise in population and economic value in the region. To this end the sub-programme Safety examines whether the current level of protection (flood protection standards) is still sufficient. This could lead to a third safety task for the Rhine Estuary-Drechtsteden region.

In spatial terms, large sections of the three tasks are expected to fall within the Rhine Estuary-Drechtsteden region, hence the importance of a comprehensive view and approach. The question also arises as to whether the current safety approach is adequate or whether there needs to be a shift in strategy.

The national and regional authorities seek to realize their urbanization tasks within the towns and cities. In this region inner-urban development usually means building outside the dykes. Because of this already intensified spatial development outside the dykes, such as urban restructuring or intensified port activities, the effects of extremely high waters increase.

Rising sea levels and altered river regimes also increase the chances of a high water situation in the area outside the dykes. First to flood are low-lying natural and agricultural areas, followed by the old urban and port areas. Any potential high water situation would mainly give rise to material damage and the likelihood of casualties is very limited. Relatively new areas such as the new port areas like Europort and the Maasvlakte industrial location are virtually problem-free in this respect as neither have sufficient elevation or have been planned adaptively.

The Maeslant flood defence system in the Nieuwe Waterweg is an important link for flood defences for the west of the country, and will continue to be so for the next several decades. The flood defence system was designed to cope with a rise in sea level of up to 50cm and will continue to do so with no major alterations. Based on the Steam-scenario this increase will not come about before 2070 at the earliest. More frequent closing of the defence system in the future could affect accessibility for both the mainport and the hinterland. At present the Maeslant defence system complies with the set standards.

The Delta Commissioner recommends a review of a further increase in safety provided by this flood defence system, given the important role it plays in protecting the hinterland. The government has adopted this recommendation and the state secretary of I&E will instruct Rijkswaterstaat to conduct this additional study within the framework of the Delta Programme.

### Freshwater tasking

Freshwater plays an important role in the west of the country. It is used in preparing drinking water, for agriculture and horticulture and for industrial processes. It is also deployed to maintain water levels and to flush out the drainage system/temporary reservoirs. The availability of freshwater is essential for industry, agriculture and horticulture – including the greenports of Westland, Oostland and Boskoop.

Freshwater supplies in the west of the country are strongly dependent on the water intake points near Gouda (Hollandsche IJssel) and Bernisse (Spui). There are already incidences of water at the intake points being too saline to use. This is due to seawater intruding the river (external salinization) which pressures functions dependent on freshwater. In the future this will happen more often and for longer periods due to diminishing summer drainage from rivers, together with rising sea levels. This could make the intake point near Gouda virtually non-operational around 2050 – as it has to close during the growing season (in the Steam scenario). Under the Rest-scenario this could happen around 2100. A similar trend is visible at the intake near Bernisse, but with either scenario it should be able to go for a while longer thanks to buffer capacity at the Brielse Meer and tidal factors. A timely alternative is required for the intake point near Gouda or there will be major pressure on freshwater supplies for the west of the country. Increasing evaporation and salt water seepage could double demand for freshwater up to 2050. Population growth and economic growth can further increase demand.

It is likely that lower river discharges in the future will mean more frequent constraints for shipping with shallower channels reducing cargo capacity.

### Preview of potential strategies

The heaviest task in the Rhine Estuary-Drechtsteden area is linking spatial ambitions and flood risk management tasking, in the short and medium-terms, with long-term strategy around safety and freshwater supplies. Such a long-term strategy is required for the spatial ambitions in the Rhine Estuary-Drechtsteden area. The PBL recommendation (footnote 20) on linkage with the Nieuwe Waterweg will be used here.

A study is underway within the framework of the Delta Programme into realizable spatial ambitions that do not conflict with potential spatial reservations for safety tasking or new policy principles. In view of linkage with the Southwest Delta and Rivers sub-programmes, the next stage these sub-programmes will jointly examine potential strategies for the Rhine-Meuse delta.

## MIRT Study ‘Delta Programme Rhine Estuary-Drechtsteden’

Name	Reason and objective	Planning	Parties involved
Delta Programme Rhine Estuary-Drechtsteden	Re. climate change: development of longer-term strategy for flood risk management and freshwater supplies in a synergetic relationship with a sustainable and vital spatial development of the Rhine Estuary-Drechtsteden region.	2012 Potential strategies 2013 Promising Strategies 2014 Preferential strategy (input for Delta Decision Flood risk management and Rhine-Meuse delta)	I&E, EA&I, provinces, municipalities and regional water boards, Delta Commissioner, business community, social organizations, general public and scientific institutions.

## Southwest Delta

The Southwest Delta is the outcome of centuries of human intervention, the most recent being the Delta Works. This has made the delta safe, albeit constantly on the move. A significant part of the area's socio-economic vitality is determined by the safety and quality of the water basins. The southwest Delta's economic functions comprising mainports, industry, shipping and agriculture are highly significant in northwest Europe, as are the ecological functions.

### Safety tasking

With safety measures including improvement of stone cladding on the estuarine dykes, Room for the River etc. Within the framework of Room for the River, additional capacity is being realized for the Volkerak-Zoommeer for storage of river water in the event of extreme high water levels and closed storm surge barriers. This is necessary to prevent water levels exceeding design conditions at locations including the Hollands Diep and Haringvliet.

The findings of the Third Safety Assessment Primary Flood Defences could increase safety tasking in the short term. The impact of climate change will be mainly in the medium- to long term. Calculations show that, depending on the delta scenario, storage capacity in the Volkerak-Zoommeer will no longer be sufficient somewhere between 2030 and 2060. This requires additional measures to cope with high levels of river discharge.

In the case of the Scheldt basins and the Voordelta Coast continuation of the current safety strategy (sand replenishment, reinforcement of the foreshore and dykes) will be adequate for the time being. The impact of the autonomous morphological development (additional sand required to restore equilibrium within the closed Eastern Scheldt) will in due course represent a problem for safety, nature and the landscape.

Lastly, the possible updating of flood protection standards could add to tasking.

Storm surge duration is an important boundary condition in preparing for the Rhine-Meuse delta decision. The current wind surge duration is 29 hours in line with the Statutory Review Instruments (WTO) established in 2006. Studies in the framework of the WTO which have been reviewed internationally show the need to take amended wind surge duration into account.

To this end the Delta Commissioner recommends that the Delta Programme's analyses and studies for subjects including the Delta Decision Rhine-Meuse delta, should – in anticipation of later decision-making – observe 35 hours storm surge duration - alongside the 29 hours duration. The government accepts this recommendation.

### Freshwater tasking

Freshwater plays an important role in the Southwest Delta. It is used in producing drinking water, and for industrial process water. It is also essential for agriculture and horticulture in the delta – as well as being deployed to maintain water levels and regulate water quality. Freshwater is the basis for the quality of life and economic vitality in the delta.

The Southwest Delta and Rhine Estuary-Drechtsteden sub-programmes have made a joint regional analysis of constraints around the freshwater system in the west of the country. This shows that rapid climate development<sup>30</sup> across large parts of the Southwest Delta would increase demand for freshwater due to internal salinization, with increased salt water seepage in the regional water system. This type of scenario would require a larger external input of freshwater to flush the regional water system. More freshwater would also be needed for drinking water and industry. In or around 2050 freshwater requirements in the delta could rise by a total of 40% on 2011. Whether or not this additional requirement for freshwater forms a constraint as from 2050, will depend on input from the main water system and regional basins (West-Brabant and Zeeuws-Vlaanderen). This provides an international dimension to the analysis of constraints. The additional demand for freshwater in the delta cannot be viewed in isolation from the upstream demand for freshwater.

<sup>30</sup> Delta scenarios Steam and Warm.

Specific to this area are the so-called freshwater lenses and their important function in supplying freshwater for agriculture. Area-based studies are underway into whether and where a tipping point is reached, i.e. if and when the freshwater lenses will disappear due to desiccation and freshwater discharge via drainage. Overall strategic freshwater reserves for the entire southwest of the country are formed by the Biesbosch, Hollands Diep and Haringvliet. Reduced river discharge would put pressure on this reserve. The issue of external salinization at the Rhine Estuary-Drechtsteden also applies to the southwest delta.

#### Implementation Programme Southwest Delta 2010-2015+

Short-term urgent issues are incorporated in the Implementation Programme Southwest Delta 2010-2015+. Involved here are water quality issues, salinization around low level river discharges jeopardizing freshwater supplies, the need to store water in the event of storms at sea and/or closure of the delta - parallel with high level river discharge. In view of intended regional economic developments this complex cluster must be formed into a cohesive, directional decision on Volkerak-Zoommeer and Grevelingen, as early as 2012.

#### Preview of potential strategies

All delta scenarios show increased chances of salinization in the southwest of the country. In collaboration with the Freshwater and Rhine Estuary-Drechtsteden sub-programmes the next stage seeks strategies for freshwater supplies for the economic functions in the Southwest Delta. Short-, medium- and long-term safety tasking around the Southwest Delta provide input for Delta Decisions on Flood risk management and the Rhine-Meuse Delta. In view of linkage with the sub-programmes Rhine Estuary-Drechtsteden and Rivers there will be a joint approach to strategies leading to a proposal for an area-based approach in the Southwest Delta.

## MIRT Study: 'Delta Programme Southwest Delta'

Name	Reason and objective	Planning	Parties involved
Delta Programme Southwest Delta	Re. expected increase in sea levels and extremes (high/low) in river discharges – crafting a long-term strategy for the Southwest Delta to ensure ongoing development of a safe, resilient and vital region.	2012 Possible strategies 2013 Promising Strategies 2014 Preferential strategy (input for Delta Decision Flood risk management and Rhine-Meuse delta).	I&E, EA&I, provinces, municipalities and regional water boards, social organizations, Delta Commissioner.

## Rivers

The past several decades have seen a strong increase in economic activity in the river region (Meuse and Rhine tributaries) and pressure on space has increased apace. Functions depend directly or indirectly on the river and on flood protection and the future will bring claims on space both from the angle of flood risk management and other functions.

### Safety tasking

The starting point for the analyses of safety tasking for the sub-programme Rivers is the completion of 'Room for the River' and 'Meuse Works'.

In the short-term the findings of the third Safety Assessment Primary Flood Defences could increase tasking. At the same time, in the medium to long-term the overall river region could take on additional safety tasking. The primary cause for this is the possible increase in peak discharges and higher sea levels: indicative levels for 2100 are 18,000 m<sup>3</sup>/s for the Rhine tributaries and 4,600 m<sup>3</sup>/s for the Meuse. Moreover, the detailing of safety tasking in the Delta Decisions Rhine-Meuse Delta and IJsselmeer Region could impact on tasking for both the Meuse and the Waal, and the IJssel-Vecht Delta.

Lastly, the possible updating of flood protection standards could add to tasking in the river region.

River discharge distribution between the Rhine tributaries represents an important boundary condition of flood protection along the Rhine tributaries: this has been

established and there is little room for manoeuvre. The discharge distribution also affects the IJsselmeer Region, Southwest Delta and Rotterdam-Drechtsteden sub-programmes. These sub-programmes examine the chances and threats of greater flexibility in the discharge distribution in relation to long-term tasking. Existing studies on this topic provide a starting point here.

Safety tasking in the region of the major rivers – in the short, medium and long terms – serves as input for the Delta Decisions Flood risk management and Rhine-Meuse Delta and will lead to a proposal for an area-based approach from rivers. In view of linkage with the Rhine Estuary-Drechtsteden and Southwest Delta sub-programmes there will be a joint approach to strategies.

### Freshwater tasking

Low river-discharge levels impacting on shipping and water supplies (salinization, drought and water shortages) are regular occurrences, as in spring 2011. Calculations with the delta scenarios show how, in the long term, the river inflows can drop sharply in summer and more frequently reach extremely low levels. This will impact on nationwide water supplies (also see Freshwater, IJsselmeer Region, Rhine Estuary-Drechtsteden and the Southwest Delta). The system lacks flexibility due to limited alternative water reserves. This can lead to problems for fresh water intake and for shipping, due to low river levels along the Rhine tributaries, the Meuse and canals in Brabant. It could also spell problems for drinking water supplies in the south of the country and availability of cooling water for utility operations along the Meuse, Amer, Amsterdam-Rijnkanaal,

## MIRT Study 'Rivers Delta Programme'

Name	Reason and objective	Planning	Parties involved
Delta Programme Rivers	Given expected increases in drainage from the Meuse and Rhine tributaries integral area tasking will be formulated for the riverine area and safety strategies will be detailed based on tasking (safety, freshwater) and ambitions.	2012 Possible strategies 2013 Promising Strategies 2014 Preferential strategies (input for Delta Decision Flood risk management and Rhine-Meuse delta).	I&E, EA&I, OCW provinces, municipalities and regional water boards, social organizations, Delta Commissioner.

and the Noordzeekanaal. The practical possibilities of steering low-water distribution and the consequences of implementing this in practice will be illustrated in the Rivers sub-programme; a cohesive high- and low-water approach is important here.

In order to link the short- and long-terms the Delta Programme Rhine & Meuse steering group will identify a limited number of projects giving short-term insights into the systematics of an a regional specification of long-term tasking. The projects in question are Maasplassen, Ooijen-Wanssum, Ravenstein, IJsselsprong Zutphen and Waalweelde.

Integral area tasking will be further detailed in 2011. The initial focus will be on current policy, and documented visions such as the Quicksan Meuse, Integral Review Meuse 2, Waalweelde and Climate-proof IJssel. Where possible flood risk management and fresh water tasking will be linked with the ambitions for other functions in the area of the main rivers and – where necessary – joined with the impact for the regional system.

### Preview of possible strategies

Linked strategies drawing on search-paths such as ‘getting more out of dykes’ (e.g. delta dykes), ‘room for the river+’ or ‘a different look at water’ (e.g. multi-layer flood risk management) will be detailed in subsequent stages. Insights around construction gained from the New Urban Development & Restructuring sub-programme will be deployed here.

## Coast

The coastal base is the foundation for the Coast sub-programme. The coastal foundation, with its dunes and dykes, fulfills an essential role in the flood defence system as the sea level rises. At the same time, the coastal base supports the natural and recreational uses of dune- and coastal areas, including their harbours: in turn, developing these requires extra space. Reinforcement of the weakest links is the starting point for the analysis of safety tasking in the Coast sub-programme.

### Safety tasking

Coastal safety tasking is based on the conclusions of the third Safety Assessment Primary Flood Defences, the (intensity of) rising sea levels, and, where applicable, the possible updating of flood protection standards. Currently, depending on the market situation, some 12 million m<sup>3</sup> of sand is replenished annually and an increase to 20 million m<sup>3</sup> is needed for the entire coastal base to grow apace with the current rise in sea levels.

The current replenishment approach is designed to prevent coastal erosion, to maintain current uses, and to stop the Netherlands from getting smaller.

### *Maintaining the basic coastline*

The ordnance coastline is the average coastline in 1990. Article 2.7 of the Water Act states that government shall prevent or counter the landward shift of the coastline insofar as, in the opinion of our minister, this is necessary with a view to maintaining flood protection standards.

## MIRT Study ‘Delta Programme Coast’

Name	Reason and objective	Planning	Parties involved
Delta Programme Coast	Study around spatial development going hand-in-hand with sustainable safety strategy for the coast.	2012 Provincial coastal visions 2012/2013 National Coastal Vision	I&E, EA&I, OCW provinces, municipalities and regional water boards, social organizations, Delta Commissioner

Moreover, since 2001 it has been policy to have the sandy coastal base – which stretches from the -zom line up to the inner edge of the dunes – grow apace with rising sea levels. ‘Care for the coastline’ is our term for joint maintenance of the basic coastline and the sandy coastal base and the above mentioned replenishment strategy is directed to this end.

The construction of the Sand Motor (‘Delta dune’) on the coast of Zuid-Holland has also meant the start of an innovative method of replenishment. The programme follow-up will also examine new and efficient ways of sand replenishment. The business community (civil engineers and consultants) will also be closely involved in this process. A further important goal is to enhance the benefits to society by also deploying sand required for (long-term) safety measures for other purposes.

With a steady rise in sea level, the volume of sand needed to maintain the coastal base also increases apace. According to initial estimates this can vary, rising to an annual average of 30 million m<sup>3</sup> in 2050<sup>31</sup>, rising to as high as 65 million m<sup>3</sup> annually in 2100. Sustainable management and use of supplies of sand in the North Sea are essential. The various factors at play during sand extraction, such as use of space, borrow area management and effects on nature, must be assessed transparently. To this end Rijkswaterstaat has developed a sand extraction strategy.

Aside from safety tasking, the most important ambitions for the coast lie with spatial and economic development (a quality boost for coastal towns where tourism and recreation are important sources of income). Proposals around spatial development for the coastal towns can be developed by the provinces. The question here is, in how far spatial development can take shape in the medium- and long-term – given possible, longer-term, safety measures. This will involve cooperation with the Safety and New Urban Development & Restructuring sub-programmes in relation to multifunctional use of the flood defence system.

The National Framework for Coastal Development (NKK) was adopted in March 2011<sup>32</sup>. This National Framework forms the basis and handles for provinces’ visions and

strategic agendas and the National Coastal Vision (NVK). The next stage will see the elaboration of the provinces’ visions and their inclusion in the NVK. The provinces’ coastal visions and NVK will include cohesive solution strategies.

Studies carried out within the Coast sub-programme have contextualized the feasibility of large scale coastal expansion. Also, the NKK concluded that in terms of safety, large scale coastal expansion will not be needed at least for the next 50 years.

For this reason, the Delta Commissioner has proposed that large scale coastal expansion should no longer form part of the Coast sub-programme. The provinces can still develop spatial proposals for the coastal towns. There will also, in the framework of the Delta Programme, be a search for options to connect the ambitions for small-scale local coastal development (which stimulate the economy and spatial development) with the sand replenishment needed for the safety tasking to have the coastal base grow apace with rising sea levels. Government has adopted the Delta Commissioner’s advice.

## Wadden Region

### Safety tasking

For the Wadden Region the conclusions of the third Safety Assessment of primary defence systems will also provide significant input for safety tasking – as will the effects of rising sea levels, subsidence and the possible updating of flood protection standards.

With current strategies including sand replenishment and dyke reinforcement long-term safety is assured. This could change given the rise in sea level and related shifts in tidal currents and sediment flows. For example, in several locations channels relatively near flood defence systems represent a possible threat to the stability of the system. There may also be an impact on the coastal base and on the safety of the areas outside the dykes. The current replenishment volumes along the coast are not sufficient to also have the Wadden Sea fully grow apace with the sea level. As yet it is uncertain where the sand shortfalls will eventually create safety problems. Changes in the estuary could mean increasing high water levels in the Eems-Dollard. Given these factors it is likely that safety tasking will increase in the long run.

<sup>31</sup> Delta scenarios Busy and Rest

<sup>32</sup> See attached DVD.

The quick scans in 2011 gave insights into available knowledge to deal with policy issues around flood risk management and climate shifts in the Wadden Region. At the same time the quick scans also clarified gaps in knowledge. Knowledge development and ongoing monitoring of the status of the Wadden system are particularly valuable in answering long-term issues. The tri-lateral Wadden Sea collaboration will be included when detailing the monitoring.

Safety tasking in the Wadden Region provides short-, medium- and long-term input for the Delta Decision Flood risk management. This will lead to a proposal for an area-based approach. Where safety tasking requires measures to be taken, the ambition will include linkage with nature and economy.

#### Freshwater tasking

Rising sea levels impact on freshwater reserves on the Wadden Islands with a possible effect on drinking water production, agricultural potential and drying-out of the natural environment. The Freshwater sub-programme reviews solutions.

#### Preview potential strategies

First and foremost the Wadden Region must remain safe. Given that this area has the status of a World (natural) Heritage Site ecological interests must be ensured in every strategy.

To this end 2012 will see work towards improved charting of future safety tasks, a review of flood risk management strategies and the set up of required monitoring. Other aspects in focus will include: concepts to reduce wave-load, multi-layer flood risk management, adapted construction, innovative flood defence systems and potential strategies contributing to the Wadden system's capacity to grow apace with the sea level.

Links will be sought with the Safety and New Urban Development and Construction sub-programmes for solution-paths for possible problems in areas outside the dykes or around flood defence zones.

Changes in the IJsselmeer drainage regime could impact on water quality in the Wadden Sea. To this end prerequisites for the drainage regime will be provided by the Wadden Region sub-programme to the IJsselmeer Region sub-programme. The current safety policy appears adequate in the short term. In the long term continuity of the Wadden Region in its present form is uncertain and alterations to safety strategy may be required.

## MIRT Study 'Delta Programme Wadden Region'

Name	Reason and objective	Planning	Parties involved
Delta Programme Wadden Region	A long-term safety study of the Wadden Region and the set-up of a monitoring plan to establish the impact of climate change on the Wadden Sea.	2012 Potential strategies 2013 Promising Strategies 2014 Preferential strategies (input for Delta Decision Flood risk management).	I&E, EA&I, provinces, municipalities and regional water boards, social organizations, Delta Commissioner.



# 3 Approach

The Delta Programme takes a down-to-earth approach, adaptive and renewing – with knowledge as a key foundation. The down-to-earth and adaptive aspects are evident in ‘adaptive delta management’. It means doing what is necessary, neither too much nor too little, while not ruling out future options. Renewal is implicit in the organization – which was assessed this year – and in the market/innovation ambitions. This is underlined by international interest in the ‘Dutch Delta Approach’.

*Coastal reinforcement at Scheveningen. More sand, a sturdy dyke and a brand-new promenade add up to a safe and attractive Scheveningen.*

### 3.1 Knowledge

Knowledge is a mainstay for the preparation, foundation and selection of the strategies of the sub-programmes and Delta Decisions. The knowledge-intensive nature of the Delta Programme promotes interaction between knowledge-seekers and -suppliers, between national and regional knowledge and scientific and practical knowledge. It reinforces collaboration between knowledge institutions and programmes. In this context the Delta Programme provides focus and direction both in opening-up existing and developing new knowledge and innovation. The Delta Programme's first Knowledge Conference was held on 16 June 2011. The activities of Topteam Water on behalf of the Top Sector Water will be included in the work of the Delta Programme<sup>33</sup>.

To date there has been valuable input from a wide range of knowledge institutions, knowledge programmes, and consulting and engineering bureaus. Both sub-programmes and knowledge institutions collaborate as far as possible in

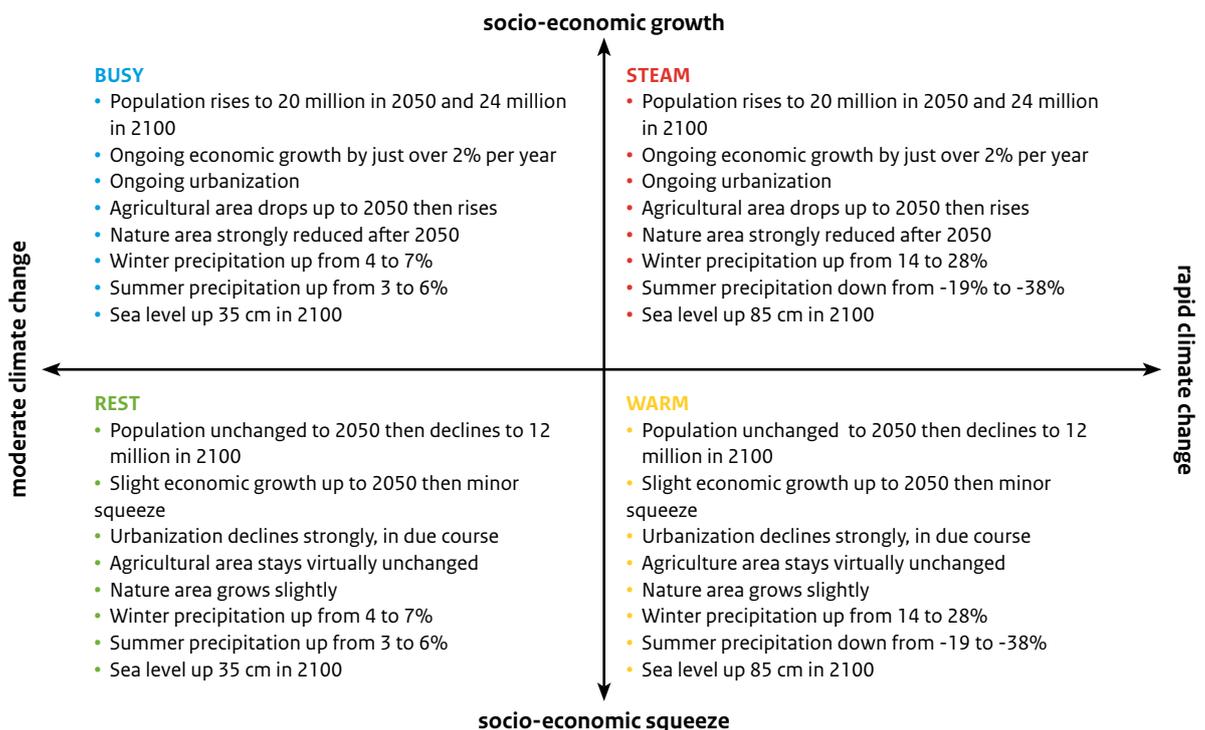
this respect. Hence, the results of the study 'A delta on the move – building blocks for a climate-proof development in the Netherlands' are being deployed by the sub-programmes for development of strategies. In this study the Environmental Assessment Agency worked under the auspices of the knowledge programmes Knowledge for Climate and Climate for Space, collaborating with Deltares, Alterra, UNESCO-IHE, WUR, Utrecht University, Grontmij, UniMaas, Vista, KWR and the WHO.

The operating procedure for the knowledge function in the Delta Programme focuses on:

- Consistent use of data, assumptions and starting points, ensured reproducibility of choices made.
- Maximum opening-up and utilization of existing knowledge.
- Targeted and efficient development to make good knowledge shortfalls.
- A shared approach to (factual) studies.

<sup>33</sup> See 3.4.

Figure 4 Brief description of the Delta scenarios



Consistency and reproducibility are realized via a uniform approach to development of strategies (the 'Process design'<sup>34</sup>), a system for the evaluation and comparison of the strategies and fine-tuning of the Delta instruments. As part of the Delta instruments the Delta model forms the computing heart of the water management analyses. Other elements are unit prices for cost estimates and future scenarios.

Delta scenarios are deployed for uniform operation with possible forward views, within the Delta Programme. The Delta scenarios that became available in early 2011 combine the existing KNMI-2006 climate scenarios and the socio-economic scenarios of the collaborating planning bureaus (WLO scenarios, 2006). Together these comprise the playing field of plausible developments that could be relevant for future water tasking in the Delta Programme<sup>35</sup>. 2011 marked the start of an update of these scenarios which will also include new insights on climate development. These 'delta scenarios next' will be delivered in late 2012/early 2013.

Work is underway on a wide-ranging system of evaluation for the assessment and mutual comparison of potentially promising strategies developed per sub-programme. This system will also be used in the transparent and consistent construction of a linked set of preferential strategies and options for Delta Decisions. In this context we work from broad to fine in line with the Faster & Better approach.

The set of criteria at the heart of the evaluation system comprises results directly from the objectives of the Delta Programme (flood risk management and freshwater supplies), from seeking to achieve these at acceptable costs, and with measures that can count on maximum support – and from the basic values of national water policy, namely solidarity, flexibility and sustainability. Where necessary these will be supplemented with criteria that are specific to the regions. The set of criteria will be designed in such a way as to check in advance for obligations that will apply at a later stage to, for example, environmental reporting, cost/benefit analysis and the MIRT game rules.

Economic analyses play an important role in the Delta Programme in seeking and assessing solution strategies.

To this end the Delta Commissioner formed an expert group in support of the subject. One aspect covered is the limitation of existing economic instruments when it comes to the Delta Programme's integral and long-term approach. For example this applies to the current discount rate as applied to social cost/benefit analyses. The rate for infrastructure is 5.5%, and 4% for unavoidable external effects. Hence, effects occurring in the long term scarcely count. There are several possible approaches to determining the discount rate.

The Delta Commissioner is in consultation with experts including the CPB (Netherlands Bureau for Economic Policy Analysis) on alternative approaches to the discount rate, given the long-term nature of Delta Programme. Delta Programme 2013 will take this further.

An administrative base is highly important in the design of a evaluation system and the development of game-rules for its application. The shared detailing and application substantiate the principles of joint (factual) study.

Project studies help towards putting joint (factual) studies into practice. Involved here is the analysis, development and interpretation of geographic information, visualization of (political) ambitions and the spatial impact this has within the variants, and interpreting these in adequate (map)images for various target groups. Hence this tool leads both to substantive broadening and the reinforcement of communication between the partners involved. Existing initiatives, both in- and outside the Delta Programme are tied-in and supplemented. The experience gained in the Southwest Delta, Rhine Estuary-Drechtsteden, IJsselmeer and Wadden is very promising. Project studies in the 'Delta-atelier' can make an important contribution to – for example – the area-based detailing of possible solution-paths for the upcoming stage of the Delta Programme.

In regard to required knowledge the sub-programmes have formulated a large number of questions<sup>36</sup>. in the context of problem analyses. Knowledge questions relating to interconnectivity of the sub-programmes and preparation of Delta Decisions are prioritized.

<sup>34</sup> See appendix F on attached DVD.

<sup>35</sup> See figure 7.

<sup>36</sup> See Appendix G on the attached DVD.

## 3.2 Adaptive delta management

In the first instance as much knowledge as is available is deployed to answer these questions. This is achieved by maximum utilization of existing knowledge from knowledge institutions, universities (e.g. Pleio/Deltaweb, Delta Programme-Link-Delft/TU Delft), and ongoing programmes (e.g. Knowledge for Climate). Any knowledge still required is developed in conjunction with ongoing knowledge programmes in the framework of NWP/NKIAW and programmes such as Knowledge for Climate, Delta-proof and NWO/Water and Climate. In this context the Council for Delta Studies (RDO) advises on programming of strategic study issues arising from the Delta Programme.

The Delta Programme takes a down-to-earth approach, meaning that intervention should not be tailored to worst-case scenarios, and not assuming 2100 as a fixed end-point. The major uncertainties around future developments and the desirability of responsible financial investment lead to a flexible and realistic approach or 'adaptive delta management'. This approach was introduced in DP2011. Government has instructed the Delta Commissioner to further detail this concept in DP2012, as shown below, whereby appendix D (on the attached DVD) provides two specific examples of the application. The approach taken for the Thames Estuary in London (see 3.5) was a source of inspiration here.

Adaptive delta management is a transparent way of including uncertainty around future developments in decision making. In this context we aim for 2050 with a forward view to 2100. The approach combines existing insights into working with several potential strategies ('adaptation paths'), and appraising flexibility around solution-paths.

Preparing for decision-making is time consuming and the actual realization of the measures decided on needs to take account of a substantial time-frame. In the meantime a range of developments are underway, also in terms of use of space and water management. Some developments may lead to higher costs. Examples of this include building-over spaces which could later have been usefully deployed for measures. Meanwhile, other developments could lead to cost reductions, e.g. river widening being combined with replacement of sluices approaching obsolescence. Assuming that they are financially viable, decisions on short-term measures should be taken in such a way as to avoid the unnecessary mounting of longer-term costs, while agreements should be reached on processes that could be linked cost-effectively.

Adaptive delta management develops a schematic overview with adaptation paths for tasking in the relevant area. This assumes a bandwidth comprising potential, plausible future outlooks (delta scenarios). Starting with the current situation, this scheme charts out the next decision. Moving further ahead it looks at possible amending or adaptive strategies at a later stage, including conditions under which it would be wise to shift strategies. Next, it focuses on possibilities for linking realization of the strategies with other investment agendas.

Two specific practical situations were analysed in this way<sup>37</sup>. This shows that adaptive delta management leads to new insights and can mean added value in preparing for decision making.

### Political-administrative aspects

From the administrative angle the added value of the concept of adaptive delta management lies in linking long-term tasking with short-term decisions. The concept enables insights into the physical and administrative complexity of the environment, as well as the possible solutions – making them more digestible. The complexity of the actual method of analysis is in itself a point for consideration. With adaptive delta management there is an active search for possibilities to link up various investment agendas and policy objectives. This gives the politicians and administrators additional information with which to expand the effectiveness of their investments and the integral character of their solutions. The same applies to the shared preparation of decision making in the Delta Programme as an inter-governmental programme between the responsible government bodies.

### Financial aspects

From the financial viewpoint adaptive delta management can contribute to efficient solutions. Whereas in the regular cost-benefit analysis a strategy will often be weighed-up against other strategies in a single move, with adaptive delta management there is the possibility of introducing several follow-up decisions on top of the initial choice. This approach enhances the standard cost-benefit analysis. Adaptive delta management achieves a better balance in the chances of over- and under-investment. Adaptive delta management provides benefits in that it is easier to take advantage of later, follow-up decisions. For example, there is the enhanced outlook on the benefit and necessity of future measures; the arrival of new innovative techniques which are cheaper or provoke less resistance from the public; the possibility of cost-effective synergy effects in the meantime, and increasing the return on investment by reducing the time between expenditure and income. At the same time there is the possibility of missed income related to keeping decisions open, and possible additional costs due to activities being carried out in such a way that expansion could be needed in the longer term.

Various government bodies are shifting to life-cycle-costing. This means that government explicitly includes the consequences of the various options in the cost-planning stage and the subsequent administrative and maintenance stage in the selection process, and incorporates these costs in the budget. The adaptive delta management approach matches well with the underlying objective of life-cycle-costing. This means working with a long forward view to ensure greater continuity in implementation. In line with the Management Plan for National Waters 2010-2015, over the next several years Rijkswaterstaat will bring into focus replacement spending on water related engineering structures, such as weirs, sluices and pumping stations. The adequate functioning of these engineering structures is most important for current and future tasking around flood risk management and freshwater supplies. The Delta Programme brings short- and long-term issues together. The replacement strategy which is scheduled for development will need to take account of uncertainties in the long-term. This is necessary for a flexible, timely and positioned response to change, and for linkage with national and regional spatial developments.

### Legal aspects

The concept of adaptive delta management fits within existing legislation and regulation. In the event of constraints at the project level no difficulties are foreseen in realizing any amendments at the legal level. An alert stance is required to avoid unintended constraints around the development of new legislation and regulation.

There are various legal options for the mutual fine-tuning of tasking and ambitions in the water and spatial domains. Alongside instruments such as the Water Test and legal constructions such as double zoning, ground policy and preferential rights, the Spatial Planning Act provides the state with options for directional action regarding spatial reservations. Temporarily re-zoning areas also allows for the combination of ambitions. The sub-programme New Urban Development and Restructuring offers a vision for the further improvement of fine-tuning between water and space for a more future-proof spatial organization.

The government plans to reform and significantly simplify the environmental law to improve linkage between sectoral rules, legislation and procedures and to make application less complex, faster and less costly. The programme 'Simply Better' aims to make regulation more flexible, and to offer

<sup>37</sup> See Appendix D on the attached DVD.

### 3.3 Organization of the Delta Programme

more scope for local and regional administrative considerations while offering more possibilities for an area-based trade-off of national standards. In a nutshell 'Simply Better' seeks to contribute to wider administrative room to manoeuvre. The programme supports the introduction of adaptive delta management – as mode of operation – as this maximizes scope for solutions, and expands it where need be.

#### Next

The year ahead will bring more experience with the application of adaptive delta management in practical situations. A number of sub-programmes are already taking an adaptive approach to tasking. This will be reflected in the strategies that are developed. Rijkswaterstaat will deploy the approach in the set-up of the extensive replacement task for 'wet' engineering structures. Lastly, the method will also be further detailed in conceptual terms. The experience gained will be processed into an aid for use by the sub-programmes in the development and detailing of possible and promising strategies.

As announced in DP2011 an external evaluation has been carried out into the organization of the Delta Programme. The purpose of this evaluation was to ascertain if and how the Delta Programme could be more effectively organized. The evaluation report is an attachment to this DP2012<sup>38</sup>.

The evaluation showed that the organizational structure is regarded as logical, given the complex tasking and the importance of meaningful substantive and administrative embedding. The configuration and organization offer a firm basis to link the national and regional sides around tasking for the Delta Programme – while utilizing the strength of the collaboration to the full. The parties involved seek to work together. The Administrative Agreement on Water contributes in this respect in that the responsibilities of the governmental bodies are refined and clarified while – in line with the agreement underlying the coalition government – further detailing is underway around linkage of the MIRT processes. Linkage with MIRT is essential to ensure the connection with other spatial developments.

The evaluation concludes that it is neither necessary nor desirable at this time to effect major changes in the organization of the Delta Programme. The approach taken by the Delta Programme details the principle of Faster & Better. The recommendations of the evaluation will be adopted. The most important recommendations to increase effectiveness and to have the processes in the Delta Programme mesh better with the Faster & Better approach are:

1. Prioritizing and sequencing of the sub-programmes are to be clarified. Fine-tuned planning and procedures are needed. To this end and as per the assignment in DP2011 the Delta Commissioner has detailed the logistics and preparation of the five Delta Decisions. There is a certain hierarchy in the process whereby generic topics are detailed per area. The generic sub-programmes in the Delta Programme will deliver national frameworks in late 2011 and early 2012 at which time they will be detailed by area. Appendix E on the attached DVD contains administrative planning per Delta Decision and sets out a total overview. This has since been discussed with the administrative partners and offers them clarity.

<sup>38</sup> See attached DVD.

2. There will be increasing clarity around the administrative fine-tuning of Delta Decisions. The Delta Commissioner prepares proposals for the Delta Decisions. He is advised by the Steering Group Delta Programme (SG DP) which comprises administrative representatives of steering groups from all sub-programmes, representatives of the umbrella-organizations of water boards, provinces and municipalities and the relevant departmental directors general of I&E and EA&I, chaired by the Delta Commissioner. This gives the SG DP a central role in preparing the linked Delta Decisions and the annual Delta Programme; it will meet twice a year, in April and November.

Administrative fine-tuning occurs on an annual basis in the National Water Consultation Committee (NBO), in June. This is prior to decision making on the Delta Programme in the Council of Ministers. The State Secretary of I&E acts as coordinating minister and chairs the NBO for the Delta Programme. Other participants are the State Secretary of EA&I, representatives of the umbrella-organizations of water boards, provinces and municipalities, the chairs of the steering groups, and the area-based sub-programmes with the Delta Commissioner as secretary. Within the NBO the representatives of the umbrella-organizations speak formally on behalf of their members. The chairs of the steering groups represent their steering group and provide support in consultations. The various partners will have sufficient time to meaningfully prepare for administrative fine-tuning in the NBO. On one hand this is achieved by good timing of meetings of the SG DP and the NBO and on the other by smooth programming of consultations – both of which are planned well in advance.

3. The short- and longer-terms are more explicitly linked within the area-based sub-programmes. Where necessary the assignments to the organizations in the area-based sub-programmes are adapted. Chapter 2 provides a specific impetus for this – including the approach of the Delta Decision Flood risk management and the Flood risk management Programme or linkage of the long-term water level ordinance for the IJsselmeer Region with the relevant Delta Decision.

4. Active social participation in the sub-programmes and transparent communication around the Delta Programme will be continued. All sub-programmes organize the input of the social organizations at their (regional) level. The recommendations of the social organizations are visibly included in the considerations of the regional steering groups. There must be uniform quality in participation to match with the faster and better principle. This is already well organized in several sub-programmes and others follow. The Water and North Sea consultative body (OWN) provides advice on generic sub-programmes and the Delta Programme as a whole.

5. The regional steering groups remain an essential link between national government and the regions and for the steering of the sub-programmes. The coalition agreement underlying the government includes the decentralization of nature and space to the provinces. The Administrative Agreement on Water clarifies responsibilities in the water domain. In the three generic and four of the regional sub-programmes (IJsselmeer Region, Rhine Estuary-Drechtsteden, Southwest Delta and Rivers) a main thrust of tasking lies on the joint preparation of Delta Decisions from their areas. Changes to the set-up of the Delta Programme are not on the agenda at this time but cannot be ruled out at some time in the future, if there is good reason.



Low water. A view from a village street through an alley to the Meuse. Arcen in Limburg.



High water. The Water board closes the cuttings with panels. Arcen in Limburg.

## 3.4 Market and innovation

Within the Delta Programme great importance is attached to the earliest possible involvement of market and knowledge institutions. This is a prime example of a programme in which substance can be given to innovative forms of contract in the water related sector. The earliest possible utilization of knowledge from the business community, knowledge institutions and social organizations can lead to better solutions, cost-savings and greater social acceptance.

Intensive consultation is underway with partners from the business community including VNO/NCW, NL Ingenieurs, Bouwend Nederland and Vereniging van Waterbouwers on the best ways to organize market involvement. The Delta Technology<sup>39</sup> Network plays an active role here. As an experiment a private sector representative will take part in one of the organizations of the Delta Programme (IJsselmeer Region). A sought-after innovative development may be actively identified within the programme. Hence the Ecoshape consortium, which is financed by the business community and government, was asked to input knowledge around natural flood risk management measures (see 2.3). Input from the business community could also be appropriate around the development of multifunctional utilization of defence systems (e.g. delta dykes).

In the strategic development stage (2012-2014) it will gradually become clear which issues dominate the discussion and hence what are the specific points of contact for utilization of market knowledge and experience. Early involvement of the market requires a meaningful separation of interests around tendering. In this context the Delta Programme underscores the most recent insights on early involvement with the market. These insights come from the I&E ministry and Rijkswaterstaat<sup>40</sup> whereby the 'MIRT and MARKET' white-paper forms a starting point. Alongside linkage with latest practice the Delta Programme wishes to invite the market to further renew collaboration via Rijkswaterstaat's 'Market & Alliances' innovation programme.

The recommendations for realization of the Top Sector Water were announced in June 2011<sup>41</sup>. These featured seven distinct spearpoints offering special opportunities to reinforce the position of the Netherlands within the water sector, while promoting innovation and exports. The Delta Programme will fulfil an important role for the Top Sector Water. Four of these seven spearpoints relate directly to the Delta Programme. Pilot projects and space for experiments can be created within the Delta Programme. The Delta Programme offers a wide range of chances for concrete application of innovative solutions (customer-launch) while acting in liaison abroad. The Delta Commissioner is seen in a booster-role for these opportunities.

<sup>39</sup> The Delta Technology Network comprises representatives of private parties, knowledge institutions and governmental bodies.

<sup>40</sup> E.g. the 'Separation of interests' Memorandum which is in force at Rijkswaterstaat and others and is applied in the list of tender announcements. This was compiled jointly with the market.

<sup>41</sup> "Water verdient het" (Water deserves it), advice Topsector Water.

## 3.5 International

Self-evidently the approach to the issue of flood risk management and freshwater supplies in relation to spatial planning is not exclusively Dutch. Firstly, because the rivers have river basins that spread over several countries. To this end the I&E and EA&I ministries maintain contacts with neighbouring countries, (respectively on water & climate and the natural environment) via regular international consultations as well as river basin commissions covering the Rhine, Meuse, Scheldt and Eems. Joint action is a priority here. These commissions fine-tune European directives, such as the Flood Risk directive per river basin. The commissions also form a good consultative platform for issues and harmonization around future availability of water in dry periods. This is an important point that has arisen from the analysis of tasking around freshwater supplies and which has only been tabled to a limited extent in the international context. Moreover, flood risk management and freshwater supplies need to be viewed in tandem: examples would include evaluating implementation of flood risk measures in terms of impact on drought situations – while seeking robust measures for these, rather than problem-shifting.

The Delta Commissioner recommends that the agendas of the river basin commissions should include the importance of a linked approach to flooding and drought. Moreover, insofar as is necessary, the commissioner advises reaching agreements on low-water situations via river basin commissions.

The government also takes the view that flood risk management and freshwater supplies need to be considered jointly. While being aware that this is already a topic of discussion in the international river commissions and the European Commission, the government wishes for studies into possible improvements. In the international context only the Rhine and the Meuse are significant for freshwater supplies. As a rain-fed river the Meuse fluctuates strongly. In times of drought the Meuse discharge agreement with Belgian Flanders ensures an output of  $10\text{m}^3/\text{s}$ . Thanks to a mix of sources the discharge from the Rhine is generally more stable than that from the Meuse.

In July the International Commission for the Protection of the Rhine completed a study into extreme discharge levels. Around the middle of the century discharge from the Rhine-river basin could be to be 20% up in winter and 10% down in summer. These changes may show regional differences. The international commissions have the low-water issue for the Rhine and Meuse on their agendas for further detailing. Given the impact of long periods of drought on society as a whole, consideration might also be given - in these international river basins – to focusing political attention on this issue.

At the European level there are a number of important issues, alongside the existing directives. Given the approach of the Delta Programme it is important that development-oriented measures are enabled by legislation and regulation. Several directives are aimed at preservation and this can hamper an adaptive approach. Here again the Delta Programme joins with ongoing actions by the responsible departments.

The level of flooding seen worldwide emphasizes the importance of tasking in the Delta Programme. Similar problems are faced by other countries – with rivers, sea and spatial planning combining. There are mutual lessons to be learned and to this end in 2011 the Delta Commissioner visited London and Hamburg to compare the British, German and Dutch approaches. Meanwhile, in March this year a delegation including the state secretary of Infrastructure and the Environment went to Vietnam. Public administrations, experts and journalists from other countries have also shown considerable interest in the Dutch delta approach.

*Hamburg: restructuring port area*

The main point here is linkage between governmental and private responsibility:

- Government maintains the flood defence system with an eye to safety within the dykes; outside the dykes it lays down construction and residence regulations.
- Constructions financed by private parties protect sections (owned by these parties) outside the dykes to the same level as inside the dykes
- A number of (flood risk management) game-rules are in place outside the dykes. But compliance is up to the residents – i.e. individual responsibility, within legal frameworks, to realize safety
- Examples of regulations include the necessity for good evacuation routes, not living on the lowest floor, and individual protection for buildings.
- Considerable attention has been given to multi-layered flood risk management, flood-proof building, and around informing the public about flood risk management.



*London: approach Thames Gateway*

Highly comparable to the Dutch situation, for the following reasons:

- The approach: use of adaptive delta management  
Adaptive delta management has been effectively applied and given form and substance in the Thames Estuary 2100 plan which is designed to protect London from flooding for the next 100 years. The plan is adaptive; a tipping point analysis sets out when which decisions are to be taken.
- The task: combination of water management in relation to spatial planning and urban areas.  
Over the next several years the Thames Gateway area will see large scale (re)development in locations prone to flooding. Procedures for dealing with risks of flooding are set out in the UK's spatial planning system. This approach evidences meaningful public-private collaboration.





# 4 Resources

Adequate financial resources are mandatory for ongoing investment in a robust and safe delta, and the Delta Fund plays a crucial role here. The Delta Fund is embedded in the Delta Act which also determines operational scope. With the Administrative Water Agreement the regional water boards also make a structural contribution to financing the flood risk management tasking of the Delta Programme – namely reinforcing primary flood defence systems managed by the regional water boards.

*Low water near Arnhem. Fork IJssel and Lower Rhine.*

### Situation regarding financing of the Delta Programme's ongoing implementation programmes and sub-programmes

Funds for ongoing implementation programmes and projects are included in the budget of the Infrastructure Fund and/or budget chapter XII. Further information can be obtained from the MIRT Projects Book 2012.

Financing of the implementation of the plans of approach for the Delta Programme sub-programmes is a joint responsibility of national government and the regions (provinces, municipalities and regional water boards). The agreements as set out in DP2011 in regard to costs during the period of the MIRT studies (between now and 2015) are ongoing. Funding for the MIRT studies and for the sub-programmes (approx. € 1.5 million per sub-programme annually) are borne by the commissioning ministries I&E and EA&I and incorporated in the relevant budgets for 2012-2014. This budget also covers studies crossing ministry borders.

### Situation Delta Fund

As soon as the Delta Act comes into force the Delta Fund will commence as budgetary fund and in principle will be submitted to parliament with the next draft budget (third Tuesday in September). The Delta Fund budget will be configured in such a way as to mesh with the Delta Act. The Delta Programme's primary tasks – investment in flood risk management and freshwater supplies – will take a prominent place. The experiment clause will also be explicitly positioned in the Delta Fund budget. This clause serves the integral approach of the Delta Programme: next year its added value will be further specified for integral project financing.

Up to and including 2028 the Delta Fund will be filled with budgets and programmes currently reserved for topics including flood risk management and freshwater supplies within the Infrastructure Fund. As set out in DP2011 (page 72) for the implementation the Delta Programme the Delta Fund will be filled with a set, stable and substantial input of at least one billion Euros annually, as from 2020. This decision originates from the previous government's 'supplementary policy agreement'<sup>42</sup>.

The Delta Programme aims for the most economic possible deployment of funds from the Delta Fund. Over the next several decades major water tasking will require substantial government funding. Partly bearing in mind the scarcity of these resources, the funding must be used effectively and efficiently, while seeking to attract private resources. To this end various innovative contract formulas and promising alternatives for financing were mapped out for the realization of the Delta Programme, with an eye to involvement of both public and private parties. This was carried out under the direction of the Delta Commissioner together with the water managers and others and will be reported on as part of the Delta Programme 2013.

Undertakings in the Administrative Agreement on Water safeguard financing of the Flood Protection Programme (HWBP). Parliament was duly informed in the letter regarding the Administrative Agreement on Water, the cabinet reaction Ten Heuvelhof taskforce and flood risk management tasking<sup>43</sup>.

On balance, the budget is sufficient to meet the commitments of the Administrative Agreement on Water for the period up to and including 2028. However, the current budget does not cover the state's share of funding for the period 2011 to 2020. To this end the government took the decision to involve part of the extended plan horizon for the Infrastructure Fund destined for the Delta Fund, which was to be established, to solve this constraint around cash<sup>44</sup>. The required budget of € 1.2 billion for the period 2011 to 2020 is to be brought forward (cash transfer) via cross-departmental funding. On the basis of the Emergency Act the regional water boards will contribute € 100 million during this period with € 1.46 billion from the Administrative Agreement on Water. This ensures that the current HWBP 2 can be completed and that a start can be made with the follow-up to the Flood Protection Programme, as per the Administrative Agreement on Water.

<sup>42</sup> Parliamentary paper 31 070 No. 24.

<sup>43</sup> Parliamentary paper 27 625 No. 190.

<sup>44</sup> Parliamentary paper No. 32 500-A No 83.

Parliament was also informed that, alongside current implementation programmes and the IJsselmeer Dam, a number of projects around flood risk management, water quantity and quality, and fresh water supplies are in the preparatory stage, involving several billions of Euros<sup>45</sup>.

In order to do justice to the major water tasking the Delta Commissioner recommends that the Infrastructure Fund and the Delta Fund should be disentwined in such a way that funds transferred from the Infrastructure Fund to the Delta Fund will ensure that over the next several decades the water tasks can be dealt with credibly and within a reasonable period of time. As soon as the Delta Act becomes law, the government will submit the Delta Fund to parliament on the next budget day. The considerations around the disentwining of the Infrastructure Fund will be clear at that time.

## Delta Commissioner's additional recommendations on long-term financing

### Introduction

During legislative conciliation around the draft Delta Act on 20 June 2011 parliament (second chamber) requested the State Secretary of Infrastructure and the Environment to ask the Delta Commissioner to include in his proposal for the Delta Programme, on an annual basis, the safeguarding of the financing of the Delta Programme in the long term. The State Secretary specified this in a written request for advice to the Delta Commissioner (see appendix) and the Delta Commissioner replied in writing.

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<sup>45</sup> Parliamentary paper 24 625 No. 190: '...This confirms the picture I outlined in December last year to the effect that medium-term spending will more likely involve billions than millions. This does not yet take account of possible additional, substantial investment, in the longer term, on the basis of updated flood protection standards and review findings.'

**Letter of recommendations from Delta Commissioner to state secretary of Infrastructure and the Environment for the funding of the Delta Programme.**

Mr J.J. Atsma  
State secretary for Infrastructure and the Environment  
Postbus 20901  
2500 EX The Hague

16 August 2011

Analysis and recommendations re. ensuring financing of the Delta Programme

Mr. Secretary,

In the recommendations under consideration here, which supplement that already included in Chapter 4 Resources of DP 2012, I report for the first time, at your request and the request of Parliament (second chamber), at the time of the proposal for the Delta Programme to examine ensuring long-term financing for said programme. To this end I focus on the year 2050, as per the Delta Programme horizon. I do so in the knowledge that the course of the Infrastructure Fund/Delta Fund is now fixed up to and including 2028.

In order to provide insights into the long-term effective ensuring of finance for the Delta Programme there should be clarity as to the scale of national flood protection and freshwater tasking and as to the level of resources available for this in the Delta Fund. To this end – given the limited time available – I have only requested information from the Ministry of Infrastructure and the Environment (as per article 3.6c of the draft Delta Act) and within this short time frame no clarification can be provided as to possible contributions by other government bodies. At the time of the next progress report on the Delta Programme (DP2013) I shall request information from the parties involved. At the same time the draft Delta Act clearly sets out national governmental responsibilities in this context.

Based on the information provided by the ministry the conclusion has to be that, self-evidently – also given the current stage of the Delta Programme – at this time it is not yet possible to provide an exhaustive insight into this matter, although it is possible to provide an initial indication on the period needed to realize the current and future tasking. In my view this is likely to be a very long period and one for which I, as Delta Commissioner, request the attention of the Cabinet and Parliament. I have provided further information to this end below.

En route to the proposal for the Delta Decisions and related flood protection programme in 2014, the upcoming annual reports of the Delta Programme will be able to provide an increasingly more focused – also more financially focused – picture of national flood protection and freshwater tasking, whereby an increasingly better founded opinion can be given as to ensuring financing of the Delta Programme. To this end, I shall draft annual recommendations, as agreed by you with Parliament (second chamber). Below I start by outlining a number of background aspects to these recommendations and then go into the financial consequences of the coalition government agreement and the Administrative Agreement on Water before giving a picture of available financial resources, followed by an examination of the tasking of the Delta Programme. These tasks are then compared with available financial resources, and I end with a number of conclusions.

### **Background**

In dealing with the Draft Delta Act Parliament (second chamber), among other things, stated that given the fundamental importance of protecting the country and its continuity against water, there should be a continued emphasis on physical safety. Put another way: we cannot permit another flood disaster. This is also my definite recommendation to the political administration: do not take unnecessary risks. The last century saw substantial investment in protecting this country against water, but action always followed (near) disaster. The IJsselmeer Dam and later the Delta Works were built in the wake of drastic flooding. The weaknesses were known in advance. And plans to reinforce the river dykes were only

implemented after a near-miss with the river in 1993 and 1995 when some 250,000 people had to be evacuated. What matters now is to stay ahead of a new disaster - partly given growth in population, notably in vulnerable parts of the country subject to flooding and strongly increased economic activity and value here. This not inconsiderable assignment is additionally significant in the light of rising sea levels, ongoing subsidence and potentially greater extremes in river discharge, and in rain and dry spells.

Alongside the flood protection task the second major task in the national Delta Programme comprises freshwater supplies. Although the Netherlands is rich in water the past has brought repeated dry periods with all the economic impact this entails. Virtually no one still recalls the incredibly dry year of 1921, but 1976 and 2003 are still etched in the memory; and this has also been a historically dry spring. From June onwards this was followed by a wet summer whereby it was possible to make good the water shortfall. Dry periods plus salinization across much of the country could pose a serious problem – one which will confront us more often in the future and which could harm the economy and utilities.

The key to meaningfully ensuring finance for the Delta Programme lies in the Delta Fund. The Delta Fund is the financial base of the Delta Programme and was set up as a result of recommendations by the Second Delta Committee<sup>1</sup>, issued in early September 2008. This Delta Committee advised the setting up of a Delta Fund whereby structural financial resources would be available for flood protection and freshwater supplies. According to this committee between € 1.0 and € 1.5 billion<sup>2</sup> would need to be allocated annually for the Delta Programme whereby this could be considered as an insurance premium (albeit low) for the interests to be protected: the land, the people and the economic value. In this way national flood protection- and freshwater tasking would be dealt with credibly, and within a reasonable time frame, within the next several decades.

In response to the recommendations of this State Commission it was agreed in the Supplementary Policy Agreement of March 2009 to actually establish a Delta Fund<sup>3</sup>: “A solid Delta Fund will be established to ensure the dynamic implementation of the Delta Programme with fixed, stable and substantial supply, with as from 2020 a minimum of € 1 billion annually from the real constant continued Infrastructure Fund.” In so doing the Cabinet at the time indicated that – notwithstanding the financial crisis that had broken out in autumn 2008 – with all the consequences this had on government finances, priority would go to protecting this country from the water. This realized a structural financial provision for flood protection and freshwater supplies, with annual supply.

### **Financial consequences of the coalition agreement and the Administrative Agreement on Water**

The financial crisis and the ensuing economic recession left deep marks. There were also cuts in ‘spending around water’. Under the coalition agreement, implementation of the Framework Directive Water will be temporized and during this government’s period in office (2011-2015) € 150 million and then € 50 million is to be structurally cut via a more down-to-earth approach in the implementation of the Framework Directive Water.

Moreover, within the framework of effective water management (in addition to the previous annual reduction of € 100 million resulting from the Supplementary Policy Agreement which was collected under the Emergency Act via the regional water boards) the coalition agreement included a cutback and reductions to the ‘regional water board share’ of the Flood Protection Programme (HWBP) of € 150 million during the period of this government (€ 50 million in 2014 and € 100 million in 2015) and subsequently € 100 million structurally. Cuts within the framework of effective water management have been mitigated under agreements on behalf of the Cabinet with the regional water boards in the Administrative Agreement on Water, whereby, on balance, there is no reduction in resources available for flood protection.

<sup>1</sup> Working with water. A country that lives builds for its future. Findings of the Delta Committee 2008.

<sup>2</sup> In the period 2010-2050 between € 1.2 and € 1.6 billion and in the period 2050-2100 between € 0.9 and € 1.5 billion; average over the entire period between € 1.0 and € 1.5 billion.

<sup>3</sup> Parliamentary paper 31 070 No. 24.

Under in the Administrative Agreement on Water it has been agreed that as from 2014 both the national government and the regional water boards will contribute 50% to HWBP water projects. In concrete terms the Administrative Agreement means that the regional water boards' contribution to the HWBP, as per the Emergency Act, will increase in the period 2011-2013 from € 81 million annually (as per the coalition agreement) to € 131 million in 2014, and from 2015 to € 181 million annually.

As from 2014 national government will provide the same amount. The required national budget of € 1.2 billion up to and including 2020 will be brought forward via 'funds movement' whereby available financial scope in the Delta Fund in the period 2021-2028 is proportionately reduced. This leads to an earmarked annual sequence in the Delta Fund for the regional water board projects under the HWBP (€ 262 million in 2014 and from 2015 € 362 million<sup>4</sup>). For the time being the regional water boards' contribution to the HWBP will be entered in the national budget; currently in the Infrastructure Fund and after the Delta Act becomes law, in the Delta Fund. In the event that a further detailing of the Administrative Agreement elects for a differing financing form, the sequence incorporated in the budget will be altered proportionally.

The agreements in the Administrative Agreement on Water mean that financing of the current HWBP is ensured whereby – in any event for the period of the current government – there are appropriate answers to allocate tasking around flood defence. In fact, the regional water boards' contribution to the HWBP provides cover for the expenditure (including shortfalls). Hence, the current HWBP can be completed and a start made on reinforcing primary water defence systems (marked down by the third safety assessment) under the management of the regional water boards. These measures will be included in the linked flood protection programme (2014) under the Delta Programme.

### Available financial resources

At such time as the Delta Act is passed the Delta Fund will commence operation as a budgetary fund and in principle will be submitted to Parliament (second chamber) with the next draft budget. Currently all resources relating to flood protection, freshwater supplies, management and maintenance of the 'wet' infrastructure are incorporated in the budget of the Infrastructure Fund. Hence, in due course these resources will be transferred from the Infrastructure Fund to the Delta Fund. In this context the government will need to make choices<sup>5</sup>.

Based on the information received I note that up to and including 2020 all 'wet' resources are invested and that there is no investment scope up to and including 2020. I further note that in the period 2021-2028 it was proposed to Parliament that the Infrastructure Fund and the Delta Fund should be disentwined in such a way that of the total available budget of € 59.8 billion<sup>6</sup> in this period € 9.7 billion should be used to maintain the Delta Fund, which means an annual budget of just over € 1.2 billion. This amount includes the regional water boards' contribution to the HWBP of € 181 million per year; a total of € 1.45 billion for the period stated.

I also note that the Framework Directive's € 50 million annual cutbacks have been entered in the Infrastructure Fund. For the period 2021-2028 the amount involved is € 400 million. Given the Lucas-Smeerdijk (VVD)<sup>7</sup> amendment adopted by Parliament, whereby implementation of the Framework Directive Water will not be funded from the Delta Fund, this is a relevant point in the choice to be made around disentwining the Delta Fund and the Infrastructure Fund. Your attention is requested here.

During the period 2021-2028 'wet' management and maintenance, including a provision for replacement and renovation, and operating expenses for Rijkswaterstaat, are expected to be approx. € 4 billion, or approx. € 0.5 billion per year. At the risk of over-emphasis it should be noted that good management and

<sup>4</sup> It should be noted here that activity planning means some variation in annual amounts up to and including 2020.

<sup>5</sup> 'Delta Fund' is used from here on, although strictly speaking it is still the 'Infrastructure Fund'.

<sup>6</sup> Parliamentary paper 32 500-A No. 83.

<sup>7</sup> Parliamentary paper 32 304 No. 29.

maintenance are essential to preserve the current level of protection. Hence, the budget available for investment in flood protection and freshwater tasking (i.e. the Delta Programme) during this period is just over € 5.6 billion. This is approx. € 0.7 billion per year.<sup>8</sup>

Of the budget for investment that can be made available in the Delta Fund up to and including 2028 – currently just over € 5.6 billion - € 3.3 billion is already invested in projects; mainly involved here are the HWBP plus the reinforcement of the IJsselmeer Dam, and several other projects. Hence, I note that up to and including 2028 the Delta Fund has some € 2.3 billion which is not specifically committed financially, whereas the Delta Decisions (for the Delta Works of the Future, including the flood protection programme) are still to be taken in 2014-2015.

As previously noted, my annual proposal for the Delta Programme mainly focuses on 2050 and beyond. At this time financial resources are available in the Delta Fund up to and including 2028. Hence, in these recommendations I differentiate between two periods: the period currently covered by finance up to and including 2028 and the period not yet financially covered from 2029 up to and including 2050. In order to make a statement here as to ensuring long-term finance of the Delta Programme, I have, on my own authority, extrapolated the building-up of the Delta Fund until 2050.

As outlined above, in the period 2021-2028 there is an investment budget of € 5.6 billion. Without the cash transfer the investment budget would have been € 1.2 billion higher (€ 0.15 billion per year) namely € 6.8 billion, i.e. € 0.85 billion per year. Hence, for the period 2029-2050 in this additional recommendation, working from a basis of autonomous extrapolation of the annual amount, € 0.85 billion per year will be available for investment. With continuation of agreements under the Administrative Agreement on Water € 0.36 billion of this € 0.85 billion would be earmarked for implementation of HWBP<sup>9</sup> regional water board projects. Based on this extrapolation a total investment budget of some € 18.7 billion would become available in the period 2029-2050, including the contributions by the regional water boards to HWBP water board projects.

The above is further illustrated in the chart below (see page 64).

### Tasking

The major problem around flood protection arises where sea and river meet and the same applies to salinization. In these transitional zones between sea and river – where most people happen to live and where economic activity is at its highest – tasking around flood protection and freshwater supplies are the most far-reaching. Indeed, the proposal for the Delta Decisions in 2014 specifically focuses on this situation.

### Flood protection tasking

First, flood protection tasking. As already described above, the agreements in the Administrative Agreement on Water ensure the financing of the HWBP. This financially covers the current implementation programmes around flood protection. Involved here are the HWBP, Weak Links on the Coast, Room for the River, Meuse Works (Grensmaas and Zandmaas), Sand Motor and restoration of stone-cladding of the East and West Scheldt).

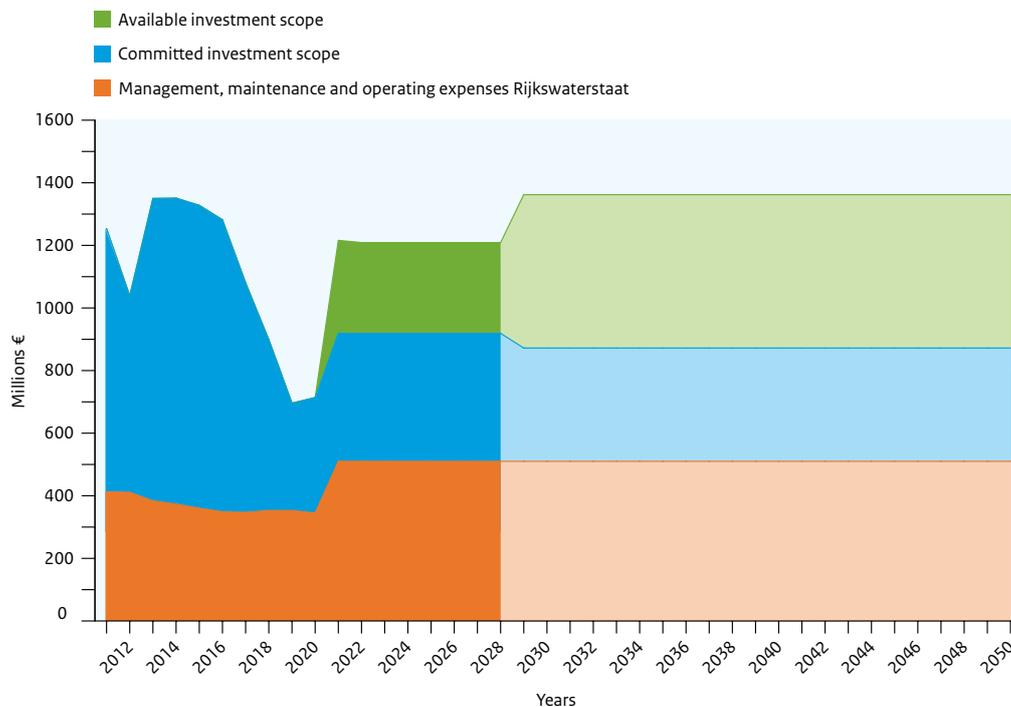
In addition, in order to comply with the current safety standards under the Water Act a wide range of projects are being prepared which still require decisions. Matters involved here include dyke reinforcement by countering piping, dealing with defence systems managed by the national authorities – which had been given a negative report in the third safety assessment and necessary increases in sand replenishment along the coast from 12 to 20 million m<sup>3</sup> per year, in order to counter the current rise in sea level and/or to maintain the coastal base. Tasking is estimated at around € 4 billion. Parliament (second chamber) has

<sup>8</sup> If Rijkswaterstaat's annual approx. € 60 million operating expenses for the investments are included the available investment budget would come to approx. € 0.76 billion per year.

<sup>9</sup> Hence, this would leave € 0.49 billion per year for construction of all other necessary flood protection and freshwater supply provisions.

**Figure Budgets Deltafund**

Diagram based on the draft budget 2012<sup>10</sup>.



been informed in the letter of submission<sup>11</sup> with the Administrative Agreement on Water, and as per the undertaking to Parliament will be further specified by you for discussion of the budget. Hence this will not be done in this recommendation. It should therefore also be clear whether and to what extent this approx. € 4 billion tasking is already covered. For the meantime, in this recommendation I assume that this tasking is not financially covered at present.

Over and above this there are major upcoming expenditures which cannot be accurately estimated at this time, e.g. tasking around the updating of flood protection standards. The National Water Plan states that the measures required to comply with the updated standards must be realized before 2050. Exactly how the updated flood protection standards will look, and where this will lead to whatever reinforcement measures, is as yet unknown. The updating of standards is an important part of the Delta Decision Flood risk management to be taken in 2014-2015. The reports for the updating of flood protection standards will appear after the summer recess: this will feature a quality review by the Central Planning Bureau and Expertise Network for Flood protection (ENW).

Even so, it is possible to say something by way of indication concerning the flood protection task up to 2050. The most useful current source for this is the Social cost-benefit analysis flood protection in the 21st century (MKBA) by Deltares which will be released into the public domain following the summer recess. I have seen an indication of this tasking in the MKBA<sup>12</sup> appendix and have used it in these recommendations. In this context I am aware that, in the anticipation of the validation of the overall MKBA by the CPB and the

<sup>10</sup> The Lucas-Smeerdijk amendment (Parliamentary paper 32 304 No. 29) has not yet been incorporated in the budget. Hence the diagram (the committed investment scope) up to and including 2020 includes investment in water quality.

<sup>11</sup> Parliamentary paper 27 625 No. 190.

<sup>12</sup> Social cost-benefit analysis 21st century, appendix B Estimate of investment costs up to 2050; based on the second reference situation in the MKBA, where new insights are taken into account.

ENW, these are provisional figures which must be 'firmed-up' over the next several years. Meanwhile it should be noted that this MKBA is not definitive for the level of the flood protection standards and the scope of tasking; it is primarily designed to support decisions. The MKBA gives a global picture and in the next several years - based on the sub-programmes of the Delta Programme's area-based strategies (which are to be developed) – the choices will gradually become clearer, as will the impact in financial and spatial terms.

Having said that: this MKBA calculates the economically optimal levels of protection for the Netherlands. According to the MKBA up to 2050 flood protection tasking (not including sand replenishment, including the effects of climate change, without the level of protection deteriorating anywhere, and with all safety measures carried out in a down-to-earth manner) will amount to € 14 billion plus an as yet unknown PM item. If this figure is corrected for the additional sand replenishment required – if only to counter the rise in sea level – and overlaps<sup>13</sup>, flood protection tasking up to 2050 still comes to an estimated € 14 billion, plus the as yet unknown PM item. Taking account of the previously outlined specification of around € 4 billion, total flood protection tasking up to 2050 would then come to around € 18 billion. However, it should be stressed that this estimate does not yet incorporate a number of important matters, e.g. the findings of the Deltares casualty analyses. Also not included is the fact that future review rounds may give rise to additional tasking. Additional flood protection tasking that could arise from the Delta Decisions Rhine-Meuse delta and Water level management IJsselmeer Region is similarly not included. Taking account of the fact that the cost estimates in the MKBA Flood risk management 21st century assume down-to-earth flood protection tasking I believe it is very probable that the total as yet uncovered flood protection tasking up to 2050 is likely to be more rather than less than some € 18 billion. This would particularly be the case if the estimated costs are compared with the considerably higher estimated costs<sup>14</sup> used by the Second Delta Committee (see note 2). As noted, this will become clearer during the next several years.

At this stage these figures are only indications, however, they do give some idea as to the scope of the minimal flood protection tasking between now and 2050.

### Freshwater tasking

Second, freshwater tasking, which is so important for the economy and utilities. A meaningful assessment of freshwater tasking is not possible at this time. The current approach only works with the priority sequencing for occasional major dry periods. In the period ahead the Delta Programme's sub-programme Freshwater will focus on formulating objectives and the still to be determined spread of responsibilities (market - government) for freshwater supplies. Financial and other tasking and measures can be derived from this and policy will be generated.

The fact that no meaningful assessment of freshwater tasking can be made as yet, does not mean that there will be no expenditure around freshwater supplies. During the course of the next decade investment in aspects such as an innovative bubble screen in the Nieuwe Waterweg, or around the Gouda intake point, and for improved freshwater supplies in the Southwest Delta (around the Volkerak-Zoommeer), could already make demands on resources. What is clear is that this country faces a task around freshwater in the next several decades. In financial terms this will probably be less than flood protection tasking, even so, it could well amount to several billions of Euros following 2020.

Even so, it is possible to speak with a greater degree of certainty about annual damage due to drought and salinization. For example, average annual drought damage amounts to € 350 million for agriculture and € 90 million for shipping. In a dry year, which occurs on average once in ten years, damage to agriculture

<sup>13</sup> Countering piping is part of the previously outlined specification of an estimated € 4 billion and of the cost estimates in the MKBA Flood risk management 21st century.

<sup>14</sup> Part of the difference between the higher cost estimates by the Second Delta Committee and lower cost estimates in the MKBA mentioned here is due to the fact that the Committee worked on the basis of an integral increase in the safety of all dyke rings by a factor of 10, while the MKBA flood protection 21st century worked on the basis of economically optimal levels of protection.

doubles to € 700 million<sup>15</sup>. To illustrate this, in 2003 which was a dry year the water shortage led to an approximate € 1 billion fall in agricultural revenues<sup>16</sup>.

### Financing tasks

Comparing the around € 2.3 billion available scope for investment with tasking it is clear that even the flood protection task on its own - estimated at around € 4 billion – cannot be fully implemented in the period up to and including 2028, not counting the additional safety measures resulting from the Delta Decisions of 2014-2015 and freshwater measures where – assuming that priority is given to the statutory flood protection task – at present there is apparently no financial scope to this end. If the around € 4 billion tasking were prioritized with the currently available resources this would only be completed in 2032, and only then could the additional tasking be taken in hand. This would include realizing more updated safety standards and measures to counter drought and salinization.

If the previously outlined flood protection tasking up to 2050 (at least € 18 billion) and freshwater tasking resulting from the Delta Decision Freshwater Strategy (possibly several billion Euros), are combined with the available investment scope up to and including 2028<sup>17</sup> and the extrapolation of the currently available financial sequence in the period 2029-2050<sup>18</sup> (together approx € 21 billion), I foresee<sup>19</sup> that, also taking into account additional tasking under the other Delta Decisions, realizing the tasks outlined for 2050 will be a daunting prospect. Furthermore, as previously detailed in DP2012<sup>20</sup>, self-evidently, the Delta Programme deploys adaptive delta management in aiming for the highest possible level of cost effectiveness.

### Conclusion

It is for the political administration to judge whether or not implementation of the outlined flood protection and freshwater tasking is realized within an acceptable period of time in order to maintain the country's status as safe and economically attractive.

In any event, for the period of the current government there is financial cover for the now identified flood protection tasking: this includes agreements made by you in the Administrative Agreement on Water on behalf of the coalition government. In the subsequent period a number of projects will be in a more or less advanced stage of preparation whereby alongside the possibility of a cash transfer, in the longer term, over the next several years, in my opinion, one cannot rule out an additional call on the national budget, certainly where means of alleviating pressure on said budget (including third-party financing) are insufficient. This will be apparent in due course. For the period after 2028 there appears to be no question of a financial squeeze on that part of tasking which can be reasonably translated in financial terms, as set-off against the financial sequence I have extrapolated. However, as explained above, the scope of flood protection and freshwater tasking up to 2050, as translated into Euros, will be far more extensive than in these recommendations. This is based on information at my disposal.

In the next several years, and certainly in 2014-2015, when the Delta Decisions are taken (giving direction to the 'Delta Works of the Future'), and the initial, interconnected flood protection programme is drafted, it will be possible to speak with a greater level of certainty on the possible additional requirements for financial resources in the period up to and including 2028 and beyond, to protect the country from water while ensuring good supplies of freshwater, even in dry periods.

<sup>15</sup> See also para 2.3.

<sup>16</sup> Oosterbaan, L.(2004) Report of round-table meeting eastern Netherlands, 10 February 2004, Droogtestudie Nederland fase 2 (integral study water shortages), RIZA, Lelystad.

<sup>17</sup> € 2.3 billion, as detailed under 'available financial resources'.

<sup>18</sup> € 18.7 billion, including the contribution of the regional water boards, as detailed under 'available financial resources'.

<sup>19</sup> Hence, without taking account of a possible change in financing following the evaluation of the Administrative Agreement on Water (at end 2013). Whether or not agreements made will be continued unchanged will be clear at this time. In this context it is important that a substantial majority of Parliament voted on 30 June 2011 for the current financial agreements and against total financing of the regional water board projects of the HWBP by the regional water boards (motion Wiegman-van Meppelen Scheppink c.s., Parliamentary paper 27 625 No. 219).

<sup>20</sup> See para 3.2.

I am also currently examining opportunities to use innovative contract forms, public/private collaboration, financial participation by other governmentals and stakeholders, and the possibility of attracting loans, and so to realize more projects than would appear possible, in the first instance with the available resources of the Delta Fund. Self-evidently this is in compliance with budgeting regulations. For the time being, given the public task and responsibility I do not see a great likelihood of substantial additional resources coming available here. I shall report on my findings in DP2013.

Lastly, I trust that this explanation has helped enhance insights into ensuring finance for the Delta Programme on the part of yourself and the members of the permanent Parliamentary Committee for Infrastructure and the Environment.

I remain, yours faithfully,

Wim Kuijken,

Government Commissioner for the Delta Programme

**Translation letter from the state secretary of Infrastructure and the Environment to Delta Commissioner requesting recommendations for the funding of the Delta Programme.**

Dear Mr Kuijken,

As you will be aware on 20 June 2011 the permanent Committee for Infrastructure and the Environment was in consultation with me concerning the Delta Act.

During the course of this consultation several members of the Committee expressed concern as to the current and future availability of adequate resources for implementation of the flood risk management and freshwater plans.

The Committee made the suggestion that the Delta Commissioner should be asked to make recommendations – in reports – concerning safeguarding the financing. I adopted this suggestion by the Committee. In this regard the stenographer's report states that: "... (the Delta Commissioner)... should report annually on safeguarding of financing of the Delta Programme in the long term and to submit the initial result for the discussion of the budget in 2011". At the same time as this undertaking I would also like to include the remark that I made during the legislative consultation as to possible alternative sources of finance. I said that "... I believe that is more important for the Delta Commissioner not only to consider safeguarding but in particular to consider how we can obtain funds over and above the amount of 1 billion". It was agreed with the Committee that I should already ask you to give an initial indication within the Delta Programme 2012. In my opinion the request meshes well with stipulations on content of the Delta Programme as set out in article art. 4.9b of the Delta Act.

In brief, I am requesting your advice on the following points.

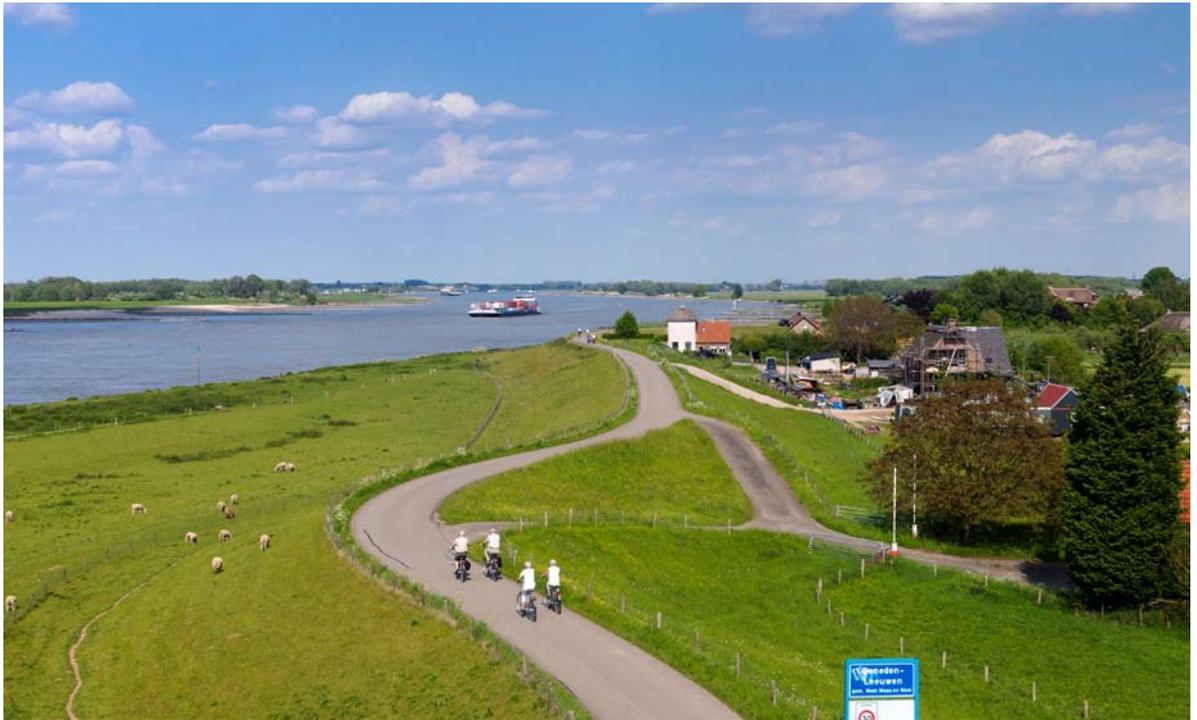
1. My starting point on flood risk management is the letter from Parliament (lower house) dated 22 April 2011 (parliamentary paper 27625, No. 190), in which I outline current flood risk management tasking and indicate such resources are currently available for this. In the short term the current implementation programme can be funded. In the medium term a discrepancy arises between envisaged programme and resources.
2. What is your assessment of the tasks for freshwater and flood risk management? In this regard please differentiate between current and already determined programmes; programmes under preparation and long-term programmes that may result from Delta Decisions. I realize that giving a realistic cost estimate for tasks which are further in the future – is problematic.
3. Can you show what is available for flood risk management and freshwater supplies (the scope of the Delta Programme) from governmentals other than the I&E budget? (For the actual status re. available government revenues you can contact DGW. The DGW will fine-tune this position with FMC).
4. Can you advise how – over above existing resources – additional resources could be generated from other governmentals or others (with due regard to relevant, current regulations around the national budget)? An opinion on feasibility levels would be desirable in this context.
5. In terms of timing it is desirable to keep to six-year planning periods here. I would think in terms of an indication up to the end of the current planning period (2015), a forward view to the next two 2 periods (12 years) up to 2027 and possibly thoughts on subsequent years.
6. To provide advice on the above on an annual basis starting with the Delta Programme 2012.

On 21 June the sub-ministerial council I&E gave its approval for the inclusion of this advice (after inter-departmental tuning) in the Delta Programme 2012.

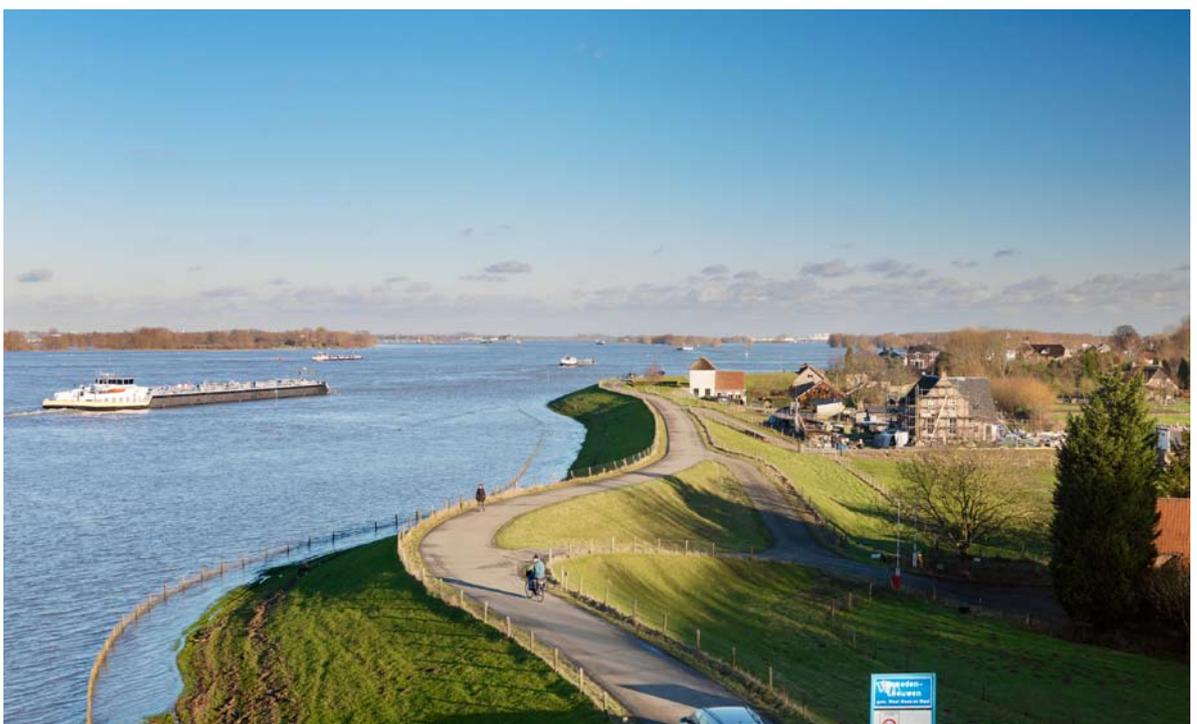
I trust that the advice will enhance the financial insights of both myself and the members of the financial committee.

Yours faithfully,

The state secretary for Infrastructure and the Environment,  
Joop Atsma



Low water. River landscape Waal.



High water. River landscape Waal.

## Glossary

Terminology used in the Delta Programme differs in meaning per specialized area (spatial, water, nature etc). The definitions stated here are those applying in the Delta Programme.

### **Adaptive delta management**

Operating approach designed to transparently include uncertainties around future developments in the decision-process. In this context we focus on 2050 with a forward view to 2100. This approach combines existing work-insights with several possible strategies ('adaptation-paths') while assessing flexibility of measures.

### **Analysis**

Studying in how far – within a given situation – set objectives can be realized. Hence, this is about comparison of a given situation (current, future) with (the criteria of) one or more sets of objectives.

### **Basic values**

Values mutually linking the parties and functioning as beacons for choices to be made. Within the Delta Programme it is about the values of flexibility, solidarity and sustainability.

### **Criteria**

Measurable yardsticks whereby the analysis can determine in how far a set objective is to be realized. This is to enable assessment of a situation – either current and/or future.

### **Delta Decisions**

Decisions to be taken for the future of the Dutch delta. Pointing the direction for the long term and creating room to manoeuvre around future developments. The Delta Decisions result in extensive interventions. There are major economic and spatial consequences and many ordinary people, corporates and social groupings will feel the effects.

### **Delta dykes**

The height, width and robustness of Delta dykes is such that there is virtually no chance of a sudden uncontrollable flood. The character of the Delta dykes differs with the specific situation and the particular design demands a tailored, local approach. Depending on design Delta dykes can be combined with other functions. At the end of 2011 exploratory studies at the initiative of the national authorities will show whether or not this is a promising concept in the Dutch situation.

### **Objectives**

The Delta Programme's desired situation in a given year. This can be formulated per social stakeholding or area.

### **Sustainability**

Where possible taking natural processes into consideration – offering resistance where necessary – and making the most of chances for welfare and prosperity. Sustainability is a basic value within the Delta Programme.

### **EA&I**

Ministry of Economic Affairs, Agriculture and Innovation

### **Flexibility**

Scope needed to adequately anticipate climate uncertainties/changes, shifts in socio-economic developments, and deploying innovative methods. Flexibility is a basic value within the Delta Programme.

### **Current policy**

Current policy is taken to mean policy set by the national or regional government bodies in so far as this is of importance to the scope of the Delta Programme and whereby official decision making has taken place. This includes policy has already been decided on but has yet to be implemented.

### **Current tasking**

Current tasking describes eventual policy shortfalls in the current situation (for current objectives) around safety and water supplies.

### **Current situation**

The current situation is the most recent situation (usually a year) for which all relevant variables (criteria) in the assessment system are known to the same level of detail and comprehensiveness regarding the situation, policy and tasking.

### **I&E**

Ministry of Infrastructure and the Environment

### **Integral approach**

Pro-actively seeking possibilities to link physical implementation of the Delta Programme with tasking in other policy fields in the same area, e.g. spatial quality or the natural environment.

## **IPO**

Association of Provincial Authorities

## **Cost-benefit analysis**

The cost-benefit analysis (KBA) is a monetary evaluation method whereby costs are weighed up against expected financial benefits for one or more subjects, whereby the most advantageous solution can be chosen.

## **Constraints**

Elements in a strategy whereby an analysis (comparative system) shows that objectives will not be realized.

## **Social Cost-benefit analysis**

A social cost/benefit analysis (MKBA) shows the return on investment for society as a whole. The power of the MKBA lies in generating insights for all pros-and-cons of an investment, wherever they may come from. All effects impacting on our welfare and prosperity are included - as are aspects that are not directly financially measurable, such as landscape and the natural environment. Hence, the MKBA is also well-anchored in economic theory around prosperity. MKBAs are often applied to investment involving public funds.

## **Measure**

A singular action that contributes to realizing a given objective.

## **Tipping point**

A tipping point occurs when, due to changes in climate or socio-economic circumstances, (existing) policy, measures or infrastructure is insufficient to comply with set criteria, standards or agreements. This may be due to physical, technical or financial constraints or socially unacceptable effects.

## **Scenario**

A scenario is a description of the possible course of autonomous developments (developments influencing the Delta Programme but on which the Delta Programme itself does not exert any influence) and the impact of this on flood risk management and freshwater supplies. Given that the future course is uncertain several scenarios will always be presented. The Delta scenarios comprise plausible future views and are based on the KNMI's climate scenarios (2006) and the socio-economic scenarios of the collaborating planning bureaus (2006).

## **Solidarity**

Sharing the ups-and-downs of chosen measures around generations, areas and sectors. Solidarity is a basic value within the Delta Programme.

## **Strategy (policy alternative)**

A strategy is a more or less linked body of objectives, solution-paths, measures and timing-preferences. Hence, a strategy describes:

- Objectives at which the strategy is targeted.
- Measures to realize objectives.
- Timing preferences for deployment of the measures

A strategy can be expressed in or derived from a vision. In that event the vision leads in terms of objectives and types of measures (e.g. Room for the River or Higher Dykes).

## **Target (vision)**

This is a long-term vision focusing on desirable future situations. Target visions specify ambitions and, particularly in the long term, can be used to inspire the development of strategies. They can also play a role in or derive from shorter-term objectives.

## **Future situation**

The future situation is the situation arising under the influence of current policy and autonomous developments as per the Delta scenarios. The choice has been made within the Delta Programme for (in any event) two focus years for the future situation: 2050 and 2100.

## **Comparative system**

System enabling evaluation and mutual comparison of strategies that develop sub-programmes – in that the basis is a single set of criteria.

## **UvW**

Association of Regional Water Boards

## **Flood risk management programme**

A programme with a linked package of measures and provisions whereby an appropriate answer is given for tasking resulting from the third review, new technical insights, anticipation of possible future changes in sea level, river discharges and subsidence, and eventual updating of current standards.





*Photo page 72-73:  
Coastal defences on the beach at  
Julianadorp – beach replenishment  
with sand from the North Sea.*

## Colophon

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KCAP Architect & Planners (p55, photo Hamburg)

Jos van Alphen (p55, photo London)

### Photography inside cover

Tineke Dijkstra

- New urban developments and reconstruction - '*Stad van de Zon*' ('*Sun City*'), new housing estate, rich in water and energy-neutral
- Coast - *New dune on a level with Nieuwesluis, Zeeuws-Vlaanderen province*
- Rivers - *Tip of the IJssel where the Pannerdensch canal divides into the (Gelderland) IJssel and the Lower Rhine*

Marcel Kentin

- Safety - *Dyke reinforcement Lekkerkerk*
- Southwest Delta - *Eastern Scheldt defence system*
- Wadden Region

Theo Bos

- Rhine Estuary-Drechtsteden - *Wilhelminakade, Rotterdam*
- Freshwater - *Irrigation (strawberry cultivation), Erp*
- IJsselmeer region - *Monument on the IJsselmeer Dam*

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### Sources maps

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(as yet unpublished)
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ABF research, May 2011

# Contents DVD

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- Appendix B Overview of progress compared with Delta Programme 2011
- Appendix C Signals and recommendations Delta Programme 2011
- Appendix D Detailing adaptive delta management
- Appendix E Administrative planning
- Appendix F Process design
- Appendix G Knowledge agendas

### **Reports**

- Nationaal Kader Kust (Framework for Coastal Development), March 2011 *(Dutch and English)*
- Ecoshape, Perspectief natuurlijke keringen (Perspective natural defences), June 2011 *(Dutch with English summary)*
- BMC, Evaluation study into governance of the Delta Programme, April 2011 *(Dutch with English summary)*

### **Video Delta Programme**



If there's no DVD and you would like to order one  
you can do this free of charge from [info@deltacommissaris.nl](mailto:info@deltacommissaris.nl).  
You can also download the contents of the DVD from  
[www.deltacommissaris.nl](http://www.deltacommissaris.nl) and [www.rijksoverheid.nl/deltaprogramma](http://www.rijksoverheid.nl/deltaprogramma).

## Delta Programme

The Delta Programme is a nationwide programme. The national government, provinces, municipalities and regional water boards work together with input from social organizations and the business community. The objective is to protect the Netherlands from flooding and to ensure adequate supplies of freshwater for generations ahead.

The Delta Commissioner promotes the formation and implementation of the Delta Programme. The Commissioner makes an annual proposal for the Delta Programme to the Ministers of Infrastructure and the Environment and Economic Affairs, Agriculture and Innovation. This proposal comprises measures to limit flooding and water shortages. The Delta Programme is submitted to the Dutch parliament (second chamber) annually, on budget day.

The Delta Programme has nine sub-programmes:

- Safety
- Freshwater
- New urban developments and restructuring
- IJsselmeer Region
- Rhine Estuary-Drechtsteden
- Southwest Delta
- Rivers
- Coast
- Wadden Region

[www.rijksoverheid.nl/deltaprogramma](http://www.rijksoverheid.nl/deltaprogramma)  
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