Delta Programme 2012

Appendices

Acting today, preparing for tomorrow

Working on the delta

Appendices

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Acting today,
preparing for tomorrow

Contents

Appendix A
Summaries problem analyses sub-programmes

The summaries of the problem analyses were arrived at under the auspices of the relevant sub-programme. The complete analyses are on www.deltaprogramma.nl The following are included in this appendix, in the order below.

- Sub-programme Safety
- Sub-programme New Urban Developments and Reconstruction
- Sub-programme Freshwater
- Sub-programme IJsselmeer Region
- Sub-programme Rhine Estuary-Drechtsteden
- Sub-programme Southwest Delta
- Sub-programme Rivers
- Sub-programme Coast
- Sub-programme Wadden Region

Sub-programme Safety

The Sub-programme Safety addresses the issue of the best way to counter flooding and the level of protection to be realized. The programme is in four parts: actualization of flood protection standards, delta dykes, regional pilot schemes for multilayered safety, and policy on land outside the dykes. The sub-programme works jointly with other sub-programme towards a Delta Decision on Flood Risk Management in 2014; this will involve both the realization of Flood protection standards announced in the National Water Plan and the first Delta Programme, as well as in the Flood Risk Management programme as announced in the National Administrative Agreement on Water. This will detail the threefold flood risk management tasking for the short and long terms:

- Current tasking (meeting current flood protection standards, Safety Assessment primary defence systems and new technical insights).
- Tasking resulting from higher sea-levels, soil subsidence and possible changes in river outflow.
- Tasking resulting from possible realization of flood protection standards.

Realization of the flood risk management tasking takes in the principle of multi-layered flood risk management from the National Water Plan. Flood prevention based on actual flood protection standards remains the main foundation of flood risk management policy. Sustainable spatial planning

aimed at damage limitation and disaster management can provide a significant addition; in some areas it could also offer alternatives in complementing or combining preventative measures. Conditions to this end are being formulated within the sub-programme New Urban Development and Restructuring.

Current situation

Current counter-flooding policy is rooted in the 1960s when the first Delta Committee developed flood protection standards in response to the 1953 flood disaster. These standards for primary flood defence systems are established in the current Water Act which requires regular assessment and checking of the height and robustness of all major flood defence systems (dunes, dykes, engineering structures). Where necessary implementation programmes will be carried out to reinforce the defence systems (Flood Protection Programme, Meuse Projects and Room for the River). These projects will be carried out dynamically, in line with the National Water Plan. It is most important that the basics for Flood Risk Management are in order and that all flood defence systems comply with current flood protection standards. The findings of the third Safety Assessment primary defence systems will be available in 2011 and are expected to produce additional tasking.

Safety strategies and flood risk management programme

During the period 2012-2014 the Delta Programme will issue an area-based detailing of flood risk management tasking. Cohesive safety strategies will be developed, forming a basis for an initial cohesive Flood Risk Management programme – as announced in the Administrative Agreement on Water. The area-based strategies and the Flood Risk Management programme based on these detail the short- and long-term safety tasks. This enables phased insights into the overall task of water of flood risk management, required financing, openings for spatial integration, public support, feasibility and potential for realization. The first Flood Risk Management Programme, based on the Delta Decision on Flood Risk Management, will be presented to Parliament (Lower House) in 2014. This programme will then form part of the annual Delta Programme.

Starting points, objectives, methodology and agreements will be determined in a joint administrative process proposal for the period 2012-2014; this will be developed under the direction of the Delta Commissioner. The process proposal will ensure that the safety strategies in the area-based sub-programmes are developed uniformly and in mutual cohesion – with due linkage to short-term safety tasking in line with the third review process and new technical insights.

Updating flood protection standards

Updating flood protection standards objectives to enhance these standards over the upcoming decades, to a protection level that is more appropriate than the current level, given the increase in population and economic value behind the dykes. The main areas for this are likely to be where population and economic value have strongly increased since the 1960s. The Second Delta Committee proposed increasing the height of all dyke rings in the Netherlands by a factor of 10. The announced results of casualty risk analyses and social and economic damage (Social Cost/Benefit Analysis) will enable more meaningful statements on where honing might be required. A position on updating flood protection standards is expected to be reached following completion of the Casualty Analysis and the Social Costs/Benefits Analysis at the end of 2011.

Definite decision making around updating standards can be made in 2014 as part of the Delta Decision on Safety. The objective is to legally embed the updated Flood protection standards in 2017 and to provide appropriate, related instruments for Assessment and Design. Preparations for this will be dealt with by the Sub-programme Safety while taking account of the deployment of the classification of the dyke rings, aspects including category c-defences and new technical insights and approaches around flood management, e.g. from the Veiligheid Nederland in Kaart (charting a safe Netherlands) research project. Under the terms of the National Water Plan flood defence systems must comply with updated standards in 2050.

Sub-programme New Urban Developments and Reconstruction

Delta dykes and regional pilots

The feasibility study into Delta dykes announced in the National Water Plan will be available during the course of 2011. The same year will also see completion of the regional pilots around multi-layer safety. In developing the safety strategies the area-based sub-programme can also include the potential of delta dykes and the findings of regional pilots around application of the multi-layer safety concept in practice, and examine a cost effective contribution to the desired safety levels.

Policy areas outside the dykes

It is intended that the State Secretary should take a decision on the course of generic policy for flood risk management around areas outside the dykes at the end of 2011. This will be input for the sub-programme New Urban Developments and Restructuring.

Robust spatial planning, also in terms of water, easily adaptable in the course of time will prevent spiralling costs and problems, both now and in the future. Any (re) configuring of this country needs to take in potential risks including flooding, inundation, salinization, subsidence, drying-out and the effects of extreme temperatures. To this end the sub-programme New Urban Developments and Reconstruction provides:

- A well-founded outlook on risks, risk-areas, action perspectives and the spread of responsibilities.
- Preconditions enabling local, regional or national governmentals to steer towards the preferred (re) development of the built-up area.
- A cohesive set of instruments to support a balanced spatial assessment and the realization of a robust and future-proof (re)development.

Current tasking

Although the chance of flooding is small, the impact can be substantial. With the NWP the government has opted for a 'multi-layer' safety strategy. Alongside prevention this strategy also takes in potential for limiting impact and disaster management. A large part of the Netherlands (some 59%) is vulnerable to flooding. The past several decades have seen substantial urbanization – often in high-risk flooding locations. The area of the major rivers and low-lying parts of the country show a mixed pattern of areas vulnerable to rapid or substantial inundation. This could yield a large number of casualties and widespread social disruption. There is potential for limitation by taking account of the impact of dyke breaches when (re)developing built-up areas; this applies equally to the meaningful selection of a location and the adaptation of buildings, neighbourhoods and infrastructure – or by establishing evacuation routes. High priorities here are vital objects and vulnerable functions including hospitals and energy resources.

The lack of space in urban areas around the defence systems diminishes potential for dyke improvement while costs rise apace. Expanding potential for multifunctional use of flood defence system would be desirable with the proviso that the interests of water management are safeguarded. In legal-technical terms there appears to be no problem with building on or directly adjacent to the defence systems. However, in practice, there are a number of thresholds to be dealt with. Multifunctional dykes (Delta dykes) could play a significant role in reducing the impact of flooding.

An estimated 115,000 people live in the areas outside the dykes, of whom around 64,000 in the Rhine Estuary-Drechtsteden region. Any damage occurring is the responsibility of householders or businesses. Safety is a local government responsibility while national government ensures a good information base. Building in areas outside the dykes does not generally pose any major safety problems – as long as the risks are known and construction is robust when confronted by water. However, prevention of environmental damage must be borne in mind.

Recent years have seen an increase in heavy rain-storms – often in summer; this is an ongoing trend in all the meteorological service's (KNMI) climate scenarios. The frequency of surfacing makes urban areas highly dependent on drains to cope with rainwater, however, capacity is not sufficient to deal with these rainstorms. Hence, 90% of municipalities suffer from problems caused by rain; this is largely concentrated in a number of vulnerable – low-lying – locations and streets. Around 10% of municipalities face higher levels of flooding and damage. Tolerance of water build-up on the streets appears to be falling; meanwhile, local authorities' ability to counter claims on the grounds of force majeure is also shrinking. Even so, given the many small-scale cases, quantifying the level of damage is problematic. Flooding is a locally determined and complex issue with a mainly sector-based approach. Agreements are in place with water managers to combat flooding and currently there are several good examples. Even so, there is no question of an all-level, structural approach by all parties or area processes involved, encompassing buildings, neighbourhoods and infrastructure. Water supply to urban areas is necessary for level management (to prevent subsidence of buildings and infrastructure and to protect wooden pile foundations) for flushing waterways – in the interests of good water quality – and for supply of water to maintain – largely public – greenery. Water quality is also important with an eye to eco systems and for the living environment.

Future tasking

The next several years will see a large volume of new construction. This will be more in existing than new expansion locations, and mainly in the Randstad, but to a degree also outside the dykes in the Rhine Estuary-Drechtsteden area. Scenarios with strong urbanization (surfacing/density) combined with major climate change, increase the tasks around inundation, urban water supplies, flooding and higher temperatures in towns and cities largely due to the increase in extremes, e.g. heavy rain. Given the configuration and build-up of the ground there is an accumulation of tasking, mainly in the west of the country. More frequent dry summers threaten water supplies to urban areas and this could lead to costly subsidence and damage to foundations. This is most likely in towns and city on less firm ground such as peat and clay, where levels are stringently managed. Admitting "foreign" water for flushing can impact negatively on water quality. Meanwhile, hotter towns and cities will pose high risks to health, e.g. for older people, to productivity and to the overall quality of life. The central task of (re)developing the urban environment is to realize a (water) robust, future-proof and (flexible) configuration. Enhanced linkage between land development and management development can offer perspectives for the financial feasibility of projects. To this end more sustainable planning with higher quality buildings and public spaces mean lower costs in the management stage, which is more attractive for end users.

Ambition

The chances of a successful approach are increased by linkage with other social issues including crisis control ('Simple Bwetter'), shrinkage and measures to reduce energy consumption while increasing sustainability. Water also offers potential to reinforce less robust functions and values such as greenery in and around the town or city.

Sub-programme Freshwater

The task for the sub-programme Freshwater is the development of strategies for sustainable freshwater supply in the Netherlands in the long term. By 2014, this should lead to a Delta Decision on the new strategy for freshwater. The first phase of the sub-programme Freshwater was marked by the constraints analysis. This is now complete, and gives a clear view of where freshwater supply and demand are not evenly balanced, both now and in the long term (this covered the year 2050, also with a future view to the year 2100). The freshwater constraint analysis was the first step in the process in the run-up to 2014, and came about via joint (factual) studies, enabling the first broadly supported quantitative and qualitative description of the entire water system. In main lines, both the national and regional analyses reach the same conclusions. National analysis is enhanced by regional analyses based on the more detailed models and local knowledge.

Where are we now

An adequate availability of freshwater has always been taken for granted in the Netherlands. One of the reasons for this is the almost inevitable annual rainfall surplus, and the fact that the main rivers carry much more water than we can use. That is why, even during dry years, the rivers carry freshwater to the sea. This means there is ample freshwater, but not always in the right season, in the right place or of the right quality. In the six winter months, rainfall is carried away by the rivers as surplus. In the summertime, when the water is needed, there is often a great shortage of rainfall. Also, it is impossible to bring the water from the major rivers to every place it is needed.

Currently, an average year will yield a few local constraints, albeit these are usually accepted, partly because the damage is inevitable. In dry years, constraints mostly occur in areas influenced by external salinization, where water supply is not feasible. In dry years, the constraints mostly impact on economic utilization functions, with the exception of the area influenced by external salinization. Here, the constraints have negative consequences for safety, the environment and utilities. In an extremely dry year, heavy constraints present themselves, and all surface water in the Netherlands is utilized for a period of around 90 days. This means that no water flows from the IJsselmeer to the Wadden Sea and the Haringvliet sluices are fully closed. Hence, water flowing through the Nieuwe Waterweg to the sea, is needed to prevent salt encroachment. The available water is then divided up in line with the distribution priority sequence. This was created to prioritize water consumers. It is important in social terms that certain functions are supplied with water as long as possible to guarantee the safety of peat dykes, to prevent irreversible damage to the environment and to keep the utilities operational for as long as possible. In an extremely dry year, constraints arise in all parts of the Netherlands for all utilization functions.

Future constraints with unchanged policy

In view of socio-economic developments and climate change an increase is expected in demand for water in three of the four scenarios (BUSY, WARM and STEAM) while there will be (strongly) reduced demand in two of the four scenarios (WARM and STEAM). This means an increase of existing constraints in three of the four scenarios (WARM, STEAM and BUSY). As yet current calculations take no account of increasing demand for water from abroad, and possible reactions from the water utilization functions. These developments may reinforce or indeed limit the constraints.

In 2050 the impact of the WARM and STEAM scenarios on fresh water supply will differ by region:

- In the IJsselmeer supply area in a dry year – which happens every ten years – changes would be needed to current water level management to meet demand.
- In areas impacted by external salinization, i.e. mainly the coastal provinces, the intake standard is exceeded for long periods during dry years.
- In areas dependent on supplies from rivers and canals the average year will see shortfalls in surface water and around intakes.
- In areas without external water supply constraints will arise in an average year.

Looking at the utilization functions and the two warm and dry scenarios the expectation is that continuation of current policy and management in 2050 will mean that in a dry year there will be pressure on the uninterrupted power supply and drinking water across large parts of the country; this will also involve irreversible and not always avoidable damage to nature and damage to infrastructure. One exception is the area supplied by water from the IJsselmeer. Given the reserves in the IJsselmeer problems will only occur in an extremely dry year. If more constraints arise damage to the economy will rise sharply.

A sufficient supply of freshwater has always been taken for granted in the Netherlands. This is linked to an almost invariable surplus of annual rain and that the major rivers deliver far more water than we can use. However, the water is not always available in the right season, in the right place and in the right quality. Traditionally the system is designed to channel off surplus water. Even in an average year, by 2050 unchanged policy could mean real constraints. In three of the four scenarios this means that current fresh water policy, management and use will require reconsideration prior to 2050. The effects will only grow stronger nearer to 2100. While confirming previous studies this is the first time that regional and national analyses have been conducted on this scale.

What is the task ahead?

The constraints analysis shows that our current water system, management and policy around fresh water supplies are reaching their limits. In terms of short-term solutions the sub-programme Freshwater will focus on measures and provisions to ensure greater flexibility in the water system. This could involve additional retention of freshwater in the six winter months, utilization of additional supply routes and optimization of water consumption. A more fundamental approach is also needed. Alongside examining the flexibility and efficiency of the system the sub-programme Freshwater also looks at the more efficient use of water. In this context the questions arising are: Looking ahead, how much water will we supply and at what price? – And, what will be the responsibilities of the consumer?

Objectives are needed to translate constraints into solutions and strategies. In contrast to flood risk management and water quality there are no specific objectives for freshwater. The challenge lies in formulating freshwater objectives that focus on socially-weighed and economically meaningful freshwater supply and seeking strategies to realize these objectives. Alongside expanding water resources this quest for strategies and related measures will specifically take in reductions on the demand – user's – side. Also included will be agreements around water quantity and quality with neighbouring countries.

The IJsselmeer Region remains important for the supply of freshwater. The analysis findings show that in 2050 the scenarios with rapid climate change will indeed feature adequate water reserves for a dry year (on average once every ten years), whereby current functions can be met in the present areas served. However, this will require changes in current water level management to make the system more flexible and fully utilize available reserves. In an extremely dry year (1:100 years) according to these scenarios there will be a substantial water shortfall in the IJsselmeer Region in the year 2050. The analyses also show a large bandwidth and are as yet incomplete (water quality has not yet been covered).

Objectives are needed for the supply of freshwater in order to determine the right strategy for the IJsselmeer Region. By 2050 the constraints in areas affected by external salinization – precisely the areas depending on inflow from rivers – and areas without external inflow of water, could be routine: hence, they demand changes in policy.
The preferred approach will provide direction for the development of sustainable freshwater supplies. This will anticipate future developments and enable the taking of opportunities intrinsic to the unique position of the Netherlands within the delta. Phase 2 of the sub-programme Freshwater will tackle this jointly with the regions, utilization functions and other sub-programmes within the Delta Programme.

Sub-programme IJsselmeer Region

The IJsselmeer Region has an important function in water management in parts of the Netherlands. This involves discharge and supplies of water. The way this is organized has a major impact on protecting the regions from flooding. It is an area of ecological and cultural value, with a large number of utilization functions. The objective of the sub-programme IJsselmeer Region is to ensure the region's long-term safety and attractiveness. To this end a strategy is being developed for water level management from 2015 to 2100 with the ambition of linkage with spatial developments. The national government, provinces, regional water boards and municipalities are jointly involved and there is input from social organisations.

Tasking

Safety

There are three important safety aspects: the current safety situation, the future tasking due to climate change and the task due to possible updating of flood protection standards.

At this moment in time the safety of the IJsselmeer Region is less than totally in order. In 2006 the coastal section of the dykes, the IJsselmeer Dam, and the Houtrib dyke (and adjacent engineering works) were declared sub-standard by the Safety Assessment of primary flood defences. Moreover, the rise in sea level over the past 80 years makes it increasingly difficult to maintain the winter target level. Work is underway within the Flood Protection Programme (HWBP) to regularize the dyke situation. The Verkenning Toekomst Afsluitdijk (exploratory forward study of the IJsselmeer Dam) examines a number of options to reinforce the dyke, combined with other ambitions. The ESA or Extra Spuicapaciteit Afsluitdijk project (extra discharge capacity IJsselmeer Dam) should enable maintenance of the level in the meantime. Safety in the IJssel-Vecht delta and the downstream from the IJssel is assured both by water levels in the IJsselmeer and by river discharge. Measures under the Room for the River programme are being carried out along the IJssel in preparation for higher peak discharges from the river.

Sea levels are rising faster due to climate change and peak discharge from the IJssel is increasing apace. The intended increase of discharge capacity (ESA) can cope with a 25 cm rise in sea level. Current level management will no longer be possible if there is a further rise in sea level, and there will new safety tasking for the IJsselmeer Region.

Depending on the speed or rise in the sea level this will happen in between 30 and 70 years from now. With gravity drainage this will mean a rise in the level of the IJsselmeer; to this end a decision was reached within the NWP not to allow the Markermeer and Randmeren (border lakes) to rise apace. A rise in level in the IJsselmeer affects the IJssel and other waters with open links to the IJsselmeer. Hence, choices made around water level management for the IJsselmeer require fine-tuning between the sub-programmes IJsselmeer Region and Rivers.

The Delta Programme Safety works towards new safety standards for flood protection. New standards mean an additional safety task for parts of the IJsselmeer Region and supplements existing tasking and tasking resulting from climate change.

Freshwater supplies

Just over 30% of the Netherlands depends directly or indirectly on the IJsselmeer Region for supplies of freshwater. The lakes carry water from the IJssel to intake points for the hinterland. These lakes also have buffer stocks of freshwater. The part of the buffer stock ready for use is the "water slice" between spring water levels and the lowest level permitted in summer. This water slice is currently 20 cm which is equivalent to some 400 million m^3. Even in extremely dry years this would be enough to meet demand. To ensure the actual availability of this reserve the present level management with fixed summer and winter target levels needs to be replaced by a more flexible control/management system. This would enable an increased level apace with demand and a lower level in periods of heavy water consumption.

Demand for freshwater may change in time. Dry summers may well be more frequent due to climate change. Analysis by the Delta Freshwater Programme says that the current buffer stock for freshwater is sufficient to cope with strong climate change (KNMI W+ scenario) up to around 2050 and to meet demand in a dry year – occurring on average once in ten years. In extremely dry years (1:100), with this level of climate change, the buffer stock would soon be outstripped by demand. Objectives around freshwater supplies must clarify the level of extremes for which we need to prepare.

Problem analysis

Future water level management plays an important role in choices to be made around the climate-proof development

of the IJsselmeer Region. There are two core issues here. Firstly, will the level of the IJsselmeer eventually rise apace with the sea enabling continued gravity drainage, and secondly – there is the possibility of greater fluctuation of summer levels and hence a larger available volume of freshwater. The first phase of the Delta Programme IJsselmeer Region further explored the consequences of the various water level management variants. This covered both the higher level (maximum 1.5 metres above the winter target level) and a further lowering of the level in summer (to max.1.2 metres under the current summer target level).

Results: working together as a success factor

Acting jointly with a large number of parties has proven extremely useful within the programme. This process of joint fact finding has yielded better information. However, at least equally important is that the issue of the IJsselmeer Region is now on the agenda for many parties who are now actively looking to the future and are aware of the extent of the problem – which produces a mix of insights. Joint working sessions and two "IJsselmeer weeks" to broadly share administrative and management insights were key factors in the process. The success is based on openness and trust. The increased confidence generated enables any differences to be jointly disposed of.

Results: IJsselmeer Region vulnerable to level shifts

The study shows the limited flexibility of the IJsselmeer Region. Current water level management is a compromise that takes account of the various functions. Dykes, engineering structures such as locks, intakes and pumping stations, as well as jetties and quays, sewer outflows etc. have been designed in line with current water level management – with its limited level fluctuation. Minor changes in water level, both higher and lower, can have a major impact on safety, water management and utilization functions. Nature and recreational areas outside the dykes are lowlying and even limited increase in levels can mean flooding. Areas inside the dykes are locally impacted by changes in ground water levels and seepage. There may be major consequences on a local scale. Changes in water level management also filter down into bodies of water with open links with the region's lakes like the IJssel, Vecht and Eem. Moreover, it transpires that the IJssel-Vecht delta is a particularly sensitive area. Higher levels in the IJsselmeer strongly impact on levels in the various bodies of water with open links to the IJsselmeer; the area is also impacted by increasing river discharge. Lastly, ground water levels in the various regional locations can change significantly apace with shifts in water levels – for example around Zwolle. The sensitivity of the system to level changes means that any such changes will lead to new (derived) expenditure.

Areas involved are safety, including height and stability of dykes and new and existing engineering works – water management, including alterations to pumping stations and intakes – measures for groundwater management – utilization functions, including adjustment of shipping lanes, quays and jetties and nature (inc. compensation for loss of nature).

In principle there are ways to combine these tasks with regional ambitions around construction outside the dykes, recreation and nature development, plus regional water tasking due to climate change. Involved here is integral regional development along the banks of lakes. The potential needs to be further examined by location. Meanwhile, there is a complicating factor in the form of the one century time-window. In the context of regional processes weighing up the opportunities and threats at a distance as long as a hundred years from now prove problematic.

Results: freshwater and nature pose different demands to water level management

For a variety of function water level management needs to be more flexible than the present situation which is based on fixed target levels for summer and winter. Specifically, investigations covered the possibilities of a more seasonal level progression for the benefit of both freshwater supplies and nature – with safety providing the prerequisites. However, it transpired that the two functions pose quite different demands on level progression so that – given the current layout of the region – it is not feasible to adjust level progression in such a way as to enhance both functions.

Results: no imminent decision on a decision on levels for the meantime

According to the NWP an imminent decision will be made on levels. The objective had been to create a larger buffer reserve of freshwater via a limited adjustment of water level management. This was expected to be no-regrets measure, with low costs and low negative impact. However, examination of the problem showed the following:

1. For the time being available reserves of freshwater are sufficient to meet demand.

2. The intended adjustment of water level management is not a no-regret measure as water management would require significant costs to enable the adjustments and because of the major damage to nature caused by the change.
3. That the intended time schedule for the decision on levels prevents meaningful integration around planning in the short and long terms.

Hence government elected not to reach a decision on levels in the short-term. An integral assessment will be made on the future of the IJsselmeer Region; this will deal with water level management in the short and long terms as well as related packages of measures.

Strategies

Future water level management for the IJsselmeer has been taken as the starting point in developing strategies. Two issues are involved:

1. The issue of drainage. In the event that the sea level rises to such an extent as to make current water level management unfeasible a choice will have to be made between continued gravity drainage – which involves a higher water level in the IJsselmeer – or maintenance of the current water level. The latter would require construction of a pumping station on the IJsselmeer Dam. Depending on the rise in sea level, which delta scenarios put at between 35 and 85 cm in 2100, and the choices we make, the average winter level in 2100 could be between 0 and 60 cm above the current level.
2. The freshwater buffer. The freshwater buffer is the difference between the water level in spring and the level to which it may be reduced by consumption, during the course of the summer. Depending on the choices made this may vary between 0 and 150 cm. The 150 cm upper limit comes from the NWP. Examination of the effects of changing water level management show that a 150 cm buffer stock can only be realized with farreaching measures in the area, and if the winter level increases by 60 cm. Hence, the choice of method for dealing with drainage also impacts on potential to increase the buffer stock. If it is decided to maintain the current winter level using a pumping station, the maximum realizable reserve-stock will be less than with the option of rising apace with the sea.

The Markermeer/IJmeer and the Veluwe border lakes are subject to the decoupling order. Hence, appropriate water levels have been derived for all IJsselmeer levelvariants and these deviate less from the current levels than those for the IJsselmeer.

Approach

In future governmentals and stakeholder organizations will work together. The endobjective for the next phase is to arrive at a set of potential future strategies for the IJsselmeer Region. The following points are important in detailing the strategies:

- Elaborating the strategies, which are now strongly related to water-tasking, into integral views of the future with spatial policy whereby future visions of the area and the potential for regional ambitions and tasks linked to the water-related tasking.
- Studies of possible development paths between the situation as it is now and possible situations in 2100, starting points being adaptive delta management and linkage of short and long-term tasks. A focal point here is in how far there will be synchronisation between upward sea-levels and increasing demand for freshwater. Failure of the two developments to run in tandem will have consequences for potential strategies.
- Further limitation of the playing field as a move in the funnelling process for all possible strategies into potentially promising strategies – enabled among other things helped by availability of objectives for freshwater provisions.

Detailing these strategies is an iterative process whereby fresh insights can lead to a whole range of adjustments and reconfigurations within the set of strategies.

Sub-programme
Rhine Estuary-Drechtsteden

The Rhine Estuary-Drechtsteden region is strongly urbanised with significant economic value on a national and regional scale – notably thanks to the ports and industrial complex. With some 430 million tons annual through-put (2010) it is the biggest in Europe. Greenport Westland, the high-tech knowledge economy, business services and the international trade centre all make substantial contributions to the global competitive position. Space is at a premium in Rhine Estuary-Drechtsteden. Its some 1.6 million residents make it among the country's most densely populated areas. The cities of Dordrecht and Rotterdam form the heart of the region. Around 64,000 people live outside the dykes in Rhine Estuary-Drechtsteden. The region's urban network is ringed by coast and delta landscapes and the Green Heart, as it's called. Agriculture and horticulture are the most important functions in the rural area.

Current tasking

Flood Risk Management

Under the current system flood risk management in the Rhine Estuary-Drechtsteden region is ensured by a combination of storm surge barriers backed by dykes and river widening. Without the Maeslant and Hartel barriers the dykes would need to be higher, by 0.5 metres in Dordrecht and as much as 1.2 metres in Rotterdam. Within the region intensive use is made of the area outside the dykes for homes and work. These areas are positioned at relatively high elevations in addition to being protected by the storm surge barriers.

Freshwater

Freshwater plays an important role in the west of the country. It is used in the preparation of drinking water, agriculture and horticulture, for industrial process water and for management of natural areas. Freshwater is also deployed for water level maintenance and flushing surface water. Availability of freshwater is essential for industry, agriculture and horticulture – including the Westland, Oostland and Boskoop greenports.

Freshwater supplies in the west of the country depend strongly on the intake from the main water system in the Rhine Estuary-Drechtsteden region. In the current system the intake points near Gouda (Hollandsche IJssel) and Bernisse (Spui) are crucial. Situations may arise, as in 2003 and 2011, when salt levels at the inlet points are so high that the water cannot be taken in for freshwater supplies. This external salinization is caused by seawater penetrating further into the river. This causes problems for functions dependent on freshwater such as the port/industrial complex – in addition to the greenports of Boskoop, Westland and Oostland, and drinking water supplies. To take an example, in the current situation, there is a chance, that in one year in ten, it will not be possible to take up water from Hollandsche IJssel for 44 days, creating problems for the Boskoop greenport.

Ground water is salty in much of the west of the country, including the Rhine Estuary-Drechtsteden Region, and seeps upward causing internal salinization; salt content in drainage channels is then too high for use in agriculture, horticulture and industry. Apart from potential for climate change, saltwater seepage is increased by subsidence.

Future tasking

Safety

The findings of the third Safety Assessment of primary flood defence systems are expected to lead to reinforcement of the current system in the Rhine Estuary-Drechtsteden Region whereby dykes are strengthened for a 50-year lifespan.
The past several decades have seen a significant increase in the population and economic value of the region. With this in mind the sub-programme Safety is checking the continued adequacy – i.e. standards - of protection levels. This could lead to a second Safety task for the Rhine Estuary-Drechtsteden Region.
Climate change and subsidence give rise to a third Safety task for the region. Based on the Steam scenario by 2050 just over 30% of dykes will be below standard, rising to 50% in 2100. Subsidence is successively lower in a number of polders in the Rhine Estuary-Drechtsteden Region increasing the likelihood of flooding.

In spatial terms major sections of these three tasks are expected to come together within Rhine Estuary-Drechtsteden, hence it is important to view and approach them in combination. The question then arises as to whether and for what period of time the current safety approach is adequate or whether strategy change is needed.

National and regional authorities both seek to realize tasks around urbanization within the towns and cities. In this region development within towns and cities means building outside the dykes. Spatial intensification outside the dykes (urban reconstruction, intensification of port activities) boosts the impact of extreme high water levels. Rises in sea level and changes in river discharge also increase chances of high-water situations in areas outside the dykes. First to flood are low-lying natural and agricultural areas, followed by existing urban and port areas. Any possible high-water situation would mainly cause material damage but there is only a limited risk of casualties outside the dykes. There would be scarcely any problems for recently developed sites, including port areas like Europort and the Maasvlakte which have been built on a higher elevation and/or are configured to adapt.

The Maeslant barrier in the Nieuwe Waterweg forms an important link in protecting the west of the country from the sea, and this situation will continue for the next several decades. Without any major adjustments the Maeslant barrier can cope with a 50 centimetre rise in sea level – indeed it was designed to this end. Based on the Steam scenario this increase will not come about until 2070 at the earliest. Currently, the Maeslant barrier meets the relevant standard. Given the rise in sea level the Maeslant barrier will close more often. Working on the basis of present logistic flows continuing this will negatively impact on the accessibility of both port and hinterland.

Freshwater

Declining river discharge in summer plus a rising sea level will put the intake points at Gouda and Bernisse out of operation for longer periods in future. Currently there is a one-in-ten years chance of a 44-day long stop on water being available from the Hollandsche IJssel. The Steam scenario puts the chances higher at one-year-in-ten and zero take-up availability for 143 days in 2050. Hence the intake point near Gouda could be virtually non-operational in around 2050 as it would have to be closed during the growing season (under the Steam scenario). Based on the Rest scenario this situation is expected in around 2100. There is a similar trend at the intake near Bernisse, however, both scenarios suggest a slightly longer run thanks to buffer capacity in the Brielsemeer and tidal factors. If there is not a timely alternative for the Gouda intake point there will be serious pressure on freshwater supplies in the west of the country.

Potential climate change could increase evaporation leading to increased demand for freshwater while higher sea levels boost salt seepage, all of which could lead to a doubling of demand for freshwater up to 2050. Population and economic growth will mean an additional growth in demand for water – although this would be limited compared with higher demand due to internal salinization. It is expected that lower summer discharge from rivers in future could mean constraints on shipping due to shallower channels potentially limiting the amount of cargo carried.

Tasking and urgency

The major task in the Rhine Estuary-Drechtsteden Region lies in melding spatial ambitions and the flood risk management tasking, in the short and medium terms with long-term strategy for safety and freshwater supplies. This long-term strategy is needed given the spatial ambition for the Rhine Estuary-Drechtsteden area. A feasibility study is underway within the framework of the Delta Programme into realization of the spatial ambitions while avoiding clashes with possible spatial reserves for the safety tasking or new policy principles. It is fair to call investments made at this point which do not mesh with future policy, mistaken. This can apply both to investments in flood risk management and in realizing spatial ambitions strongly influenced by the water system.
In the long term one has to ask whether current strategy around storm surge barriers and dykes will be sufficient or whether a shift in strategy is required. A different strategic choice could have a major impact on the level of sustainable realization of current spatial ambitions; at the same time it would also offer potential. Uncertainty around long-term strategy could have a negative effect on the investment climate.

A major advantage in studying strategies for safety and freshwater at this early stage is that building in the town or city, port or landscape – which is already underway in the short-term – would be easy to mesh with activities around safety and freshwater supplies, and vice-versa. For example, if renovation is underway in an area outside the dykes, this would be the time to review necessary safety measures (adaptive construction). The results of the sub-programme New Urban Developments and Reconstruction would be used here. The same applies to granting concession for the port, dyke reinforcement and adaptation of ribbon construction along the dyke.

A timely alternative for the Gouda intake point is also needed; failure to achieve this will put serious pressure on freshwater supplies in the west of the country. In the Netherlands the process from decision making to realization often runs into decades and the same applies to other measures. Hence, it is important to start right away on determining the alternatives.

In view of linkage between the sub-programmes Southwest Delta and Rivers the next stage will feature a joint approach to possible strategies for the Rhine-Maas delta.

Sub-programme Southwest Delta

The Southwest Delta is the outcome of human intervention over the course of centuries, the most recent move being the Delta Works. While this has ensured the safety of the delta, it is not a stationary situation. The area shows a close relationship between land and water. The social economic vitality of the area is largely determined by the safety and quality of the basins. Both economic functions, i.e. mainports, industry, shipping and agriculture, and ecological functions in the Southwest Delta, are highly significant for northwest Europe.
The sub-programme Southwest Delta aims to ensure long-term flood risk management and climate protection, plus creating preconditions for sustainable water supplies so as to integrally contribute to the ecological and economic reinforcement of the area.

Current tasking

Safety

Current statutory levels of safety are being ensured with measures including enhanced stone-cladding, Room for the River and action on weak links along the coast. As part of Room for the River capacity is being realized in the Volkerak-Zoommeer for the storage of river water in the event of extremely high water levels. This is designed to avoid normative water levels in areas including the Hollands Diep and the Haringvliet.

In the short term the findings of the third Safety Assessment of primary flood defences may expand safety tasking. The lesson of the delta scenarios is that the combination of higher sea levels and possibly higher river discharge will in future lead to higher basic water levels in the Southwest Delta. Calculations based on a 29 hour wind-surge duration, show that – depending on the delta scenario – between 2030 and 2060 storage capacity in the Volkerak-Zoommeer will no longer be sufficient.

In the case of the Scheldt-basins and the Voordelta coast continuation of the current safety strategy involving sand replenishment, foreshore and dyke reinforcement, is adequate for the time being. The question is how continuation of the current safety strategy can be slotted into the future management and utilization of these water systems. In the course of time the effects of the autonomous, morphological development will create a problem for safety, nature use and landscape. Under the present strategy sand replenishment will take care of the

coastal erosion issue. In due course the demand for sand in the Easter Scheldt, the morphological development after completion of the Easter Scheldt barrier, will eventually form a problem for safety, economic activity and ecology. A study is underway into whether sand replenishment will ensure growth apace with sea levels, and the desired morphology of the intertidal areas. Lastly, the potential updating of flood protection standards could expand safety tasking.

Hence, safety tasking for the Southwest Delta has three components:

1. Conclusions based on the third Safety Assessment of primary flood defences and new technical insights.
2. Increases in sea level, subsidence, and possible changes in river discharge.
3. Potential tasking following on from updating of flood protection standards.

The framework for flood damage control in the area inside the dykes as per the Sub-programme New Urban Developments and Reconstruction follow in due course. The Southwest Delta will detail this in more depth within the area-based safety strategies.

Freshwater

Freshwater plays an important role in the Southwest Delta. Freshwater is used in the preparation of drinking water and industrial process water.
Freshwater is crucial for agriculture and glasshouse horticulture in the delta area. Freshwater is also deployed to maintain levels and the regulation of water quality. Freshwater forms the basis for a liveable and economically vital delta. The Southwest Delta and Rhine Estuary-Drechtsteden have conducted a joint regional constraints analysis around the freshwater system in the west of the country.
'freshwater lenses' are a special aspect in this part of the country, with their function in supplying freshwater for agriculture. In particular the study examines if and where tipping points will be reached; where and when the freshwater lenses disappear via discharge, due to drying-out.

The strategic freshwater reserves for the entire southwest of the Netherlands are formed by the Biesbosch, the Hollands Diep, the Haringvliet and in the specific case of the Delta, freshwater lenses. Lower river discharge will jeopardize these reserves. The problem of external salinization around Rhine Estuary-Drechtsteden also applies to the Southwest Delta.

The current situation around freshwater supplies across the entire Southwest Delta is as follows:

- Demand for fresh water will rise apace with drying-out in West Brabant and internal salinization in the delta. Ground water is salinified in large parts of the South-west Delta and the water in this area seeps upwards and salinifies water in drainage channels (internal salinization) whereby this is too salty for agriculture, horticulture and industry. This also impacts negatively on the ecological value of the waterways.
- Freshwater supplies in the Southwest Delta are strongly dependent on the water intake from the main water system. The system in the Southwest Delta forms part of a far larger area stretching from Gouda to Flanders.
- Under the current system the intake points at Gouda and Bernisse are essential for the northern part of the delta and the southern part of the province of South Holland. With the situation as it stands there is a chance that water at the intake points is too salty (excess chloride levels) for it to be taken up in freshwater supplies. This is due to salt seawater encroaching up the river as external salinization. This puts pressure on functions that are dependent on fresh- and drinking water.
- Water quality is unstable in the Volkerak-Zoommeer and Grevelingen. In periods of burgeoning blue-green algae, effects will include a stop on freshwater being allowed to enter regional water systems. This has a direct economic impact, including on the agricultural and recreation sectors in the region.
- In the Southwest Delta in particular there is tension between the urban and regional water systems. There are conflicting interests in terms of intake and outflow between agricultural and urban functions.

Interface of short and long-terms

Urgent short-term issues are incorporated in the Southwest Delta implementation programme for 2010-2015+. Involved here are water quality issues, combating salinization around low river discharge posing a threat to freshwater supplies, the need to store river water in the event of storms at sea and/or closure of the delta simultaneously with high river discharge. This concerns provisions for busy north-south shipping, major expansion of the leisure sector – part of which is outside the dykes –

options for tidal energy, and alternative freshwater supplies given potential salinization of the Volkerak-Zoommeer. Given intended regional economic developments this complex entity needs to become a cohesive, directional decision on the Volkerak-Zoommeer and Grevelingen as early as 2012.

Future tasking

At some time between 2030 and 2060, with the current wind surge duration of 29 hours within the framework of Room for the River, water reserves to be realized in the Volkerak-Zoommeer will no longer be sufficient. The same will apply in around 2030 for the Steam scenario and for Warm (W+). The option of extending reserves in Grevelingen could offer some scope but it would also mean reserving additional space for water storage.
Another option would be to substantially reinforce the dykes along the Haringvliet and Hollands Diep.

At such time as storage in the Grevelingen is no longer sufficient other strategies may be needed after 2060, alongside further increasing the height of dykes in intensively built-up areas. Alongside possible developments around sea levels and climates (delta scenarios) the wind surge duration is a determining factor for the timing of tasking. With a higher wind surge duration additional measures alongside storage in the Volkerak-Zoommeer would be required right away. Internationally reviewed studies by Deltares indicated the need to take into account a 35-hour wind surge duration.

Rapid climate development (the Steam and Warm scenarios) in large parts of the Southwest Delta means an increase in demand for freshwater due to internal salinization. There will be increased salt seepage into the regional water system. This will require a greater external supply of freshwater to flush the regional water system. More freshwater will also be needed for drinking and industry. As from 2050 total delta requirements for freshwater will rise by just over 40% on 2011. Whether or not this will represent a constraint as from 2050 depends on available supply from the main water system and regional basins (West-Brabant and Zeeland Flanders). This gives the constraint-analysis both a national and an international dimension. The additional delta demand for freshwater has to be viewed in conjunction with additional upstream demand for freshwater.

Looking at the Scheldt basins and the coast the long-term question has to be whether the current strategy with storm surge barriers and dykes will be sufficient or whether a system change will be needed. Meanwhile, the challenge for the Scheldt estuary, i.e. realizing a sustainable balance between international interests around a safe and accessible, natural estuary and cohesion for the freshwater system of Belgian and Zeeland Flanders.

In the long term studies will be needed into a possible alternative policy strategy for ecology which takes greater account of dynamic processes in the Southwest Delta.

Approach

Possible strategies are being defined for the Southwest Delta which cohesively detail the relationship between safety and freshwater, ecology and economy. The possible strategies are going with the flow, with or without emergency stops and offering resistance. Given linkage with the sub-programmes Rhine Estuary-Drechtsteden and Rivers there will be a joint effort towards alternatives that focus on the Delta Decision for the Rhine Meuse Delta.

Sub-programme Rivers

The objective of the sub-programme Rivers is to formulate an integral long-term approach for the Meuse and for the tributaries of the Rhine, whereby integral (spatial) tasking and solution paths are set out for the riverine region in the long term (2100), as well as establishing key organizational choices. Preconditions for this are Flood risk management and expected discharge levels amounting to 18,000 m^3/s for the Rhine tributaries and 4,600 m^3/s for the Meuse.

Current tasking

The starting point for the sub-programme Rivers is completion of the River and Meuse works (Zandmaas 1 and Grensmaas) on schedule with the PKB Room for the River.

Tasking: high water

Looking at Flood risk management in the area of the major rivers, in terms of upward levels there are three potential causes requiring tasking:

a. Current tasking (meeting current flood protection standards, third Safety As-sessment primary flood defence systems and new technological insights).
b. Tasking due to higher sea levels, subsidence and potential changes in river discharge.
c. Tasking resulting from possible updating of Flood protection standards.

Ad a.

The results of the third Safety Assessment primary flood defence systems, which will be available in 2011, are expected to present supplemental tasking. For the IJssel and the Meuse in particular, increased indirect flow may lead to increased tasking as many regional water systems also discharge into these rivers.

Ad b.

In order to ensure long-term safety there will be additional tasking for the overall river area, primarily due to increased peak discharges and a higher sea level. Indicative discharging in 2100 of 18,000m^3/s for the Rhine tributaries and 4,600 m^3/s for the Meuse are physical maximums. It is by no means a given that the county's long-term task can be solved by measures taken abroad. The (remaining) upstream options are either limited and/or have only a limited effect or thrust. However, international consultations do involve a quest for new, suitable measures and there is fine-tuning to avoid shifting.

The estuaries of the rivers Rhine and Meuse (Rhine-Meuse delta) and the IJssel (IJssel-Vecht delta) see the convergence of a large number of issues. The manner in which safety tasking is detailed in the Delta Decision for the Rhine-Meuse delta can impact on both the Meuse and the Waal. Along the Waal this could penetrate as far as Nijmegen, along the Meuse to Ravenstein. Tasks around rising sea levels, increased peak discharge from the IJssel and from an possible rise in the level of the IJsselmeer converge in the IJssel-Vecht delta. Elaboration of safety tasking in the Delta Decision IJsselmeer could mean heavier tasking around the IJssel with a noticeable impact far upstream of Zwolle.

The current spread of river discharge between the Rhine tributaries may lead to future system inflexibilities. In 2011, a study will be carried out into threats and chances around changing river outflow in relation to long-term tasks in conjunction with the sub-programmes IJsselmeer, Southwest Delta and Rhine Estuary-Drechtsteden. Existing studies into the subjects will be taken as a starting point. In/along the section of the Meuse starting at the Belgian border and ending in Mook – the socalled undyked Meuse- the quays in Limburg influence water levels when river outflow exceeds the standard of 1/250th a year. If the water exceeds this level, the water will flood the quays and the areas behind them. Water will be able to flow freely, resulting in a drop in the water level. If the areas beyond the quays are not flooded, the area of the river bed will decrease by 28%, which in turn would lead to a rise in water levels. This has consequences for the long-term tasking. Hence, a focused approach to the quayed areas is essential for the long-term area processes.

Ad c.

For the riverine area the possible updating of flood protection standards could lead to additional safety tasking.

Future task: low water

In the long term, summer season inflow into the rivers will decrease, often to extremely low levels. This has consequences for the Biesbosch, Hollands Diep, Haringvliet and Gouda, which make up the central areas of the water reserves in the west of the country. Inflexibility in the system due to limited and/or missing alternatives to the water reserves will also lead to problems with inflow – due to low water levels in the Nederrijn-Lek – and for shipping along the Meuse and canals in Brabant. This may mean an additional task for the sub-programme Rivers, as well as

potential problems with the availability of cooling water for power plants along the Meuse, Amer, Amsterdam-Rijnkanaal and the Noordzeekanaal. The possibilities for controlling the spread of low water in practice and its consequences will be visualized by the sub-programme Rivers. A joint approach to high and low water is important in this context.

Future tasking: integral regional tasking

The purpose of the sub-programme Rivers is to reach an integral approach to the task around Flood risk management and freshwater. To this end the tasks will be combined – where possible – with the goals and ambitions of other functions in the river area. This forms the integral task for the sub-programme Rivers. In the short term, emphasis will be on the current policy and the documented visions such as the Quickscan Meuse, IVM2, Waalweelde and a climate-proof IJssel.

Connecting short- and long term

Various parties are developing initiatives for spatial projects along the rivers. Many of these initiatives contain a (sub) task for high Flood risk management. With an eye to connecting the short- and long-terms steering committees Rhine and Meuse identify a limited number of projects which can provide short-term insight(s) into the systematics of area-based detailing of the long-term task. The projects in question are Maasplassen, Ooijen-Wanssum, Ravenstein, IJsselsprong Zutphen and Waalweelde.

Approach

Integral area tasking will be detailed in 2011. This can be done in various ways, leading to several policy alternatives. The guiding element for the policy alternatives is the choice of coherent strategies which draw from sources like “do more with dykes” (such as delta-dykes and natural Flood risk management measures), “room for the river+” or “a different look at water” (such as multi-layered flood risk management). Insights in regard to construction and Flood risk management from the sub-programme New Developments & Restructuring will be deployed here.
In 2011, the sub-programme Rivers will work closely with regional partners in developing a joint approach to the area processes which will take place in 2012-2013. The task will be defined within the various area processes, whereby a link will be made with the development of other sub-programmes such as Safety, Freshwater, IJsselmeer and Rhine Estuary-Drechtsteden. The status and manner of embedding of the result also forms an important aspect; in which (spatial) decisions will the results of long-term review of Rivers be most noticed?

Sub-programme Coast

The objective of the sub-programme Coast is to arrive at a sustainable, safe, robust and attractive North Sea Coast in the longer term.

Current tasking

Current policy will ensure action on prioritized weak links in the Flood Protection Programme. The year 2013 will see a start on implementation of the last two weak links. Work is also needed at several additional locations. New insights into the behaviour of the coast and coastal base (such as shifting channels) can also lead to safety problems. Based on an expert opinion from Rijkswaterstaat and the regional water boards a further study is underway into expected safety problem locations over the next several decades.
An increase in replenishment volume from 12 million m^3 to 20 million m^3 annually will be needed for the entire coastal base to grow apace with current rises in sea level. Additional sand replenishment will help prevent new weak spots in coastal defences and the timing of this intensified input is being examined.
The current replenishment strategy aims to counter coastal erosion while preventing the Netherlands from shrinking. More than is now the case new replenishment strategies will aim to prevent future safety problems. Studies around alternative replenishment strategies will provide greater clarity here. The social benefits of replenishment are also likely to increase by also deploying sand needed for long-term safety, for other purposes. The study into new replenishment strategies will be completed during the course of 2012.

Future tasking

There are three components in safety tasking for the coast (see sub-programme Safety):

1. The third Safety Assessment of primary flood defence systems and new in-sights.
2. Rising sea levels and subsidence.
3. Tasks due to updating of flood protection standards.

Even if updating flood protection standards does not impact on coastal standards (see chapter 2.2), the sub-programme Coast will still have a safety task to fulfil on the basis of the first two components. Studies are currently underway into the significance of potentially higher sea levels for additional replenishment over and above the previously mentioned 20 million m^3.

Insofar as the coast is made up of solid defences, these will also need to grow apace with the sea level. The sub-programme Coast is examining the best way to achieve this.

Ambitions

Alongside the safety tasks, the most important ambitions are in the area of spatial and economic development as far as the coast is concerned. This means a quality boost for coastal towns where leisure and tourism are major sources of income. The coast also has significant national and international value in terms of nature and recreation.
Taking account of potential longer-term safety measures the question is how spatial development can be realized in the short and long term; this should also focus on ways to maintain linkage between the coastal towns and the sea. A study into multifunctional use of the flood defences should show what is and what is not acceptable, with significant input from and interaction with the sub-programmes Safety and New Developments & Reconstruction.

Approach

The Framework for Coastal Development (NKK) was completed in March 2011. This forms the basis for – and an approach to – the provincial visions/strategic agendas and National Coastal Vision (NVK). The provincial visions will be ready at the end of 2011 and the NVK will be ready at the end of 2012.
The provincial and national visions will develop cohesive solution strategies. Any problems identified will be treated in more detail and interfaced; methods used here will include studies, workshops and case studies.
The National Water Plan's preferred strategy is, "where possible going with the flow of natural processes and resisting where necessary, while utilizing chances for welfare and prosperity, adaptive approach plus cooperation in- and outside water management".

The sub-programme Coast meshes with the development of the NVK strategy. The vision will give an integral picture for longer-term linkage with the sea, the adjacent hinterland and along the coast.
The NKK has reconnoitred the direction of legal, economic and technical feasibility of large-scale coastal expansion: the latter is not required for safety.

Sub-programme Wadden Region

The two main objectives of the sub-programme Wadden Region are development of an integral approach to ensuring coastal safety along the islands and the mainland in the long and short terms, while monitoring the impact of climate change on the Wadden Region.

Current tasking

Primary flood defences

Primary flood defences in the Wadden Region are some 300 kilometres long. Alongside existing tasking the second review of these defences will involve tasking under the Flood risk management programme. These will comprise the findings of the third review round and new technical insights, the impact of increasing sea levels and subsidence, as well as a possible updating of flood protection standards. At several locations there are channels relatively near to the flood defence system; in due course, together with higher sea levels these could pose a threat to the stability of the flood defences.

Areas outside the dykes

There are a wide range of areas outside the dykes in the Wadden Region. These include ferry terminals, commercial and port sites, tidal marshes and natural environments, and housing and leisure accommodation. Safety is not an issue at present and flooding of harbours and causeways during storms is not seen as a threat. Even so, this does impact on accessibility. A further rise in sea level might well require the elevation or adaptation of some areas outside the dykes. Meanwhile, users and owners of these areas are uncertain as to the spread of responsibility.

North Sea coast

Much of the coastline around the Wadden Islands is maintained – when required – by sand replenishment. In recent times this has mainly been the case on Texel, Ameland and – to a limited degree – Vlieland. From the angle of nature management it is desirable to have greater dynamism in the sandy coastal zone. This could also contribute to longer-term safety in that the sandy coastline might then grow apace with sea levels. A discussion is underway on this management formula.

Future tasking

The quickscans provided in 2011 gave insights into available knowledge that might yield answers to policy issues around the Wadden Region. In particular these issues involved Flood risk management and climate change, in addition to highlighting gaps in knowledge. There are a large number of open knowledge questions around the mutual reinforcement of safety and nature. Knowledge development and extensive monitoring of the state of the Wadden system are particularly important with an eye to long-term issues. The survival of the channel shoal system in the Wadden Sea does not go without saying. In the longer term this could mean increased stress and wave-load on the flood defences.
The current replenishment volumes along the coast are theoretically insufficient to have the coastal base of the Wadden Sea to fully grow apace with the sea level. The Wadden Sea's need for sand could, in the longer term, produce a safety problem for the islands; and high water levels in Eems-Dollard could increase due to changes in the estuary. Given these factors it is likely that safety tasking will increase in the longer term.

A rising sea level could also impact on fresh water supplies in the Wadden Islands, which in turn could affect production of drinking water, agriculture, and cause the drying-out of nature sites. Solutions are being studied under the sub-programme Freshwater.
With an eye to possible long-term problems in areas outside the dykes or in regard to construction inside the dykes or in flood defence zones there is linkage with the sub-programmes Safety and New Developments & Reconstruction.

Changes in the discharge regime in the IJsselmeer may impact on water quality and morphology in the Wadden Sea (changes in 'freshwater' for habitats and varieties and shifts in behaviour by channels). Hence, the sub-programme Wadden Region provided preconditions for the drainage regime for the sub-programme IJsselmeer Region.

Ambition

There are optimal ongoing safeguards around the safety of residents and users of the Wadden Region. Where possible the region grows naturally apace with the sea level. Put another way, the entire North Sea coastal zone, the Wadden Islands, the intertidal area comprising the Wadden Sea and Eems-Dollard – and the mainland coast are being preserved as a climate buffer for the mainland. Where required by present or future-oriented tasking around safety measures,

the ambition will also be to benefit nature and the economy. In the case of Eems-Dollard there may be opportunities to combine safety with enhancement of the morphology and the ecosystem.

Strategy

First and foremost the Wadden Region must remain safe. However, in an area listed as a World Heritage natural treasure, every strategy needs to safeguard ecological interests. In the short term current safety policy appears adequate. In the longer term the survival of the Wadden Region in its present form is uncertain given possible developments in sea level and it may be necessary to adapt safety strategy. Hence, 2012 will also see work towards more effective charting of future safety tasking, studies of solution structures and the set-up of necessary monitoring. The following elements also play a role: concepts to limit wave-stress, multi-level safety, adapted construction, innovative sea defence systems and potential strategies towards the Wadden system growing apace with sea levels.

Appendix B

Overview of progress compared with Delta Programme 2011

Table Overview of progress compared with Delta Programme 2011

Sub-programme	Decision planning in 2011, as incorporated in DP2011	Situation DP2012
Safety	Proposal decision in principle on safety standards	Standpoint on updating standards expected end 2011
Freshwater	Problem analysis detailed	Complete
IJsselmeer Region	Based on existing knowledge and regional processes an initial set of promising strategies	Forward look strategies complete, DP2013 describes all possible strategies
	Start-up white paper water level management IJsselmeer	No short term preparation decision on water level by cabinet; this to be integrated in Delta¬ Decision 2014
	Aid for quality back-up spatial development IJsselmeer Region	Complete
Rhine Estuary-Drechtsteden	Problem analysis and regional urgency	Complete
	Proposal solutions to be detailed	DP2013 describes possible solution strategies
Rivers	Integral regional tasking	Complete in 2011
Coast	National Framework for Coastal Expansion	Complete
Wadden Region	Delivery Quickscans 2011	Complete

Appendix C

Signals and recommendations Delta Programme 2011

Table Signals and recommendations Delta Programme 2011

Description	Current situation	Future
Consistent scenarios (KNMI, PBL and CPB) in 2013	Delta scenarios have been compiled for the Delta programme. These are based on KNMI '06 and the WLO scenarios.	Delta scenarios next will be available in late 2012/2013. These will be based on the update of the KNMI scenarios and a possible update of the WLO scenarios.
More effective granting of licences in programmes	Solution directions visualized on the basis of expertise gatherings.	In further detailing linkage is sought with the following ongoing processes: The ongoing process re. the approach Natura 2000 (see letter date 23/2/2011 from the State Secretary of EL & I to Parliament) and the process of the Nature Act. Moreover, in practice, possibilities for other, broader applications for multi-year/umbrella licence.
Standardization Safety decision in 2014	Planning Delta Decision Flood risk management is designed to this end.	A position on possible updating of flood protection standards follows in 2011 – with insights on the follow-up process towards the delta decision on Flood risk management.
Weak links North Holland preferably sandy/hybrid	Alternatives examined include innovative market approaches. Cooperative agreement to be signed at end June/early July 2011.	1 January 2013 all licences and contracts ready for start of realization.
Multifunctional use of flood barriers	Examined as part of the Delta dykes study. Findings are included in DP2012 on p.22.	Not applicable.
Concurrence European regulation reviewed for impact on safety	Parliament was informed of the situation by letter on 7 October 2010 (Parliamentary Paper 2010-2011, 31 710, No. 18). The conclusion is that there are few if any constraints for Safety.	Follow-up around reassessment of European directives via usual ministries.
Direction Knowledge- & Innovation agenda and programming	The Knowledge agenda for the Delta programme is available (www.delta-programma.nl).	For the innovation agenda there is linkage with follow-up activities within the framework of the Top Sector Water Knowledge questions are programmed via regular Knowledge programming.
Preliminary study deployment experimental article Delta Fund	The preliminary study of added-value for integral financing was conducted after the Delta Fund came into force.	Study of added value of an experimental article for one or more model projects for the Delta programme which combines tasking and ambitions.

Appendix D
Detailing adaptive delta management

The following text illustrates the concept of adaptive delta management using the issue of flood risk management in the area south of the rivers. The text does not anticipate the Delta Decision Rhine Meuse delta and only serves to illustrate the concept. This illustration is based on the current hydraulic preconditions and rel-evant flood protection standards. Parts of the line of reasoning have been taken from the 2005 'Sensitivity Analysis Water storage Southwest Delta'. The argumenta-tion has been simplified in the interests of clarity and is not intended for decision-making around the projects referred to. Over the next several months there will be further studies into applica-tions from the further detailing of this line of reasoning on decision- making in the Southwest Delta and the Rhine-Meuse estuary.

Short-term development

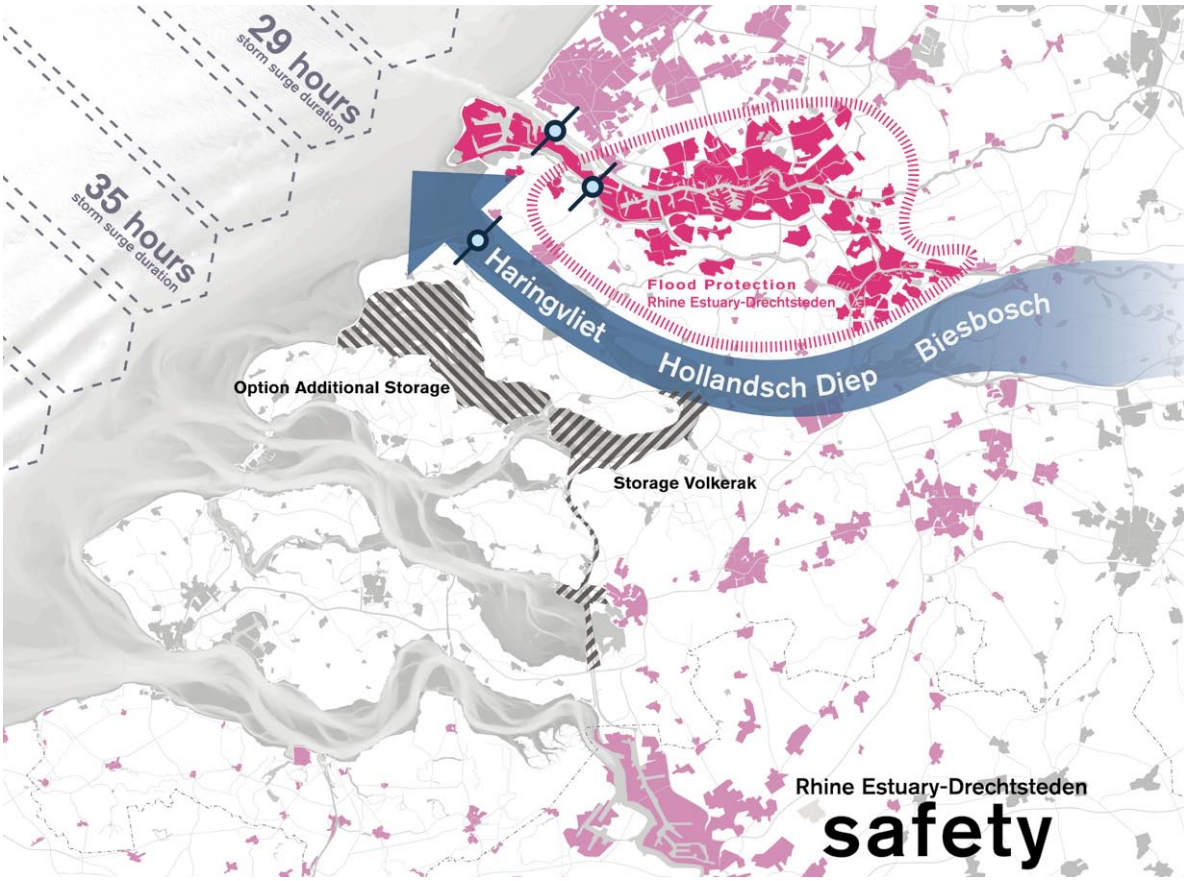
The area south of the rivers comprises towns, cities and villages around the estuary of the Rhine and Meuse. To ensure protection of this area the Volkerak-Zoommeer has been made ready to take additional water. This measure will be deployed in response to high water levels south of the rivers while, at the same time, storms at sea prevent the discharge of water via the Haringvliet sluices and Rhine Estuary. This measure enables the intake of water that flows via the Rhine and Meuse into lower reaches of the river into the Volkerak-Zoommeer. Inflow goes via the tidelocks in the Volkerak lock-complex. This temporary increase in levels requires alterations to the locks and reinforcement of the flood defences around the Volkerak-Zoommeer. These measures will be carried out in the Volkerak-Zoommeer Water storage project in the context of the PKB Room for the River in the period up to 2015.
For the meantime this measure – which will only need to be deployed occasionally given the current climate situation – will meet flood protection standards south of the rivers. However, in the longer term, rising sea levels and more frequent storms at sea plus the increased discharge of river water in winter will require additional action.

Two possibilities

There are two main options for these supplementary measures: store more water in the Southwest Delta or substantial reinforcement and heightening of the dykes in the area south of the rivers.

1. *Increased water storage.* The most obvious option for increasing water storage in the Southwest Delta would be to link the Volkerak-Zoommeer with the Grevelingenmeer. That would need additional through-put capacity via the Volkerak locks and a connection between the Grevelingenmeer and the Volkerak-Zoommeer. Moreover, a number of dykes around the Grevelingenmeer would have to be reinforced and alterations would be required to developments outside the dykes – including recreational parks. The costs involved would be strongly dependent on how these measures can be carried out.

Safety in the area to the south of the rivers



Source: Bosch Slabbers Landschapsarchitecten (map posad) for Werkplaats Zuidwestelijke Delta

2. *Reinforcement and heightening of dykes.* Reinforcing and heightening dykes south of the river would also enable ongoing maintenance of the safety standards. Work is currently underway on detailing the costs of deploying this approach to realize the same level of flood protection as with additional water storage in the Grevelingenmeer.

Implement one project now?

As noted above, for the meantime, enabling water storage in the Volkerak-Zoommeer ensures safety in the area south of the rivers. The requirement and timing for additional measures depend on the rate of change in water levels in the area – rising sea level being the dominant factor. The maximum KNMI scenario (w/w+) has sea level rising by 85cm up to 2100 which would put the safety level below standard in around 2030. However, with a slower rise in sea level (minimum scenario G/G+ foresees a 35cm rise in 2100), additional measures will not be required until 2050.[1] Hence, given current hydrological preconditions there is still time left before definitive implementation is needed.

No – but don't leave it too late!

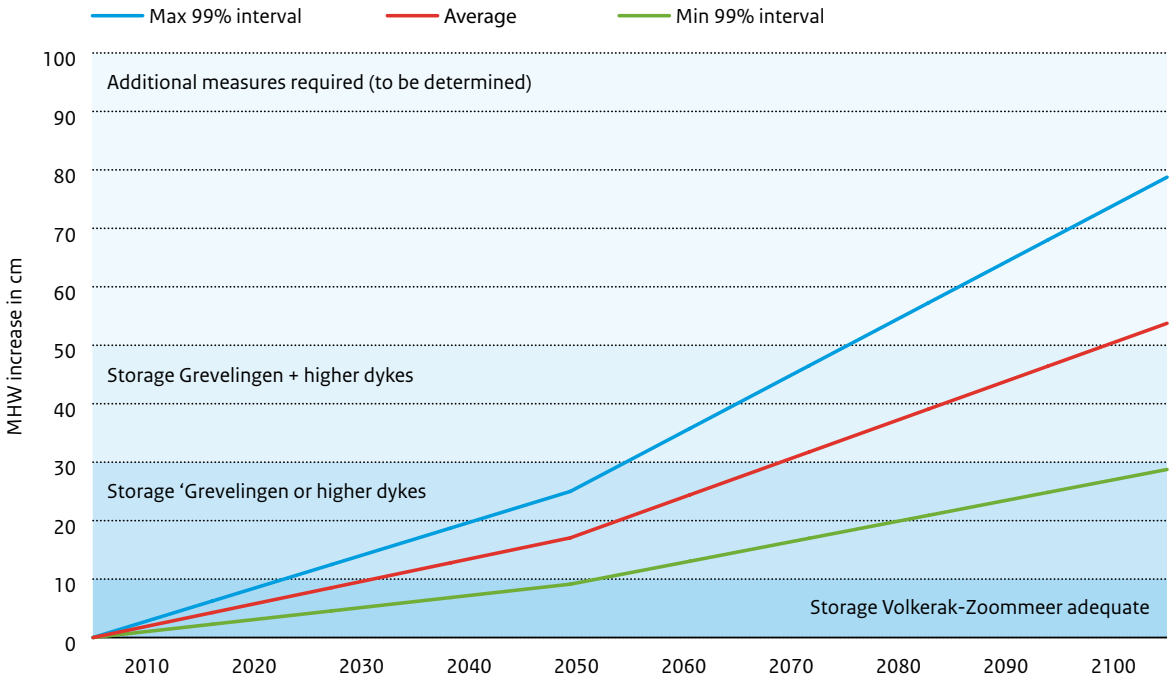
In the meantime, failure to take account of a need to implement one of the two measures is likely to progressively increase difficulties and costs. Indeed, the areas south of the rivers and around the Grevelingenmeer are set for ongoing development. Further urbanization south of the rivers could significantly limit scope for dyke reinforcement. Meanwhile, expanded leisure facilities and preliminary work underway on a possible tidal reduction, could impact on the costs of water storage. Moreover, delays could affect chances of carrying out some measures at lower cost.

Adaptive ongoing development

A non-adaptive approach provides scope for a definite choice between alternatives for timing of implementation. The preferred alternative is prepared in project form, and implemented. An adaptive approach is required to make effective use of time remaining until intervention is

1 Both measures will also be needed, in the longer term, in the event of higher climate scenarios, see figure 1.

Figure 1 Timing of additional measures depends on the pace of climate development



required and by showing the development affecting the relative attractiveness of the alternatives and to steer where this is costefficient. Hence, the decision is taken in stages: in the short term a decision is made on keeping open scope for decisions and linkage with regular developments. This avoids alternatives being disproportionately costly, and the decision between alternatives is reached at a later stage. With developments in both the areas south of the rivers and the Grevelingenmeer it is wise to take account of possible future measures before a definite choice is made.

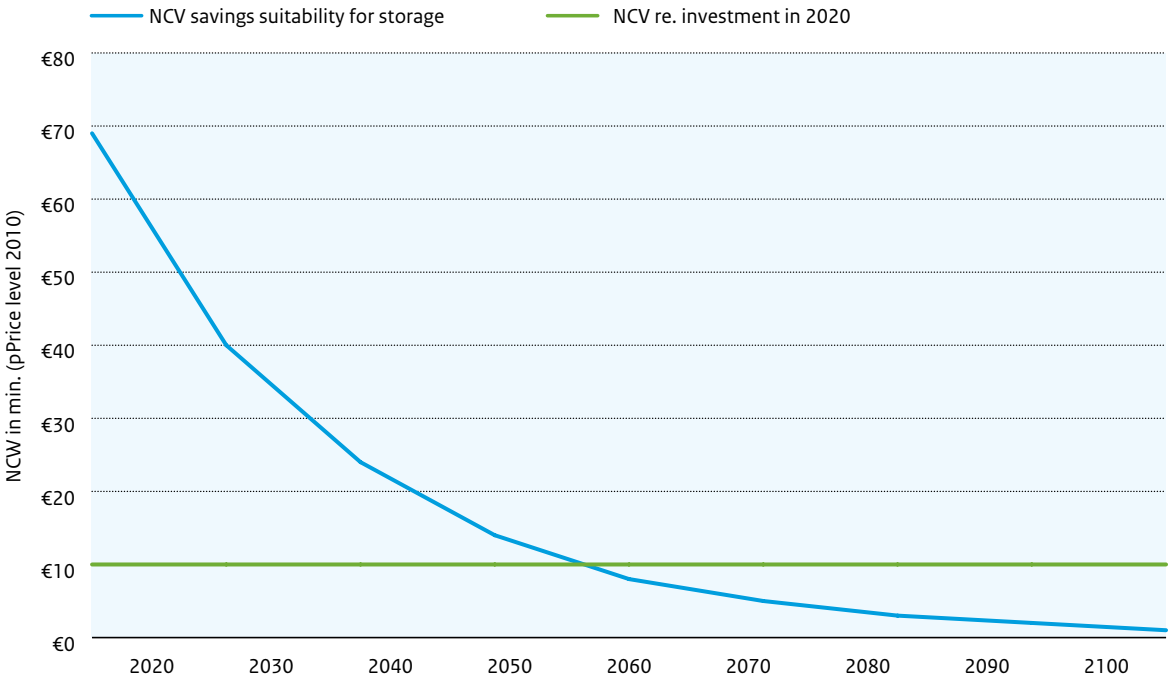
Increased water storage - Leisure businesses around the Grevelingenmeer should take account of potential future measures over the next several decades, involving new developments or replacement of their holiday homes and a possible, temporary rise in water levels in the longer term. This also needs to be taken into account with the development of new yacht marinas. If this happens gradually and combined with planned new developments and regular maintenance, there will only be limited additional investment. Minor adjustments will be needed in the future if it is decided to definitely proceed with water storage in the Grevelingenmeer.

Potentially, the Volkerak locks area offers the first concrete opportunity for a smart investment ahead of a definite decision. Increased discharge capacity is needed to store water in the Grevelingenmeer, but adapting the present time-lock would be quite costly at € 118 million. However, the next several years a decision is expected on widening of locks with a fourth lock-chamber to cope with the increased volume of shipping. If this materializes – probably around 2020 – there will be an opportunity to realize additional through-put capacity at relatively limited additional costs of € 17 million. An evaluation of climate scenarios shows this to be cost effective investment.[2] If it is finally decided to make the Grevelingenmeer suitable for storage, one of the most costly measures will have been realized with a saving of € 101 million. If at the time the Volkerak locks are being expanded a definite decision is already taken to enable water storage in the Grevelingenmeer within a foreseeable time-frame, there will actually be a no-regrets investment. At this stage there is no way of saying with any degree of certainty whether the opportunity will arise to realize the required through-put capacity in this way. However, if the chance arises, and is taken, water storage becomes a relatively more attractive solution.

Plans to salinify the Volkerak-Zoommeer and to re-establish linkage between the Grevelingenmeer and the North Sea

2 See 'Structuring Choices and Assessing Alternatives for ensuring safety in the area south of the rivers' – Stratelligence, 2011.

Figure 2 Net cash value of savings versus cost of through-put capacity to be realized with construction of a fourth chamber in 2020 (price level 2011)



also impact on costs for water storage. These plans are likely to be implemented before water storage comes on the agenda. By already taking this possibility into account and – in anticipation of a decision – taking advantage of opportunities to economize, the costs of water storage are at the lower end of the spectrum and would be less than originally foreseen.

Reinforcing and increasing the height of dykes[3] - Options can also be kept open in the area south of the rivers, e.g. by not building, or only building on a temporary basis, at possible locations for dyke-widening. And regular maintenance is also likely to provide chances to reinforce these dykes with limited additional costs involved – thus preparing for the future. In any event, current cost estimates can be made precise with further studies.

Conclusion: decide early on taking account of possible future measures and invest ahead where this is cost-efficient. This stops alternatives becoming disproportionately more costly while maintaining scope – over the course of years – to arrive at a solution that matches optimally with actual developments.

In practice these are not the only elements impacting on the costs and attractiveness of alternatives around water-safety. The most attractive alternative will eventually become clear, dependent on all these developments.

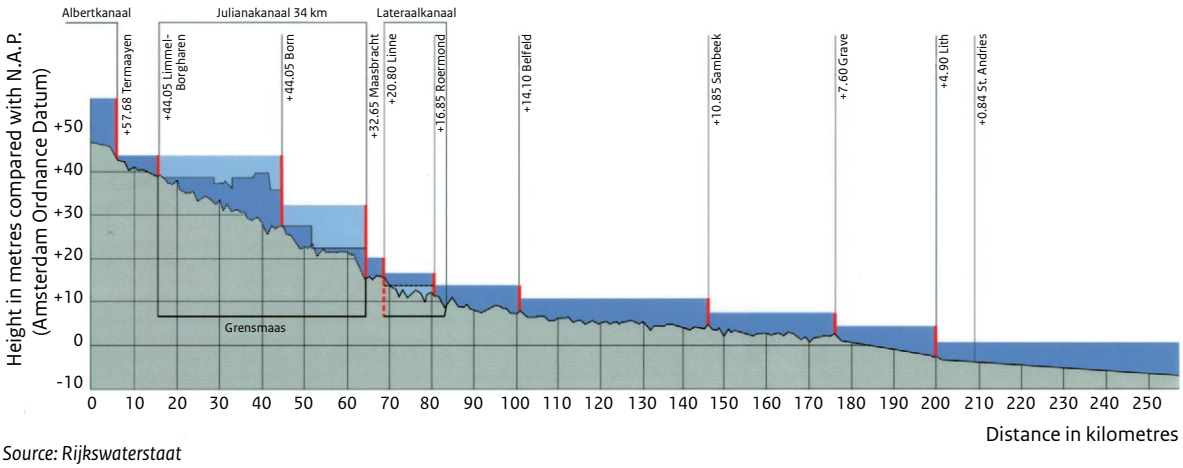
The adaptive rationale advances a measure before matters become urgent. This view on issues maps out areas of uncertainty and tracks chances outside direct scope of the project. The eventual choice is partly determined by opportunities to carry out smart preliminary work around ongoing or planned infrastructural projects. This would include construction, major maintenance and management. As applied to safety in the area south of the rivers the approach identifies both several potential saving opportunities and potential cost increases before having to take a definite choice on a measure. In the meantime, by taking advantage of the situation the area can further develop – within given bounds – and in the long run safety measures costs in particular will be as low as possible. Hence, the adaptive approach means smart and cost-effective investment.

The issue of replacement of the barrages in the Meuse

The text below is an illustration of adaptive delta management, based on the issue of replacement of the barrages in the Meuse. The illustration has no planning status and does not necessarily represent the opinion of

3 This illustration is based on available data. In that these data are more detailed around possible water storage in the Grevelingenmeer, development potential for this alternative is worked out in more detail in the context of dyke reinforcement.

Figure 3 Length profile dammed Meuse



Source: Rijkswaterstaat

Rijkswaterstaat. The text does not anticipate decisions in the framework of the sub-programme Rivers and Room for the River and its only significance is as an illustration of the concept of adaptive delta management. Elements of the argumentation are taken from the report 'Strategy for Replacement of "wet" engineering works'. 'The Meuse as pilot: a quick scan'. Over the next several months a study will clarify how the stated replacement task – which is also on the agenda in other parts of the country – can be linked with the sub-programmes.

The replacement task for the barrages in the Meuse between the Dutch-Belgian border and the barrage at Lith is interesting from the perspective of adaptive delta-management. This part of the Meuse is equipped with locks to enable shipping. Barrages and channels between locks on the Meuse are shown in the linear profile below.

The locks were built in the early 20th century and are nearing the end of their lifespan; replacement is a matter of urgency. This map gives an overview of the location of barrages and locks showing the year of construction, end of lifespan, and the main causes of technical and/or functional aging.

The issues here are how to effectively deal with this task – what are the options for in-built flexibility – does it make sense to individually replace each and every lock – and which future developments will form the bases for designs – are all the locks still needed given the future developments in the Meuse's discharge regime and shipping?

Uncertainties

Alongside the certainty around obsolescent engineering works, there are two areas of uncertainty: first are the changes in the Meuse discharge routine due to possible climate change. The current maximum discharge of 3,600 m^3/s is expected to rise to between 4,000 and 4,600 m^3/s. Depending on the scenario the current minimum discharge of 89 m^3/s will grow to 97 m^3/s, although it could also drop to 30 m^3/s.

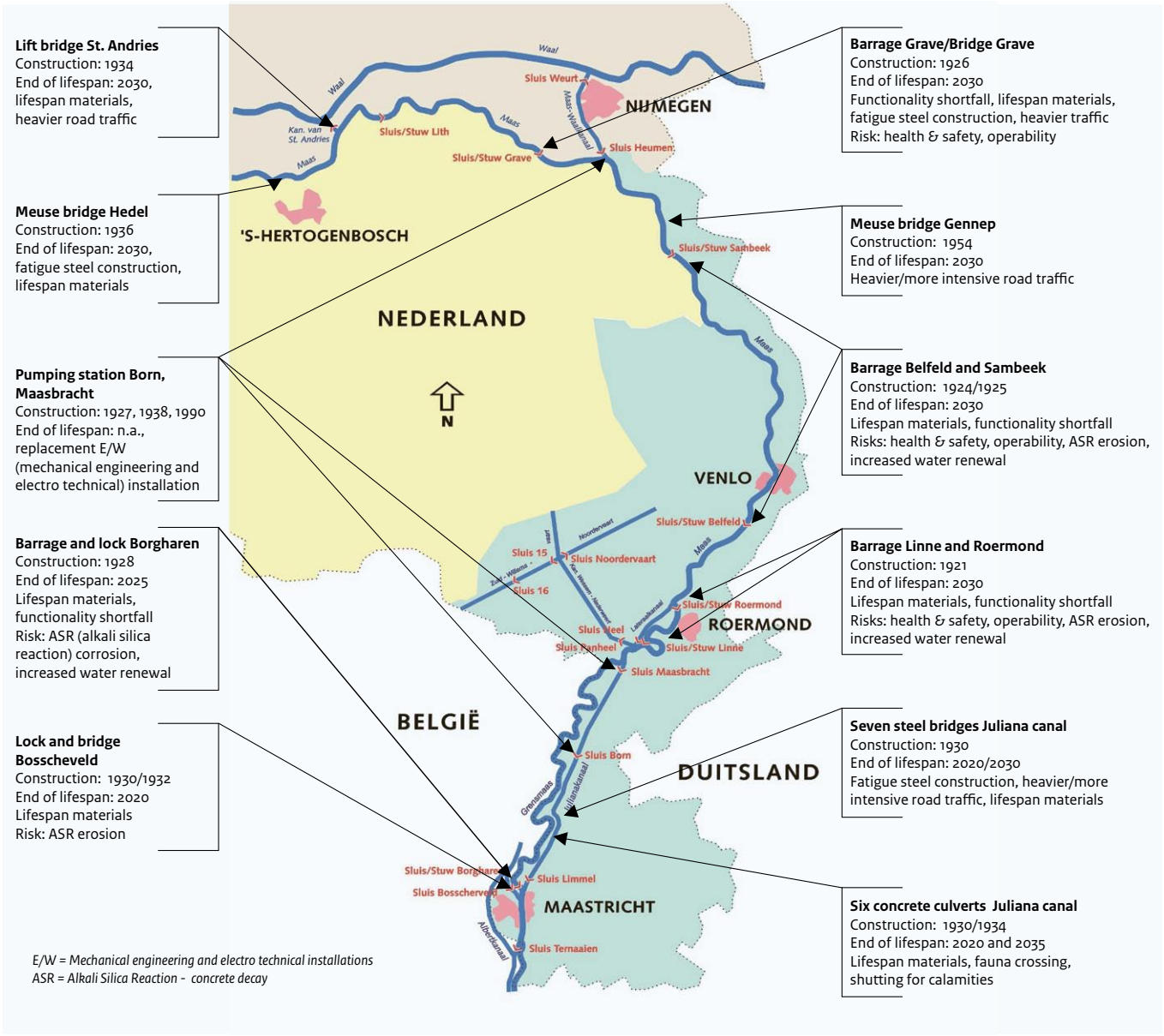
At the same time, shipping is an uncertain factor. Tonnage will grow from the present 19.6 million tons annually to 33 million tons depending on the scenario. But it could also drop slightly to 16.6 million tons (source: Network analysis shipping and inland waterway ports, Limburg province, 2008).

Seeking flexibility at two levels

The replacement tasking seeks an approach at two levels, namely the section of the Meuse equipped with locks, and the level of individual locks. There are possible alternatives at both levels, and options are indicated.

To the south of Roermond commercial shipping sails on the Lateral and Juliana canals. North of Roermond it has to take the Meuse as the Wessem-Nederweert and Zuid-Willemsvaart canals between Maasbracht and Den Bosch are currently unsuitable for larger vessels, and because a large proportion of shipping goes via the Meuse Waal canal to Germany. Hence, for the time, the Meuse is needed – as a link in shipping traffic – and the locks should maintain navigability on this part of the river.

Figure 4 Overview replacement task wet engineering works in the dammed Meuse



Source: Rijkswaterstaat

Irrespective of the choice above and of the scenarios – there are two locks which can be replaced right away, namely Borgharen and Linne. In all scenarios the Meuse route between Maastricht and Maasbracht must remain navigable for commercial and leisure traffic, at all times. Self-evidently the dimensions of these barrages/locks will be linked to the upper and lower limits of increased shipping volume and developments around the discharge regime in line with various delta scenarios. At the level of these objects it is conceivable that options would be incorporated to anticipate the bandwidth for these future developments.

The preferred choice around upgrading the canal between Wessem-Nederweert and Zuid-Willemsvaart is highly significant for the Meuse between Roermond and the Lith lock. Upgrading would give shipping the option of also – or exclusively – going by canal. This raises the question of what would happen with the barrages and locks in this part of the

Meuse. Given an alternative route it would be possible to reduce the number of locks in this part of the Meuse and/or to seek new locations. In turn these new locations would be linked in with potential for extending the Noordervaart to Venlo. The choices are intertwined.

Possible options at the network switch level

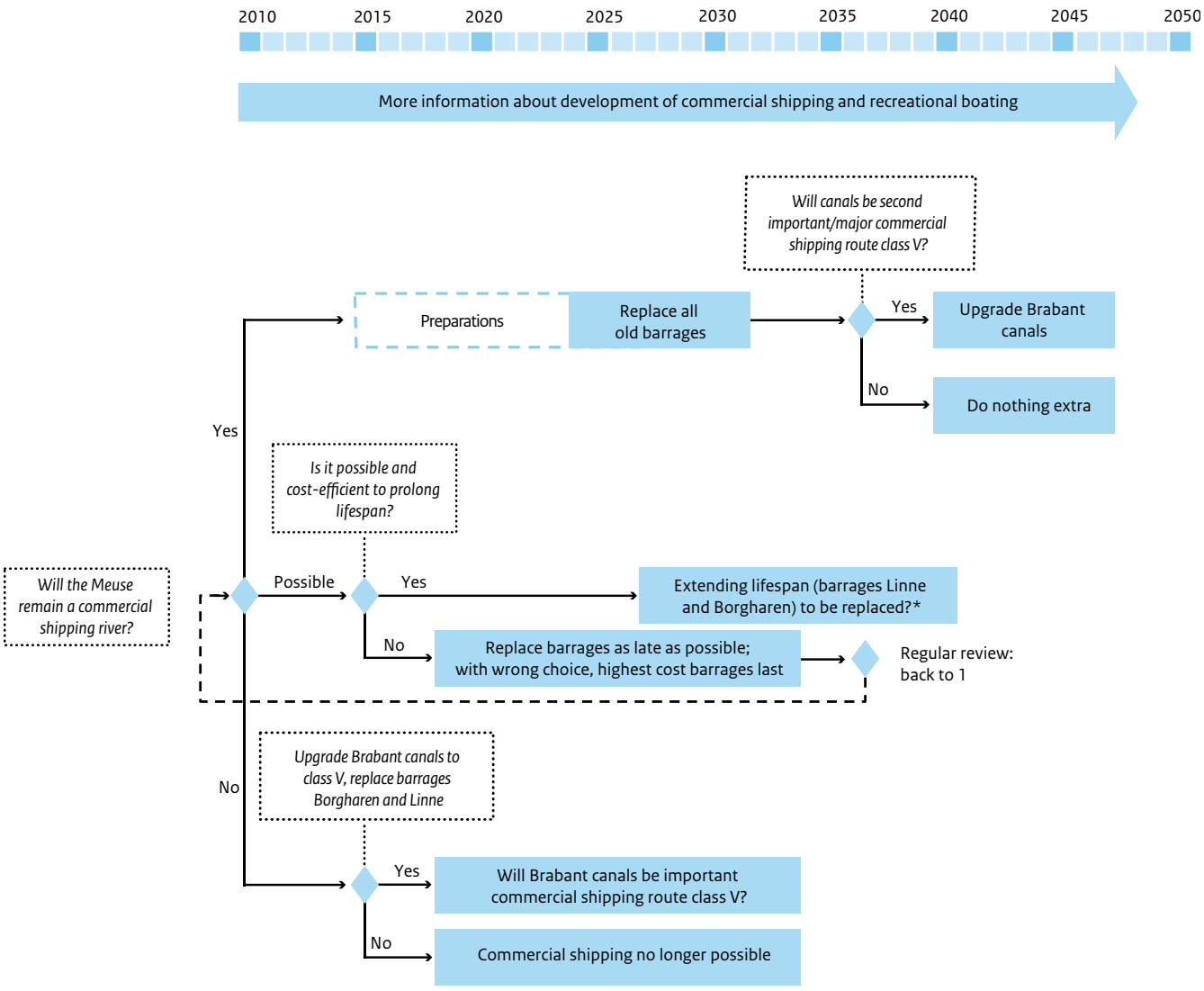
The quest focuses on the best adaptation paths and breakpoints. Developments around shipping and climate are uncertain. Even so, the need to deal with the engineering works grows more urgent.
One option at the level of engineering works is to examine the possibility of extending the lifespan of the given locks – when their condition allows – instead of replacing them. Extending lifespan buys time until – for example – there is clarity on whether or not to upgrade the canal.

Another possible option could be upgrading the canal at the level of network links. This would open up the possibility to totally reconfigure this section of the Meuse at a later date. This would entail fewer barrages, new locations, scope for other functions and so on; alternatively it could be kept as a second shipping channel.

A comparable argument can be made for the future extension of the Noordervaart to Venlo. As a greenport Venlo needs to remain accessible for commercial traffic from the south or via the Meuse or the Wessem Nederweert canal and the Noordervaart. In keeping this option open consideration must be given to location and functionality of the Belfeld and Sambeek barrages.

The example shows that a considered approach to uncertainties, establishing links between future decisions, being forward looking and being specific, are important links and contribute to more down-to-earth decision-making: not easy, but challenging and enriching.

Figure 5 Overview chart of choices and non-dependent factors around replacement of locks and barrages on the Meuse



* Costs of the wrong choice around Linne and Borgharen are zero if it is assumed that – in any event – there must be a commercial shipping route. They are needed for the route along the Meuse and the Brabant canals.

Appendix E
Administrative planning

This appendix describes the process planning for all Delta Decisions up to and including DP2015 (decision in 2014). There is a table for each Delta Decision. Where output from one Delta Decision provides input for another the given table is shown under the "receiving" Delta Decision. The summary chart included also shows planning for the annual Delta programme and for all Delta Decisions.

Administrative planning tables will be followed by a graphic version. Updates of this are on www.deltacommissaris.nl.

Table Planning Delta Decision Flood risk

Planning for the Delta Decision Flood risk management is as follows:

2011	
From spring to autumn	Joint development framework for detailing safety tasking in area-based strategies. Discussion in Steering Group Delta Programme[4].
Autumn 2011	Area-based sub-programmes start by charting possible solution paths for short- and long-term tasking (possible combinations of dyke reinforcement, delta dykes, river-widening and other spatial solutions including building with nature)
	State Secretary's proposal on bandwidth updating flood protection standards (decision in principle) and potential for Delta dykes. A decision is also intended on the (possible) reassessment of policy on areas outside the dykes.
2012	
Spring	Possible solution paths per area-based sub-programme for DP2013. Discussions in Steering Group Delta Programme. If required honing of framework for area-based strategies for detailing safety tasking
	Based on decision-making DP2013 (in National Water Consultation Committee NBO) detailing promising variants per area-based sub-programme to deal with safety tasking.
Autumn	Status and linkage discussions in Steering Group Delta Programme.
2013	
Spring	Promising variants per area based sub-programme for DP2014: options for the Delta Decision Flood risk management. Discussions in the Steering Group Delta Programme.
	Based on decision making DP2014 (in NBO), further detailing towards preferred strategies for approach safety tasking[5].
Autumn	Status and linkage discussions in Steering Group Delta Programme.
2014	
March	Preferred strategy/ies for area-based detailing of safety tasking and definite proposal for updating standards and safety strategies for DP2015: proposal Delta Decision Flood risk management. Discussions in NWO (Netherlands Organisation for Scientific Research) and Steering Group Delta Programme.
	Completion proposal Delta Decision Flood risk management via decision making DP2015 (via NBO)[6].

4 The framework must also be suitable for detailing at the level of measures.
5 Also detailing of concrete measures for the Flood risk management programme.
6 Also inclusion on a package of measures in the first Flood risk management programme.

Table Planning Delta Decision Spatial Adaptation

Planning for the Delta Decision Spatial Adaptation is as follows:

2011	
December	Draft National Policy Framework New Urban Developments and Reconstruction. In any event deals with specifications within the dykes (delta dykes, vital infrastructure), outside the dykes (construction methods), in, on and around the flood defences (multifunctional flood defences) and possible inundation (in regard to spatial design). Partly based on the findings of the Delta Decision Flood risk management.
2012	
February-March	Administrative establishment draft policy framework (in Administrative Consultation Space) for inclusion in DP2013.
March	An aid in applying area-based sub-programmes and feasibility checks by other governmentals and relevant legislative bodies.
Autumn	Status and linkage of discussions in the Steering Group Delta Programme.
2013	
February-March	Status feasibility and adjustments policy framework for DP2013. Discussions in Administrative Consultation Space and Steering Group Delta Programme.
Autumn	Status and linkage of discussions in the Steering Group Delta Programme
December	Definite draft National policy framework (in Administrative Consultation Space) as proposal for Delta Decision Spatial adaptation.

Table Planning Delta Decision Freshwater strategy

Planning for the Delta Decision Freshwater strategy is as follows:

2011	
June	Establishment of main lines of constraint analysis on the basis of the national analysis and the analyses of the seven freshwater regions in NWO for DP2012.
From June	Start with further honing of constraint analysis in cooperation with the seven freshwater regions and water utilizing functions (agriculture, nature, and drinking water/industry) and area-based sub-programmes. Illustrate possible strategies (water distribution, water saving, distribution responsibilities).
September	Aid/framework for the next phase where freshwater regions and sectors contribute.
Autumn	Status and linkage of discussions in the Steering Group Delta Programme.
2012	
Spring	Honed constraint analysis and establishment of possible strategies for freshwater supply for DP2013. Discussions in Steering Group Delta Programme and NWO
	Based on decision-making DP2013 (in NBO) detailing promising strategies and insights into packages of measures in conjunction with the freshwater regions, water utilization functions and area-based sub-programmes.
Autumn	Status and linkage of discussions in the Steering Group Delta Programme
2013	
Spring	Establishment of promising strategies for supply and demand freshwater and insights into related packages of measures for DP2014: options for the Delta Decision freshwater strategy. Discussion in Steering Group Delta Programme and NWO.
	On the basis of decision making DP2014 (in NBO) detailing preferred strategy and related/linked package of measures in conjunction with the freshwater regions, water utilization functions and area-based sub-programmes.
Autumn	Status of discussion in Steering Group Delta Programme
2014	
March	Strategy for sustainable freshwater supply and the required package of measures for DP2015: Discussions in Steering Group Delta Programme and NWO.
	Completion proposal for the Delta Decision freshwater strategy via decision DP2015 (in NBO).

Table Planning Delta Decision Rhine-Meuse delta

Planning for the Delta Decision Rhine-Meuse delta is as follows:

2011	
June-October	Joint problem analysis Delta Decision Rhine-Meuse delta and start on visualizing possible strategies for storage and protection of the area and long-term water supply.
October-November	Status of discussions in Steering Group Delta Programme.
2012	
Spring	Possible strategies for DP2013. Partly based on safety tasking from Delta Decision Flood risk management and first draft policy framework from Delta Decision Spatial adaption and status of constraint analysis and strategies from Delta Decision freshwater. Discussions in Steering Group Delta Programme.
	Based on decision DP2013 (in NBO) detailing of promising variants for the Rhine-Meuse delta.
Autumn	Status and linkage of discussions in Steering Group Delta Programme.
2013	
Spring	Promising variants for long-term strategies for safety and water supply in the context of planning developments for DP2014: options Delta Decision Rhine-Meuse delta. Discussions in Steering Group Delta Programme.
	Based on decision DP2014 (in NBO), detailing one or more strategies in terms of decisions and linked investment for the short and long term (as concrete as possible for the first six years, broadly for the next 12 years, and main lines thereafter).
Autumn	Status and linkage discussions in Steering Group Delta Programme.
2014	
March	Preferred strategy/ies and linked decisions towards 2050-2100 for DP2015: proposal Delta Decision Rhine-Meuse delta. Discussion in Steering Group Delta Programme. Insofar as applicable the proposed measures and investments for the period up to 2050 are incorporated in the integral Flood risk management programme.
	Completion proposal Delta Decision Rhine-Meuse delta via decision DP2015 (via NBO).

Table Planning Delta Decision Water level management IJsselmeer Region

Planning for the Delta Decision Water level management IJsselmeer Region is as follows:

2011	
From April	Further detailing of potential strategies for water level management for the storage of freshwater (adapted weir management, subsidence) and to ensure safety (pumping, drainage, etc.) for DP2012.
2012	
Spring	Possible strategies for DP2013. *Partly based on safety tasking from Delta Decision Flood risk management and first draft policy framework from Delta Decision Spatial adaptation and status of constraint analysis and strategies from Delta Decision freshwater.* Discussions in Steering Group Delta Programme.
	Based on decision-making in DP2013 (in NBO) detail promising combinations of adapted weir management, subsidence, drainage and pumping and measures for Flood risk management in spatial context IJsselmeer Region and in relation to impact on the Wadden Region.
Autumn	Status and linkage of discussions in Steering Group Delta Programme.
2013	
Spring	Establishing promising combinations of measures for freshwater supply and safety for DP2014: options for Delta Decision IJsselmeer Region. Discussion in Steering Group Delta Programme.
	Based on decision DP 2014 detailing preferred strategy for water level management in the short and long terms. Using related measures (as specific as possible for the first six years, broadly for the next 12 years, and main lines thereafter).
Autumn	Status and linkage discussions in the Steering Group Delta Programme.
2014	
March	Preferred strategy water level management for DP2015: proposal Delta Decision IJsselmeer Region. Discussion in Steering Group Delta Programme. Insofar as appropriate the proposed measures and investments for the period up to 2050 to be incorporated in the integral Flood risk management programme.
	Completion proposal Delta Decision IJsselmeer Region via decision DP2015 (via NBO).

Appendix F
Process design

During the period 2010-2014 the Delta programme will prepare a cohesive set of Delta Decisions via eight MIRT studies. Strategy will be developed within these studies; a process has been developed to ensure that this is transparent and consistent. The methodology is 'faster and better', or from coarse to fine, with ample participation by stakeholders and clear decision moments.

The approach features the following steps: preparation, problem analysis, solutions and decision making. Problem analysis and solutions are iterative with mutually impacting steps working from coarse to fine towards a decision. Hence the figure below shows a blue arrow which makes a loop.

The Delta programme provides an annual situation report; this is the moment when decisions can be made not to continue studies of given, potential strategies.

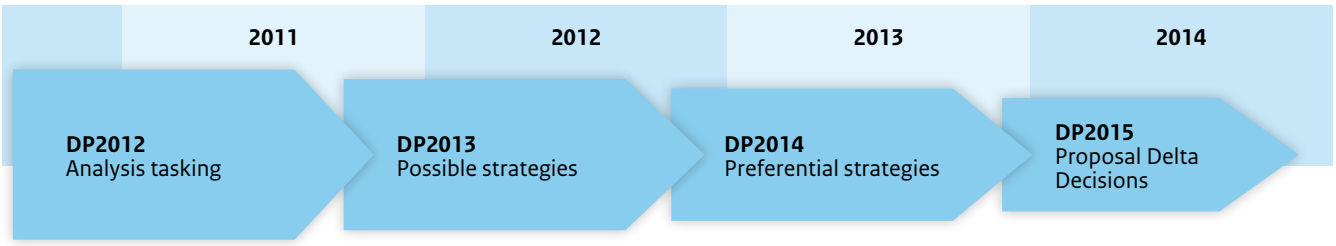
The preparatory stage (stage 0) focuses on determining starting points for the strategies, scope of analysis and criteria for comparison of strategies. The starting points and scope were determined in mid-2011; the system for comparison will be delivered no later than late 2011.

Problem analysis (stage 1)

The wide-ranging problem analysis examines the area of planning while involving a large number of stakeholders. The problem analysis covers:

- A clear description of the current situation and established policy as it stands. The current situation is defined as 2010. Taking the current situation and established policy as a basis a prognosis is given for the situation around flood risk management and freshwater supplies in 2050. The current situation and current policy provide the reference/starting point for the new policy. They also make it possible to take advantage of the current programmes.
- A confrontation with the delta scenarios, i.e. plausible visions of the future in terms of socio-economic developments in the absence of policy-driven interventions from the Delta programme. This illustrates when and in how far there will be shortcomings in current policy and current infrastructure. These intervention points mark the moment when continuing in the same way is unaffordable, technically unfeasible, or socially unacceptable.
- Objectives. An objective is a desired situation to be realized by the Delta programme in 2050. It may be an existing objective, such as around flood risk management. New objectives can also be formulated in the absence of existing ones, or the administration or other parties may determine that assessment is required. The tasking area here is the policy shortfall between the

Figure 1 Diagram Delta programme process up to 2015



current situation and current policy around objectives. Ambitions relate to objectives in policy areas other than flood risk management and freshwater supplies. Target images can be used to formulate objectives and ambitions (wishes for the very long term) while delta scenarios can provide a source of inspiration.
- During this stage of problem analysis an inventory can be made of possible strategies for achieving objectives, such as adaptive weir management in the IJsselmeer and the closable but open 'Rhine Estuary'.

Once the problem analysis has been jointly (administratively) established it provides a clear starting point for joint strategy development.

Solutions / Strategy development (stage 2)

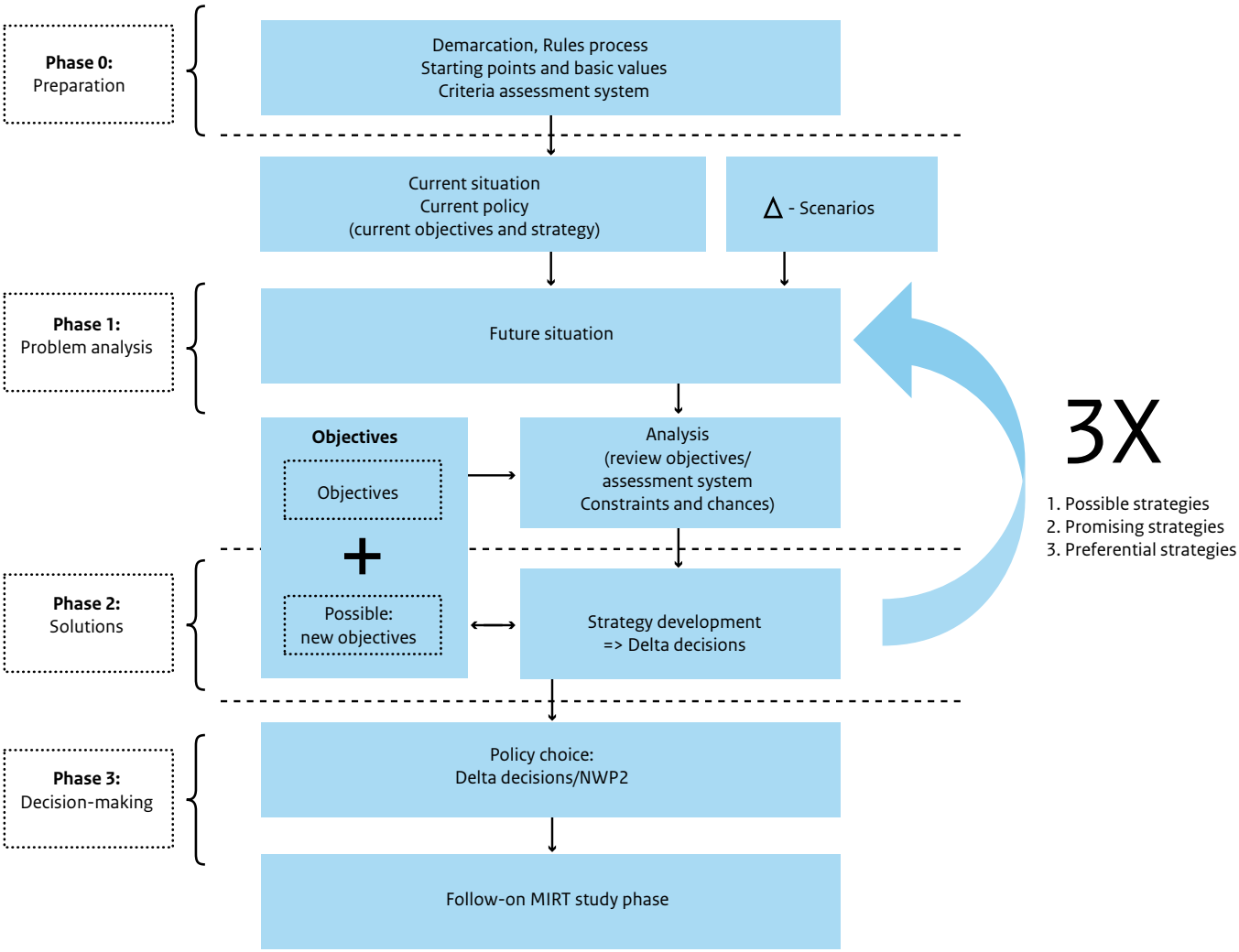
A strategy comprises the objective, measures to achieve the objective and phased input of the measures.
Strategy development involves development of a package of measures for the timely realization of set objectives. Points for attention here are possibilities for realizing other ambitions, exploiting chances around ongoing third-party programmes or initiatives.
These strategies are assessed on the degree to which they realize set objectives and how they score in terms of the criteria under the comparative system. Their future resilience can be assessed via a comparison with the delta scenario.

Possible strategies scoring well across the board are promising and can be further detailed in the next round – and detailed and refined as promising, preferred strategies. If the assessment differs it may be decided to drop the strategy or to adjust objectives.
This iterative process of developing strategy runs in three annual cycles and in mid-2014 will result in proposals for a cohesive set of preferential strategies and options for five Delta Decisions.

Making and implementing decisions (stage 3)

The cohesive set of preferential strategies and options for five Delta Decisions are to be presented in the Delta programme 2015 and can be formalized after political decision-making. Precisely how this happens depends on the actual decisions: it may occur via a policy adjustment, legislation or implementation via MIRT Review, Plan study and Realization. Implementation will take place in a cohesive flood risk management programme or a freshwater implementation programme.

Figure 2 Phasing strategic development



Appendix G
Knowledge agendas

As a consequence of their mid-2010 Plans of Approach the sub-programmes have identified a large number of knowledge requirements. At this stage these mainly relate to issues around the nature and scope of the issue – whether generic or specific to regions – interaction of the water system between sub-programmes, meshing with other political arenas such as ecology and economy – and the nature and impact of possible and promising strategies.

A large part of the knowledge questions has now been set out and answered. More in-depth approaches to problem analyses and preparation for strategy development generate fresh questions around knowledge and the Knowledge Agendas will be updated in mid-2011. This process will be repeated in 2012 and 2013 apace with the further detailing and selection of strategies.

Knowledge issues are clustered in a (progressive) knowledge agenda for each sub-programme. These knowledge agendas are available on CD/DVD and on www.delta-programma.nl.

As a complement to the knowledge questions for individual sub-programmes the topics mentioned overlap the programmes. Examples are development of the Delta model, the comparative system, cost-benefit analysis and cost indicators.

The Delta programme's knowledge agendas form the basis for ad hoc commissions for research bodies and market parties, fine-tuning with major knowledge development programmes – such as Knowledge for Climate, Delta-proof, National Knowledge and Innovation Agenda Water – and programming of strategic delta studies.

Colophon

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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
www.deltacommissaris.nl

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The Delta Programme can also be consulted online and downloaded from: www.deltacommissaris.nl and www.rijksoverheid.nl/deltaprogramma