

# change

magazine

**Adaptation to  
climate change  
in the Dutch delta**

From Doom to Bloom  
How safe is safe?  
Collaboration takes time  
The power of the delta

# Adapting together

**Foreword by Tineke Huizinga-Heringa, Vice Minister of Transport, Public Works and Water Management (left) and Jacqueline Cramer, Minister of Housing, Spatial Planning and the Environment.**



**W**ATER is the source of life and it determines the shape life takes. We live on a blue planet; water makes up 70 per cent of the Earth. However, the abundance of water is not evenly distributed over the globe. Some areas suffer from years of drought, while others are flood-stricken. In both cases, life is difficult.

As a European delta, the Netherlands has to deal with water from the major rivers entering the country in the east, while the waves of the North Sea erode our coast in the west. We have lots of experience with low swells, high swells and too much swell. Our country has a long tradition of uniting efforts in order to keep our feet dry. It is in our genes and it has been a necessity for ages. In the Middle Ages, our forefathers dug ditches to drain swampy soils. They made muddy areas inhabitable and fertile. In the centuries that followed, we repeatedly reclaimed land from the sea to add new parts to our country. Today, we are accustomed to the idea that our most densely populated areas lie below sea level. These are also the economically most remunerative areas, where we earn 65 per cent of our GNP. Without dams, dikes and dunes, two-thirds of our country would be regularly flooded.

Water shapes our spatial planning and development. We build increasingly stronger dikes to avoid flooding. We reserve space to store surplus water from our rivers. We also explore possibilities to build floating houses. After centuries of restraining the water with dikes, polders and huge infrastructure projects, it is time for adaptation. Our mindset is developing towards a search for ways to live with water, instead of fighting against it. Spatial planning and water management are inextricably linked. The consequences of climate change are incorporated into all our spatial decisions.

As minister of Spatial Planning and vice-minister of Water, we work together closely. With our fellow ministers of Economic Affairs and Agriculture, we stand united in creating a climate-proof country. Climate change means a change in our perspective on safety, biodiversity, economic strength and the quality of the living environment. These issues are interlinked and we can only tackle them if we work together. Not just within the central government, but also the local authorities: provinces, municipalities and water boards. Because our policy materialises at the regional and local level. Therefore, we draft regional water management strategies. However, adapting to climate change is not just an administrative issue. We need scientists too. Good policy is based on facts. We need information about the condition of our dikes, the stocks of freshwater and the rate at which our sea level is rising.

The vice minister of Transport, Public Works and Water Management set up a state committee to gain more insight into these types of facts. The committee investigated how we can best prepare the Netherlands for climate change. Its findings will determine the direction of our long-term adaptation plans. The contribution of science did not stop after the results of this single large-scale study were presented. We need to continue testing our policy against the facts of science as it develops. We keep building our knowledge through extensive knowledge programmes on water, climate and spatial planning. Besides the scientists, the business community is also contributing. Companies do much of the actual work: engineers tell us what is needed, dredgers are occupied with the realisation and project developers are involved in the spatial planning.

Dutch water management is highly developed. Nevertheless, we realise that the

# foreword

Netherlands is vulnerable in the face of climate change. We realise that new questions arise, questions we cannot answer by ourselves. We need knowledge and expertise from abroad, even though we are the best-protected delta in the world. Therefore, we are keen to learn from other countries.

Others learn from us too. Dutch expertise in water and delta technology is attracting attention from all over the world. After the floods in New Orleans in 2005, US delegations came to the Netherlands to see how we manage to collectively live below sea level. They took the Dutch Delta Works as an example for strengthening the coastal defences of Louisiana. Dutch companies like Royal Haskoning, Fugro and Arcadis have all contributed to the dike reinforcements around New Orleans.

We cooperate with less wealthy countries that are regularly hit by floods, because we regard this as part of our international responsibility. Our ministries work with Indonesia on knowledge exchange and capacity development. We also work with our neighbouring countries, since water does not stop at the border. The Dutch province of Gelderland has organised a high-water exercise with the German state of North Rhine-Westphalia. The major lesson we have learnt from our centuries-long fight against water is that we cannot afford to work in isolation. In a changing world and climate, we will only successfully live with water by bridging different administrative layers. By breaking down the walls that separate politics, science and industry. By transcending the boundaries between our countries and the oceans that lie between our continents.

International fora offer opportunities for us to find partners to jointly prepare for climate change. Let us build up long-lasting relationships, so we can take up the challenge of climate change together and share its weight.



Regional divisions used in the Delta Committee's report.

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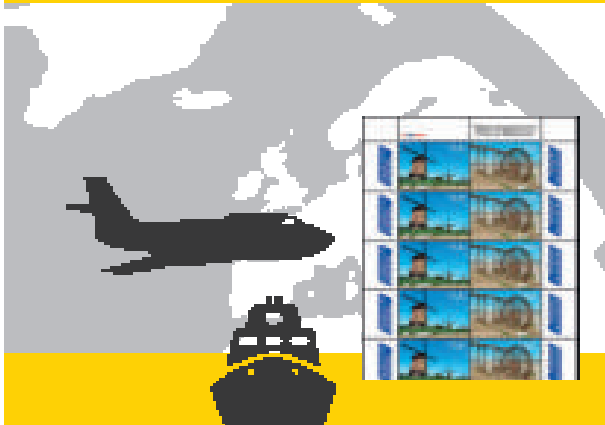
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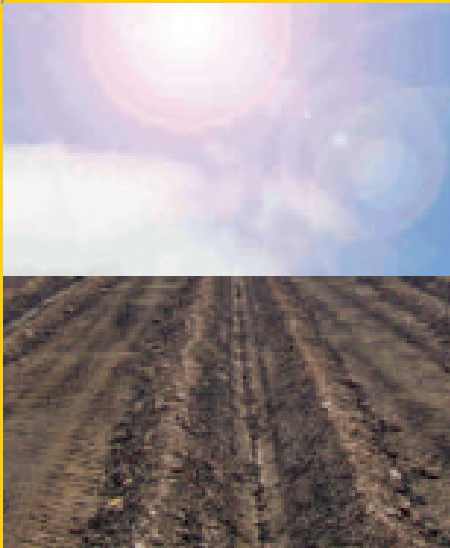


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## Water solidarity

The world is obsessed with the financial and economic crisis: work, salaries and pensions are the talk of the day. A legitimate obsession – after all, everyone is feeling the pinch. Meanwhile the climate crisis ‘babbles’ on: we notice the effects, but there are more pressing matters to attend to, is the collective thinking. Maybe the financial crisis will turn out well for the climate crisis. Obama has put clean energy high on his agenda. It’s a step in the right direction, but adaptation isn’t a priority yet.

The Netherlands is by definition an expert when it comes to dealing with water – millions of the Dutch live and work below sea level. Climate change has resulted in the creation of a new field of expertise: water, climate change and adaptation. This issue of Change Magazine is devoted to the theme. An important condition for being able to adapt is a healthy bank balance.

This condition is not present in Niger. A country six times the size of France in the African Sahel, it owes its name to the River Niger that flows through it. Rising in the mountains of Guinea Bisau, the river winds its way through Mali, Burkina Faso, Niger and Nigeria where it flows into the Atlantic. This January I sailed down the river for 250 kilometres. In some places the river is wild and two to three hundred metres wide. In the camp at safari park Double V, Abdulah Soleyman the cook complains about the high water. ‘There’s ten centimetres of water in my kitchen tent. I’ve worked here for 28 years and

it’s the first time this has happened.’ In three months’ time though the river will have shrunk to just a few metres wide in many places.

About 150 million people are dependent on the Niger, but increasing weather extremes are making its levels unpredictable. It is silting up as a result of climate change, deforestation and erosion. Its water quality is declining as the number of users increases. According to Robert Watson, chief scientist at the World Bank, three billion people will be effected by climate-change related disasters in the coming decades. Millions of people will have to go in search of clean water. ‘That’s dramatising’, says Etienne Badolo, a scientist in Niger. ‘But we are seeing the first climate refugees already, although we don’t refer to them as such. For years there’s been a steady daily trickle of people moving from the rural areas to the capital Niamey. Recently we’ve started to hear a new reason: people no longer trust the river water.’

Back in the world of the financial crisis, I’m starting to hear the word ‘solidarity’ more frequently. And it’s starting to be heard in the climate crisis too. The Netherlands possesses the possibilities, the technology and the money to make our country ‘climate proof’. We export our expertise on adaptation; we have an international network and work in various deltas. It’s big business. But now West Africa too: the Niger is crying out for adaptation attention and ‘water solidarity’. Is it inevitable that even more Africans will be displaced? After all, the river offers untold opportunities. It is a bitter pill, but solidarity is easier if there’s money. But don’t worry: they are drilling for oil in Niger and new uranium fields have been found. Adapt now, worldwide of course, but definitely in West Africa too.

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# From doom to bloom

**Climate change opens up opportunities.** While it presents important and real challenges, it can also lead to new ideas and solutions that benefit everyone. The Netherlands is a specialist when it comes to integral regional development: it has a strong tradition of collective planning, which results in coherently developed areas that are safe and pleasant to live and work in.

BY RIA DE WIT





**Raimond Hafkenscheid** “The complexity of the matter is not only a challenge for the Netherlands, it is also where our strength lies”

As inhabitants of a delta country, the Dutch have been used to living with water for centuries. A country with vast tracts of land below sea level cannot afford to ignore its water system or dikes. Currently, the Netherlands is one of the safest deltas in the world, but climate change and its effects on the water system – be it rainfall, sea level rise and river floods, or salinisation, still require urgent action on the part of water managers. Even in this low-lying country, longer and more severe droughts in summer are expected to be interspersed with periods of more intensive rainfall in winter time.

What's more, the Netherlands is one of the most densely populated countries in the world; every piece of land has a specific function. Increases in infrastructure like building, industrial areas and roads have led to a decrease in the resilience of the soil water system in recent years. The Netherlands' vulnerability to climate change has increased in turn. Two things are of vital importance to the restoration of the country's resilience: cooperation and cohesion. All parties involved, including government, scientists, the business community, nature organisations and the general public, are collectively working towards adaptive solutions. Bert Satijn is manager of the Dutch research programme Living with Water: “Cooperation is extremely important. The Netherlands is a densely populated country so realising plans is a complex task. Given spatial limitations, the adaptive changes needed confront us with a whole array of challenges, not only from a technical perspective, but also in terms of governance and communication and participation of all stakeholders.”

“Because space is at a premium in the Netherlands, every solution has to meet all kinds of different requirements”, says Satijn. A purely technical measure to deal with a water problem is of no use if it doesn't also take account of other factors such as economics, mobility, environmental quality, living conditions, nature and biodiversity. According to Satijn: “The climate-change adaptations are mainly focused on increasing the resilience of the system, for example by giving water more space in spatial planning. In practical



BARBRA VERBIJ

terms, this means making space for the major rivers that flow through the country. In rural areas water will be given more and new space; in urban development more space needs to be created for water storage. Not only in water storage basins but also on roofs, gardens, recreation parks, waters squares and in the subsoil. All these measures will contribute to making the Netherlands more climate-proof.”

#### **Knowledge development**

“The complexity of the matter is not only a challenge for the Netherlands, it is also where our strength lies”, says Raimond Hafkenscheid, director of the Co-operative Programme on Water and Climate (CPWC). He continues: “We have to adopt an integral approach to deal with adaptation, because there are so many factors we need to take into account. We are increasingly coming to appreciate the opportunities this offers and we are taking the matter seriously.” Hafkenscheid is referring to the large amount of attention that the Dutch government devotes to climate change and adaptation. This is evident not only in the Delta Committee advisory report, but also in the field of knowledge development. “The Netherlands has an impressive knowledge development programme. We invest tens of millions of euros per year in research. Our knowledge and expertise is growing, and where there are gaps, we are increasingly able to fill these by working with our international partners. This is where our reputations as water managers and as international entrepreneurs coincide. Seen from this angle, climate change may not be just ‘doom’ but can also represent a ‘bloom’.”

Hafkenscheid regards recent developments, such as the new IBM Global Center of Excellence in Amster-



**Annemarie Moons:** “We are noticing a rise in demand for our know-how abroad and we are responding to this”

dam, as positive. “Innovations in ICT and data management can merge with those in the field of climate adaptation and water management, whether it’s in the area of advanced warning and protection systems for delta areas, or advanced monitoring of water quality.” (see page 51)

Hafkenscheid asserts: “This is just the beginning of the global efforts that will be needed if we are to adapt to climate change. Climate change introduces a paradigm shift in the way we should think about water management and the problems of sustainable development.” He believes that the Netherlands can lead the way. “Of course we can’t do this alone; we have to act in an international context. The Dutch are capable of working well both collectively and efficiently. We are also good at putting our knowledge into practice. A big advantage in our small country is the enormous density of high-quality know-how, short lines of communication and a healthy attitude towards cooperation.” He points to the successful Dutch-American cooperation set up in response to the New Orleans floods in 2005.

#### Looking further afield

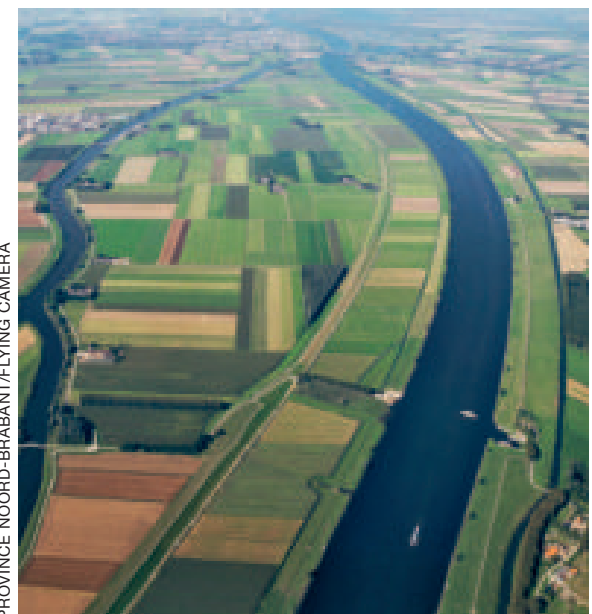
Scientists and entrepreneurs are used to thinking and working internationally, but the Dutch government tends to be less outward looking. In Hafkenscheid’s view the Netherlands could benefit from looking further afield. “Contributions from abroad and international cooperation could be increased in research and innovation projects. Currently, local authorities, such as water boards and provincial governments, are just starting to contribute to the international arena. This is a new opportunity, because much of the knowledge and expertise that is needed to make climate adaptation successful resides in the public sector. Annemarie

#### Polder makes room for the river

Flood protection measures that involve lowering dikes: it sounds like a contradiction, but in fact it’s a clever solution for dealing with high river discharges. The Netherlands is creating room for the river in forty locations, and the government has set aside 2.2 billion euros for the work. The Overdiepse polder, an area of 550 hectares in the south of the Netherlands is one of the areas where room will be given to a river. The existing dike around the polder will be lowered so that the river flows into the low-lying land at high water level. The farms that are still in the area will be relocated to mounds of earth (terps) along a new dike so that they remain safe from flooding during high water levels. Part of the polder will also be used for recreation: a small lake and eight hectares of new nature will be created. The expectation is that the polder area will flood once every 25 years. The water level in the river will then drop by about 27 centimetres, and as a result, other more densely populated areas will remain dry. This particular development is unusual because of the high degree of involvement of residents and local businesses. It was their idea to build the mounds. The plan won a major

international prize for water-conscious design and living in 2008. The German NGO Rheinkolleg awarded the top prize to this ‘room for the river’ project, which was one out of 60 European entries. The professional jury members praised the innovative character of the plan, its landscape qualities and the fact that the idea was put forward by local residents.

[www.ruimtevoorderivier.nl](http://www.ruimtevoorderivier.nl)



PROVINCE NOORD-BRABANT/FLYING CAMERA

**Bert Satijn** “Living with Water in the delta means being able to enjoy the water some of the time, but it also means learning how to deal with the remaining risks that water embodies”



Moons, member of the Noord-Brabant Executive, agrees: “Much of climate adaptation has to do with regional planning and development, and therefore much of the responsibility for this lies at the provincial level. We have a long tradition of close cooperation with the water boards. Provinces have a good overview of what’s going on and can make sure that no aspects are overlooked.”

Moons agrees that local authorities in the Netherlands could be more internationally oriented. “But we are noticing that there’s a rise in demand for our know-how abroad,” she stresses. “And we are responding to this.” Moons went on a working visit to Indonesia at the start of 2009 and encountered growing interest in local government. “Indonesia is in the process of decentralising government and we now exchange knowledge on how to go about regional development in a vulnerable delta area. This is something the Netherlands is very experienced at.”

#### **Involvement**

Moons advised her Indonesian colleagues to involve as many parties as possible in the early stages of development plans. “This way you increase commitment and gain support for your plans. It requires patience and long-term vision, but the effort you put in will be amply rewarded. In many countries decisions tend to be taken at the highest level, without explanation or discussion. If people don’t understand why a measure

is necessary, they won’t understand how it might benefit them, and you’re unlikely to be able to count on their cooperation. Of course it’s never nice to be forced to move your house because a river needs more room. But if the government explains why it is necessary and takes good care of the people affected – with money and attention – it makes a big difference.

Moons cites the Overdiepse Polder as an example (see box). This is low-lying area in her own province where farms have been affected by landscape interventions that are necessary to mitigate the effects of high river discharges. “The people living there came up with the idea of constructing earthen mounds so that the farms could remain in the area. It won’t be possible for everyone and it will take a long time, but the plan has received widespread support. That’s a real win-win situation.”

Satijn recognises the importance of stakeholder involvement as well. “Communication and participation play an increasing role across our society, including when it comes to dealing with climate change. Living with Water in the delta means being able to enjoy the water some of the time, but it also means learning how to deal with the remaining risks that water embodies – now and especially in the future. You have to do this with everyone who is involved – this is the lesson water managers should learn.”

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## Dutch safety in New Orleans

**Katrina destroyed New Orleans. The Netherlands was immediately on hand to help the battered city, and enduring cooperation followed.**

BY IRENE WEVER



Above: damage in the Lower 9th ward, march 2006, PHOTO: PIET DIRCKE / Below: test of pumps in the 17th street canal, new orleans june 2008, PHOTO: ARCADIS

Shortly after the flood disaster of 2005, delegations set forth from Louisiana to the Netherlands, searching for (technical) solutions. After all, no country has their water management sorted out so well and so securely as the Netherlands; the country that has half its lands lying beneath sea level. The Americans went back with more; Dutch safety is not just a matter of technique but above all a matter of having properly organised water management, a broad political, social and administrative basis, legal embedding, the governmental duty to ensure safety, and cooperation. Shortly afterwards Dutch delegations of politicians and members of the business community flew to New Orleans. It was the beginning of knowledge exchange and intensive cooperation.

### Joint advice

The Dutch Ministry of Transport, Public Works and Water Management and the US Army Corps of Engineers (USACE) joined in a partnership for knowledge exchange. USACE asked the Netherlands Water Partnership (NWP), the umbrella organisation in which government, members of the

business community and knowledge institutes are represented, to come up with a joint advice: a “Dutch Perspective” for the Louisiana Coastal Protection and Restoration (LACPR) program. The Dutch advice for this long term recovery programme in the Mississippi Delta is ready and is now waiting in Washington for a decision. The emphasis is on combining hard and soft measures.

Currently, the safety situation in New Orleans is just above the pre-Katrina situation, which is under the aimed-for protection scale for 2012 of flooding once in 100 years. To reach this level, work is being executed on new dikes, pumps and three storm surge barriers. Canals cut through the city and are an open passageway to the sea. The storm surge barriers should be able to close immediately during a storm, just like the Maeslantkering at Rotterdam. These barriers have to be completed before 2012; New Orleans does not have the luxury to wait. It also indicates the unique position of the disaster stricken city: simultaneously planning, proceeding to execute immediately, and combining long and short-term plans.

The NWP has played an important supporting role in the integral ‘Dutch Perspective’ water plan and in acquiring several assignments. An example is the one by the Dutch engineering company Arcadis (bigger in the USA (5000 employees) than in the Netherlands (2500 employees)), which got contracts worth for 200 million dollars for design, multidisciplinary advice and management supervision for the protection of New Orleans. The collective order portfolio of the Dutch offices now amounts to approximately half a billion dollars.

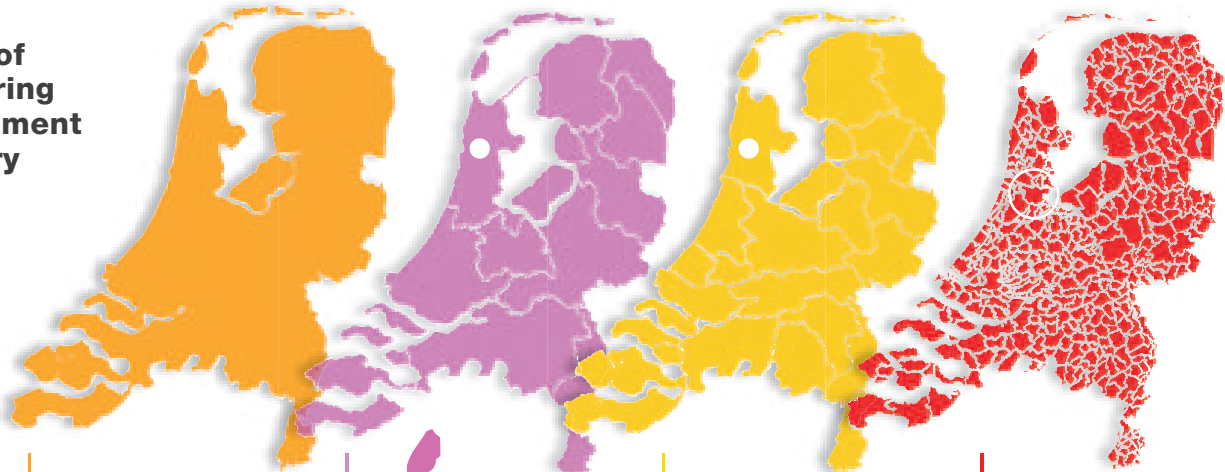
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## Division of tasks during reinforcement of primary levies



The National government is the responsible institution that governs the legally established minimum safety standards for flood barriers like dikes and dunes. Within the 'High Water Protection Programme' budgets are available for dike reinforcement projects, like the Markermeer dike, where local conditions do not meet the minimum safety standards.

The province of Noord Holland makes sure that the regional water authority takes into account broader societal interests and initiatives. By incorporating broad stakeholder interests in the project plans, high spatial quality is ensured. When a province approves of a reinforcement plan it can be carried out and the province will include the plan in its general spatial planning.

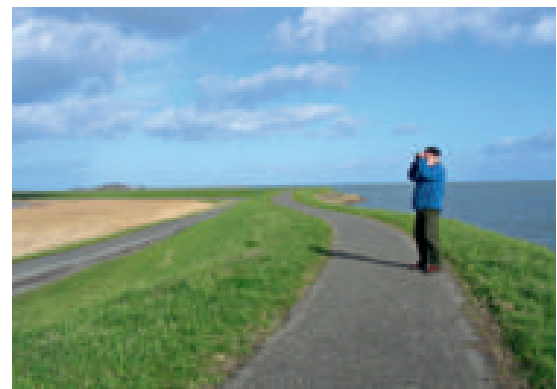
The regional water authority 'Hollands Noorderkwartier' is responsible for the upkeep of the dikes. The authority has to ensure the dikes meet the nationally established safety standards. When necessary they draw up and execute concrete reinforcement plans, that are offered for approval to both the High Water Protection Programme and the provinces.

The municipality of 'Waterland' works on a more local scale than provinces, but parallel to the province, the municipality too stimulates local spatial interests to be incorporated in the project plans. Municipalities may also need to adapt their local area destination plans to enable dike reinforcement to take place.

### Example: Reinforcement of the dike around the Markermeer lake (between Amsterdam and Edam) by the regional water authority 'Hollands Noorderkwartier'

This is one of the 13 dike reinforcement projects in the province of Noord-Holland. The preparation of the reinforcement of this dike - along the former "Zuiderzee" - started in 2008. It has a length of 29 kilometres of which about 17 kilometres do not meet the safety standards. This is partly because of instability of the dike and partly because

the dike is simply not high enough. Because of the historical value of the former fishermen's towns in this area and the characteristic landscapes between these towns - including nature conservation areas - the reinforcement of this dike has to meet high standards. Both the regional water authority and the province aim at incorporation of recreational and nature conservation interests in the project. This implies other parties will have to contribute to the budget. The actual work will start in 2011/2012 and the dike reinforcement is expected to be completed in 2016.





# Comparative Assessment can help make your country climate proof

**It is a challenge for governments world wide to include the future effects of climate change in their decision-making processes. The question is: how to make the right decision?**

BY RIA DE WIT

The consequences of climate change are of course wide-ranging and highly uncertain. But adaptation measures have to be included in plans and decisions made at all government levels – national, regional and local – and in building plans for industry and housing. The Netherlands is working on a Comparative Assessment decision-making framework which can be used by all levels of government. This framework can be used to assess the contribution to climate-proofing of town and country planning, development measures and investment plans.

## Action points

Water and climate expert Aalt Leusink is on the team that is developing the framework. Pilot tests in the province of Zuid-Holland and the harbour town of Rotterdam have been promising. “Comparative Assessment is proving to be a good instrument for getting climate proofing included in the decision-making process. Adaptation can’t just be imposed from above; it has to become an integral part of planning and policymaking at all levels of government administration. The framework provides people with a structure: a stepwise plan for screening the ‘climate-proofness’ of all aspects of the decision making process.” A checklist helps to determine whether there is sufficient information on the effects of climate change, whether the decision-making

framework is sufficient, and whether a clear picture has been formed of possible solutions and risks. After going through the checklist, a list of action points and decisions is produced.

The Rotterdam test produced a substantial number of recommendations which government bodies will be able to put to immediate use. An important point that emerged, according to Leusink, is that climate adaptation can rarely be a goal in itself, primarily because of the financial limitations. “Adaptive measures require considerable investments, which are only recouped in the medium term, and sometimes the benefits accrue to a stakeholder other than the investor. For this reason it’s better to get climate measures to ‘piggyback’ along with other objectives, such as building new infrastructure, building a new residential neighbourhood or creating an area of nature. Then success is more likely.” There’s an important role for the national government in this, Leusink believes. “It’s up to the government to make sure that all decision makers are convinced of the necessity of including adaptive measures in planning- and decision making processes. This mustn’t be done with punitive measures, but by stimulating adaptation. The government needs to use all its powers of persuasion and, above all, it must set a good example.”

## National Programme for Spatial Adaptation to Climate Change

Since 2006, the Netherlands has a special programme for Spatial Adaptation to Climate Change (ARK). This is a joint programme of the Ministries of Housing, Spatial Planning and the Environment (VROM), Transport, Public Works & Water Management (V&W), Agriculture, Nature and Food Quality (LNV) and Economic Affairs (EZ), the Associations of Provincial Authorities (IPO), Netherlands Municipalities (VNG) and Water Boards (UvW). ARK is based on the shared belief that spatial adaptation to the effects of climate change is essential and a top administrative priority. The first product of this programme was the National Adaptation Strategy, which was approved in November 2007. This strategy describes in general what is necessary to make the Netherlands climate-proof. It highlights an innovative and inter-sectoral approach and encourages parties to reflect, cooperate, reconsider and take action. In 2009 the first National Adaptation Implementation Plan is due to be published. The Implementation Plan will make the National Strategy concrete.

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**SPATIAL PLANNING IS THE  
FOUNDATION AND OFFERS  
OPPORTUNITIES FOR ADAPTATION**

# **MAKE 'CLIMATE- FLEXIBLE' USE OF SPACE**

**Spatial planning can help when implementing adaptation policies. By taking the flooding potential of an area into account at the development stage, risks can be reduced (considerably). To do this, urban planners, project developers and water managers must exchange their knowledge and expertise.**

BY RIA DE WIT





Taking a long-term spatial planning perspective can really help to make adaptation policy effective, says Professor Chris Zevenbergen, director of business development at Dura Vermeer, one of the major building companies in the Netherlands. Zevenbergen is also professor of Water Management at Delft University of Technology. “When investing in spatial planning, policymakers and administrators have to take climate change and its consequences into account. Of course, physical measures such as dikes are necessary, but spatial planning is essentially a steering mechanism for managing the risks of flooding.” Zevenbergen is involved in the Urban Flood Management (UFM) project in Dordrecht. This historical town near Rotterdam is located between three rivers and is therefore very susceptible to flooding. Part of the town centre has no dike protection. Dordrecht has plans to convert thirty hectares of a former harbour and industrial zone into a new upmarket urban area. This is an excellent oppor-

tunity to use new developments such as ‘water-proof’ building techniques.

Ellen Kelder, strategic water policy advisor at the municipality of Dordrecht, calls the proposed development ‘interesting and special’ because although the chance of flooding is real, if it does happen, the water is not fast flowing. “Under extreme conditions we can afford to allow water into public spaces as long as they can withstand inundation.” The water is unlikely to be deeper than 30-40 centimetres in most cases.” In the German city of Hamburg, which is working together with Dordrecht, the situation is very different. The River Elbe is tidal and the difference between high and low tide is several metres. To make matters worse, the city experiences higher water levels because of the prevailing north-westerly winds. Kelder: “We are learning a lot from each other through the UFM project. For example, it’s very important to look at how water behaves and to bear this in mind when planning spatial

development.” A project like UFM brings all the parties involved closer, Kelder believes. “Everything centres on water know-how, and in very pragmatic terms: how does it flow, where does the rain fall, where can the water go? The search for answers creates a bond between scientists, policymakers and those who carry out the work.”

#### Temporary use

The project in Dordrecht fits perfectly in the First National Adaption Implementation Plan of the National Programme for Spatial Adaptation to Climate Change (ARK, see box on page 11). The First National Adaptation Implementation Plan gives guidelines on how the task of adaptation should be carried out at regional level. Programme manager Pieter Bloemen explains: “It’s not that we prescribe how a neighbourhood or district that is being re-developed should be climate-proofed; our task is to show how climate proofing measures can be woven into other aspects of spatial development, and to indicate roles

and responsibilities.” Bloemen stresses the importance of innovative solutions, such as temporary use of certain areas. “An example is temporary use of space that in a few decades can be used for water storage: this can be done by constructing housing or greenhouses so that they can float or can be removed.” Bloemen wants to start pilot projects for this. “Especially in the areas along the major rivers and in the west of the country we can gain experience by building residential neighbourhoods and business parks that can be removed in thirty years’ time.” Then the area would be reverted to pristine condition so that it can be used for water storage. Think of it as the spatial variant of cradle-to-cradle.”

Zevenbergen also sees advantages to flexible use of space. “It probably means that buildings, housing and infrastructure will be written off within a shorter period. At present we commit ourselves in a more permanent way: an area that is built on stays that way. But we should bear in mind that the world and climate may have changed so much thirty years from now that we will need to change the designation of areas or develop them in very different ways. This will require not only technical innovations, but also administrative and legal innovation. It’s still virgin territory, with tremendous possibilities.”

#### Financial crisis

The municipality of Dordrecht wants to in-

## Build floating or recyclable houses in an area that will be turned over to water storage in the future – that’s what we call temporary use of space

roduce all kinds of ‘water-proof’ living in the new development area. Kelder: “We are seeking a variety of solutions: part of the area will be raised, and a small part may be dug out so that floating houses can be built there. We want to show that there are all sorts of ways of going about water-proof building and design. Part of the area will be used as a showcase.”

The first houses are due to be ready in 2013. Despite the current financial crisis, all parties involved are still in favour of going ahead with the plans, says Kelder. She admits that it is an exciting but tense time. “New ways of building cost more money. On the other hand, the financial crisis also offers opportunities: it forces us to make other choices. The time is ripe for thinking

out of the box, and water-proof building is ideally suited to this.”

Chris Zevenbergen agrees that now is the time for the building sector to grasp the opportunities presented by the tight financial situation. “Now that the market is no longer so overstretched, climate aspects are becoming important. A building company or a project developer can make its mark by coming up with climate adaptation solutions that can be implemented along with other tasks: clever combinations and stacking functions for example.” Zevenbergen cites the exciting new roof park in Rotterdam. Built to function as a dam, it will also be the largest green roof in the world. The project involves transforming an old railway yard into a 50,000 square-metre business park, with a urban park on top, complete with trees and water features.

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The city of Dordrecht has plans to convert thirty hectares of a former harbour and industrial zone into a new upmarket urban area.

## From urban to European

The Urban Flood Management project brings together public and private sectors and scientists. Three cities – Dordrecht, London and Hamburg – are working jointly on developing and applying Urban Flood Management. The project has also led to an international follow-up: Managing Adaptive Responses to changing flood risk in the North Sea region (MARE). Governments and universities from four countries are collaborating to devise adaptive strategies to reduce the risk of flooding. The

countries involved are the Netherlands (Dordrecht), England (Sheffield), Germany (Hannover) and Norway (Bergen). The project participants are looking at ways of integrating technical, administrative and operational aspects. Ensuring that the public and other stakeholders are involved receives high priority. The results of the project will contribute to regional and national implementation of the European Floods Directive.

[www.ufmdordrecht.nl](http://www.ufmdordrecht.nl)



## DELTA DIALOGUES

# So many deltas, so many solutions

**Are there effective methods for making delta areas less vulnerable to global climate change? This is a pressing question in countries with densely populated coastal regions, where more than half the world's population lives. Royal Haskoning is conducting Delta Dialogues worldwide in order to find answers.**

BY JENNY WESTRA

Through these dialogues, long-term problems in densely populated delta areas can be tackled sustainably. The concept has been successfully evaluated in the Jakarta delta area. A logical next step is to develop intensive collaborative alliances and knowledge sharing with delta areas elsewhere in the world. Experts, decision makers and stakeholders from Jakarta, Ho Chi Minh City, New Orleans, Romania, St Petersburg and the Netherlands have been invited to join forces in a series of Delta Dialogues all over the world.

### Delta Dialogues

"In Indonesia we focused on the Jakarta delta. Now we're talking about deltas in more general terms", explains Royal Haskoning consultant Stefan Nijwening. "Presentations about deltas in Vietnam and Indonesia give the international participants inspiration and generate interactive discussions. Our advice is to learn from other countries before you start on structural and non-structural strategies for your own delta. What's happening elsewhere? What have they decided to do and why? Did it work?"

### Starting points

Process (compiling knowledge), content (innovative technologies) and creativity (inspiration from other countries) are essential starting points. "New Orleans, for example, has extensive experience with emergency

response. This knowledge is new to the Netherlands", continues Nijwening, "but we are experts when it comes to flood barriers. You find effective and sustainable solutions faster by jointly analysing specific problems and sharing knowledge."

### Complete water system

Consultant Rob Bonte facilitated the Delta Dialogues in Jakarta. "We invite participants to consider non-physical measures and to share best practices relating to them. We want to move away from individual deltas during the Delta Dialogues. The key point is that we want the responsible agencies to focus not just on clever technical novelties, but to expressly recognise the interrelationship between spatial planning and water management in deltas."

"Royal Haskoning is consulting in many prominent delta areas", stresses Nijwening. "We identify the similarities and differences, and we are in an ideal position to play the part of a broker. An expensive technical tour de force is not always the right answer. So many deltas, so many solutions. Deltas can learn a lot from one another by sharing relevant knowledge and experience on a global basis."

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# Towards a Delta Alliance

**Delta areas everywhere are affluent and vulnerable for the same two reasons: an abundance of water and soft, fertile soils. These conditions are at the heart of more than 60 percent of our social and economic capital world wide.**

BY PIER VELLINGA



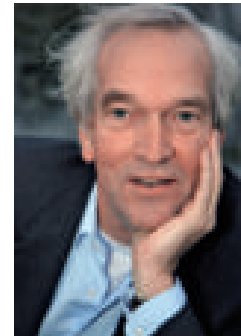
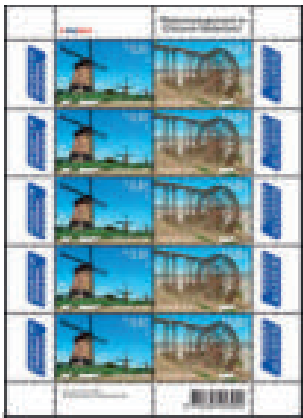
This is so because transport over water is one of the most vital conditions for playing a major role in the global economy and fertile soils and water produce food and inspiration for the many. Throughout history the development of these delta areas has not been without major challenges. Soil subsidence as a result of lowering the (ground)water tables and soil degradation being the most visible ones. San Francisco Bay area, Bangkok, New Orleans, Jakarta, all are typical examples, where the ongoing subsidence is an implicit invitation for the rivers and the sea to take over.

This process is not new. History has many illustrations of the Nile and Euphrates deltas. More recent is the experience of the Netherlands where more than a thousand years lowering of the water table and building dikes has created a megacity well below sea level. In our country, extensions of airports (Schiphol) and sea ports (Rotterdam) and the development of new towns continue to be planned in areas well below sea level. The question, "is this a wise policy under climate change?" was raised by the senate of our parliament in

2005. This question in turn triggered a major research programme aimed at exploring the feasibility of Climate Proofing the Netherlands. The Dutch research institutes and universities with expertise on water, agriculture, urban development and meteorology joined efforts. They linked their capacities with the relevant stakeholders such as national and regional governments, waterboards, NGOs and the private sector. There is also cooperation with other research programmes, like the Living with Water programme. This programme is dealing specific with the research on more space for water, not only in a physical way, but also in a mental way. To get all stakeholders involved there is more than only technics. The living with water programme is involved especially in the economic and social aspects of water as well as water governance. The shared goal is to develop innovative solutions in delta development through co-creation. Co-creation means that the theoretical knowledge about climate change, water management, land use, agriculture and urban development is combined with the practical experience and ambitions prevailing in regional gov-

ernment, NGOs and the private sector. Hotspots is the name given to the real world laboratories. Seaport Rotterdam, airport Schiphol and greenport Haaglanden have suddenly become test cases in climate proofing. And so are the highly exposed parts of the Netherlands delta such as Zeeland and the Wadden Sea region. Regional stakeholders in these hotspots generate the most pressing challenges. Multi-disciplinary research teams explore the issues and generate innovative solutions. There is a front office for articulation of the issues, there are mixed research teams of practitioners to explore the range of solutions and there are back offices doing in depth research to improve the methods, models and tools. This research effort includes the development of networks for international cooperation in dealing with the delta issues, in particular regarding the challenges that come with a changing climate. Changing rainfall patterns, changing water availability, changing river peak discharge, rising sea levels, changing patterns and intensity of storm surges and hurricanes and increasing penetration of brackish water in





Pier Vellinga



agricultural regions have a major impact on delta areas. They call for spatial planning and for interventions and investments in anticipation of climate change, while all involved are aware that this is extremely complex, as the climate signals and scenarios are loaded with uncertainties. Still the social and capital assets in delta areas are so high that one cannot ignore climate change. It is in the interest of local, regional and national governments to have an early understanding of climate change effects and adaptation options. Simultaneously it is of major importance to share this understanding with the international community involved in the development of international climate policies under United Nations Framework Convention on Climate Change.

In our contacts with researchers, policy makers and investors in several delta areas, in various parts of the world, developed and developing, we realized the value of sharing ideas and experiences in this field. An alliance of delta areas could facilitate this. It could bring together the wish to cooperate in the development and sharing

of knowledge and experience and the wish to raise awareness at international level, for the threats and opportunities faced by the low lying areas and its inhabitants. Such a network could include representatives of national, regional and/or local governments, researchers, consultants, NGOs, and private developers and investors. It could be an opensource and openended network serviced by the participants. It could focus on the major issues of water management, agriculture, and urban planning in delta areas. As such the alliance could facilitate, host and strengthen existing and more specialised networks, like the Rotterdam Connecting Delta Cities initiative (described at page 21). Research programmes like "Knowledge for Climate" and "Living with Water" and their network of researchers and policy makers are taking initial steps to shape such a Delta Alliance. The Co-operative Programme on Water and Climate is supporting the initiative. I hope you will contact us and share ideas about delta opportunities.

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PROVINCE ZUID-HOLLAND, 3D CAPACITY

# The Sand Engine: building with nature

**A rising sea level, more rainfall and subsiding land: in short a changing climate. Together with increasing spatial pressure and limited opportunities for nature and recreation this puts the Province of Zuid-Holland up for a challenge.**

The province of Zuid-Holland, with 3.5 million inhabitants, is the most densely populated province in the Netherlands. Most of Zuid-Holland lies below sea level. The lowest point in the Netherlands is located in this province and lies more than 6.5 metres below sea level. Nonetheless, Zuid-Holland is the most important economic, agricultural and service providing province in the Netherlands.

## Facing the facts

The climate is changing worldwide. The earth is heating up, glaciers are melting and rainfall is increasing. Calculations show that while the sea level is rising, the

land in the Netherlands is simultaneously subsiding and spatial pressure is increasing. For many international businesses Zuid-Holland is an attractive place to set up operations because of its ideal location. In similar regions in Europe, however, so much has been built in the 20th century that a shortage of countryside has arisen. Recognising the need for both prevention and adaptation, the province of Zuid-Holland has taken a clever approach in tackling the problems posed by climate change and increased spatial pressure.

## The Sand Engine

The province of Zuid-Holland is investigating natural ways of protecting and extending the coast by 'building with nature'. The so-called Sand Engine is an innovative project through which the principle of building with nature is applied. The Sand Engine is a large quantity of sand, 20 million cubic metres, which will be placed just off the coast of Zuid-Holland. Wind, waves and sea currents will deposit the sand along the existing coastline. This will significantly improve coastal safety, and the new land that results will provide extra space for nature and recreation.

The Sand Engine, an oval-shaped island, measures about 2 kilometres by 1 kilometre. The island is situated about 1.5 kilometres from the coast.

The Sand Engine has yet to be applied on this scale. At present it is a pilot project designed to generate knowledge about new approaches to enhance natural coastal development within the context of climate change. This first 'proof of competence' will produce 75 hectares of new land, which is equivalent to the size of 150 football fields. If the pilot scheme has the desired effect, the operation can be repeated after a number of years and applied at other locations along the Dutch coast. The Dutch Delta Works are quite unique in the world, and the Sand Engine is similar to this series of innovations. But the philosophy behind it is different: work with the forces of nature, rather than against them.

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Map showing 40 locations of measures to give rivers more space.

## ROOM FOR THE RIVER

### Breaking the trend

Throughout the centuries, space for the rivers has become only more limited. The rivers are wedged between high dikes, while the level of the land behind the dikes is dropping. If a flood were to occur under these conditions, the economic and emotional damage would be huge. To give the rivers more space, the Dutch Cabinet has created a package of 40 measures called the Spatial Planning Key Decision 'Room for the River'. The basic package consists of measures such as deepening the forelands of the rivers, displacing dikes further inland, lowering groynes in the rivers, enlarging summer beds and depoldering. The main objectives are flood protection by 2015 and improved overall environmental quality in the river basin region.

More information: [www.ruimtevoorderivier.nl](http://www.ruimtevoorderivier.nl)

## Managing the Watergame

Making sensible water management choices in a heavily populated delta area is not always easy. The multiple parties and objectives involved cause this process to develop into a series of complicated decisions. The Watergame clarifies this by means of a 'serious game' to allow parties to gain insight into each other's positions.

Four laptops, one game coach and six or seven people are required to play the game. Each participant takes on a role: project developer, housing corporation, the district water board or the municipality. The scenario is situated in the district Oost-Tiel (East Tiel), where the water system is malfunctioning. The area is lying fallow and, when the level of the river Waal is high, it floods. The project developers want to construct a new district here and need the municipality and the district water board for this. Several options are available.

Just as in real life, tough negotiations are required in this exercise in environmental planning. For each role the players are allocated performance indicators. A game coach guides the game by means of interventions and events. In the end, one thing is sure: the parties need each other. Important is that the authorities realise in what way they are a

part of the whole system. According to the game's developers, this insight will lead to a better starting point for integrally carried solutions in reality. In addition to this, the game can also be used as a learning tool for sundry target groups. In 2009 partners Tygron and Ambient will further develop the game, widen it and explore options on an international scale.

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Participants play the Watergame during an expert meeting.



# Rising water level approach offers opportunities

**Water management has always been a key element in Dutch society. The low position of the country – the lowest point, close to Rotterdam, is over 6 metres below sea level – and the direct proximity of the North Sea combine to forge an inseparable bond between the Netherlands and water. To the international port city of Rotterdam, situated by the sea and in delta of the big rivers Rhine and Maas, water is of vital importance indeed.**

AHMED ABOUTALEB

High priority is therefore attached to the approach of climate change in Rotterdam. Combating the cause and consequences of these changes requires unprecedented, worldwide innovation in the area of sustainability, water management and clean energy. Rotterdam provides a framework for this innovation in the form of the Rotterdam Climate Initiative (RCI), which offers an extensive set of climate change measures.

## **Rotterdam Climate Proof**

The ambitious Rotterdam Climate Proof programme, the climate adaptation pro-

gramme of the RCI, will ensure that the city is climate proof by 2025. The guiding principle is that the rising sea and river level is an important opportunity, rather than a threat. To take advantage of this opportunity, the city administration has reserved 30 million euros for the next few years alone for this purpose. To be sure of the latest scientific adaptation inputs, Rotterdam is an active partner in the Dutch adaptation knowledge programmes. Climate resilience means more to Rotterdam than simply ensuring that its 600,000 citizens can 'keep their feet dry'. Naturally, the city will ensure that the safety of its in-

habitants remains guaranteed, but this in itself is not enough. Water is used to make the city even more attractive as a residential area, to safeguard permanent accessibility, and to give the city an economic boost as well.

## **Water plazas**

Literally bringing the water into the city will allow us to enhance the safety and attractiveness of the districts and communities. The building of additional city moats and canals will provide for sufficient discharge when the water level is high. In places where this is not an option, the construction of water plazas offers a solution. These water plazas serve as reservoirs for excess water in heavy downpours, or as playgrounds when the rain subsides. Additional city moats contribute to the creation of an inviting image of the district, to the extent that the house prices may even go up. Thus, the measures may benefit the population in various ways. Anticipating events is the first step of the approach: climate issues should be included consistently in the construction or restructuring of a residential district or infrastructure project. The plans should include a water plaza or city moat right from the start, to prevent the need for (more expensive) measures in a later stage.

WWW.FOTOPAULMARTENS.NL







## Connecting Delta Cities

At the C40 meeting on climate adaptation held last year in Tokyo, the City of Rotterdam initiated a joint action to set up a worldwide city network: "Connecting Delta Cities" to share and ease the burden of challenges related to climate change. So far, entitled cities include Tokyo, Jakarta, Hong Kong, Shanghai, New York and London, who act as a front runner group. In the near future other cities, active in the field of climate change adaptation, will join forces. The network aims to:

- Act as a platform for exchange of knowledge and best practices;
- Operate as a show case for other cities.
- Connect councils, politicians, municipal departments knowledge institutes, NGO's and the private sector.
- Act as a motivation for project funding through international dissemination of project results.
- Provide a source of inspiration and contacts.
- Provide a platform for joint- agenda setting for international conferences and forums.

The start up of the 'Connecting Delta Cities Network' is announced at the World Water Forum 5 in Istanbul.

## Floating residential districts

In addition, Rotterdam will construct entire floating districts, office complexes and parks. Experiments with floating constructions can take place in the 'Stads-havens' district, where Rotterdam has a 'green testing ground' at its disposal. In order to realise the water plans, the city administration has entered into an alliance with a number of important partners. Apart from the national government and regional authorities, these partners include prominent universities, large companies, civil society organisations, and the water boards. All of these partners possess specific knowledge on water management and climate change, creating a unique pooling of resources.

## Connecting Delta Cities

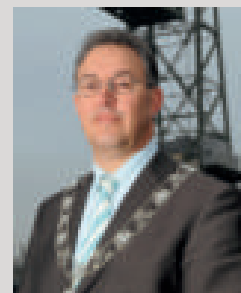
All around the world, delta cities will have no choice but to adjust to climate change. This requires the invention, development and implementation of innovative solutions that can subsequently be marketed to boot. Rotterdam is fully committed to this course of action. As this is not a goal Rotterdam can realise all by itself, the city has joined the C40 cities of the Clinton Climate Initiative. A proper response to climate change requires a new way of thinking and a new practical approach on

a global level. For this reason, on the initiative of Rotterdam, nine international cities have united in a network called Connecting Delta Cities. This network will allow the partners to share and exchange their knowledge and experience.

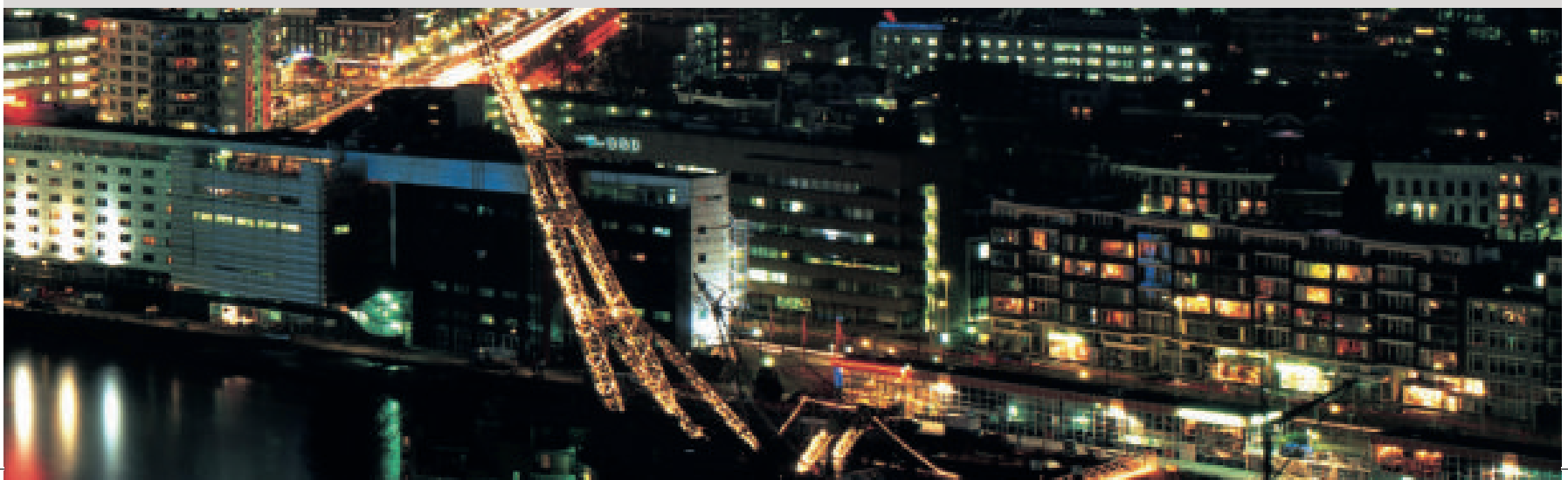
Innovations and intelligent water management will help to enhance the attractiveness of cities – which even today accommodate half of the world population. I invite you to appreciate the economic opportunity water management offers, instead of viewing water merely as a threat. And I urge you to seize this opportunity right now. The days of biding our time have passed.

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Ahmed Aboutaleb,  
Mayor of Rotterdam





# Collaboration takes time

International collaboration is important in order to live with water. **Learn from each other**, says professor Toine Smits. He quotes Prince Willem-Alexander: **Alone you go faster, together you go further.**

BY JELLE BRANDSMA

An international exchange of knowledge on water and climate is increasingly seen as the key to tackling longterm challenges such as adaptation to climate change, according to Jeroen Aerts, professor of Risk Insurance and Water Management at VU University, Amsterdam. "Ten to fifteen years ago, the subject of water management and climate change was addressed mainly by scientists. Currently, the subject is also high on the agenda with policy makers", says Aerts. "We should use this momentum to involve both scientists and policy makers in an international alliance to exchange knowledge and experience in water management."

## Cooperation in Europe

In Europe, knowledge exchange on water management has been supported by different EU Framework Programmes and has already created a vast scientific network. Furthermore, within the catchments of the Rhine and Meuse rivers, ongoing management issues are discussed by policymak-

ers of the riparian countries within these catchments. "I'm not saying exchanging knowledge across countries is always easy", Aerts says, "but the fact that people are increasingly positive towards cooperation on water issues is stimulating." The new EU Flood Directive further stimulates international river basin cooperation and hence underscores the importance of knowledge exchange.

## We cannot solve it on our own

In the Netherlands there's a great sense of urgency to seek for solutions and innovations in water management. This is not surprising as we are in a vulnerable position when it comes to flood risks. Water comes our way from the rivers as well as from the sea. The Netherlands realises climate change and water management is not an issue they can solve on its own. The climate issue is simply too complex, and, more importantly, coastal areas across the globe will face the same climate challenges as the Netherlands. "By collect-

ing water knowledge in other countries, the Netherlands can learn and at the same time, exchange the huge knowledge it already has."

## New York City

As an example, Aerts mentions a project in New York City. The greater New York area is geographically similar to the Netherlands, with a large harbour, a river coming from the inland area and flood risk coming from the ocean. The Netherlands has a track record in flood defence structures like storm surge barriers, an issue that attracts New York policymakers. On the other hand, New York has long experience with flood evacuation planning, flood insurance and large infrastructure investments such as the subway. Both the Netherlands and New York while facing similar risk, from sea level rise.

According to Aerts, other initiatives that the Dutch can learn from are in Hamburg Germany. The city of Hamburg is building



## The ComCoast project

The North sea countries Denmark, Germany, the Netherlands, Belgium and the UK are facing the same challenge along their coast. How can the coast be kept attractive and safe, even at high tide? These five countries work together in the European Interregional ComCoast project. The idea is to stop relying on dikes or a single line of high dunes for protection from the sea, but instead to create a multifunctional, wide strip of land for water-proof activities. The challenge lies mainly in combining various functions: recreation, agriculture, coastal defence and possibly housing and work, among other things. Project leaders from various countries visit each other and share their experiences, says Ad Jeuken of Deltares Knowledge Centre. For the Dutch province of Zeeland, ComCoast offers a sequel: the Climate Proof Areas.

## The trick is to find the people within the organisations that want to collaborate

elevated houses along the Elbe so the water cannot damage them. Aerts says “the choice was made to start living with the water.” The new houses are about seven metres higher than they would normally have been. The city of Dordrecht wants to do something similar. In the Netherlands we now have floating houses, and other countries are starting to show interest.

### Flood insurance

France and England have introduced flood insurance. The home owner’s own responsibility is an important factor there. Should we do that in the Netherlands too? It would make people aware of living with water. At the moment it’s still the Dutch government that takes care of public safety by building tall dikes. Adaptation seems to be a process that takes decades. International

collaboration certainly requires long-term commitment. Aerts explains how difficult it can be to persuade policymakers of the necessity to take water into account. “Municipal executives are only in office for four years. What do they gain by looking far ahead? It’s often a question of money too. Political executives or investors are always faced with the question: How certain are you that any extra efforts towards climate-proof construction are actually going to pay off?” These experiences further urge scientists and policymakers to intensify the dialogue on water and climate. According to Toine Smits the trick is to find the people within the organisations that want to collaborate.

### European Flood Guidelines

Jeroen Aerts expects the EU White Paper

on adaptation and the new EU Flood Directive will strengthen the need for practical interpretation and collaboration. “In these documents, Brussels outlines the effects of climate change and the priorities that should be established. The advice to member states is: consider the adaptation issue when you’re drawing up new plans. According to the flood guidelines laid down for the European Union, the upstream countries have an additional obligation to take the downstream countries into account.” According to Toine Smits, adaptation won’t work unless you work together, on a national and international level. He quotes Prince Willem-Alexander who, on his visit to the Waalweelde project, said: “Alone you go faster, together you go further.”



I'm not saying exchanging knowledge across countries is always easy



INSPIRATIEATLAS / BUREAU STROMING



## The rivers

Climate change can cause a river to become too full and create a flood threat. It can also create a lack of water, with consequences for plants and animals, shipping traffic and water supplies. Hendrik Buiteveld of the Directorate-General for Public Works and Water Management focuses on these issues. International collaboration is of crucial importance in order to be prepared. "We're already looking into several scenarios for the Rhine on an international level. What will the climate do and what are the consequences for the future in terms of water? What can we do to adapt? The range is rather wide. We need to work with similar starting points as the ones used by upstream countries. Otherwise they may do something that is not geared to our plans, or vice versa. In the Netherlands we use the KNMI scenarios

(Royal Dutch Meteorological Institute) and the Veerman Committee data. The International Rhine Committee (ICBR) works on formulating common climate scenarios and drawing up a concrete plan based on these scenarios."

For the Meuse the 'Sustainable Development of Floodplains (SDF) project was submitted to Interreg, the European programme for interregional collaboration. It involved countries in the Meuse basin working together to research what would happen if for example water levels in the rivers sink too low due to climate change. European funds have been used before in collaborations between the Netherlands and Germany in order to realise high-water areas along the Rhine, among other things. This SDF project was completed last year.

## Waalweelde crosses borders

The Waal is a busy river. Its banks are bordered by meadows, farms, other businesses and sometimes houses. In order to prevent flooding when water levels rise, the river needs more room. How can everyone profit from these changing circumstances? This was also the question during the earlier international project 'Freude am Fluss'. For its successor, Waalweelde, the objective was even more emphatically to make the river areas attractive and safe (by putting dikes back and digging gullies, among other things) and to organise the process better. This was achieved by collaborating with various municipalities and other parties such as knowledge institutions. "It's starting to snowball", says Toine Smits. "The approach used for the Waalweelde project is now also applied in Germany. We're entering a new phase." The restructuring plans for the river Waal started in 2006 with the section between Brakel and the German border. "Now the German town of Duisburg will use the collaboration format of the 'Waalweelde' project and we'll share our experiences with them. We have learned that it is essential to look beyond the borders of towns and countries."



## Water expertise

Of the many Dutch water organisations we present five which also work in the field of climate change, adaptation and spatial planning: the Co-Operative Programme on Water and Climate (CPWC), The Netherlands Water Partnership (NWP), Living with Water, Partners for Water and the two research programmes Knowledge for Climate and Climate changes Spatial Planning.

Co-operative Programme  
on Water and Climate

## Bridging water & climate

The Co-operative Programme on Water and Climate (CPWC) aims to stimulate international activities in the water sector that contribute to managing the effects of climate variability and change, in particular for the most vulnerable communities.

The programme builds bridges between water managers and the climate community, between science and implementation, and between public and private stakeholders. By increasing awareness of the issues and of potential solutions the Programme intends to start scientific, political and economic processes that will lead to the adoption of coping strategies and best practices from the local to the global level.

The Netherlands – public and private sectors alike – wish to contribute significantly to the international policy debate, to research and capacity building, and to projects abroad on adaptive measures related to water and climate. This ambition is streamlined via CPWC. CPWC focuses on adaptation to climate change with special reference to topics particular to Dutch interest and expertise: delta areas and coastal development, rural water supply and sanitation, rural development and urban water management.

Based on its expertise and networks, CPWC stimulates and facilitates alliances at global, national or local levels; and in developed, transitional and developing countries. CPWC links “climate proofing” partners abroad to Dutch institutions and experts. CPWC also develops and maintains relations with the relevant international water and climate institutions and organisations. CPWC supports the development and dissemination of expertise through advisory services, an expert pool, information services, events and participation in international fora.

CPWC is financially supported by the Interdepartmental Programme Partners for Water.

More information:  
[info@cpwc.nl](mailto:info@cpwc.nl)  
[www.waterandclimate.org](http://www.waterandclimate.org)



Partners for Water

## A powerful impulse

Partners for Water is a programme that aims to strengthen the international position of the Dutch water sector by uniting forces (private sector, public sector, non-profit sector and knowledge institutes). Public-private cooperation can give a powerful impulse to the water sector by developing innovative solutions for the world's water problems. Partners for Water is a joint initiative of six departments of the Dutch Government. The programme focuses on policy alignment between departments of the Dutch government, stimulating cooperation between government, companies, knowledge institutes and NGOs through network meetings and information exchange and cofinancing proposals aimed at water cooperation projects abroad. Partners for Water supports activities in 43 countries on the following themes: Integrated Water Resources Management, Water for Food & Ecosystems, Supporting Millennium Development Goals on Water Supply & Sanitation, Groundwater and Water & Climate. The current programme runs from 2005 to 2010.

More information:  
[info@partnersvoorwater.nl](mailto:info@partnersvoorwater.nl)  
[www.partnersforwater.nl](http://www.partnersforwater.nl)

Netherlands Water Partnership:

## Uniting Dutch water expertise

To make Dutch expertise and knowledge available to the rest of the world, the public and private sectors have established the Netherlands Water Partnership (NWP). The Dutch have been building dikes to reclaim land and prevent erosion since the Middle Ages. Today Dutch organisations are involved in many large-scale water management projects worldwide. Aware of the impact of climate change on water issues and the environmental aspects of living with water, the Netherlands focuses on flood control, water availability and quality as important issues in integrated sustainable water management. Many leading knowledge institutes and commercial market leaders are based in the Netherlands. They have formed a public private partnership with NGOs and the public sector, called the Netherlands Water Partnership.

The NWP supports the international ambition and collaborative approach of the Dutch water sector to stimulate the exchange of knowledge and increase the export of services and expertise. The sector is keenly aware of worldwide water issues and has mounted several projects to help achieve the millennium goals on water and sanitation.

Large-scale water engineering works always rely on a combination of different skills and expertise. Building an island calls for engineers, dredging and construction specialists, hydrologists, biologists, experts in drinking water and water purification. Companies and institutions within the Dutch water sector regularly form consortia to offer total packages. NWP facilitates this process by acting as a coordination point for the Dutch Water sector.

The Netherlands Water Partnership is the first port of call for information on Dutch expertise, products, consultancies and NGOs working in the water sector worldwide.

More information:  
[info@nwp.nl](mailto:info@nwp.nl)  
[www.nwp.nl/english](http://www.nwp.nl/english)

Living with Water

## A knowledge impulse programme

Living with Water is a Dutch knowledge impulse programme in which national and international project consortia collaborate on achieving changes in water management. These changes are required because traditional water management methods are reaching their limits: technical measures alone are insufficient. To do this Living with Water stimulates collaboration between the domains of water management and spatial planning, science and practice, economy and sociology, both in the Netherlands and abroad. With 100 projects, 150 consortium partners, both public and private partners, and an annual budget of 8 million euros, the programme stimulates research on more space for water. It not only deals with the physical aspects but especially with water governance, participation and perception. Practical experiments bring these different disciplines together, amassing new knowledge and experience. The programme functions as a catalyst for innovations.

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[www.levenmetwater.nl](http://www.levenmetwater.nl)

Knowledge for Climate

## Two Dutch research programmes on climate change and land use

Climate change will have a considerable impact on land and water use and therefore on spatial planning. Spatial planners and the climatechange community have mostly worked on isolated (research) programmes so far. In the Netherlands two research programmes have been set up to enhance joint learning between these communities and to generate knowledge to climate-proof the Netherlands. The main objective of 'Knowledge for Climate' and 'Climate changes Spatial Planning' is to offer the Dutch Government, the private sector and other stakeholders a high-quality and accessible knowledge infrastructure on the interface of spatial planning and climate change. Another objective is to engage stakeholders and scientists in a dialogue in order to support the development of spatial adaptation strategies on climate change.

'Knowledge for Climate' focuses on eight hotspots, areas vulnerable to climate change and of great economic or ecological importance. Research will be carried out into a combination of sectoral policies such as water management, agriculture, nature and city planning, finally contributing to a sound integrated strategy to adapt to climate change. Also research will be done in areas elsewhere, especially in delta areas. Knowledge exchange and transfer is a key element in both programmes.

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# UNESCO-IHE

## Building capacity for climate adaptation in the water sector

For sure, what appears in all debates on climate change is uncertainty. In particular the water sector has to prepare for making decisions without proper data. Water managers will increasingly face situations of floods as well as droughts. However, exactly when, and how intense, is difficult to predict. How, then, to balance the supply of high-quality drinking water, water for irrigation and water for nature? How to handle wastewater in a way that is safe for humans and does not pollute the environment? There are no simple solutions at hand, technological or managerial, to handle these problems in a sustainable way.



Richard Meganck,  
Director, UNESCO-  
IHE Institute for Water  
Education

Climate change will thus force water managers to include adaptation strategies into their integrated river management plans. How can they guarantee provision of basic services that are already under threat (because of population growth, urbanisation and competing demands) when the availability of water becomes uncertain? Clearly, there is a need to develop new instruments that will provide

water managers with the proper tools to develop and implement adaptation strategies. Moreover, there is an urgent need to share these with developing countries, which are hit hardest by the impacts of climate change.

The Netherlands has a reputation when it comes to developing and sharing knowledge and expertise, in particular in the water sector. The UNESCO-IHE Institute for Water Education, with support from the Dutch Government, has played a pivotal role in this knowledge transfer for more than 50 years, not in isolation, but in partnership with its global network of knowledge institutes and professional organisations. In view of the urgency to meet the challenges of climate change adaptation, experiences with climate adaptation worldwide are integrated in its educational programmes. To reach as many practitioners as possible short courses are offered, including online ones, to facilitate water managers wanting to combine study and work. Future water managers are challenged by re-





UNESCO-IHE

search on impacts of climate change and the development of appropriate adaptation strategies.

In collaboration with the Co-operative Programme on Water and Climate (CPWC), UNESCO-IHE will further develop and disseminate adaptation strategies to support developing countries. Opportunities to support businesses in water and climate issues will be explored. Together with the Netherlands EIA commission, the Strategic Environmental Assessment methodology will be made relevant for climate adaptation. Alliances will be formed between delta cities in the Netherlands and abroad to develop common adaptation strategies.

Envisioning a world in which people manage their water and environmental resources in a sustainable manner, and in which all sectors of society, particularly the poor, can enjoy the benefits of basic services, UNESCO-IHE will not allow climate change to undermine this target.

## UNESCO and IHE

The Netherlands developed the concept of integral water management through the Delta works, which were rapidly carried out after the great flood disaster of 1953. Farmers, fishermen, local and national authorities, hydraulic engineers – all parties sat down together to ensure the best design and management. The ambassador of present day Bangladesh asked the Netherlands to share their expertise. In 1957, similar requests led to the foundation of a flourishing international educational institute: IHE. In 2003 UNESCO joined IHE. The UNESCO-IHE Institute for Water Education is now the largest post-graduate water education facility in the world and the only institution in the UN system authorised to confer accredited MSc and PhD degrees. The principle of stakeholder involvement has been embraced worldwide and is the trademark of each of the 14 water education specialisations offered by the institute, based in Delft in the Netherlands.

## More water experts to reach Millennium Development Goals

In a country such as Indonesia alone 1759 water experts a year need to be educated and trained to satisfy the capacity requirements. Worldwide this number is several tens of thousands of people per year. UNESCO-IHE recently concluded that in order to reach the Millennium Development Goals, the number of water specialists has to be expanded: in Latin America by 50%, in Asia by 200% and in Africa by 300%. Therefore UNESCO-IHE operates according to a partnership model, in which they help their 50 southern partners to provide education in their own countries. Besides well-educated people, the priority is to create effective institutions and organisations. One of the projects to build knowledge locally is Waternet, a regional network of 56 education and knowledge Institutes in Southern and Eastern Africa offering joint education, training and research in the field of Integrated Water Resources Management.

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# How safe is

**With an increasing number of houses, roads and other infrastructure crowding the lowlands, the Netherlands is becoming more and more vulnerable to flooding. Does that mean more measures to keep the delta dry? Or should the Dutch learn to live with the increasing risk of getting their feet wet? Risk perception as a floating notion.**

BY ANDRE BRASSER



# safe?

If you want to live safely in a delta area, the Netherlands are your best bet. The theoretical chances of flooding of this low country by the sea are much smaller than is thought by many elsewhere in the world. But, as climate researcher Laurens Bouwer of VU University Amsterdam has worked out: "Over the next 40 years, the estimated number of casualties in a flood may quadruple. The actual risk, after all, is the chance of a flood multiplied by the consequences, which will increase tremendously. People become more and more vulnerable because all new buildings and facilities will be planned on potentially dangerous low lying sites." This begs the question whether the Netherlands is and will be sufficiently protected. Ben van den Reek, high-water protection coordinator for the province of Brabant: "The increase of this risk forces us to adapt our protection policy. How that should be done exactly is as yet unclear." This issue not only concerns the Netherlands, adds Bouwer. "All over the world people are moving to the cities, often close to the coast. You cannot just tell them to leave and live somewhere else. That makes the problem quite unmanageable."

According to Bouwer, the first thing that should be done is to map the flood risks objectively. "Flood risks are not the same everywhere, not even in the lowest parts of the Netherlands. You can use models to predict where the water will flow. Those are the places where you should not build. But if you do, you should incorporate the extra protection costs involved in the project price. The consequence is, however, that such locations with extra protection can price themselves out of the market." Such measures are very theoretical as yet. Nevertheless building on safe places is ultimately the most sustainable solution. That means staying away from the dangerous places. "But also the most thorny one", adds Van den Reek. "You might consider building transverse dikes. If you compartmentalise areas, the area that floods will be

smaller. But this, too, is a sensitive issue." Another strategy is to create more space for the river by relocating the dikes. The Netherlands has some experience with this approach.

## Burst-proof dikes

An adaptation researched at the moment, as simple as it is ingenious, is making dikes wider instead of higher. Van den Reek: "Widening the dikes by five to ten metres will immensely reduce the chances of it breaching at high water level. You will have to accept the fact that water can still flow across the top. But the effects of those floods are marginal compared to those of a dike breach." Tokyo has already had some experience with a so-called burst-proof dike. They have accepted the higher risk of smaller floods there. The damage is minor compared with a traditional dike that will collapse when the water is very high. "The dike is so wide there, they even dug a tunnel for a toll road underneath!" In the Netherlands, the first test for this new dike concept is now being done on a dike section along the River Meuse. Clearly, the Netherlands will have to adapt its policies regarding flood risks. The direction of the developments will depend on a cost-benefit analysis. When will it be safe enough? How much do we want to invest, how much can we invest? Bouwer: "The question is how far you can go in that respect. For that reason, risk perception is drawing more people's attention these days. We measure the attention by means of public opinion polls, for example, about what kind of damage people expect. Traditionally we are builders and protectors, but perhaps we should accept the idea that not everything can be completely manufactured. Including our safety."

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## The Zuidplas polder: widening 4.5 kilometres of waterways

The Zuidplas polder in Zuid-Holland province has been regularly affected by flooding as a result of heavy rainfall in recent years. In 2001 residents in various parts of the polder got wet feet. The water boards responsible for the area have therefore decided to widen the waterways by an average of 14 metres so that the area will immediately be able to store more water temporarily. In some places the width of the waterways will increase from 5 to 18 or even 20 metres; and the total stretch will be 4.5 kilometres long. As a result, an extra 5 hectares of water storage space will be created in the polder. The widening work will also result in an important water connection – a long-term benefit. As a result of this, the water in the Zuidplas will be able to drain out of the polder via different routes. If climate changes are stronger than expected, the water system can be adjusted relatively easily. The wider drainage ditches can then 'transport' more water out of the Zuidplas polder to the nearby pumping stations. These developments will make the water system more robust and flexible.



Moordrecht, Zuidplaspolder

# Large-scale flood drill



November 2008: over 10,000 emergency workers and administrators took part in the largest ever disaster response drill in the Netherlands. Different disaster scenarios were simulated over five days: flooding of the North Sea coast, of rivers and of the low-lying polder province Flevoland.







The reason: flood risk is small in the Netherlands, but if it were to happen, the consequences (in terms of human suffering and material damage) would be huge. After hurricane Katrina hit New Orleans in 2005, a high-level Flood Management Taskforce (TMO) was established. The TMO, as organiser of the drill, concluded that the level of preparedness for a real national flood disaster has risen significantly over the last few years. Bottom-up decision-making processes were swift, but dissemination and implementation of national decisions were hampered. Information management requires extra attention. In a flood crisis decision makers should be aware of their interaction with the media and the effect on public response, as a basis for high-impact decisions and crisis communication strategy.

Extra attention is necessary to identify and manage vulnerable citizens: handicapped people living in sheltered accommodation, hospital patients and the elderly.

All parties involved drew up complicated situation reports, and disseminated them untar- geted. Furthermore various incompatible in- formation systems were used simultaneously, requiring duplication of efforts. There is need for an evacuation strategy at national level. This will enhance safety and create order in a chaotic situation. A traffic management plan should be part of this. Finally, TMO advises regular flood drills, regionally every two years and nationally every four years.

More information: [www.platformoverstromingen.nl](http://www.platformoverstromingen.nl)



# Local solutions all over the world

The Netherlands has development cooperation projects in the water management and adaptation area all over the world. Capacity building is becoming increasingly important: stimulating education, research and better functioning institutes. Working together on durable local solutions.



Women transplant seedlings in the demonstration garden. Farmers can take sowing-seeds and seedlings from this garden to expand their acreage or to sow again. (Ethiopia)

KARIN ANEMA

# Yemen: Research paradise with increasing extremes



Sana'a, capital of Yemen.

**The groundwater in Yemen is dropping fast. Drastic changes in water management have to take place in the short term. A large number of the 20 million inhabitants are relying on these sources for their water requirements.**

BY IRENE WEVER

The water has to be pumped up from deeper and deeper in the aquifers. In the capital Sana'a, with its 2 million inhabitants, the groundwater level is dropping approximately 4 to 6 metres a year; its current level is already at a depth of 300 metres. In this area the yearly precipitation rate is less than 250 mm, often falling in very short periods of a few days. It is estimated that the aquifers will be depleted in 10 years.

## The groundwater level is dropping 4 to 6 metres a year

"A technological solution such as putting down a 200 km long pipeline from the Red Sea seems to be the only option", says Jan Luijendijk, head of the Hydro-informatics and Knowledge Management department of UNESCO-IHE, Institute of Water Education in Delft. "From there desalinated water can be pumped up to Sana'a, which is located 2,500 metres above sea level.

However, such an operation would require an enormous investment from this poor developing country. On top of this, desalination of seawater is expensive because of the high energy costs. Now, the idea is to employ solar power in this sun-drenched country. To achieve this, an area of about 40 square kilometres of solar panels will be required. A decision will have to be made in the short term."

Besides increasing drought and groundwater problems, Yemen will also face more and more extremes as a consequence of climate change. In October 2008 for instance, 650,000 people became victims of flooding after a tropical storm in the east. Aboudou Karimou-Adjibadé, CEO of Unicef-Yemen, claims that storms of this calibre are rare in this area and ascribes it to climate change: "The damage is huge, because this area isn't prepared for flooding. Houses, mostly made of clay, farmlands and vegetation suffered enormously and a lot of cattle died."

### Yemenite professional capacity

In the late eighties, UNESCO-IHE started training water experts in Yemen. Now, educational responsibilities have been

transferred to Yemenite colleagues of the University of Sana'a and a water centre of their own has been founded to research water and environmental problems. Luijendijk: "A critical mass of Yemenite professional capacity has been formed just in time to cope with the big problems of the next decade."

Not only the Yemenites, but the water experts from Delft too have gained knowledge about durable small-scale water management in dry, arid areas. Luijendijk: "At the time of the Queen of Sheba, in the tenth century BC, Yemen had an advanced civilisation with a highly sophisticated water system. The precipitation that fell in short, heavy rains there was caught and distributed by means of an ingenious system of dams and canals. Historical research has given much insight into how people back then were already cleverly using the physical and social-cultural circumstances to achieve optimal water management. For our hydro-geologists Yemen was a real research paradise. The knowledge gained there will prove useful to us elsewhere in the world."

# Invest in the future, harvest rain

**Decreasing water availability is a worldwide problem, especially in areas where people struggle to get water. Water shortage is expected to increase in the face of population growth and the impacts of climate change, making fetching water an even more time- and energy-consuming chore, particularly for women and children.**

The RAIN Foundation improves water supply in water scarce regions using context appropriate rainwater harvesting (RWH) technologies and creating local capacity to implement and manage these.

In the Borana region (Ethiopia), RAIN Foundation and its partner organisations\* have provided water to more than 2.000 people through small-scale community-managed rainwater harvesting systems. The project, winning the Swiss Re Award for Sustainable Watershed Management, combined knowledge and capacity strengthening between African and European organisations, with on-job training and implementation of sand dams in combination with surface runoff RWH and belowground water storage tanks using a catchment-based approach.

J.M. Munguti, Manager SASOL\*\*, Kitui, Kenya: “Local participation and ownership are key to the success of sand dams. Beneficiaries are involved from the beginning of the project and are trained and educated on water management, maintenance, hygiene, setting-up payment-schemes and the possibilities of income-generating activities, which enable them to improve their own livelihoods.”

In the Kiindu catchment in Kenya, it was found that, as a consequence of improved water access from the sand dams, time previously spent fetching water was now used by 33% of the households for farming, 29% for domestic tasks like increasing hygiene or cooking meals and by 43% for other income-generating activities like brick making.

A. Seifu, Technical engineer at AFD in Ethiopia: “It was through the effort of RAIN and ERHA that sand dams and other rainwater harvesting technologies got attention at a national level in Ethiopia. At a local level, the demand from people who have not yet profited from a rainwater harvesting system is increasing dramatically.”

\* Ethiopian Rainwater Harvesting Association (ERHA), Action For Development (AFD)  
\*\* Sahelian Solutions Foundation (SASOL), Acacia Water

For more information:  
[www.rainfoundation.org](http://www.rainfoundation.org)

## Woman benefiting from a rainwater harvesting system in Borana: “This is not just water: this is milk.”





# Bangladesh: living in the chars



**A Dutch solution in Bengal context: no solid dikes, but small underwater levees made of natural materials such as bamboo and jute to guide the river current.**

BY IRENE WEVER

In Bangladesh people are accustomed to moving constantly due to the frequent flooding of rivers. Five million people live in the chars in Bangladesh, an area of mudflats formed by the sand and silt deposited by the great rivers. They are vulnerable to sudden flooding, erosion and loss of land due to the powerful flow of the river, which constantly changes course. This makes life in the chars dangerous and uncertain. Climate change is affecting the water budget in the area: changing rain patterns and the accelerated melting of the Himalayan glaciers mean that more water is flowing to the sea, less regularly. The ever-changing floods that have impacted the chars since time immemorial are becoming more unpredictable and more severe. The need to study all adaptation possibilities is increasing, as is the need to act. Bangladesh and India will see refugee streams of unknown proportions. A rising sea level and changing rain patterns will force 125 million people out of their homes

by the end of this century, estimates climate expert Sudhir Chella Rajan of the Indian Institute of Technology in Chennai (Madras, India). In Bangladesh the number is estimated at 75 million people, mainly because of the onward pressing sea water. Many people will seek refuge in the richer India. But here too, in the densely populated coastal areas, masses of people will be on the move. According to IPCC, a sea level rise of one metre will inundate 6,000 square kilometres of land in India, including parts of megacities like Mumbai, Kolkata and Chennai.

Raising dikes against the rising water and other adaptation measures are unaffordable for India, Rajan says. The professor cites from a study that has calculated the costs of protecting coastal areas against a sea level rise of one metre at more than 300,000 euros per square kilometre. On top of this, dikes and flood reservoirs of this sort would only protect a fifth to a half of

the threatened population. The Dutch approach might offer a solution. "Building dikes is not the best solution in the chars", according to Luijendijk of UNESCO-IHE, Institute of Water Education in Delft. The rivers and the amounts of sediment are so large that "solid" structures would be unaffordable and do not last. Luijendijk: "We have learnt to use natural processes to our advantage. Where we would normally build levees in order to curb the river, the Delft river morphologists devised a solution for Bangladesh involving small underwater levees made of natural materials such as bamboo and jute. The approach of working with the forces of nature instead of against them is also being applied more and more in the Netherlands."

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## Nicaragua: solving the puzzle

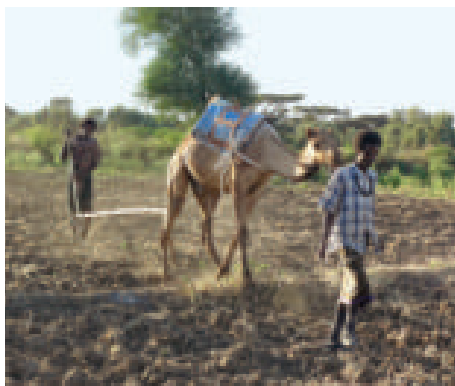
Finite groundwater sources are forcing the mountain town of Matagalpa in Nicaragua to take new measures in its complex water system. Matagalpa is located in a vulnerable water catchment area where two rivers rise. Discharge of the rivers appears to be declining and becoming more unpredictable, and there is increasing pressure on the available water sources due to a high population

growth rate of about 5% per year. Groundwater extraction is finite, and in this case the supply is expected to run out in about 10 years' time. In the longer term, the town's population will be dependent on alternative sources for its drinking water supply. The municipality of Matagalpa has started a three-year cooperation programme to improve water management with two Dutch water boards and non-profit organisations. They are looking jointly for ways in which the parties in the Netherlands can contribute ef-

ficiently to the water supply problems, with a focus on capacity building. The programme aims to provide 2,400 people with access to a drinking water system and 5,500 people with sanitation. The parties involved will assist the municipality of Matagalpa in formulating a long-term management plan for the catchment area.

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# Ethiopia: from shepherd to farmer



This farmer, who used to be a nomad, ploughs his field with a camel, saved from his previous existence as a shepherd.

**The extreme drought conditions in the north of Ethiopia are leading to an increase in conflicts between clans. When the Afar nomads livestock was decimated in 2003, the NGO Support for Sustainable Development (SSD) set up camp in the area. Irrigation led to a radical change.**

BY KARIN ANEMA

The Afar were very distrusting to start with. Initiator and general manager of SSD Gebreyes Haile: "Out of desperation they had to change their lifestyle to growing food crops and animal feed. But we were careful to work with respect for their cultural values. The starting point was their traditional laws and rules, addu and medda, which were strongly embedded in the community. Power resides with the clan leaders, so we talked first with them. They in turn were able to convince the villagers. Pastoralists live very much from day to day and expect to see immediate results. Nobody had any experience of sedentary farming. We dug drainage channels together and within a year we were able to irrigate the first gardens. We sowed fast-growing crops, like cabbage and maize. We also set up a demonstration garden, for training and for use as a nursery. This way, the farmers can always get seed."

## **Filter planting**

The inconceivable happened: in the stony desert of the Afar region small oases have

emerged. The nomads built huts near their fields. They now grow animal feed, fruit and vegetables. Slowly these people who had always lived from milk learned to appreciate unfamiliar vegetables and to break through their own food taboos. They take it in turns to herd livestock, but only keep as many animals as they can feed.

## **In the stony desert small oases have emerged**

Now the farmers can boast good crop yields and healthy livestock. Thanks to SSD's assistance, the irrigation works are technically sound. Filtering plants have been planted in the channels, and bridges constructed over them so that the animals don't trample over the edges. Multifunctional crops are grown, which protect the soil and provide food.

Farmer Omar uses a camel to plough his field. He says he's no longer a nomadic pastoralist but a farmer. "Our animals stay nearby; we no longer run the risks we used to during the long treks. We eat the vegetables ourselves. Before, when a cow died it was a disaster. Not any more, now we have the crops. Our problems are solved, as long as the river continues to provide enough water."

The Mille Disaster Risk Reduction Programme, supported by the Dutch NGO Cordaid and other donors, runs in seven villages. Water committees look after the irrigation schemes and maintain them on the basis of their own traditional legal system. The first village is almost self-sustaining. Gebreyes: "We'll keep up the counselling for a while yet."

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# Towards hydrosolidarity



Water and climate issues are currently flooding international agendas. More people are getting involved. Henk van Schaik has been actively involved in the international dialogue for more than twenty years. Answering five questions, he gives his vision on the developments.

BY MICHAEL VAN DER VALK

**1 Nowadays international water meetings seem to follow each other at a daunting pace. How did we get where we are now?** “In 1978, Martin Beijer of UNICEF, Fritz Dietrich of WHO and John Kalbermatten of the World Bank spent a weekend together in a cabin in the French Alps. They set out to agree upon a water agenda for the 1980s. The outcome of that weekend was a joint call for an International Drinking Water Supply and Sanitation Decade, the first call for global hydrosolidarity. It resulted in access to water supply for hundreds of millions of previously deprived people.”

**2 What was the key to this success?** “The key was the connection between external support agencies and local actions reaching to the village level. At the global level, the most remarkable achievements were the global water supply policies and financial support commitments among international support agencies; and developments in water technologies, most notably the developments in plastics for water transport pipes and water pumps. At the time I was working as policy advisor in DGIS and was directly involved in the establishment of the Collaborative Council on Water Supply and Sanitation. This alignment of global policies and financial support with local actions for access to water and sanitation continues to this day.”

**3 The concept of Integrated Water Resources Management (IWRM) has sparked the development of IWRM plans in most countries and basins. How did it get this far?** “Well, the global attention for access to water

supply of the late 1970s was followed by the emergence of global concern about the increasing scarcity and deteriorating quality of water resources due to economic development. These factors threatened social equity, economic efficiency and environmental sustainability. In 1995, at the global water conference in Barbados, Malin Falkenmark and others initiated a global movement, resulting in the IWRM concept, which is now universally accepted, though not always followed. Another result was the GWP.”

## How a dialogue in an alpine mountain hut evolved into a global water movement

**4 What lies ahead of us?** “Since the early years of this millennium, the water sector has been concerned about the impacts of climate change and land use change on water resources and water services. Climate change leads to rising sea levels, disappearing glaciers, and changes in all components of the hydrological cycle. Land use changes and new settlements have increased the number of water-related disasters as well. This, together with the magnitude of these changes, complicates matters for water

managers. It requires that they reach out beyond the boundaries of traditional water management to engage with sectors involved in climate science and spatial planning, so as to better address the increasing complexity of evolving risk. These new challenges can only be addressed through joint efforts of sector professionals. This realisation led to the Cooperative Programme on Water and Climate in 2001, which initiated a global dialogue on bridging water and climate, of which I became the first Programme Coordinator.”

**5 Can we say that the international water meetings follow the issues of the day, rather than set the scene for the future?** “Yes and no. Recently, events such as the World Water Fora, the World Water Weeks and the World Water Congresses have been increasingly paying attention to the challenge climate change poses to water professionals. They provide the floor to raise awareness, discuss politics, share views on policies, and disseminate information – actively working to transcend national and professional borders. The enormous participation in this dialogue is in itself an expression of its relevance to our challenging times. These events present a necessary and valuable platform for furthering and developing an essential dialogue and for strengthening the partnerships necessary to implement the critical actions they foster. They create solidarity – hydrosolidarity.”

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# More farming on less land

**How can you feed more and more urban dwellers from less and less good farmland? It sounds like a high school exam question, but this is the challenge facing agriculture all over the world. On top of this, climate change is making access to water more and more difficult.**

BY ANDRE BRASSER

Put like this, the future of farming bears a lot of resemblance to the history of the Netherlands. While over half of the world's inhabitants now live in cities, in the highly urbanised Netherlands just about everyone now lives in an urban environment. In such a densely populated country you always run up against different land users with different wishes. "If you develop an area with the sole aim of maximising production, sooner or later you run into problems," says Mathieu Pinkers, coordinator for international policy development at the Dutch ministry of Agriculture, Nature and Food Safety. The intensification of agriculture in the Netherlands after the Second World War initially led to higher yields. But many of the costs that were incurred, such as treating polluted water so that it was suitable for drinking, were only seriously taken into account later. Pinkers: "We had to make up for these mistakes retrospectively. Converting to more environment-friendly forms of farming after the event is an expensive way of going about things. When we advise other countries we always try to make them aware of these issues."

Meanwhile the whole world is urbanising at a rapid rate. This process is taking place mainly in the low-lying coastal areas, where climate change is also felt most strongly. Can't the lessons from Dutch agriculture just be applied directly in these areas? "It's not as simple as that", Pinkers asserts, "but it does always come down to planning. A farming system has to be adjusted in such a way that it takes other

**Laissez-faire is no longer an option; we have to adjust the agricultural system in ways that take other systems – nature and safety – into account**

systems in the area into account, such as ecological features or safety aspects. In the Netherlands we are now experiencing higher peak discharges from the rivers and more frequent drought during the growing season. You have to organise your activities to deal with these kinds of things. Laissez-faire is no longer an option."

#### **Nature or technology**

Three-quarters of the world's cities are built in the flat, fertile coastal deltas, on what was once the best agricultural land. The consequence? Agriculture makes way for urbanisation and often ends up on lower quality soils. Faced with the task of feeding the growing number of mouths in the cities, how do you go about solving the dilemma? Pinkers: "You can come up with two extreme solutions. You can go all out for a technological solution. That means exercising as much control as possible over





all growing conditions. Then you end up with greenhouse cultivation that's perhaps best compared with farming in an office building along a six-lane highway. In that kind of system you have maximum control over all variables. At the other extreme you make sure that the farming is in tune with the processes of nature as much as possible. That means, for example, that in a period of drought you don't water, but grow different crops than those you would grow in a wet period. Or that you don't fight salinity but take it as a given and introduce salt-tolerant crops. Between these extremes there is a range of options to choose from."

#### **Piece of the cake**

In the end it boils down to the question "who gets the water?" Pinkers: "You can only take well-founded decisions by involving all the parties that are dependent on the water. And then the trick is to make sure that the parties with the least influence also get an honest piece of the cake." This was the case for example in Ethiopia, where a Dutch flower grower set up in business and as a result immediately became a water guzzler. Pinkers: "We managed to get a dialogue going between all water users, including the small farmers and labourers. A way was found of weighing up the advantages of extra income as a result of employment opportunities with the flower grower against the water stress that his activities could cause for other parties. This worked because we managed to make people aware of the problem."

But collaboration remains the most difficult way of working. "The urgency of the need for this approach is not yet generally felt. Nevertheless, we are receiving request for advice increasingly frequently." And however difficult it is, the essence is simple. "The most important thing is to listen to what the parties themselves have to say and not to overwhelm them with your own solutions, which are often not the best. Moreover, you always need to take a

broader view than just the agriculture. The best solutions are often found in the most unexpected places."

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#### **Nature as an ally**

**A place in the top five areas in the world most threatened by climate change seems to have brought out the best in Vietnamese water managers and their Dutch partners. The combined effect of a rising sea level, more storms and higher peak river discharges makes the country very vulnerable. Along the coastal strip, which stretches for thousands of kilometres, the rich farming soils are increasingly threatened by salination in the dry periods and flooding in the wet periods. "The best solution is to maintain a buffer of brackish water between the two zones", says Gerardo van Halsema, assistant professor of irrigation and water engineering at Wageningen University and Research Centre. The idea is as simple as it is effective. "Create room to store fresh water in the hinterland and regulate the drainage of this to maintain the salt level that you want in each of**

**the three zones." In the freshwater zone you grow rice and raise pangasius, in the brackish water you farm fish, and in the saltwater zone regeneration of the mangrove forest ensures coastal safety while also working as a helophyte filter for polluted water. Van Halsema: "You can raise prawns in the higher-lying areas of the brackish water; crab and fish in the lower-lying areas use the waste products from the prawns. This way you organise the agriculture, coastal defence system and the ecological system in relation to each other. The combined effect is stronger than if each of the systems is dealt with separately. It's none other than a new version of the old saying: the whole is greater than the sum of its parts."**

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# de DUURZAME 100

deVerdieping  
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## Wie is de 'Al Gore van Nederland'?

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## EXCHANGING KNOWLEDGE WITH CALIFORNIA

# ‘Bring in the Dutch’

**Sinking peat, rivers in need of diking in, in danger becoming brackish and having high water levels. These typically Dutch problems also affect California, especially the Bay-Delta and the delta triangle between San Francisco, Sacramento and Stockton.**

BY IRENE WEVER

Joint research is possible because of the likeness with the Netherlands and the similar climate challenges. California, like the Netherlands, has an agricultural background, is rich, technologically developed and has a densely populated, compactly built-up and therefore vulnerable delta. California has polders and peaty soils that have in some areas sunk to ten metres below sea level in a time span of century and a half, and it has river embankments that prevent the land filling up like a bathtub. In the dry summer of 2003, in the Netherlands it was noticed that some of the dikes built of peat were drying up. At the Dutch village Wilnis the peat dike had become so light that it floated away after heavy rain-

fall. In California too, this risk is increasing, especially since droughts and rainstorms are becoming more and more frequent.

### Clean industry

Four years ago, the State of California invited the Netherlands to visit. The Dutch Ministry of Economic Affairs led the delegation with several research, engineering and advisory firms. Piet Dircke, Programme Director Water of advisory firm Arcadis: “Hurricane Katrina had destroyed New Orleans. It was a wake-up call for governor Schwarzenegger. This was not going to happen to him; measures had to be taken. A Delta commission was created following the Delta Protection Act

of 1992, a risk analysis was drawn up and foreign parties were invited to come and discuss. While the Netherlands were helping to rebuild New Orleans, in California a call sounded: ‘Bring in the Dutch!’ Once the Dutch climate adaptation knowledge programmes had been set up, and we were looking for international partners, California was a perfect candidate.” (see also page 16).

The Dutch have been organising water management since the foundation of the district water boards in the 13th century. “As such we are quite advanced in water management”, says Dircke. “However, California can teach us a lot about mitigation.” California is known for its progressive environmental policy where the State takes on a leading role: strict laws to reduce CO2 emissions, investments in large windmill parks, that attracts sustainable forms of industry. Dircke: “Look at the film industry in Hollywood and the computer branch in Silicon Valley with companies such as Google and Microsoft. Their basic philosophy is that attention to the climate and the environment should not be seen as only a threat; it offers opportunities as well. That’s also how we see cooperation in the Hotspot California.”

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CALIFORNIA DEPT. OF WATER RESOURCES

# The Dutch delta in transition: uncertainty about future climate should not prevent us from investing in adaptation measures

PAVEL KABAT

It is hard to think of the Netherlands without water. Through the centuries, and still today, the inhabitants of our delta have made great efforts to protect our country from the grasp of the large rivers Rhine, Meuse and Scheldt and of the North Sea. The sea and the rivers have shaped our identity and the country itself: its nature and landscape, its prosperity and economy, and even the way it is governed – the water boards are one of the oldest democratic government forms in Europe.

The Netherlands is a small, densely populated country with a prosperous, open economy situated largely in coastal lowlands. Nearly 9 million people, more than half of the population, live in the areas that lie below sealevel or are otherwise flood-prone. These areas are the economic heart of our land, where 65% of GNP, close to 400 billion euros per annum, is generated.

The disastrous floods of 1953 are still etched into our collective memory. As an immediate response to this disaster, the Dutch government set up the “first” Delta Committee, to recommend which hydraulic engineering works should be undertaken in relation to areas ravaged by the storm surge, including a closure of the sea

inlets at several places along our coast. The implementation of these recommendations took place in the second part of the last century and it radically altered the appearance of the south-western Netherlands. The completion of the “first” Delta Works in 1986 laid a solid foundation for our long-term water safety.

The flood protection standards for the Dutch coast are based on the work of the first Delta Committee and date from the 1960s. Since that time many things have changed and this process of change will continue in both the near and long term future. Since 1960, the number of inhabitants and economic capital in the low parts of the Netherlands have grown enormously. Coming decades, multi-billion euro investments in housing, industrial estates, nature development, mobility and transport infrastructure are planned in these low-lying areas of the country. Climate change and sea level rise confronts the Netherlands with major adaptation problems. Globalisation and the current global economic scene with its inherent uncertainties severely impedes our expectation for a sustainable future. The Dutch Delta will experience ever increasing pressure on, and high competition for

available space, by all sectors of the economy and all segments of society. There is a continuous competition between urban, agricultural, nature and recreational land developments. Transport infrastructure and utility and energy networks occupy increasingly larger portions of space, both above and below ground. Flood protection measures, both coastal, urban and along the waterways require more space than in the past due to their flexible nature (“room for water”). New energy sources, such as wind, solar and biomass based, CO<sub>2</sub> (underground) sequestration as well as climate adaptation measures such as green roofs or natural climate buffers all interfere with existing use of available space.

How to position all measures which are needed to keep our country safe from water in this complex and highly uncertain environment of transition in our delta? Many policymakers, industries and the general public still tend to perceive most of these changes merely as a threat to our present and future prosperity. This applies to climate change, as well as to the present global economic crisis. However, an intriguing paradigm shift debate is starting to take off: rather than a threat, these changes can also be seen as opportunities. Climate





Pavel Kabat

change, the current financial and economic crisis, the infrastructure-congestion crisis, energy crisis, water crisis: can these be turned into triggers to boost innovations and transitions to sustainable socio-economic settings?

To see the future climate change as an opportunity is one of the leading principles adopted by the “new” Delta Committee, appointed by the Dutch Cabinet in 2007 with the mandate to formulate a vision on the long-term protection of the Dutch coast and its hinterland. In its advisory report presented last September to the Dutch cabinet ([www.deltacommissie.com/en/advies](http://www.deltacommissie.com/en/advies)), the “new” Delta Committee presents an integrated vision and strategies for the Netherlands for centuries to come. These strategies explicitly pay attention to both safety and environmental (spatial) quality, putting focus on innovative measures and possible synergies between flood protection and other societal and economic functions such as nature protection, fresh water supply, recreation, landscape quality, infrastructure and energy. The Delta Committee recommendations became a matter of active, often passionate public, political and academic debate. Do these recommendations sufficiently

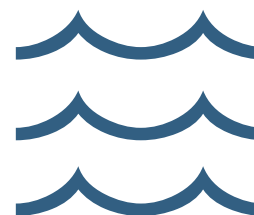
reflect highly uncertain future changes, especially in climate and sea level rise? The Delta Committee introduces a concept of so-called plausible high end sea level rise scenarios. These are high-end values which, according to the current scientific state of the art, cannot be excluded to happen, even if the probability that they will happen may be very low. These go together with no-regret, flexible and adaptive measures: step-wise flood protection adaptation measures which can be undertaken now and which are robust enough to accommodate new insights about changing climate. An example of these measures are the sand nourishments of the coastal line in order to protect it from the rising sea. We should start now but it can be done – in a slower or faster pace – over many years to come, along with good monitoring of the actual rate of sea level rise, and taking into account the latest scenarios of sea level rise. Thus the uncertainty surrounding climate scenarios is not a reason for no action at all.

The Dutch Delta Committee clearly illustrates that, even with existing uncertainties about future climate, economically viable and responsible investments in adaptation measures in the water sector

and beyond can be made, if these anticipatory interventions are flexible, can be implemented gradually and if they offer prospects for action in the short term in regional planning and development. As a result, the climate issue is gradually moving from being perceived as a threat to become an opportunity. Together with integrated nature and innovative solutions, technologies and transitions which are rapidly emerging along this paradigm, this presents a major opportunity to accelerate the transition of our valuable and highly exposed Delta to a more sustainable future.

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# MANY VOICES, ONE APPROACH

**A country with its national airport five metres below sea level does not sound like the most obvious advisor on climate change, water management and land development. And yet that is exactly what the Netherlands is: expertise acquired over centuries is used to offer solutions elsewhere in the world.**

BY ANDRE BRASSER

"One of the main things we learned in the Netherlands is that you need to bring as many disciplines as possible together and involve the construction people in the planning. It is even more important when adapting to climate change", Wim van Driel says. He is International Development Manager at Wageningen University Research Centre (WUR) and involved in one of the Dutch climate adaptation knowledge programmes. This Dutch lesson is by no means accepted internationally. "We've been collaborating with Taiwan for a while now. They have to cope with serious flooding in some coastal areas because a lot of subsoil water is tapped for fishponds. Their civil engineers try to solve it by building higher quays and larger storage reservoirs. Which is fine, but it's not enough. If the water extraction goes on, the soil will drop lower and they'll have to build higher quays and larger reservoirs. In the Netherlands we learned that you have to have a wider scope and involve other land users in finding a solution. These are the kinds of issues we try to get off the ground in our collaboration with Taiwan. We should realise that the Taiwanese culture is completely different from ours. But the problems can be very similar."

#### Hotspot team

Taiwan is one of the provisional hotspots on which the Dutch climate adaptation knowledge programme wants to focus. In agreement with the Dutch experiences, the idea is to get the problem sufferers and the problem solvers together per region. Together they will form the hotspot team. It's an attempt at linking research and execution as efficiently as possible. Says Van Driel, "In Vietnam, for example, we're

forming a team together with ministries, research institutes, consultants and NGOs from both countries. Representatives of the local population are also on the team so it can benefit from local expertise. One of the themes we're working on is the changing ratios of fresh, brackish and salt water in the deltas caused by climate change. Vietnam is already running some practical tests on how to arrange the future fresh-water zones for rice and the salt-water zones for fish farming and nature development, for example. We can certainly learn something from them for our Dutch deltas." Besides Taiwan and Vietnam, international hotspots for the Dutch Climate Adaptation Knowledge Programme are California, China, Indonesia and the Upstream Nile area (Rwanda/Uganda). New Orleans was originally listed but has dropped out.

#### Customised solutions

"In this type of research it's important to interpret the available climate scenarios correctly. You need customised climate information. And that's where things go wrong sometimes." Janette Bessembinder, intermediary for researchers and end users at the Dutch meteorological institute, KNMI, speaks from experience. "Many countries have problems with water management in the cities. Extreme precipitation is likely to increase in the future. Climate scenarios offer information on the change in precipitation extremes on a daily basis, but for urban water management you need that information hourly or even more frequently. You need an accurate interpretation of climate scenarios in order to estimate future flooding in the cities." KNMI wants to make its expertise more

applicable on an international level. This approach has already proved successful in the Indonesian capital Jakarta (see box).

#### Moral obligation

In areas like the upstream part of the Nile it may be more difficult to gather historical data, but it has to be done regardless. In this provisional hotspot in Rwanda and Uganda, the climate has always been extremely varied by nature. The effects of a structural climate change still seem a long way off. But here, too, agriculture in

## The Netherlands should feel obliged to share its expertise with countries like Rwanda and Uganda

particular should adapt to the unavoidable changes in the rain regime. Says Van Driel, "It's a lot to ask of African countries, knowing that their contribution to the climate problem is only 2%! That in itself is enough reason why the Netherlands should feel obliged to share its expertise with countries like Rwanda and Uganda."

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## IBM chooses Amsterdam

The low countries by the sea are the first to notice the effects of climate change. So what better country than the Netherlands to establish a knowledge centre focusing entirely on adaptation of water management to the climate? This is why IBM decided to locate its Global Center of Excellence in Amsterdam.

According to IBM, no country in the world knows more about coastal protection than the Netherlands. The Center will assist

clients in the public sector throughout the world in their development of advanced forecast systems and protection systems for low coastal areas and river deltas. In collaboration with the Dutch government and local authorities IBM will use its expertise to contribute to solving water-related problems.

By establishing their Center in Amsterdam, IBM wants to capitalise on the high-quality know-how of local experts. This fits in with the company's strategy to make use of the

skills and knowledge of local specialists to further improve their service.

The Center will play an important role in the implementation of Flood Control 2015, the water management innovation programme initiated by the Dutch government in 2008. The programme is a joint venture of Dutch industry, education and other government institutions. Its objective is to protect the low-lying delta areas against flooding.

[www.ibm.com/technology/greeninnovations](http://www.ibm.com/technology/greeninnovations)

# Jakarta: from difficult case to shining example

Over the past few decades, one flood after another made it quite clear: without intervention, the city of Jakarta would be heading for disaster. A consortium of Dutch companies and research institutions appears to have succeeded in cutting the Gordian knot that is water management in Jakarta. Simplicity is the hallmark of the real thing.

Jakarta is sinking by no less than 10 to 25 centimetres a year. This is the result of sub-soil water being extracted on a large scale at 200 metres depth. At the same time the surrounding mountains receive 5.5 metres of rain every year, which flows down to a city slowly sinking into the sea. This was anticipated as early as 1920. A system of channels was built so the water would go around the city on its way to the sea. 50 years later it was adapted to the modern age. Then nothing happened to the water system for 40 years, except that it became completely surrounded by a city growing uncontrollably. The system was neglected and used as a rubbish dump by the locals, resulting in a

dilapidated, blocked-up drainage system running straight through the city. After every disastrous flood, none of the authorities responsible had the faintest idea where to start with the renovations.

After the city was hit by heavy floods in 1996, 2002 and 2007, a consortium of Dutch companies and research institutions was asked to provide a solution. Jan Jaap Brinkman, involved in the Jakarta Flood Management Initiative on behalf of Deltares Research Institute: "We managed to involve the countless decision makers, the experts and the citizens. First we mapped the entire water system of Jakarta together. That had never been done before. Up to this point everyone had operated alone, using different data, speaking different languages." Proper communication and the ensuing common vision laid the groundwork for this success.

Brinkman: "Once we had mapped the system, we asked which no-regret measures could be taken now. It led to the astound-

ingly simple realisation that we didn't need to design a new system, we could renovate the old one! We worked out that the 2007 flood would have been 80% less damaging had the existing channels been dredged and renovated." Small Dutch dredging companies dredged the channels and quays were mended. The mood changed from apathetic to hopeful. Also, a World Bank project that had been stopped was restarted. "That raises hope for permanent change", says Brinkman. In fact, there's another huge operation on the cards for this city that will grow from 25 to 40 million inhabitants over the next few decades. "Adaptation to climate change is only one of the problems. And it may not even be the most urgent one. If the new channels fill up again with rubbish in no time, it will all have been for nothing", says Brinkman. "But I have high hopes because for the first time ever all parties are really cooperating, including the citizens of Jakarta themselves."



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## SAFE FLOOD DEFENCE SYSTEM THAT FOLLOWS RISES IN THE SEA LEVEL

# Afsluitdijk (IJsselmeer Dam) and WaddenWerken

BY HILKE FLORIS

**Flood defence systems like dikes are essential for safety. This is particularly true for the Netherlands, which is largely situated below sea level. The Afsluitdijk, one of the most important primary flood defence systems in the country, no longer meets safety requirements. The solution: create salt marshes which follow rises in the sea level.**

With traditional dike reinforcement, the 32 kilometre long Afsluitdijk would have to be raised several metres and re-clad, an extensive operation that would have significant consequences for the current cultural historic value profile. The WaddenWerken\* vision addresses the safety issue through sustainable, integral area development.

The plan entails the enhancement of the natural processes around the dike. The dike is not heightened, but rather widened on the sea side with salt marshes, the same overgrown salt marsh shallows that are commonly found in the Wadden area. The salt

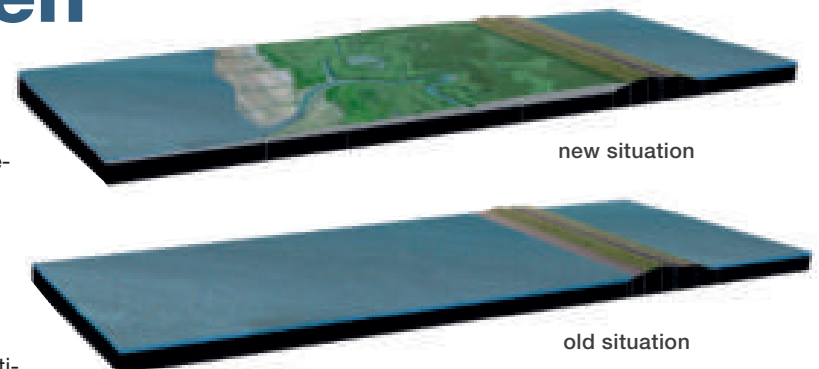
marshes create a fore-shore to the dike and weaken the incoming waves. Natural silting allows them to follow rises in the sea level – up to more than one centimetre a year. This process can be easily accelerated by digging channels and creating brushwood dams. This growth is sufficient to create a sturdy and sustainable flood defence system that meets current and future safety requirements. The salt marshes can be created within the available budgets and require little maintenance, since they are part of the natural Waddenzee ecosystem.

The creation of these new salt marshes results in a new 1,500 hectare natural area that also offers recreational opportunities. The landscape experience is enhanced by constructing two tall bridges that enable a simultaneous passage of boats/shipping traf-

fic and road traffic and offer fantastic views of the Wadden Sea and IJsselmeer lake.

The WaddenWerken project is unique. Never before has a foreshore been created on this scale as part of a safety concept, while at the same time enhancing the natural values of the area and diversifying the landscape experience. The design respects the rich cultural history of the area by ensuring that the original Afsluitdijk remains recognisable.

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\* WaddenWerken is a vision on the reinforcement of the Afsluitdijk developed for the Directorate-General for Public Works and Water Management by the consortium of the DHV consultancy and engineering firm, Wageningen IMARES knowledge institute and Bureau Alle Hoesper landscape architecture and urban development firm.



# Prevent, be safe or be sorry?

Water is increasingly becoming a worldwide concern. In some areas there is insufficient water, while in others it challenges us through violent storms and dike breaches— not to mention the matter of rising sea levels and water pollution. Water is essential and it demands our attention. So whether the concern is water treatment, coastal development, ports and waterways or water

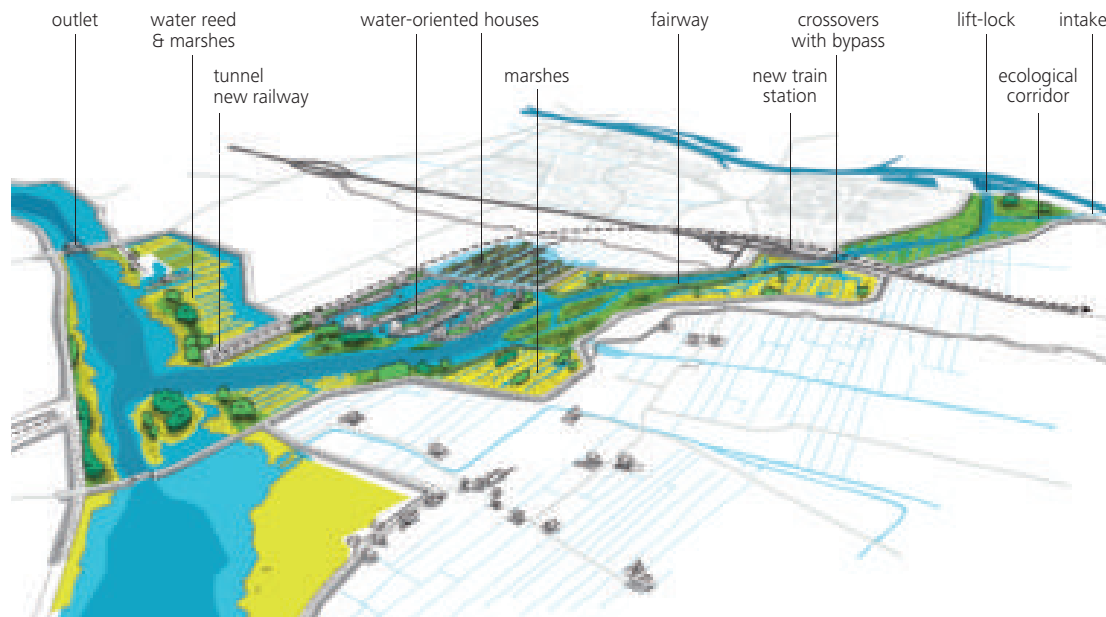
management, water can never surprise our experts. Though we might surprise you with our innovative solutions to every conceivable water problem, be it in Panama, the Netherlands or Bangladesh. If you're facing water challenges, let us help you develop sustainable solutions. Because at DHV, we've got nearly 100 years of experience with water.

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*Gateway to solutions*

## Climate adaptation in the IJssel delta: the Overijssel approach



Bird's eye  
perspective of  
the plan for  
the IJssel delta  
(autumn 2008)

The river IJssel in the Netherlands is a major branch of the river Rhine, the third largest river of Europe. It discharges its flows to the IJsselmeer lake. The IJssel delta is a low-lying area that is threatened by floods from both the river IJssel and from the IJsselmeer lake.

In 2005 the Province of Overijssel initiated the process of drawing up a sustainable development plan for the IJssel delta area,

with a strong focus on climate adaptation. The challenge was to combine and integrate several spatial developments (housing, infrastructure, leisure, nature, agriculture), together with the construction of a so-called bypass of the river IJssel.

The result is an integral plan that is supported by more than 20 governmental and non-governmental organizations. With the construction of the bypass some 350 hectares will be added to the floodplains of the delta

of the river IJssel. The effect of the restoration of the floodplains is that the water levels of the river IJssel will decrease substantially during situations of high river discharges. This contributes to the safety and resilience of the area.

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### SUPPORT INSTRUMENTS:

## Adaptation scan and climate atlas

Climate change and adaptation measures are increasingly integrated in the decision process of policymakers. To assess the impact of climate change, they can use a range of instruments. One of these is the 'Adaptation Scan', a computer program that municipalities can use to find out how well equipped their new or existing plans are to deal with climate change. The instrument has been developed in cooperation with the Royal Dutch Meteorological Institute. The scan includes a

five step assessment procedure that leads to an overview of threats and opportunities.

Another useful tool is the Climate Effect Atlas (Klimaatatlas). This instrument links scientific knowledge to policymakers' questions. The Climate Effect Atlas uses geographic information system data (GIS), to map the spatial effects of climate change at the regional scale.

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# Nature and landscape as climate buffers

**The trend in the Netherlands is towards letting nature take its course. The sea is no longer regarded as the enemy that needs to be kept out. This ‘opening up’ means the Dutch are learning to live with constantly changing boundaries between wet and dry land. The climate buffers that are being formed will help safeguard the country from flooding and provide more room for flora and fauna.**

BY MICHEL VERSCHOOR

Imagine you are looking at the Netherlands on Google Earth about sixty years from now. You'd be in for a few surprises. From somewhere in space you wouldn't notice much difference in the contours. But zooming in you would soon notice that big changes have taken place as a result of interventions in the landscape. The Wadden

Sea coastline looks more jagged since tidal marsh areas have been created in front of the IJsselmeer Dam and along the northern coast. Weak stretches in the North Sea coastline have been strengthened. Immediately behind the dikes of the IJsselmeer lake, IJmeer and Markermeer lakes there are now foreshores and lagoons. The big

rivers also have more space, enabling them to discharge far more rainwater. Higher lying areas of the Netherlands look much drier, but agriculture is still possible as a result of crop adaptations and improved water distribution. The river network now has an ingenious distribution system and in the central part of the country many water buffers can be seen, ensuring sufficient water for all provinces in times of extreme drought. Along the north and western coast farming activity in marshland areas is visible, with salt-tolerant crops like salicornia and perennial goosefoot.

## **Nature reserve**

Perhaps most noticeable is that around 2100 the Netherlands looks like one big nature reserve, with urban agglomerations embedded in an attractive water-rich green environment. Small and large areas of nature are linked with each other by ecological connecting zones, enabling freer movement of animals and plants. The Google Earth visitor probably won't realise, but these geographical changes have occurred in response to a widely felt sense of urgency among the Dutch at the start of the twenty-first century.



Jasper Fiselier works for DHV consultants, one of the partners in the Building with Nature programme. Fiselier: "We are seeking ways to improve hydraulic engineering by incorporating well-thought-out natural designs. Call it green hydraulic engineering: we not only look at what is technically feasible, but also how we can build natural processes into our designs and work methods." Building with Nature is an independent private-sector based initiative. It is supported by advisory bureaus, dredging companies, knowledge institutions, universities, industrial partners and two government agencies. There's a budget of 26 million euros available for the next five years, split equally between the private sector and the Ministry of Transport, Public Works and Water Management. Fiselier recently completed a study on creating a tidal marsh area outside the IJsselmeer Dam. "The dikes in the Netherlands have to be made higher and wider if they are to be able to withstand rising high-water levels in the future. The IJs-

selmeer Dam also needs strengthening. But you can weaken wave power by creating a foreshore. This increases safety and gives more room to natural processes. Salt marshes are useful for nature and for fisheries. Once we have worked out how to optimise green hydraulic engineering we can start on real projects – like the 'sand motor.'" (see also page 22).

#### **Biodiversity is rapidly declining**

Nature organisations together with other parties are also contributing to the flood prevention efforts. One of these projects involves dune restoration along the Dutch coast. Marc Scheepers is the Climate Buffers programme manager for the Dutch nature organisation Natuurmonumenten: "Weak links in the chain of coastal defence are being strengthened by replenishing sand to stimulate natural process of dune formation. The line of dunes is becoming wider and the beach higher." Natuurmonumenten also works in areas where water storage, nature development and

improvements in agricultural structure converge. As far as Scheepers is concerned, the increase in the area under nature is a welcome side-effect; the main priority is to reduce the risk of flooding. "But of course, biodiversity is declining rapidly. Climate buffers are helping to make nature in the Netherlands more robust, which is the idea behind the National Ecological Network (EHS). And one aspect of robust nature is

**Climate change is paving the way for nature to once a course and the Netherlands has adopted a more open stance toward the sea**





that vulnerable species can move along with climate zones as they shift.”

Creating more space for nature, so that nature is more able to take its course, is not new in the Netherlands. In 1998 the forestry commission Staatsbosbeheer created an opening in the defences on the northwest coast at the dunes in Schoorl. “This was a turning point in the way we think about nature”, says Harry Boeschoten of Staatsbosbeheer. “We used to think in terms of conserving existing nature. Now we regard nature as constantly changing. And we need to consider whether we are allowing enough space for these dynamic processes.”

### Enough drinking water

According to Alphons van Winden of Stroming advisory bureau, in this scenario the Netherlands also takes a more open stance with regard to seawater. Van Winden: “This is inevitable as the prospect of rising sea levels looms ever larger. And there’s another problem too. As the sea comes further inland at high tide, it becomes more and more difficult to discharge water during wet periods.” Municipalities and Water Boards are generally worried about salt water, rivers flooding and drinking water shortages in times of drought. Van Winden thinks

that climate buffers can provide part of the answer to these problems. But the western region of the Netherlands is also going to have to get used to the new situation. Van Winden: “We’re probably going to have to learn to deal with subtle transitions between fresh and salt water. In the not so distant future it’ll be more a case of the rivers gradually flowing back and the sea gradually flowing in. At the moment the transitions are more abrupt, but the more we let nature take over, the more subtle these will become.”

And drinking water supply problems? Van Winden: “In fact, there is no water shortage. The problem is that we don’t store enough and we distribute our (river) water wrongly.”

### Brighter future

No matter what solutions are found for water distribution in the future, the Biesbosch nature reserve will almost certainly store more water than it does at present, according to Tracy Metz, a member of the Council for the Rural Area and the recently disbanded Delta Committee. “At peak water levels, the water surface area is likely to double. Farmers will have to make more space for nature. Whether they will succeed is the question, as agriculture is a crucial factor in some areas of

the Netherlands.” Metz envisages substantial growth in the amount of new green areas. The Delta Commission is also in favour of widening the coastal zone and creating more space for river water. “Both are good news for the National Ecological Network where progress is painfully slow. I’m hopeful that climate change will give the impetus needed to get the EHS really up and running. In the future there will be far more areas of water in the Netherlands. And as a result there will be more contrast in our landscape, making it even more attractive.”

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## ‘Bring back the water’

**In the Ems delta of Northern Holland the tides are being returned in a controlled manner. This should deliver an attractive area, where people will enjoy living and working. Climate adaptation and area development reinforce each other.**

BY TSEARD ZOETHOUT

Groningen's coastal area has a lengthy history of flooding, alluvial deposits and diking in order to both protect man from water and clear lands for arable farming. The Lauwerszee was confined to an ever decreasing inland sea, the *boezems* (polder outlets) of the Ems and Dollard were opened up to agriculture and, after a disastrous Christmas flood, the Fivel boezem was entirely diked in from 1717 onwards. Due to the changing climate and the rising sea level, the government is reconsidering its sole measure of raising the dikes. After the partial flooding of the area, the pro-

vincial authorities want to let in sea water through the Fivel, a small river running past historical villages and flowing out into the sea west of Delfzijl.

### The challenge of the Ems delta

Rob Roggema, strategy and environmental policy manager for the Province of Groningen, strikingly characterises these challenges. “This region is a precursor of what is going to happen in the rest of the Netherlands”, he says. “If there is social growth in an area it is relatively easy to finance climate adaptation. In case of a decreasing

population, such as here, this is more complicated. Furthermore, the rate of precipitation is varying in this region: less water in the summer, more in the winter. This creates a discussion as to how the fresh-water supply in the Ems region should be distributed. Both power plants and farmers are asking for water. One for increasing cooling, the other for sprinkler irrigation. In addition to this, the weakest point in the coastal defence of our province is precisely in the Ems delta.”

### Opportunities

The government is now seeking solutions in the form of a flexible coast where briny circumstances are the rule and where allowing the dynamics of the tides invites a new resilience. In the Fivel *boezem* a unique living environment can be created, one which is also attractive to people from outside the Ems delta. And that will then provide a small contribution to driving back the shrinking population development. The approach breaks down to two segments: a communal climate-proof structural vision coupled with previously existing initiatives. “One can imagine climate-proofing temporary housing for new employees in the Ems harbour. Or a sanatorium outside the dikes”, Roggema concludes.

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VINCENT BASLER

# Resilient water governance: balancing between robustness and flexibility

ARWIN VAN BUUREN EN GEERT TEISMAN



Resilient social-ecological systems can be characterised by the robustness with which they resist external disturbances and their adaptiveness to change their internal order in response to external changes they cannot refuse. This system resilience is an important cornerstone for their longterm sustainability and their ability to adapt to changing climate conditions.

The resilience of water systems such as river basins and deltas is tested in the face of changing climate conditions. New conditions due to sea-level rise, extreme rainfall but also more periods of drought put new demands to these systems. And especially in a vulnerable delta as the Netherlands extra investments in the robustness are necessary. Due to sea-level rise and higher river discharges it is necessary to invest in new water works to safeguard the huge economic investments in this country and especially in the economic centre of the Randstad which is located below sea level. However, at the same time we know that it is not longer able to invest only in our 'fight against water'. More and more the negative consequences of a technocratic engineering approach in water management become visible. Especially in the South Western Delta the negative consequences

on the (ecological) quality of water systems due to closing off sea arms hermetically become manifest. The same holds true for continuously broadening or elevating river dikes. These traditional – rigid – solutions are poorly able to adapt to changing situations.

Therefore we have to think about how we can deal flexibly with new water challenges. Under the umbrella of the concept Living with Water a couple of new approaches is launched. One of them is the programme 'Space for the River' in which higher river discharges not only are countered by dike enforcements or river bed enlargements but also by creating temporary retention areas, secondary trenches and other solutions which combine water safety and other spatial functions such as recreation, nature, housing or agriculture. These solutions do have the flexibility to adjust to emerging situations.

This water management approach aimed at realising technical solutions thus has a two-sided orientation in order to realise system resilience that consists both of robustness (guarantees for safety) and flexibility (possibilities for adjustment). However, this resilient approach has to be reflected in the governance approach that is

used to organise both decision-making and implementation of water management. On the one hand this governance approach has to safeguard a basic level of safety and a set of norms that guarantee the quality and robustness of water management solutions. This part of the governance approach can be called robust governance.

At the same time water governance has to be oriented towards enabling creative solutions and synergy with other spatial ambitions and flexibility with regard to fast changing conditions. This part of the governance strategy we call adaptive governance.

The robustness of water governance has to do with institutionalising a set of principles necessary to shape water management in such a way that it is able to cope with climate change and new, extreme challenges. One of these principles is the principle of non-passing: each water system has to find a solution for its own problems and is not allowed to shift them on other systems. Another principle has to do with the responsibility of users to pay for the water services they use. Especially in times of growing scarcity this is a necessary principle to safeguard the availability of fresh water. A third principle has to do with the precautionary





Arwin van Buuren



Geert R. Teisman

principle to prevent societal detriments. However water governance also has to do with organising flexibility. To enhance the opportunities to link water ambitions to other ambitions water governance processes have to be open to other stakeholders and have to be organised in such a way that water issues can be coupled with other spatial ambitions. A closed organisation of water management is not compatible with the spatial complexity of modern societies. Many water challenges can only be realised when they become connected with other spatial claims like infrastructure, housing, agriculture, recreation or nature, especially when they have to fit in the logic of 'living with water'.

The Dutch organisation of water governance is increasingly evolving towards a more horizontal, integrative approach in which various governmental actors and private and societal stakeholders together form vital coalitions to bridge various agendas and interests. These coalitions are normally not located on one specific governmental level (local, regional or national) but unite various governmental layers. That makes adaptive water governance also a multi-level challenge. That requires attention for the quality of the interfaces

between national, regional and local governments. Departing from formal, legally anchored positions and responsibilities is oftentimes insufficient to realise convergence between divergent agendas and fruitful collaboration between actors with different ambitions. Each actor has to be willing to do more than his actual responsibilities, although by acknowledging the responsibilities of other actors. Investments in multifunctional solutions are only feasible when all actors involved are willing to pay for solutions which do not fit seamlessly into their own budgetary frameworks and policy guidelines.


Adaptive water governance also has to contain flexible mechanisms for adjustment and evaluation. Because the direction of climate change and its consequences is not clear and can change rather abrupt, it is crucial that water policy objectives can be adapted to changing insights. Therefore water governance practices have to be 'learning systems': systems able to pick up relevant signals and translate them into new strategies. Guaranteeing enough diversity within governance systems and openness to their environment are essential preconditions to realise this learning capacity.

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IJsselmeer as test case

# Dutch water manage



**The story of Dutch water management reads as a long history of adapting to change. Does this enable it to cope with the oncoming climate change? The proof of the pudding for this could lie in the large-scale programme for the IJsselmeer lake.**

BY ANDRÉ BRASSER

# ment is looking ahead

"If one looks closely, it becomes apparent that we in the Netherlands have always been busy solving the previous problem", says Sybe Schaap, *dijkgraaf* (chairman) of the Groot Salland District Water Board. The Netherlands has been organised in district water boards since the twelfth century in order to keep the water wolf at bay. "We were continuously involved in responding to the last set of unfortunate circumstances whenever there would be another flood or dike breach. We never thought ahead. The question of 'what is heading in our direction next' was not being asked. This has definitely changed now with climate adaptation."

## District water boards

The district water boards meant to deal with this have from times immemorial had the duty to defend a specific piece of

land against the water. Unlike most other countries, water management in the Netherlands is not monopolised by the central government. "This, of course, has its pros and cons", according to Schaap. "A dike breach on the one side of the river could mean salvation for a piece of land on the other side of that river. So there was quite a bit of competition. At the same time people realised they had to work together. In any case, it has contributed to the notion that multiple parties are needed for success. This multidisciplinary approach is still adhered to in the Netherlands." This water department also exists in the areas of Western Belgium and Northern Germany amongst others. But in none of these countries have the district water boards acquired such a strong position as in the Netherlands. Here, they are the 'masters' of the dikes, they manage them

and are accountable to the provincial governments. In the course of the seventies of last century they were given an additional specific responsibility: the management of the water quality of their area.

## Thinking ahead

The great turnabout in dealing with water management was initiated by the storm surge of 1953. Schaap: "That was when we first started looking ahead. By now, we have been looking ahead for nearly a century and we are trying to anticipate what may come our way. That focus on the future is internationally still fairly uncommon. Japan offers a good example of proactive water management. The coastal defences there are prepared for the possible effects of tsunamis." The problems around the IJsselmeer lake provide a good litmus test to whether or not, in the time to come,





the Netherlands will manage to truly plan ahead. The origin of the lake itself could be called a classic reaction to a disaster. After a flood disaster in 1916, a plan was accepted to block off the inner sea in the heart of the Netherlands. Due to subsequent storm surges it had become increasingly larger. A dike over thirty kilometers long ended this. Parts of the thusly created 'inland lake' were reclaimed to become polders.

### Safety

The increasing drains in the hinterland are now compelling the various water departments to look at the lake with fresh eyes. Schaap: "Currently there is no reason for large-scale interference. But the safety situation is going to deteriorate. How will we adapt to that?" To find an answer to this, the integral area-oriented project for the IJsselmeer lake was set up. Its most important task is to bring coherence to the many projects that have meanwhile all developed

separately. The river drain from the hinterland will change. The rise of the sea level can have profound effects on the level of the IJsselmeer lake. It could rise. Should a pumping-station therefore be placed on the IJsselmeer Dam to prevent the lake from filling up and the embankments consequently needing to be raised? Or can the water level rise in parts of the lake? And how does the effect of the storms, which are expected to be increasingly heavy, come into play in this? What will happen to the water quality? To all these questions the managing authorities are collectively attempting to find an answer. Schaap: "Be sure never to underestimate the risks. A little extra safety always pays off!"

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## Province of Noord-Holland: so many coastlines to keep strong and beautiful ...

Noord-Holland is one of the provinces around the IJsselmeer lake. The province is closely involved in the development of new spatial plans for both the lake area and the Afsluitdijk, the dike that closes off the IJsselmeer lake from the Wadden Sea.

Rinske Kruisinga, vice governor of the province of Noord-Holland, is very much aware of the complexity of decisions to be made the next couple of years. "It is not just about water management and coastal defence under changing climatic circumstances, but also about where to build houses, where to find extra airport capacity and what to do with the accompanying rail and road infrastructure."

Kruisinga has to take into account all these interests, but leading are two preconditions for the lake area: the recovery of natural habitats in the southern part of the lake, where many ecosystems are currently in a very bad shape, and – in the northern part of the lake – mitigation of the spatial consequences of an eventual water level rise.

The new Delta Committee advised preparing the embankments of the northern part of the lake for a water level rise of a maximum of 1.5 metres, mainly to create a strategic freshwater reservoir. The province of Noord-Holland has many historical towns along the IJsselmeer lake, big changes in the water level will have an enormous effect on their waterfronts.

When it comes to the IJsselmeer dam, the province aims at innovations that combine safety with renewable energy and at the same time respect the unique landscape. Imagine the ever changing skies above a straight dike of 30 kilometres, a dike separating two 'seas'...

The specific role of the province is to incorporate the interests of the municipalities along the lake into the plans that are being developed. The province informs the municipalities and other stakeholders and involves them in the decision making process. Because of the big interests at stake, all parties must be on board!

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# The power of the Delta

BY GERARD VAN DEN ENDE AND WENNEKE KOENDERS

**Safety comes first. Since 1953, this has been the leading principle in the south-western delta of the Netherlands. On the 1st of February of that year the North Sea Flood inundated 165,000 hectares of land. 2,000 people drowned and another 100,000 lost their homes. The sea and river dikes were unable to withstand the force of the north-westerly storm and the waters surged to record levels. The Delta Works were built to prevent this from happening in the future.**

The Delta Works ([www.deltawerken.com](http://www.deltawerken.com)) have been providing safety for decades. By closing the sea arms in the delta and constructing storm surge barriers, the sea coast of the provinces of Zuid-Holland, Noord-Brabant and Zeeland was shortened by hundreds of kilometres. The

project was completed at the end of the 1990s with the installation of the Maeslant Barrier (a storm surge barrier) in the “Nieuwe Waterweg”, the mouth of the Meuse river and also the access channel to the seaport of Rotterdam. It is a tour de force of hydraulic engineering to be proud of. According to the American Society of Civil Engineers, the Delta Works are one of the seven wonders of the modern world.

## The down side

This success story has a down side. For the past fifty years, the pursuit of safety has resulted in little attention to the effects of the Delta Works on the natural ecosystem, which has been in visible decline for years. The removal of the tidal fluctuations (estuarine dynamics) behind the dams and barriers has disturbed many natural processes. Effects have included the growth of toxic blue-green algae, noxious odours, shore erosion, fish and bird deaths, swimming bans, shortages of fresh water for agriculture and salinisation of the soil.

This has led the three provinces involved (Zuid-Holland, Noord-Brabant and Zeeland) and the Dutch State to take another look at the Delta Works. Acting on the advice of the Delta Committee (a special task force on flood safety for the Netherlands), a steering committee and a special project office are now busy planning for the future. The committee will focus on improving water quality and the natural

environment, and on guaranteeing the fresh water supply. As we now know, due to climate change, the Delta Works may never be definitely finished. The rise in sea levels and corresponding increase in the chance of flooding in the south-western delta calls for a powerful new Delta Plan.

From mosaic to a watercolour painting  
The Dutch cabinet has asked the Delta Committee what must be done to adapt to climate change while restoring the natural ecosystem. In addition to ensuring continued long term safety for the south-western delta, the committee advised to use the area for temporary storage of river water, strengthening the unique ecosystem and safeguarding the threatened fresh water supplies.

The character of the south-western delta will change once again as a result of these measures. The area now comprises separate bodies of water that are fully separated from each other by hard boundaries, not unlike a sharply defined mosaic. In the future the boundaries will become less distinct. The delta will come to resemble a watercolour painting in which the colours flow into each other naturally, while guaranteeing safety and fresh water.

## More information

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## Advances in science and technology to support

HERMAN VAN DER MOST



Herman van der Most

Many of the world's deltas are economic and environmental hotspots. Deltas are, however, under stress due to population growth, economic development and climate change. Available space is under pressure, vulnerability to flooding is increasing, fresh water resources are being threatened, environmental quality is deteriorating. To promote the climate-proof development of deltas, an integrated approach is required to assess and monitor their vulnerability and to determine adaptation paths for the different sectors to make these sectors more resilient. Advanced knowledge of the behaviour of natural systems as well as innovations in planning and design are essential to the success of adaptation paths, as these advances may provide us with new solutions.

### Perspectives for technological development

Technological development may help to extend the life time of infrastructure and to develop more cost-effective and multifunctional designs. Advances in sensor and simulation technologies may promote the development of more accurate warning and forecasting systems, important for the development of both local- and global-scale monitoring and diagnostic systems. Integration of knowledge from soil mechanics, chemistry and biology may generate a whole family of innovations. Using bacteria as 'micro contractors' may provide opportunities for 'on demand' adaptation of soil characteristics. New materials may be eco-designed.

### Exchange of knowledge and experience

Advances in science and technology may provide essential input to the climate-proof development and management of delta areas. These advances, however, should be embedded in the socioeconomic dynamics and cultural diversity so characteristic of the many deltas around the world. It is only by experience and learning that we can succeed in coping with the impacts that climate change will pose. Therefore, co-creation and exchange of knowledge and experiences should be enhanced to develop best practices and to build capacity in dealing with delta issues. Deltares'

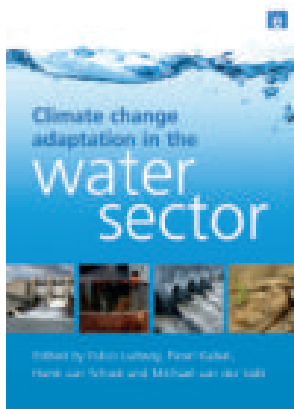
ambition and mandate is to play a key role in this. For that reason Deltares carried out research on trends and responses in the sustainable development and management of a number of deltas around the world.

**It is only by experience and learning that we can succeed in coping with the impacts that climate change will pose**

The results of this research have been presented at the Aquaterra 2009 Conference (the World Forum on Delta and Coastal Development, organised every two years in the Netherlands). Deltares supports the proposal in the draft National Water Plan of the Netherlands (December 2008) to set up an active and longstanding cooperation with a number of delta areas in the world. Deltares is also leading or participating in a number of European research projects on adaptation to climate change. These projects offer ample opportunities to exchange experiences in planning, design and management approaches between European deltas as well to strengthen our role in the development and management of climate-proof deltas around the world.

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## NEW BOOK **Climate change adaptation in the water sector**



Earthscan, London,  
ISBN 978-1-84407-652-9.

Many people within the water sector are aware that climate change is affecting water resource management, but they are unsure how to incorporate climate information into their management structures. Climate change adaptation in the water sector is a new book for students and practitioners in the water sector on how to adapt to climate change and variability. Its main purpose is to offer a compendium of specific adaptation strategies for students, water managers and decision makers. After reading this book, water professionals and advanced students should feel much more comfortable in using climate data in decision support and/or managing water resources. They will know what kind of data or information on climate change and variability are available and how they can be used within the water sector.

The book consists of two parts: the first part describes the general issues and the second part contains specific case studies. These are drawn from a wide range of contrasting countries, including Australia, Thailand, The Netherlands, Germany, Philippines, South Africa, and Yemen.

This book is a product of the Co-operative Programme on Water and Climate (CPWC), and is a Dutch contribution to the International Hydrological Programme (IHP) of UNESCO and the Hydrology and Water Resources Programme (HWRP) of WMO. The production of the book was funded by Netherlands Government through the programme 'Partners for Water'.

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## NEW DOCUMENTARY **'Connecting Delta Cities'**

The documentary 'Connecting Delta Cities' is a film on how the climate change affects delta cities all over the globe. The film shows how scientists and policy makers in Rotterdam, New York, Jakarta and Alexandria respond to climate change. The key message of the film is that by exchanging knowledge across cities, the challenge of climate change can be tackled.

The documentary is an initiative by IVM, CPWC, UNESCO-IHE, SWITCH and the City of Rotterdam and will be presented at mayor fora throughout 2009.

More information: [www.deltacities.com](http://www.deltacities.com)



## REPORT OF THE PARTNERSHIP FOR EUROPEAN ENVIRONMENTAL RESEARCH

# Climate change: Europe adapts

Over the last few decades, Europe has almost exclusively focused on mitigation. Now, the impacts of climate change are increasingly felt, and European countries have started to adapt. Since 2005, eight countries have adopted national adaptation strategies and others are expected to follow shortly. How this was done, which knowledge needs remain, and which lessons can be learned is discussed in a new report by a team of the Partnership for European Environmental Research (PEER), led by Alterra.

Most national strategies are strong in their systematic planning process based on scientific information with involvement of relevant stakeholders. However, allocating clear responsibilities, coordinating action at different administrative levels, and designing policy instruments to put strategies into action remain major challenges. Institutional barriers may well be at least as important as technical questions. To support the rapid policy development, targeted research programmes are required, which would benefit from international cooperation.

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The report is available from April 2009 from  
[www.peer.eu](http://www.peer.eu)

Swart, R.J., Biesbroek, G.R., Binnerup, S. Carter, T.R., Cowan, C., Henrichs, T., Loquen, S., Mela, H., Morecroft, M.D., Reese, M., and D. Rey, (2009) 'Europe Adapts to Climate Change: Comparing National Adaptation Strategies. (no. 01/2009). Partnership for European Environmental Research (PEER), Helsinki,

# DeltaDialogues:

## Joining forces to adapt deltas to climate change



Credit: Bottom Left, Essex Estuary Massachusetts by Dennis Hubbard, Oberlin Top Right, Jacques Descloitres, MODIS Rapid Response Team, NASA/GSFC

**We believe that sharing knowledge and joint learning are essential factors in delivering appropriate solutions for densely-populated delta areas.**

With the DeltaDialogues Royal Haskoning offers a process innovation to achieve sustainable solutions for climate adaptation.

The Royal Haskoning DeltaDialogues: interactive sessions with experts and decision makers from delta cities working together for the sustainable development of delta areas around the world.

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all dimensions