

# WORLD WATER DAY

## *FLOODS AND CLIMATE CHANGE: WATER MANAGEMENT RISKS*

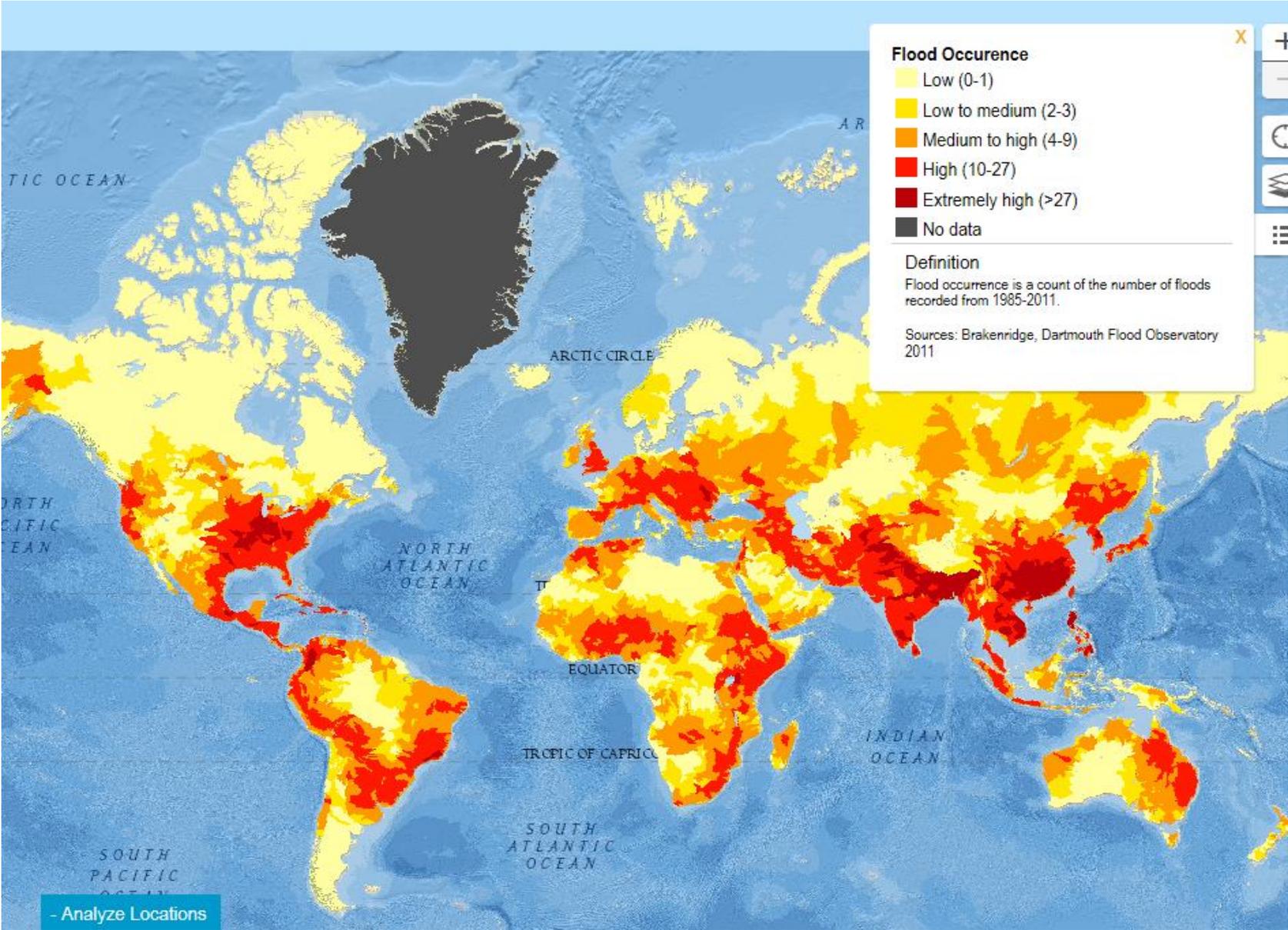
### Netherlands Perspective

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- WaterPartner Foundation

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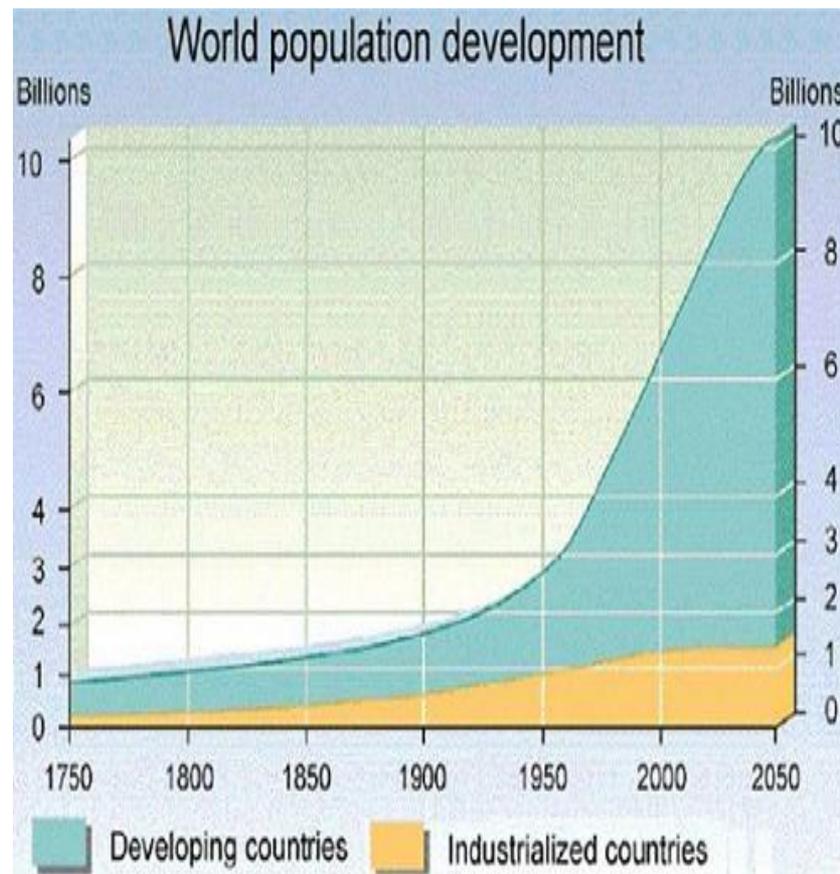
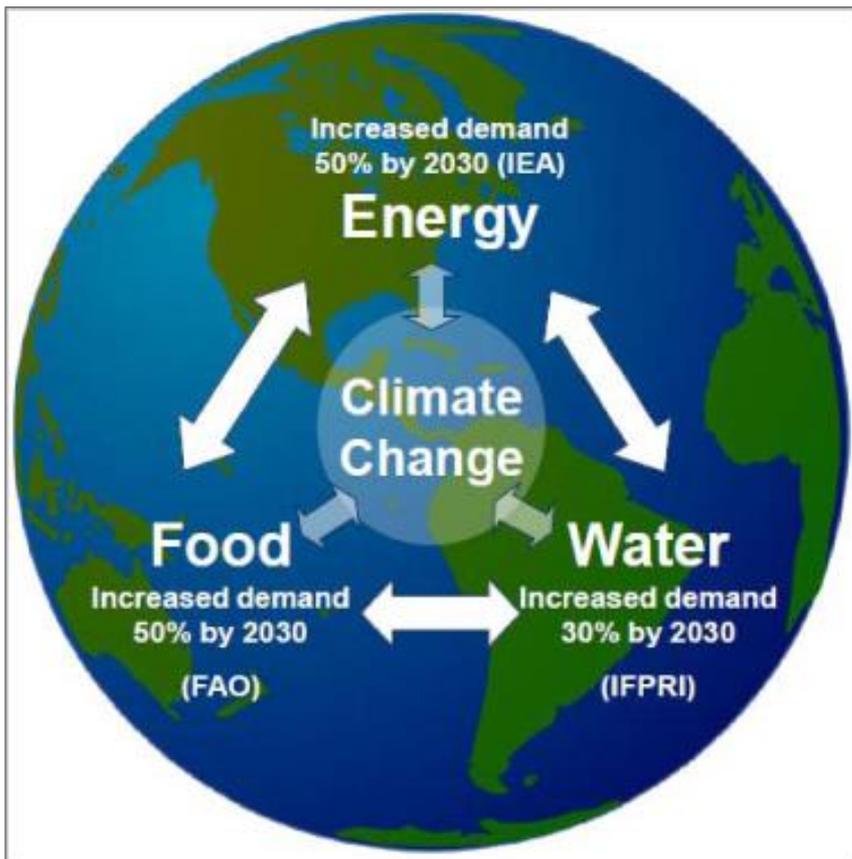
# GOOD REASONS TO TALK FLOODS ON WWD



# **WATER AFFECTS MANY PEOPLE'S LIFE**

- **90% of all global disasters are water related**
- **1.2 billion people live in areas with shortage of water, possibly rising to 3.5 billion by 2050**
- **1.6 billion persons suffer economic loss due to water shortage**
- **WEF mentions the water crisis (2015 and 2016) as one of the three largest risk for the world and failure to adapt to climate change as the second.**
- **In 2050 15% of the world population will live in flood prone areas (an increase of 1/3, most in low and middle income countries).**

# INCREASE OF DEMAND AND FLOODING ; PEOPLE MOVE TO MORE RISKY AREAS



# COSTS OF DISASTERS AFFECT GDP

The cost of natural disasters can reach 15% of GDP



*Flood in Germany 2013 - Deggendorf*  
World Water Assessment Program, 2009

Image UN



# MAJOR FLOODS, SOME 250,000 CASUALTIES

- **838** Friesland **2,437** victims.
- **1170** *Allerheiligenflood: the Zuiderzee was created*
- **1212** Noord-Holland **60,000** victims.
- **1219** St. Marcellus' Flood, **36,000** people.
- **1287** St. Lucia's flood appr. **50,000-80,000** people lost their lives
- **1362** Grote Mandrenke killing at **least 25,000** inhabitants.
- **1421** 2nd St. Elisabeth's Flood between **2,000** and **10,000** casualties
- **1570** All Saints' flood **above 20,000** victims
- **1703** great storm at sea killing **thousands** of victims.
- **1717** Christmas flood: approximately **14,000** people drowned
- **1825** Groningen **800** people lost their lives
- **1836** Two floods in Haarlemmermeer threatening Leiden and Amsterdam
- **1916** *Flood disaster in Zuiderzee area*
- **1953** (*Zeeland, Brabant*) **1,835** victims

# For the Dutch: FLOOD RISK MITIGATION IS A MATTER OF LIFE: 1953



**In 1953 floods  
1853 casualties and billions of damage**



# Netherlands: living with water...IWM is must



# The Netherlands without dikes



**29 % below sealevel**  
**26 % flood plains**

**55 % flood risk area**

**Billions of euro investment**  
**in houses, buildings**  
**and infrastructure**

**Without maintained dikes**  
**- 10 of 17 million people and**  
**- 70% of our economy**  
**is affected**

# AIRPORT SCHIPHOL : 3.5 m. below sea level



# Agricultural and Infrastructure 5m. -SL

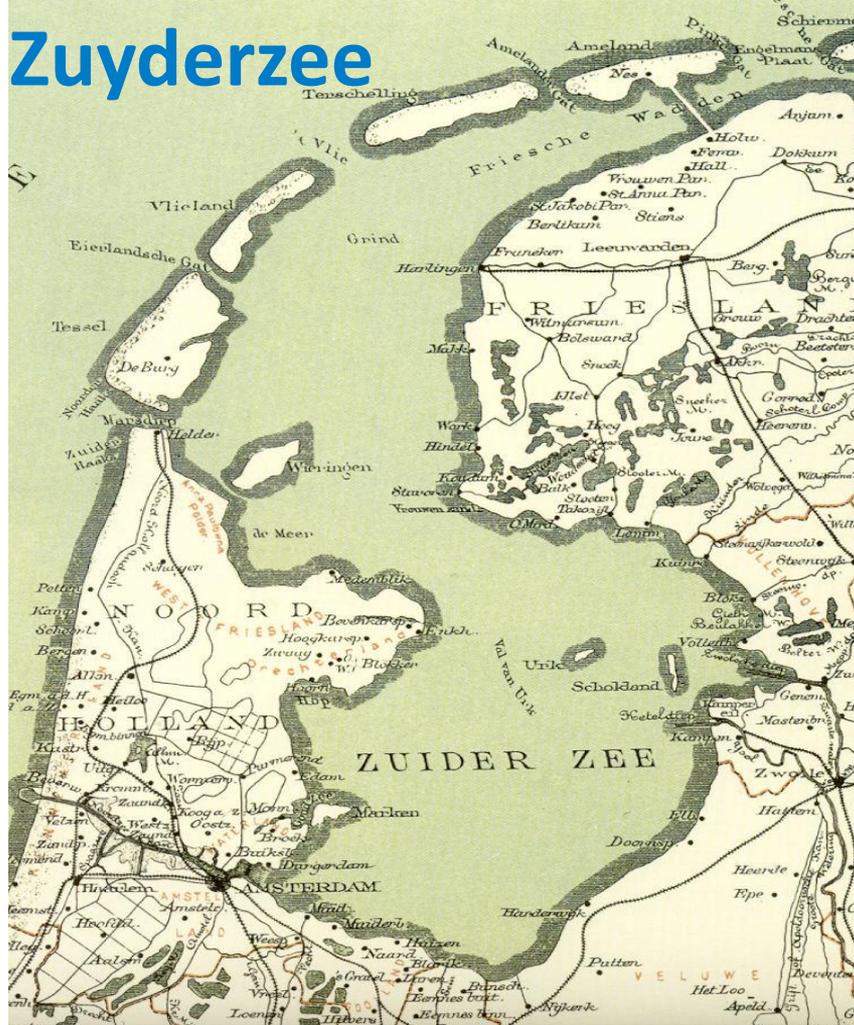


**no cultural heritage deserves protection:  
historic city of Delft**



# HISTORICALLY TWO VULNARABLE AREA'S :

Zuyderzee



- Open connection with North Sea, many dike breaches/casualties/damage
- Poor water quality &
- Food shortage during WW1

# ANSWER: THE ZUYDER ZEE PLAN

Enclosure dam (1927 – 1932)



# SW of THE NETHERLANDS in Feb. 1953; Dike breaches and floods

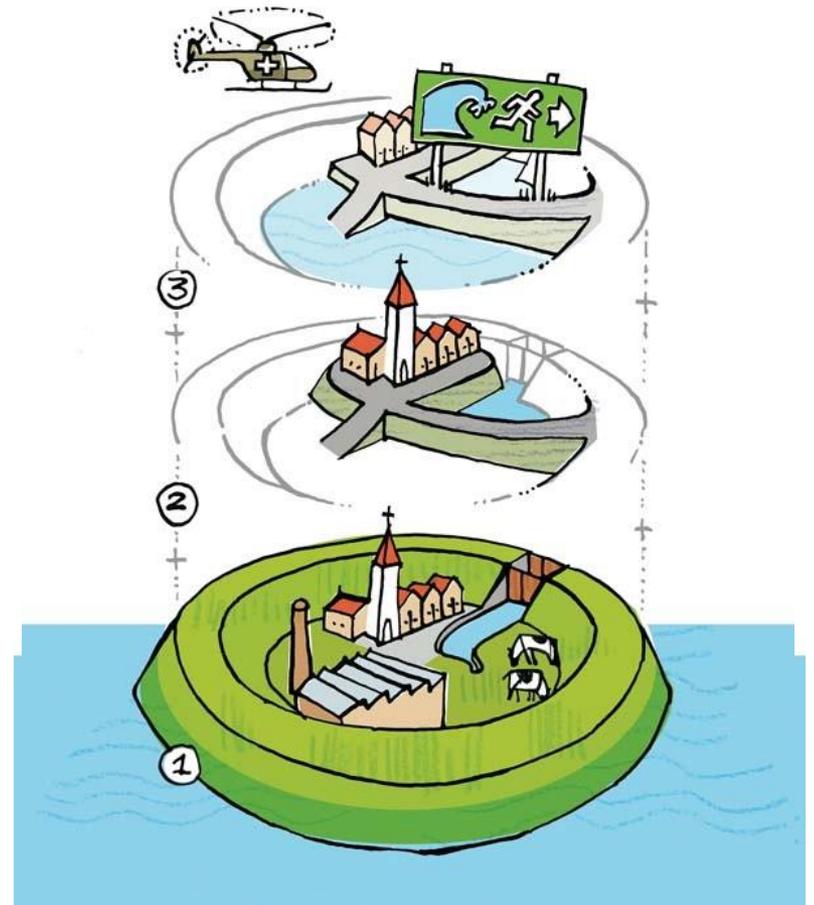


# ANSWER: THE DELTAPLAN



# TODAY: MULTI – LAYER APPROACH in NL

- Crisis management (3)  
*Reducing the consequences of a flood*
- Sustainable spatial planning (2)  
*Limiting the effects of flooding*
- Prevention (1)  
*Limit the risk of a flood disaster  
(dikes, dunes and barriers)*



# CONTINUOUSLY RISK SPOTS ARE IDENTIFIED



**INFRASTRUCTURE IS TO BE MAINTAINED !**

- *7 weak spots along the coast*
- *73 along the rivers*

**With the changing climate: increasing the heights of dike system is necessary**



**Design discharge now  $\Rightarrow 15,000 \text{ m}^3/\text{s}$**

**Design discharge 2050  $\Rightarrow 18,000 \text{ m}^3/\text{s}$**

# **CLIMATE CHANGE NOT ONLY CHALLENGE**

- **population growth,**

- **urbanization ,**

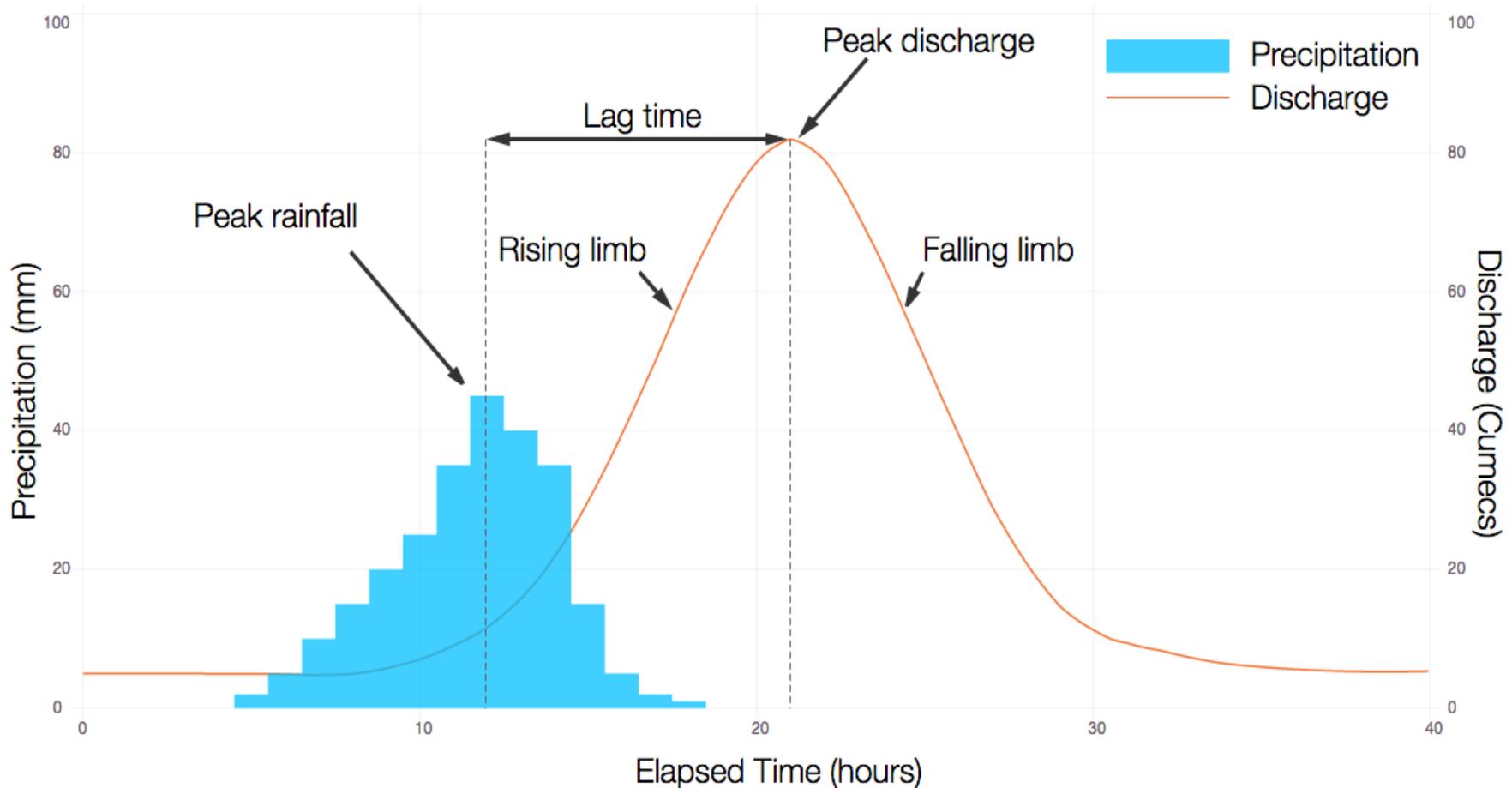
- **deforestation,**

- **increased drainage in upstream**

**catchments also cause higher run off**

**peaks**

# PEAK FLOWS RHINE / MEUSE INCREASE



# ANSWER: ROOM FOR THE RIVER MEASURES



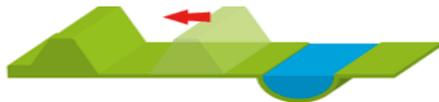
Lowering the flood plain



Water retention



Lowering perpendicular groynes and building attracting groynes



Depoldering



Deepening the summer bed



Dyke relocation



High water channel

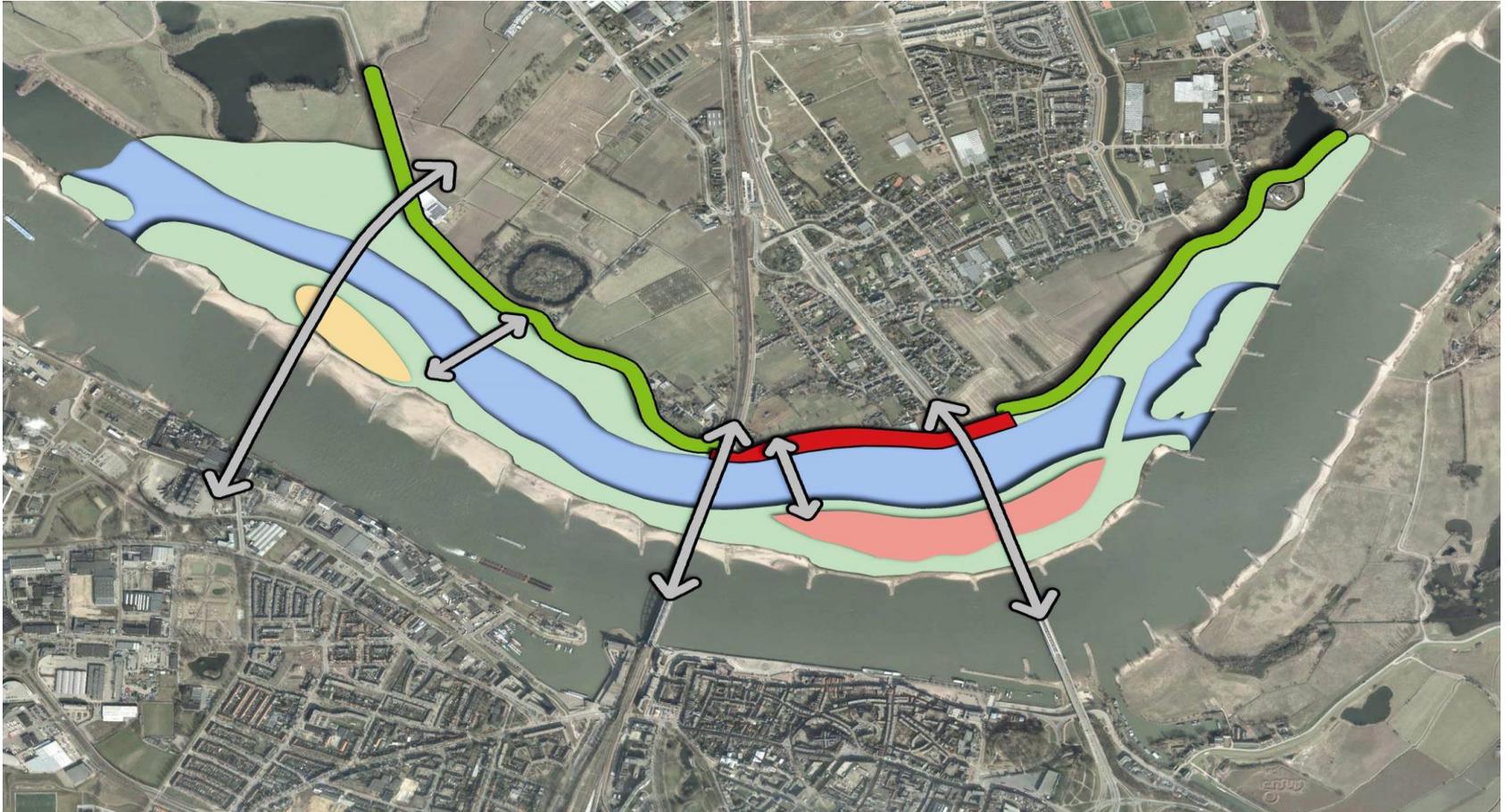


Removing obstacles

# ROOM FOR THE WAAL RIVER, NIJMEGEN



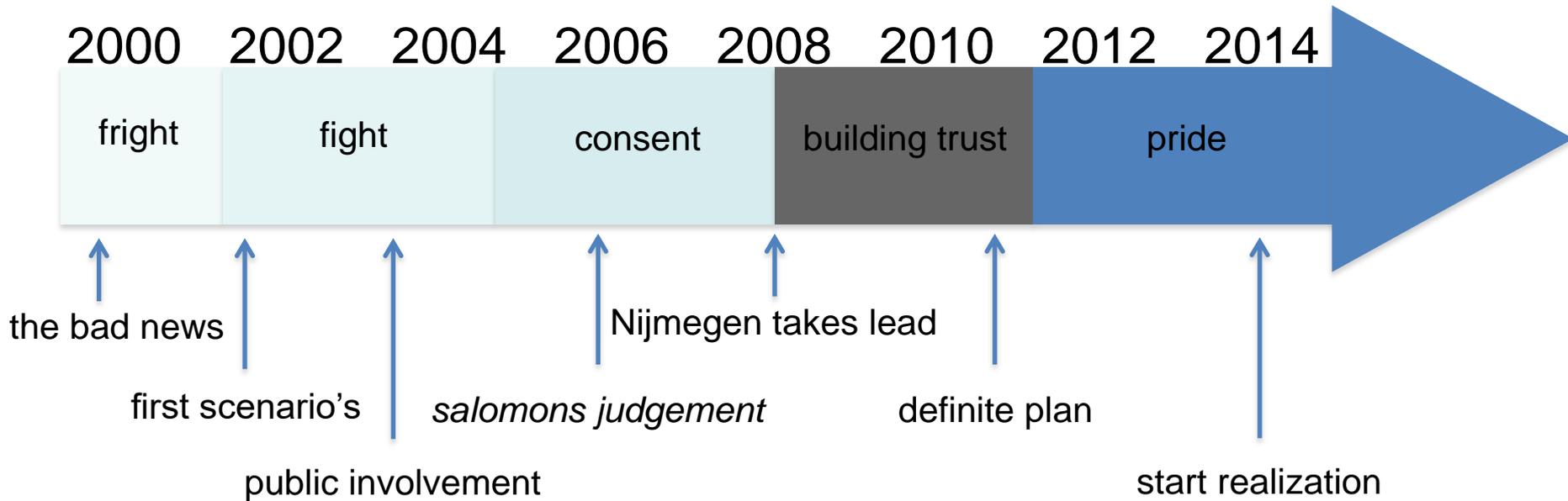
# THE PLAN



# INVOLVE STAKEHOLDERS



# Stages



# ROOM FOR THE WAAL RIVER, NIJMEGEN



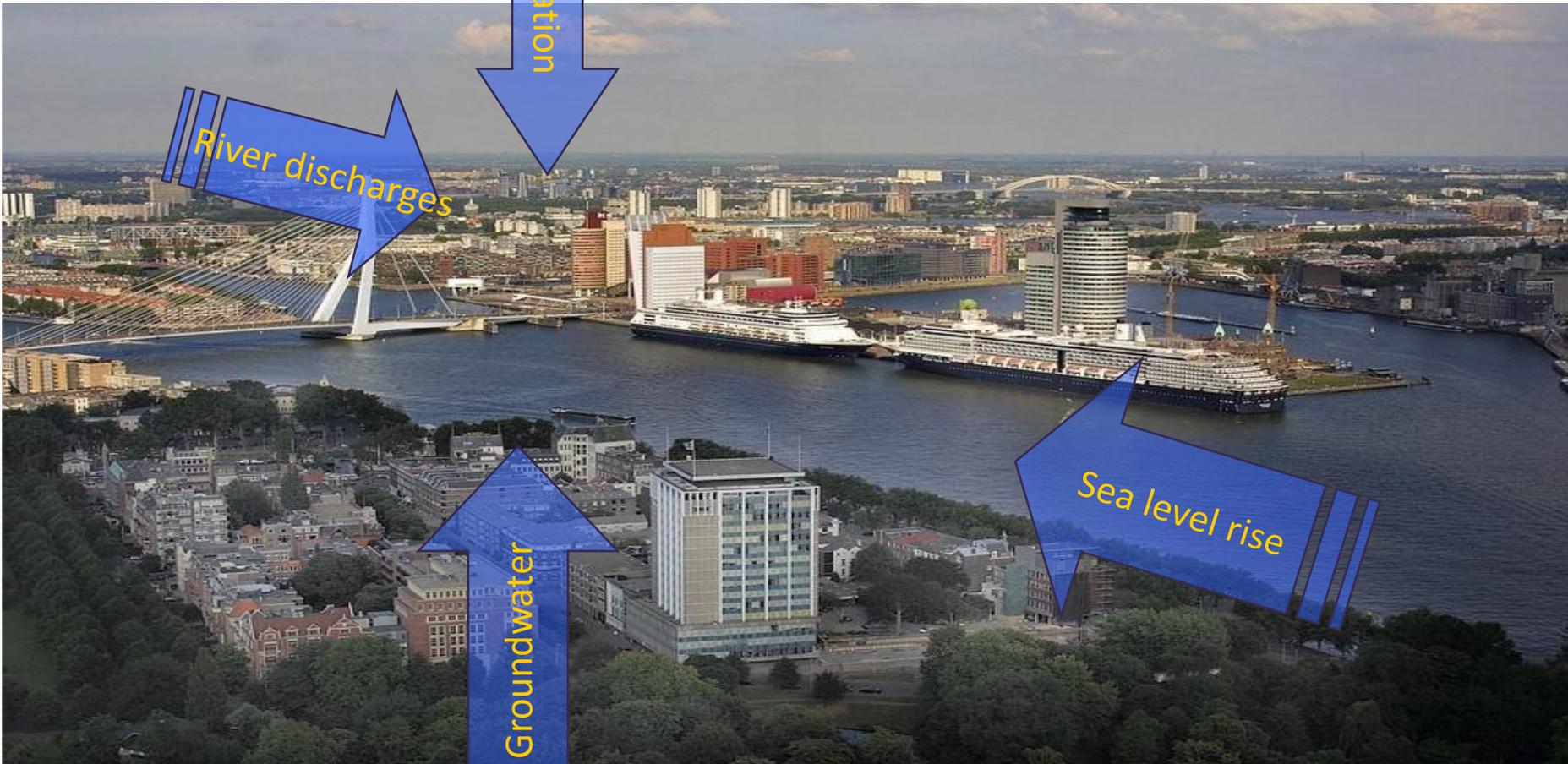
New situation

# ROTTERDAM'S ANSWER TO FLOODS



**FLOODING**

**THREAD FROM FOUR SIDES**



precipitation

River discharges

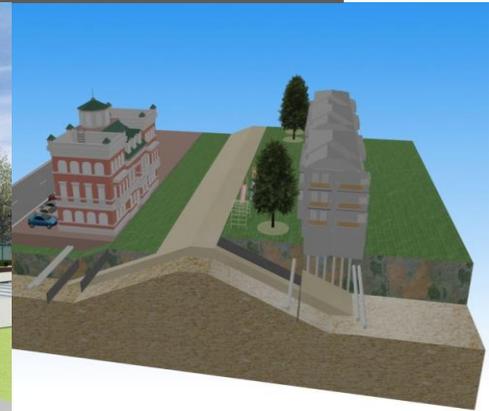
Groundwater

Sea level rise

# INUNDATIONS ARE CATERED FOR BY ALLOWING TEMPORALLY FLOODING

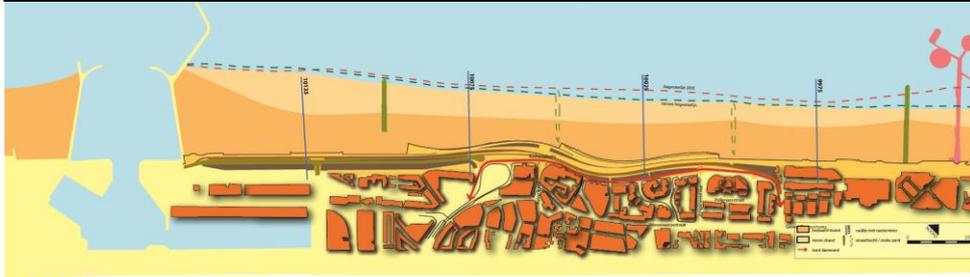


# Rotterdam Flood Protection: multifunctional urban dikes



# **CLIMATE CHANGE ALSO AFFECTS THE SAFETY COASTAL DESIGN CRITERIA**

- **SEA LEVELS WILL INCREASE WITH GLOBAL RISE**
- **STORMS BECOMES MORE INTENSIVE**
- **THIS AFFECTS WAVE HEIGHT AND DUNE FORMING.  
ADDITIONAL SAND IS REQUIRED TO PREVENT  
EROSION**
- **ALSO NATURAL FORCES ARE USED:  
*“ BUILDING WITH NATURE ”***



# Dutch coastal resort Scheveningen

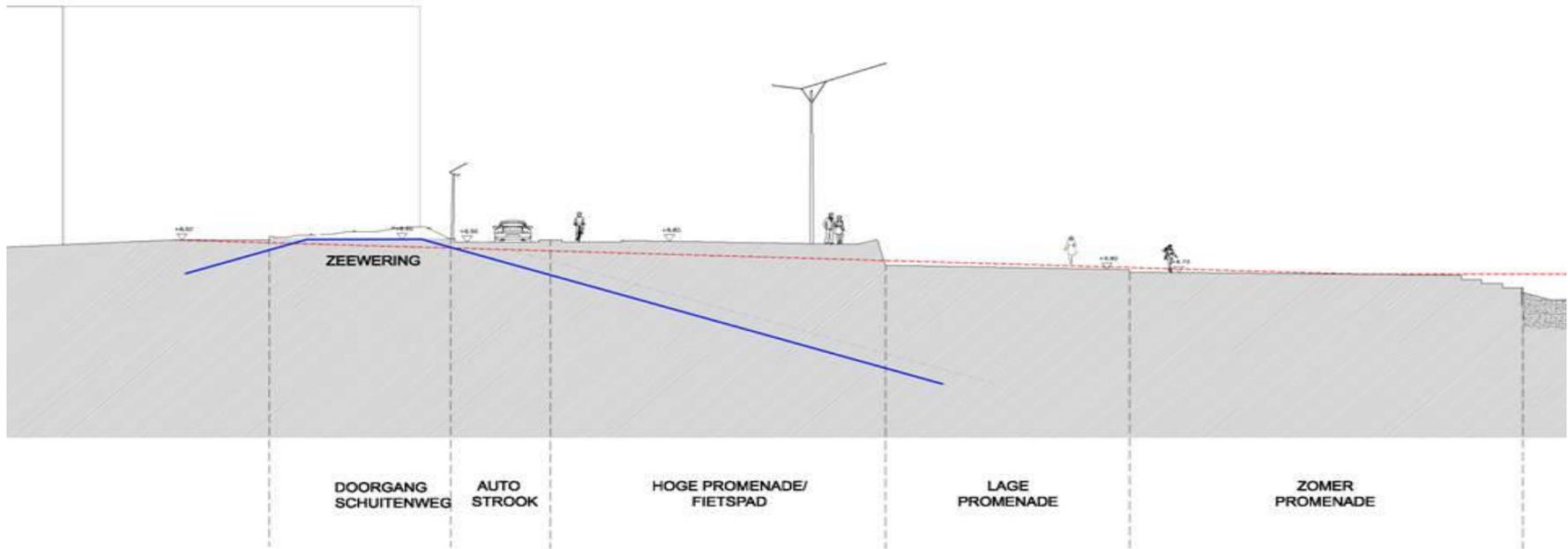
- *Reinforcement and Boulevard Development*

Within the existing infrastructure

Complicated process

Many stake holders

# SAFE FOR INCREASED WAVES, NATURAL APPEARANCE MAINTAINED



# EXTRA SAND SUPPLETION NECESSARY



# KATWIJK. SAND SUPPLETION, HIGHER DUNES THAT HOLD A PARKING GARAGE



# ***“Sand motor”*: Building with nature**



# ***“MAAS KERING”* protecting Rotterdam**



# **NEW HARBOUR OF ROTTERDAM: SAFER, LARGER, BETTER ACCESS**



# Building with nature: extra dunes at Petten



# **CLOSURE DAM, SOON TO BE HIGHER PLUS ENERGY, RECREATION & NATURE**



# **INSTITUTIONAL ELEMENTS OF DUTCH IWM**

## ***Governance of water management :***

- anchored in the law,**
- far reaching powers to the *Dutch Delta Commissioner* (e.g. closure of Rotterdam port during emergencies)**
- investments in infrastructure (dikes, dams) including maintenance in the public budget, (currently 1.56% of our GDP on an annual basis)**
- Close links with research institutes: innovative solutions applied like " Building with Nature".**

# Dutch Delta Technology available for other countries (trade and aid)

- ◆ Flood protection
- ◆ Integrated River Basin Management
- ◆ Integrated Coastal Zone Management
- ◆ Port / harbour development
- ◆ Urban water management + WASH
- ◆ Risk management
- ◆ Monitoring & ICT
- ◆ Institutional set up



# United Kingdom 2013



Bangkok, 2011 Thailand 2011



**Bangladesh**  
**(1953-2003**  
**450,000**  
**casualties)**



# Philippines 2013



# Indonesia

*Great Garuda*

The Netherlands supports Indonesia in IWRM and Urban Water Management , a combination of risk management and development.

Image: Consortium NCICD | Design: KuiperCompagnons

# US: NEW ORLEANS AND NEW YORK



# Structural Cooperation with 7 Delta Countries



**BANGLADESH INTEGRATED DELTA PLANNING**

**Name:** Bangladesh Delta  
**Population:** 166 million  
**Urban or rural:** Rural, with several rapidly urbanising cities  
**Above or below sea level:** Just above  
**Total investment:** EUR 7.6 billion

Bangladesh, encompassing the Ganges-Brahmaputra-Meghna river systems, can in many respects be considered one of the most dynamic deltas in the world. Huge amounts of water and sediment often exceed the carrying capacity of Bangladesh' rivers. Cyclones and coastal floods, intensified by climate change effects, add a range of socio-economic trends, plus additional challenges. The Bangladesh Delta Plan 2000 (BDP2000) attempts to address these issues by developing a long term, holistic delta vision and adaptive strategy.

Almost socio-economic population and a growing demand for food. The already high pressure on available land adds to the complexity of water replet processes

The Bangladesh Delta Plan aims to deliver an umbrella development vision, strategy and implementation plan that can act as a frame of reference for new government policy, thereby supporting the integration of existing sectoral development plans. At the same time it aims to provide anchorage for numerous on-going projects and to promote measures to deal with changes in the short term.

A range of stakeholders is involved in an interactive manner, ensuring the necessary institutional support for the development and implementation of the programme. BDP2000 links with the Five Year investment plans, which are coordinated by the government of Bangladesh. Importantly, the Bangladesh Delta Plan will build on insights from the Dutch Delta Programme and the Mekong Delta Programme.

[www.bangladeshdelta.org](http://www.bangladeshdelta.org)

- INTEGRATED APPROACH
- COOPERATION WITH OTHER GOVERNMENT LEVELS AND STAKEHOLDERS
- STRONG AND IMPLEMENTATION
- SUPPORTED ANALYSIS



**COLOMBIA BALANCING INTERESTS AROUND THE CAUCA RIVER**

**Name:** Upper valley of the Cauca River  
**Population:** 4.6 million  
**Urban or rural:** Rural and urban  
**Above or below sea level:** -1,000 to +1,800 m  
**Total investment:** Approx. EUR 2.6 billion

The Regional Autonomous Corporation of the Cauca Valley (CVC) plays a central role in this initiative. With support from a Dutch consortium, CVC experts analyse present water safety levels and assess the effects of potential measures. They draw up a master plan using the experience from the Dutch Room for the River Programme. This includes an active participation of stakeholders and an integrated approach.

Dutch experience has shown that stakeholders need to be involved in an active and timely manner. It is important to provide the right level of detail during the development process, moving from general concepts to concrete actions. Ultimately, the individual landowners and local councils are responsible for the implementation of structural or physical measures. The CVC can assist in the implementation of non-structural measures such as subsidy programmes, training programmes, economic and enforcement. The project also includes searching for funding from external sources, such as the World Bank or the Inter-American Development Bank.

In the Cauca Valley has caused major socio-economic damage. As the valley is an important agricultural region, represents the heart of Colombia's sugarcane industry. Flooding also affects Colombia's national economy. The challenge is to draw up a master plan from the river and tackle the problem of insufficient drainage while paying sufficient attention to river ecology recovery. This requires balancing the interests of a large number of stakeholders.

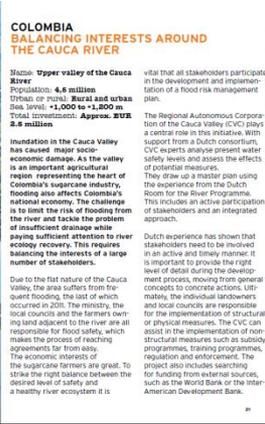
Due to the flat nature of the Cauca Valley, the area suffers from frequent flooding, the last of which occurred in 2011. The ministry, the local councils and the farmer's own land adjacent to the river are all responsible for flood safety, which makes the realisation of agreements far from easy. The sugarcane farmers are glad to strike the right balance between the desire of level of safety and a healthy river ecosystem is it

view that all stakeholders participate in the development and implementation of a flood risk management plan.

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**INDONESIA TURNING THREATS INTO BENEFITS**

**Name:** Greater Jakarta metropolitan area  
**Population:** 4 million  
**Urban or rural:** Urban  
**Above or below sea level:** -5 m to +1 m

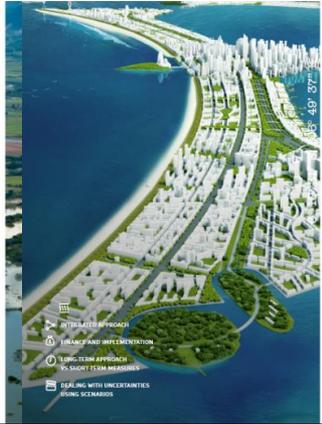
Indonesia is booming and its capital Jakarta is growing right along with it. The greater Jakarta metropolitan area is urbanising rapidly. While immigrants from other parts of Indonesia are spreading the city and squatting uncontrollably, office buildings, shopping centres and housing for poorer and middle-income households are being developed in a well-organised fashion. Jakarta's urbanisation is putting the infrastructure under enormous pressure and causing environmental problems such as pollution. Meanwhile, Jakarta is sinking into the sea due to subsidence and a rising sea level.

The overexpansion of groundwater resources is causing Jakarta to sink slowly below sea level at an alarming rate of 7.5 centimetres a year. As a result, the structures must constantly be protected against flooding from the sea and the rivers that run through it of the so-called Great Jakarta. This calls for a radical change in the way the National Capital Integrated Coastal Development (NCKICD) programme is designed to turn the tide and protect Jakarta from floods while maintaining its coastline, improving the water quality of channels and rivers and providing new socio-economic opportunities in the coastal area. The integrated approach draws on experience the Dutch have gained in river creation and water management. An important first step is to slow down the subsidence process which is causing ever greater problems with water drainage, demanding increasingly higher dikes of up to 7 metres. The water sanitation programme must be accelerated as large water retention reservoirs will have to be constructed to store the urban drainage water. Given the current water quality, these reservoirs are bound to change into open-septic tanks. The existing coastal protection structures and river embankments will also need to be reinforced to limit the expected overtopping in one or two locations.

The current strategy of onshore sea defences will only last 10 to 15 years. After this period, an offshore protection and water storage system is required. Revenues from land reclamation and other roads can largely finance this flood protection system. The land reclamation is fully integrated with the Outer Sea Wall and the National Capital Integrated Coastal Development (NCKICD) programme is designed to turn the tide and protect Jakarta from floods while maintaining its coastline, improving the water quality of channels and rivers and providing new socio-economic opportunities in the coastal area. The integrated approach draws on experience the Dutch have gained in river creation and water management. An important first step is to slow down the subsidence process which is causing ever greater problems with water drainage, demanding increasingly higher dikes of up to 7 metres. The water sanitation programme must be accelerated as large water retention reservoirs will have to be constructed to store the urban drainage water. Given the current water quality, these reservoirs are bound to change into open-septic tanks. The existing coastal protection structures and river embankments will also need to be reinforced to limit the expected overtopping in one or two locations.

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**INDONESIA TURNING THREATS INTO BENEFITS**

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**Urban or rural:** Urban  
**Above or below sea level:** -5 m to +1 m

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## Bangladesh

## Colombia

## Indonesia



**EGYPT NILE DELTA NEEDS A SHORELINE MASTER PLAN**

**Name:** Nile Delta  
**Population:** 100 million  
**Urban or rural:** Urban and rural  
**Above or below sea level:** Just above  
**Total investment:** EUR 4.4 billion

The Nile delta is heavily populated, with up to 400 inhabitants per square kilometre. The Nile delta coastal zone encompasses more than 40% of Egypt's industries and hosts vital centres for tourism, agriculture and fish farms. By the year 2075, a coastal area of about 500 km<sup>2</sup> will be vulnerable to flooding. The sandy barrier separating the inland lands from the sea, is very narrow and low lying, presently subject to strong erosion.

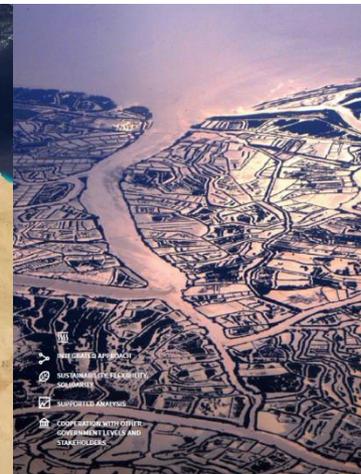
Next to the tremendous natural challenges there are also a number of institutional and legal challenges. The institutional framework for addressing responsibilities in Egypt is complex and sometimes unclear. Cooperation among agencies is limited. The ICM strategy must incorporate all required legislative and institutional changes that would facilitate the adoption, buy-in, and seamless development and implementation. The project, with a total budget of EUR 2.4 million, will be funded by European and should start in the end of 2014 and be finished within 30 months, and will be led by the year 2016.

A UNCP report on climate change impacts estimates that hundreds of billions of Egyptian pounds, about 2 to 4% of future gross domestic product, could be lost from effects of climate change on water resources, agriculture, coastal resources and tourism. Thousands could die from air pollution and heat stress. Millions could lose jobs in agriculture as the result of climate change. In a middle scenario of sea level rise, about 40 km<sup>2</sup> of agricultural land will be lost by the year 2060.

The Egyptian-Dutch High Level Water Panel, established 38 years ago, addresses these very urgent coastal zone challenges. Dialogues, knowledge exchange sessions and preparatory studies led to a public procurement for the development of an integrated Coastal Zone Management strategy (ICZM) and a shoreline management plan for the Egyptian Mediterranean Coast from the Libyan border to the Gaza border. It should recognise, incorporate and address the concerns of all stakeholders through a well-defined and structured participatory approach.

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**VIETNAM MEKONG DELTA PLAN: LONG-TERM VISION AND STRATEGY**

**Name:** Mekong Delta  
**Population:** 37 million  
**Exploited shrink to 18 or 20 million**  
**Urban or rural:** Rural  
**Urbanisation:** 88%  
**Above or below sea level:** Greater parts - 1.8 m

In the past decades, the Mekong Delta, with its rich land and water resources, successfully developed into the granary of the country and turned Vietnam into one of the leading rice exporters globally. On the other hand, the economic development of the delta lags behind other regions in the country. In its present state, the Mekong Delta is very vulnerable. Floods, droughts and salinity are dominant problems, hampering a prosperous and sustained economic development.

Inspired by the experiences in the Netherlands, the Government of Vietnam expressed the strong intentions for moving towards a Mekong Delta Plan for a safe, prosperous and both economically and environmentally sustainable development of the delta. It presents a vision to harness the comparative advantages of the delta and focus on agro-business industrialisation. Organisation of the agricultural producers enables a better position to reduce transaction costs, platforms for more sustainable land and water resources management, improvement of product quality and competitiveness.

Diversification over the provinces is necessary to adopt as much as possible to available land and water resources. Important examples are a saline coastal zone with room for aquaculture integrated with mangrove restoration and in the upper delta controlled flooding with water retention and fish farming in the flood season instead of a direct crop. Still, large-scale measures to quarantine flood protection and fresh water availability may be required when climate change causes persisting sea level rise and droughts.

The plan offers an assessment framework for government donors and international financial institutions for moving from planning to implementation. The plan enjoys broad support from the World Bank, the Asian Development Bank, the United Nations and countries such as Australia and Germany.

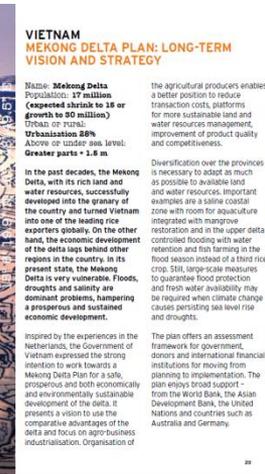
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**MYANMAR MAKING USE OF THE RESILIENCE OF THE DELTA**

**Name:** delta, Ayeyarwady  
**Delta Population:** 6.6 million  
**Above or below sea level:** -5 m to +1 m

The Ayeyarwady Delta in Myanmar is extremely fertile. The area, which is plagued by floods, salinity and erosion, can play an important role in the economic development of this Southeast Asian country. The first step is to assess the vulnerabilities, in particular the resilience of the delta.

At about three metres above sea level, the delta's sediment plays a dominant role in the large-scale coastal management of the river system, in which local stakeholders are involved, will lead to sustainable solutions in the long term. The most likely locations along the rivers and streams.

That is why the destruction caused by Cyclone Nargis in May 2008 was so catastrophic, causing nearly 140 thousand casualties and severe economic damage.

Myanmar has asked the Netherlands to take the lead in striving up an adaptive, integrated water management plan for both the delta and the rest of the country to cope with Myanmar's expected huge economic growth and increasing pressure on water resources as a result of this Delta Alliance. Partners Deltares and Alterra are conducting a Vulnerability and Resilience Assessment. Ayeyarwady Delta study, which is financed by the Global Water Partnership (GWP) and Bay of Bengal Large Marine Ecosystem (BOLME).

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- COOPERATION WITH OTHER GOVERNMENT LEVELS AND STAKEHOLDERS
- STRONG AND IMPLEMENTATION
- SUPPORTED ANALYSIS



**MYANMAR MAKING USE OF THE RESILIENCE OF THE DELTA**

**Name:** delta, Ayeyarwady  
**Delta Population:** 6.6 million  
**Above or below sea level:** -5 m to +1 m

The Ayeyarwady Delta in Myanmar is extremely fertile. The area, which is plagued by floods, salinity and erosion, can play an important role in the economic development of this Southeast Asian country. The first step is to assess the vulnerabilities, in particular the resilience of the delta.

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## Egypte

## Vietnam

## Myanmar (+ Mozambique)

## **IWRM LONG TERM CHARACTER**

- **No fast money earner, but saves huge amounts on the long run**
- **Inclusion of stakeholders and consultations with science institutes and consultants is time consuming but pays off**
- **Studying the forces of nature and building with nature increases sustainability and support**



THANK YOU