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Water-related risk reduction: tools to implement a preventive approach

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1. Why water-related risk reduction needs urgent action

Climate shifts and other global changes are already impacting water-related risks

The projected impacts of climate change clearly indicate the consequences for the occurrence of disasters: enhanced sea level rise and more pronounced hydro-meteorological extremes, with a higher frequency of intense storms, locally more intense rainfall, higher river discharge extremes, but also longer dry periods and droughts that can lead to deterioration of already scarce water resources.
In some regions, new kinds of disasters are occurring, such as droughts, in areas that have not experienced such kinds of impacts before.
Meanwhile, other global drivers contribute to the resulting potential risks and to the casualties and hazards that may occur in the case of extreme events. Population growth, asset deterioration, rapid urbanisation and subsidence from groundwater extraction may pose an additional risk to already vulnerable urbanised flood prone areas, as does the increased value of assets which are often concentrated in and around these same urban areas.

Water-related disasters have large impacts and these impacts are growing in scope and severity

Globally, water-related disasters already account for 90% of all natural disasters.[1] Their frequency and intensity is generally rising due to climate change, causing enormous damage to life and property. Climate change is a factor in these trends. Damages attributed to water-related disasters can mount up to 15% of annual GDP for certain countries.
Population growth, poverty, land shortages, urbanization, the poor condition of flood protection and drainage infrastructure, and water storage facilities, especially in developing countries, have increased the vulnerability of people to flood hazards and

[1] WWDR4, 2012. http://unesdoc.unesco.org/images/0021/002156/215644e.pdf

droughts, and, *inter alia,* have multiplied impacts on public health associated with water-borne epidemics.
Moreover, droughts, as slowly developing disasters, lead to the collapse of social structures and to refugees that may cause disruptions in social structures of adjacent regions.
Recent history has taught us that even the most developed countries are vulnerable to water-related hazards. Climate change is very likely to exacerbate this trend, both for floods and droughts, although in different parts of the world different trends in precipitation and temperatures are expected.

2. Pro-active strategies for water-related disaster risk reduction are advantageous

Prevention: a shift from reactive to proactive

Risk reduction, preparation and prevention are sensible investments that pay off in terms of reduced loss of life, avoided damage, and long-term economic growth and stability.
Disaster management as currently practiced is typically reactive, rather than proactive. Historically, water-related disasters have been thought of and treated as isolated, one-off events that triggered responses in their aftermath as reactive crisis management (relief and response). Hence, disaster risk reduction has often focused on improving primary, reactive responses, such as capacity building for civil defence on how to cope with major disasters such as tsunamis, or developing drought or flood contingency plans on how to coordinate emergency responses amongst a variety of actors. Compared to relief and response much less attention has been paid to prevention and mitigation.
Preventive action aims at developing measures to prevent disasters from happening or measures to increase the resilience (see Box 1) to cope with potentially disastrous events.

Box 1: Resilience, vulnerability and risk assessment

Resilience can be described as "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UNISDR, 2009).

Climate adaptation assumes that, under novel conditions, rather than recovery also transitions into new states are inherent elements of resilience.

Resilience concepts need to be further developed for critical infrastructures (supply of basic services like water, food, energy, transport, housing/ shelter, communications, finance, health), but also for the wider public to integrate and address human and social dynamics in crises and disaster situations.

Resilience concepts take into account the necessity to anticipate, to plan and to implement in the crises time a substitution process aiming to deal with a lack of material, technical or human resources or capacities necessary to assume the continuity of basic functions and services until recovery from negative effects and until return to the nominal position. Immediate civil organisational arrangements post-disaster are essential.

Moreover, as resilience management and vulnerability reduction are closely related, it is necessary to link the on-going efforts and share risk assessment and mapping approaches, e.g. physical exposure mapping with relevant resilience management approaches, to ensure that risk assessment is followed by the development of resilience concepts in the various security sectors, based on the results of the risk assessments.

More and more, the concept of resilience management is being put into practice. A practical example of how this has been done to address flood issues through integrating "green infrastructure" in management plans is shown in Box 2.

Box 2: Green infrastructure for Disaster Risk Reduction in the Mekong Delta, Vietnam: merging traditional and innovative solutions

Floods play an important role in the life of people living in the Mekong Delta. Each year floodwaters inundate 1.9 million ha and affect the lives of more than 2 million people. Normally, these floods are essential to food security and biodiversity and people have a tradition in living with the floods. However, extreme flood events can be destructive and cause enormous damages.

Sea level rise is expected to result in large areas of more frequently and even permanently inundated coastal plains. Furthermore, sea level rise will increase salinity levels in the Delta rivers and its water network. Agricultural production will be affected through more frequent and longer periods of flooding as well as because of salinity intrusion. The population size is projected to almost double by the year 2050 from 17 million up to around 30 million. This will fuel the urbanization trend, taking more land out of agricultural production. At the same time more people need to be provided with food and fresh water. Ongoing industrialization will also take up more space and increase the demand for water as well as the production of wastewater. Both trends will increase the need for proper spatial planning, efficient water supply, investments in water treatment and stringent enforcement of environmental legislation.

The current water management system is based on the 1994 Mekong Delta Master Plan. An update is presently under discussion in order to include environmental and socio-economic developments as well as recent innovations and modern approaches, such as green water defenses. This concept can be very useful in combination with the traditional measures for flood control. In fact, several good practices of the concept can be found in Government decisions and design guidelines for infrastructure and land use.

Source: Worldbank, 2012. Growth in Concert with Nature – Green water defence for flood risk management in East Asia.

This approach pays: risk prevention is usually a sensible investment. For example, some studies show that in certain situations every euro/dollar spent on preventive measures

can pay back up to ten-fold in avoided damage and loss of life. As the incidence and severity of extreme events are expected to continue to increase, investment in prevention is becoming increasingly advantageous. These observations are not new. In 2005, the Hyogo Framework for Action articulated the need for a more risk based and preventive approach, though little progress has been observed in this area in response to this agreement. This has to be considered against an underlying problem of deterioration of existing assets and asset systems due to long-term under-investment around the world.

A risk-based perspective as the basis to prioritize actions

More data and better tools for risk assessment are ready for use now and need to be more widely deployed to identify and prioritize actions. However, information to manage and predict water-related disasters needs improvement. Data on the impacts of water-related disasters (floods and droughts) is increasingly available but varies considerably in quality and quantity.

Another limitation is our understanding of how to account for secondary (or indirect) economic consequences, such as long-term disruptions to economic chains, economic damage through infrastructure impact, and environmental damage from increasing competition between increasing water resources demands from human communities and activities and ecosystems. Greater consistency in the reporting and documenting of water-related disasters, as well as a better understanding of impacts based on common criteria, are crucial to establish baselines, set priorities, track trends and assess the effectiveness (costs and benefits) of any proposed response.

Seizing opportunities instead of averting risks

Disaster Risk Reduction, Water Resources Management and Climate Adaptation should no longer be treated as separate topics. Risk prevention should be integrated with long-term planning. This allows communities and decision makers to identify and exploit opportunities for synergies with planned investments, including plans for adaptation to climate change.

There are many opportunities for reducing water-related disaster vulnerabilities in the face of global change. Whilst aging infrastructure and building stock in the developed world pose a risk due to increasing vulnerability, this also provides an opportunity to introduce new technologies in the redevelopment process and to adapt infrastructure and buildings to enhance disaster resilience. Urban restoration, regeneration and modernization can be a key driver of economic development, both as a result of the initial investments required and the benefits that will accrue over time (e.g. formerly flood-prone areas may become available for productive use). In addition, in many new economies and developing countries, their growing economy also provides an opportunity to use the lessons from the developed world to avoid some of the past mistakes (leap frogging).

3. From vision to action: an example of an integrated, risk-based and preventive programme water-related disaster reduction

In this section, the Dutch Delta Program is described in more detail as an example of the aforementioned pro-active strategies for water-related disaster risk reduction. It describes the recently developed Netherlands' risk reduction philosophy, aimed at protecting a densely populated delta at a lasting high safety level throughout this century while addressing the impacts of climate change and socioeconomic developments.
In 2010 the Delta Programme was set up, headed by the so-called Delta Commissioner. The main objective of the Delta Programme is to create a safe and attractive Netherlands, now and in the future, by providing adequate flood risk management and fresh water supply. The Delta Programme is a national programme, in which national, regional and local authorities prepare key decisions, develop strategies and implement measures, in close cooperation with the public, stakeholders and knowledge institutions. Since 2013, a Delta Fund of about € 1 billion per year will provide stability in financial resources to implement the decisions of the Delta Programme. Since 2012 the Delta Act has formed the legal basis for the implementation of the programme, the Delta Commissioner and the Delta Fund.

In 2014, after 4 years of analyses and strategy development, the key decisions have been presented to Parliament:

- ✓ national policy frameworks on flood risk management (See box 3), on fresh water supply, and on water-proof and climate-proof reconstruction and new developments of the urban environment, and
- ✓ two overall strategies for areas where flood risk and fresh water supply interact (the transitional areas between the rivers and the North Sea.

Box 3: The basic principles of the current Dutch flood risk policy

1. a minimum safety level for each citizen in the Netherlands (a probability to die due to a flood of at most 1/100,000 per year),
2. the introduction of a new set of safety standards for the Dutch flood defences based on a societal cost-benefit analysis,
3. counteracting social disruption in case of flooding, and
4. protecting vital and vulnerable infrastructure.

These key decisions form a framework for regional strategies regarding 6 specific hydraulic regions in the Netherlands.

The key decisions and regional strategies have been developed with a long-term perspective, i.e. a time horizon up to 2100. This long-term perspective stimulates the combination of investment agendas of different policy fields or authorities. In addition, it

helps to anticipate on climate change gradually by making future-proof decisions on nearby capital investments in infrastructure, flood defences and the built environment. On the other hand, this long term perspective introduces uncertainty about the future conditions for which these measures have to be designed[2]. This uncertainty has been tackled by using four so-called Delta Scenarios that present the "corner flags of the playing field of plausible futures" [3]. Each scenario describes a plausible future in which climate change (rapid or moderate) and socioeconomic development (growth or decline) are combined. The climate change parameters are based on a study of the Dutch Meteorological Institute[4]. The socioeconomic parameters describe the future size and spatial distribution of population and land use, and constitute basic data for flood risk potential and fresh water demand.

Box 4: An overview of the key features of the Dutch Delta Programme

- The Delta Programme is based on success factors such as being led by an independent coordinator (the Delta Commissioner), having a long-term financial commitment of € 1 billion/year, and having a firm legal basis.
- Many stakeholders are involved in a joint decision making process to make sure that the decisions are socially broadly based.
- A risk-based perspective is taken as a basic principle.
- A flexible approach is adopted in the possible strategies by valuing flexibility with regard to the timing of implementation.
- Various investment agendas are linked and opportunities to mainstream actions with planned investments are used.

2 Alphen, J. van, 2014. The Delta Programme and updated flood risk management policies in the Netherlands. Proceedings of the 6th International Conference on Flood Management, Brazil, 2014.

3 Bruggeman, W. and E. Dammers, 2013. Deltascenarios for 2015 en 2100, 65 pp.

4 KNMI, 2014. KNMI'14 climate scenarios for the Netherlands. Report KNMI, De Bilt, 34 pp (text in Dutch)