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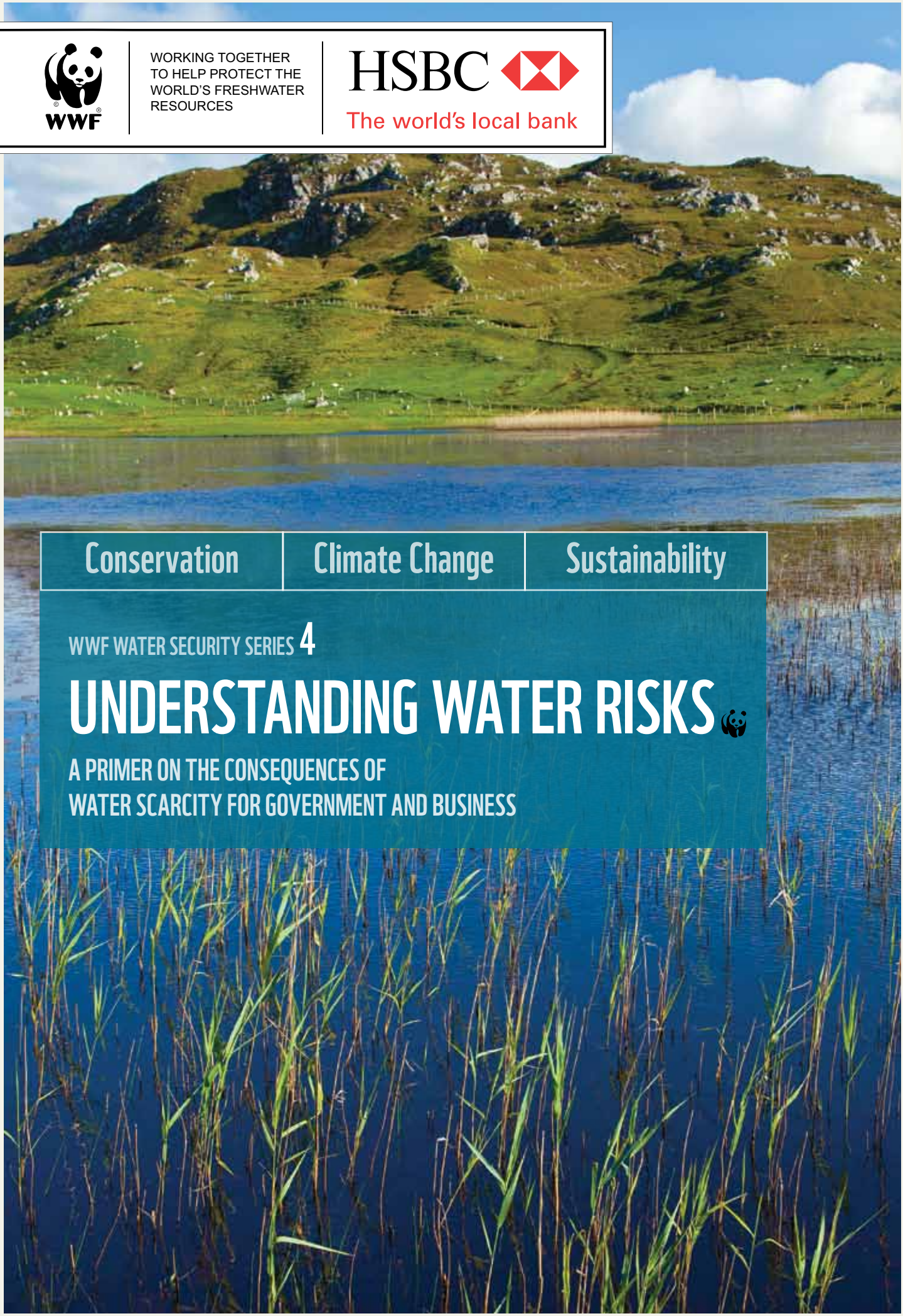

Conservation | Climate Change | Sustainability

WWF WATER SECURITY SERIES 4

UNDERSTANDING WATER RISKS

A PRIMER ON THE CONSEQUENCES OF WATER SCARCITY FOR GOVERNMENT AND BUSINESS

WWF's Water Security Series sets out key concepts in water management in the context of the need for environmental sustainability. The series builds on lessons from WWF's work around the globe, and on state-of-the-art thinking from external experts. Each primer in the Water Security Series will address specific aspects of water management, with an initial focus on the inter-related issues of water scarcity, climate change, infrastructure and risk.

Understanding Water Security

As an international network, WWF addresses global threats to people and nature such as climate change, the peril to endangered species and habitats, and the unsustainable consumption of the world's natural resources. We do this by influencing how governments, businesses and people think, learn and act in relation to the world around us, and by working with local communities to improve their livelihoods and the environment upon which we all depend.

Alongside climate change, the existing and projected scarcity of clean water is likely to be one of the key challenges facing the world in the 21st Century. This is not just WWF's view: many world leaders, including successive UN Secretaries General, have said as much in recent years. Influential voices in the global economy are increasingly talking about water-related risk as an emerging threat to businesses.

If we manage water badly, nature also suffers from a lack of water security. Indeed, the evidence is that freshwater biodiversity is already suffering acutely from over-abstraction of water, from pollution of rivers, lakes and groundwater and from poorly-planned water infrastructure. WWF's Living Planet Report shows that declines in freshwater biodiversity are probably the steepest amongst all habitat types.

As the global population grows and demand for food and energy increases, the pressure on freshwater ecosystems will intensify. To add to this, the main effects of climate change are likely to be felt through changes to the hydrological cycle.

WWF has been working for many years in many parts of the world to improve water management. Ensuring water security remains one of our key priorities.

Acknowledgements

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March 2009

Stuart Orr, Anton Cartwright & Dave Tickner

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Summary:

Water scarcity is one of the key challenges facing the world in the 21st century. The continuing availability of water underpins action on food security, energy security, poverty reduction, economic growth, conflict reduction, climate change adaptation and biodiversity loss. But increasing global exploitation of water resources across the world has led to significant degradation of ecosystems and the goods and services they provide. In many places, the result has been rivers that no longer reach the sea, lakes that are a fraction of their natural size and aquifers whose levels have fallen drastically.

As well as being an issue of concern to environmentalists and communities, over-exploitation of water has economic impacts on businesses and can adversely affect the ability of governments to meet a broad set of policy goals. The concept of risk can be used to describe the impacts and highlight potential responses.

Experience from WWF freshwater programmes around the world and from a long history of engagement with the private sector suggests the following key propositions about water scarcity risk:

1. Water scarcity risks can be classified in terms of insufficent water to meet basic needs and in terms of the consequences which arise from this situation such as political and business instability or lost economic opportunities. There are also risks that arise from poor policy responses to water scarcity.
2. Water scarcity normally arises due to a complex interaction of social, economic and environmental factors. It is seldom the product solely of a lack of precipitation. Similarly, responses to water scarcity require intervention by a range of stakeholders at the local, national and international scales if problems are to be resolved for the long-term.
3. Tackling water scarcity in such a way that reduces long-term risks to a range of stakeholders can have multiple pay-offs in relation to a range of government policy priorities on poverty reduction, economic growth, food security and trade, health and conflict reduction.
4. As businesses seek to secure long-term prosperity, to maintain competitive advantage and brand differentiation, and to secure stability and choice in supply chains, increasing water scarcity presents physical, financial, regulatory and reputational risks. The type of business will determine the level and exposure to risk and the appropriate response. Heavily water-dependent businesses with the best known brands will encounter the greatest reputational challenges. But many other businesses will face challenges and uncertainty due to the increasing scarcity of water.

Summary

5. Companies will come under greater pressure to reduce water use and increase efficiency. Where such actions are not be enough to guarantee a social license to operate – for example where a company's operations rely on a poorly managed water resource – the company may need to become involved in supporting better water policy for all users. Ultimately, if and when companies start to suffer from absolute water shortages, and may not be able to influence or bring about better water management, businesses may face closure or relocation due to environmental rather than purely financial constraints.

6. Risk from water scarcity is often shared between government and business. Likewise, there are common principles for effective management and mitigation of water scarcity risks that apply to both governments and businesses: a focus on long-term sustainability; prioritisation of water allocation for those least able to cope from scarcity; flexibility of response in the light of changing hydrological reality; and the need for better public policy, stronger institutions and broad stakeholder engagement.

7. Businesses and governments both rely on better water management to address water scarcity and its impacts. But out-of-date or poorly enforced public policy and weak water management institutions increase risk for everyone. Ultimately government is always responsible for putting better water management in place but businesses have a key role to play in helping to implement better management.

8. Healthy ecosystems underpin sustainable water use. But the combination of climate change and other human pressures threatens the continuing viability of many ecosystems and increase risk. Engineering solutions will always be important but management responses to water scarcity that focus on single uses of water often increase risk to a range of stakeholders. Poorly planned responses to the hydrological uncertainty arising from climate change scenarios could increase risks to ecosystems and the service they provide.

9. A key step in reducing water scarcity risks is to understand freshwater ecosystems better and to seek to optimise the range of goods and services these ecosystems provide to a broad range of stakeholders. Ultimately this means ensuring that the basic water needs of people and ecosystems are met first and foremost; and then ensuring that remaining water is allocated for economic use on a rational, equitable and transparent basis.

Introduction:

Water scarcity is likely to be one of the key challenges facing the world in the 21st century. In the next 40 years, global population is likely to increase by three billion people; there is likely to be a near doubling of water for irrigation to feed these extra mouths; more dams will be built to generate new hydropower as economies develop; competition from the water needs of bio-energy crops will intensify and pollution of water resources will continue. Freshwater biodiversity is also declining faster than that in other habitats. The implications are clear: meeting the needs of society and the environment in the future will be heavily constrained by the scarcity of freshwater.

The United Nations (2003) describes water scarcity as "The point at which the aggregate impact of all users impinges upon the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully." This seemingly physical phenomenon is in fact normally a product of the interaction between complex social, economic and environmental systems. In practice, water scarcity, is more often caused by the nature of demand and the inappropriate allocation of water, rather than by total availability of the natural resource. Addressing water scarcity risk therefore requires better water management, stronger water governance and smarter financial investment. Water scarcity is a "governance crisis, not a [water] resource crisis" (Rogers, 2004). Indeed, at a global scale there is probably enough water to provide for present and future generations providing water management improves. To date, the track record on managing water effectively – almost anywhere in the world – is poor. For most governments water management is not, in practice, a priority, and societies largely fail to value and govern their freshwater resources adequately. Thus, despite significant strides in legislation and water-efficiency technology in recent years, water scarcity continues to be an all too common occurrence.

Water scarcity has impacts on many stakeholders including governments and businesses. Often there is a surprising degree of overlap in thier interests with regard to reducing shared water scarcity risks. Consequently there is value in identifying common incentives that could motivate stakeholders to act collaboratively to reduce water scarcity risk. Leading private sector interests, national governments and other stakeholders are now using concepts and terminology derived from risk assessment to describe water scarcity and the range of responses to it.

Many WWF freshwater programmes around the world are focused on protecting basic ecosystem functioning through the maintenance of minimum environmental flows. These programmes are increasingly being implemented in partnership with governments, businesses and other stakeholders. This primer aims to set out an analysis of water scarcity using the concepts and terminology of risk with which these partners are familiar. Although risk to stakeholders can arise from poor water quality as well as scarcity, this primer's emphasis is on the risks associated with insufficent water as opposed to quality of water, although the link between the two is acknoweldged.

PART A:
What do we mean by water scarcity risk?

PART A:

What do we mean by water scarcity risk?

- Tackling water scarcity is one of the key challenges facing the world in the 21st century. It underpins the challenges of food security, energy security, poverty reduction, economic growth, conflict reduction, climate change adaptation and biodiversity loss.
- Agriculture is, and will continue to be, the major water user at the global scale. As global population increases and as food consumption patterns change (for instance, as people eat more meat), risks from water scarcity will increase unless water management improves.
- Water scarcity risks can be classified in terms of insufficent water to meet basic needs and the consequence which arise from this situation, such as political and business instability, or lost economic opportunities, and the risks that arise from poor policy responses to water scarcity.
- Water scarcity normally arises due to a complex interaction of social, economic and environmental factors. It is seldom the product solely of a lack of precipitation. Similarly, responses to water scarcity require intervention by a range of stakeholders at the local, national and international scales if problems are to be resolved for the long-term.
- Healthy ecosystems underpin sustainable water use. But the combination of climate change and other human pressures threatens the continuing viability of many ecosystems. Poorly planned responses to the hydrological uncertainty arising from climate change scenarios could increase risks to ecosystems and the service they provide.

PART A:

Water scarcity at the global scale

Whilst water scarcity is widely acknowledged as being a problem, defining and measuring the phenomenon can be complicated. On reviewing a number of water scarcity scenarios, Rijsbermann (2005) suggests that it is "surprisingly difficult to determine whether water is truly scarce in the physical sense at the global scale, or whether it is available but should be better used".

While there is potential to reconfigure societies and economies to make them more water efficient, current trends suggest that the opposite is happening:

- By 2025, there is likely to be, on aggregate, a 13% increase in water consumption (Rosegrant et al, 2003)
- More than 2.8 billion people in 48 countries will face water stress or scarcity conditions by 2025 (UNEP, 2002)
- By the middle of this century, 7 billion people in 60 countries could be facing water scarcity (UN, 2003)

In parts of the world there is rapid growth in the amount of water used for domestic purposes (currently 8% of total water withdrawals) and in industry (currently 18%). But globally, agriculture is the dominant water user (74%). Different types of agriculture exert different pressures on water resources. Producing meat, sugar, oils and vegetables requires more water and a different style of water management than the producing cereals. On average producing one calorie of food requires a litre of water, but a kilo of grain uses only between 500 and 4,000 litres compared with industrially produced meat which requires around 10,000 litres. Unless the hydrological efficiency of food production can be improved, the impact of an additional three billion people by 2050 and their changing diets (from cereals to more meat) will mean an additional five billion litres of water required annually to feed the world's population. Moreover, many of the projected shortages will occur in regions that are poorly equipped to deal with additional environmental pressures.

A global issue that needs local solutions

Although water scarcity risks primarily manifest themselves at the river basin or local scale, the origins of water scarcity, and its impacts, can be seen in the interaction of natural biophysical cycles, and the actions and decisions of people in a variety of sectors at local, national and international levels. While almost everyone in these sectors recognises water scarcity to be a 'public bad', the manner in which water scarcity impacts government and business through complex social and ecological systems is less well understood. But ultimately, better water management has to take place at the river basin or local scale if benefits are to be felt across different sectors.

It is important to note that absolute water scarcity is a poor indicator of water scarcity risk and the oft-seen maps depicting scarcity at the national scale tell us little about risks and their causes. How does one go about identifying the regions and stakeholders that are most likely to be affected by shortages? How too does one begin to understand the problems that water scarce regions and their people are likely to confront? The problem can only be understood, and action can only be effectively tailored, by focusing on the local level. Global and national scale macro assessments are useful for raising awareness, but do not reveal the dynamics, components and the biases within the water scarcity phenomenon. Risks are inevitably peculiar to specific regions and sometimes, specific seasons.

PART A:

Risk to whom and risk of what?

Whilst increasing water scarcity is a global certainty, predicting the scale, nature and location of future water scarcity risks is challenging. As Marcel Beurger of the global insurance firm Swiss Re points out, "Emerging risks are not even being called risks. They are more like uncertainties that you have to search for. Nevertheless Swiss Re has identified one big [emerging] risk: the global unavailability of water."[1]

The risks associated with water scarcity can be classified as follows:

- Risk from insufficient water resources to meet the basic needs of people, the environment and business, which in turn leads to…
- Risk from the consequences of insufficient water resources, such as higher energy prices, loss of competitive advantage, political and economic instability, population migration, or lost economic opportunities to name a few; and as a result,
- Risk from poor water management decisions taken in reaction to water scarcity, with negative consequences for some or all users. Such decisions may be a result of political or economic expediency, short-term thinking, lack of knowledge or capacity or simply desperation and lack of choice.

Discussions of risks imposed by water scarcity must involve those who are responsible for, and those who are affected by, the problems of water scarcity. Yet there are major difficulties in applying risk to a broad set of conditions. Water is a public,[2] a private and a social good, and a water scarcity event will have both private impacts and public repercussions, affecting stakeholders differently[3]. Accordingly it is necessary in any risk analysis involving water to establish who is at risk, with the understanding that the risk to an individual might be very different than risk for a society or business, and that certain groups will be more vulnerable to water risk than others. Moreover, risks of different stakeholders overlap.

It is also necessary to ask, "risk of what?" with the understanding that water scarcity is a subjective concept. For a farmer, the danger may be back-to-back years of below average rainfall. For a business such as a processing plant, the risk might be a temporary, sudden cessation of stream-flow during peak operation time. For a government, risks might include the increasing costs of accessing water for utilities and the implications of higher energy costs, or failing to deliver on economic growth and development pathways because of poor water management.

1 Reinsurance Magazine, 12/16/2002

2 Water supply is a public good because in most instances the supplying of water to one person does not prevent delivery of water to another. Similarly the ecological goods and services provided by water can be consumed jointly. In cases of water scarcity such allocation issues do become critical and the opportunity cost of increasing the water supply imposes direct costs and benefits on individuals and companies. In these instances water is a private good. The economic definition of a public good should not be confused with public or private ownership of goods. A private good can be publicly owned.

3 Le Quesne T., et al. 2007. *Allocating scarce water: A primer on water allocation, water rights and water markets.* WWF-UK, Godalming, UK.

PART A:
Risk to whom and risk of what?

Most stakeholders have some means – formal or informal – of coping with water scarcity, including increased dependence on remittances and alternative forms of agriculture. Whilst water scarcity tends to impose costs on those who can least afford them, in some instances it can provide the catalyst for effective adaptation to a less risky state. In reality, judicious water use might reduce risk as people become more affluent, better able to adapt, and adopt water saving technologies, but thresholds exist beyond which hazards overwhelm societies or ecosystems, and water scarcity risk increases suddenly and unpredictably. These thresholds depend on location, value and activity (Parry et al., 1996) and are difficult to predict. Incorrect threshold projections (including those of Malthus to food security, the Ehrlichs' to biodiversity in the 1980s and UNEP to desertification in the 1970s) underpin many of the incorrect assessments of environmental risk.

A failure to consider indirect risks further distorts the timescale of water scarcity events. Inadequate access to water (for people and business) is the obvious, but by no means the only, risk arising from water scarcity. Water scarcity imposes risks on markets and social stability. In addition, the manner in which people respond to water scarcity (using groundwater more intensely, the opportunistic breaching of legislation, violation of environmental flow requirements, pursuing unilateral strategies of self-protection, and becoming embroiled in conflict) involve additional risks, many of which are not attributed directly to water scarcity. Analyses of such issues tend to under-represent the problem by ignoring the feedback loops that often compound water scarcity risks. It is also important to note that risks arise from water scarcity which are not directly related to the use of water.

For instance, scarcity and consequent reduction in river flows can increase the risk to subsistence and commercial fisherman; and reduction in groundwater levels can cause forest dieback putting the livelihoods and businesses of another set of stakeholders at risk.

The impacts of water scarcity can be insidious, such as the disappearance of the Ogallala aquifer in the western United States, or the Edwards aquifer for the city of San Antonio, Texas. In most countries, groundwater is not well monitored, so understanding of when crisis levels are being reached is often elusive. As a consequence, the risk of water scarcity is often perceived as being in the future or manageable only by those people who can engage politically. Awareness of water scarcity could be increased through more effective communication of its real effects.

PART A:

Ecosystem risk and climate change

Equally important is risk to the ecosystems and they biodiversity they contain. WWF's Living Planet Index (2007), shows that the Freshwater Species Population Index (which comprises populations of 195 species of birds, mammals, reptiles, amphibians, and fish from lakes, rivers, and wetland ecosystems) fell 29% between 1970 and 2003. This is not a separate issue to economic growth and social stability. Rather it is a crucial consideration in delivering clean water and other ecosystem services to an increasingly thirsty world. Functional freshwater ecosystems afford the "provisioning services" (products such as freshwater, fish and transport routes), "regulating" or "ecosystem services" (such as water purification, stream flow mediation and options for adaptation to changes such as those caused by warmer climates) and "cultural services" (such as aesthetic beauty, spiritual significance and heritage value) on which society depends. Some of these services are difficult to cost and are therefore under-emphasised in cost-benefit analyses, risk assessments and other decision-support processes. But healthy hydrological systems in themselves mitigate risk. Put simply, clean, flowing rivers and healthy aquifers are a reliable source of good quality water.

Disruption to these dynamic fresh water ecosystems exposes people and the environment to a range of risks that are inevitable if difficult to predict (Baron et al., 2002). Realising this, governments are increasingly basing water management legislation and policy on the need to safeguard ecosystem goods and services[4]. Similarly, some companies are beginning to invest in ecosystem protection not just as an act of philanthropy but because healthy ecosystem can be a key tool to help ensure sustainable flows of clean water.

Significant changes to the hydrological cycle are anticipated as a result of climate change. But predicting precipitation changes is one of the hardest aspects of climate change modelling so climate change adds new uncertainty to water scarcity scenarios. Projections suggest that, in the tropics, it may get either wetter or drier depending on location. The sub-tropics are expected, on average, to become drier. In many places, uncertainty over the frequency of extreme weather events (such as severe drought) will be an unfortunate result of previously predictable weather patterns being disrupted. Summer dry spells in some areas will be drier and for longer periods of time. Changes in mountain snow-pack are a huge source of water insecurity in many temperate regions (Italy, California, France, etc.) and present some areas with changes in the timing, as well as the volume, of meltwater flows.

It is important to note that the combination of climatic variability and other human activities causes the greatest impact on ecosystems and the greatest risks to water users. For example the economic, environmental and political risks currently being experienced in the Murray-Darling Basin in Australia are the result of a combination of below-average rainfall over a ten-year period, some of which may be related to the interaction of El Niño with globally warmer climates. The impact of this climate phenomenon has been exacerbated by deforestation, increasing urban demand and a farming industry that abstracts very significant volumes of water.

PART A:
Ecosystem risk and climate change

Perhaps more importantly, inappropriate water management responses to climate change can increase risk. Many traditional water supply management solutions (typically engineering solutions based on historical hydrological patterns whose relevance is increasingly uncertain) simply displace and/or compound risks[5]. Creating the capacity for flexible responses to water scarcity is one way in which risk can be reduced in the face of changing hydrological patterns; but hydrological risks are complex and unpredictable nonetheless. Efforts aimed at enhancing resilience to a wide range of possible hydrological scenarios tend to be more effective than "resisting water scarcity" or "predict and provide" measures of adaptation that focus on engineering or specific events and responses.[6] Water demand management has the potential to circumvent a number of water scarcity risks.

Ghambiri River, India. Diversions for agricultural expansion have halted flows on the river for 5 years with massive impacts on downstream communities and livelihoods.

4 See for instance the South African Water Law (1998) and the EU Water Framework Directive (2000)

5 For a more considered assessment of best practice in climate change management and water management, see Adapting Water Management (WWF, 2009)

6 Resilience only provides a framework within which to act: without engineering you cannot get water to users. For an interactive list of technical "coping" responses that are perceived to be working, select "drought/aridity" on the following site http://maindb.unfccc.int/public/adaptation/.

PART B:
Risk to government

PART B:

Risk to government

- The concepts and terminology of risk have not traditionally been used in the context of government responsibility, but can be useful when dealing with a resource as complex as water.
- Tackling water scarcity in such a way that reduces long-term risks to a range of stakeholders can have multiple pay-offs in relation to government policy priorities on poverty reduction, economic growth, food security and trade, health and conflict reduction.
- Engineering solutions will always be important but poorly-planned management responses to water scarcity, especially those that focus on single uses of water, often increase risk to a range of stakeholders.

Standard government response to water scarcity

The management of water, for ensuring the delivery of basic services to citizens, for economic growth, and for maintaining healthy water environments, is ultimately the responsibility of governments. Yet, low prioritisation of water management and poor co-ordination within government ministries often mean that too many water resources are over-committed and undervalued. As a consequence, communities and economies around the world suffer from water shortages, poor water quality and degraded environments.

The initial response to water scarcity usually involves pressure to implement some form of "quick fix". The need to address sudden water shortages becomes a high profile, short-term priority that diverts public resources from other initiatives. Governments can fall into such traps in an institutional manner, rarely entertaining ideas of long-term stability, if the handling of each environmental pitfall is left to chance. Typical measures include the construction of water supply infrastructure, inter-basin transfers, water trucks, or desalinisation schemes. Because such measures can be expensive and seldom generate sufficient revenue to cover their cost, the fiscal burden for such interventions inevitably falls on taxpayers, undermining support for government and adding pressure to overstretched public budgets. They can also lock countries into patterns of development that rely on ever-increasing water supply. It would be better for governments to plan and institutionalise competent responses to scarcity, such as long-term healthy water supply, with robust demand management, a sound regulatory system and efficient and flexible infrastructure. This requires sufficient understanding of the range of potential remedies and broad support from a range of stakeholders for a more considered approach.

The cost of water scarcity

California's current water crisis management will cost tax-payers an estimated US$1.6 billion per year by 2020 (Jenkins et al., 2003). Australia's emergency overhaul of its water supply regime, necessitated by 10 years of over-abstraction but precipitated by the 2007 drought, is expected to cost US$10 billion. China's scheme to channel billions of cubic metres of water from the Yangtze River in support of farmers along the dwindling Yellow River involves untold costs, while Libya's need since 1991 to pump 730 million cubic metres of water a year from underneath the Sahara costs that country US$25 billion a year (UNESCO, 2002). Given the critical shortages in these instances, the costly interventions often seem the best solution; but in most instances the costs might have been avoided if timely water governance had prevented water scarcity in the first place.

The concept of risk has not typically been used to describe government's role in water services and management. However, for the purposes of improving and supporting better public policy for water management, risk is an effective way to frame the issue. Government risk must be seen in the context of government mandate and policy priorities. Water scarcity presents a range of risks to government that may affect policy agendas on poverty and inequality, economic growth, food security and trade, health, and conflict reduction.

PART B:

Poverty and inequality

The poor pay more (in proportional terms) for their water than the affluent, and receive water of lower quality (Castro, 2004). This situation can be linked to the poor performance of water delivery services, but these poorer customers also tend to live where water scarcity is greatest. “From rural communities in Angola, to the shanty towns of Port-au-Prince in Haiti, it is not unusual for the poor to pay as much as 100 times more than those with regular water connections” (UNICEF, 1998).

Water scarcity aggravates existing social problems, most notably poverty, and further entrenches their causes: gender discrimination, urban biases and vested interests. Within poor households, women tend to bear greater losses than men from the degradation of water resources. Within communities the poor are first to suffer when water tables drop. When water ran out in the informal settlement of Cochabamba, Bolivia, only those residents with sufficient funds were able to buy water from privately operated water trucks for their drinking, washing and vegetable gardens (Wutich, 2007). In southern India, only those households that can afford to sink deeper boreholes and pay for irrigation that can cope with the declining water table and less reliable rainfall. Accordingly affluent farmers cultivate water-intensive crops like rice and sugarcane, while their small, poorer neighbours plant lower value ‘dry’ crops like sorghum, cotton and millet (Mollinga & Van Straaten, 1996).

Water scarcity is often the precursor to decisions and events that hinder the alleviation of poverty. High costs, loss of biodiversity, degradation of the multitude of benefits from ecosystems, and an increasing prevalence of environmental hazards such as salinisation, land erosion and drought – all of which are the results of water scarcity – drive losses in quality of life. As such, water scarcity both initiates and perpetuates vicious circles of poverty, degradation and inequality.

The Millennium Development Goals

The Millennium Development Goals (MDGs) represent the official international targets for ending poverty and the associated risks of exclusion, conflict and terrorism. Injudicious use of existing water resources is expected to increase the improbability of achieving the MDGs, and will certainly increase the cost of reaching these goals (Southern African Millennium Ecosystem Assessment, 2004; UNICEF, 2002). Table 1 illustrates the MDGs and the associated role of water management.

Achieving the water components of MDG 7 (ensure environmental sustainability) is anticipated to provide a 7.5 fold return on investment as a result of time savings, improved productivity and improved school attendance. Unfortunately, the current trend toward ever greater scarcity makes this return improbable. Dow and Downing (2006) estimate that projected changes in water availability will result in 1% to a minus 10% change in cereal production by 2030 in much of sub-Saharan Africa and Southern Europe, and an 8-9% decrease in cereal production in the Asian sub-continent. Significantly for development, 25% or more of the children dependent on such production in both Sub-Saharan Africa and the Sub-Continent are already moderately or severely malnourished.

PART B:
Poverty and inequality

Table 1 **The Millennium Development Goals (MDGs) and water**

MDG	Role of water management
Goal 1- Eradicate extreme poverty and hunger	Increase agricultural production and productivity to keep up with rising demand Protect freshwater ecosystems to deliver food and livelihoods Increase water access and water allocation for poorest users Deliver water infrastructure for health and sanitation
Goal 2 – Achieve universal primary education	Reducing water-related diseases which cost millions of school days each year
Goal 3 – Promote gender equality and empower women	Enhancing equitable access to water and thus the ability to produce food and improve health. Eliminating lost time for water collection, a burden on women and young girls
Goal 4 – Reduce child mortality	Reducing water-related diseases which kill millions of people each year Provisioning of clean water that contribute to better hygiene and diets Provide clean and adequate supplies of water for basic needs
Goal 5 – Improve maternal health	
Goal 6 – Combat HIV/AIDS, malaria, and other diseases	
Goal 7 – Ensure environmental sustainability	Plan and implement all aspects of water management in a manner that integrates environmental flows for lake and river systems and draws on groundwater systems within natural limits of recharge Halving the people without sustainable access to safe drinking water and sanitation by 2015
Goal 8 – Develop a global partnership for development	Involve a diverse range of practitioners, researchers, water users and decision makers when planning water management projects

Source: Adapted from IWMI, 2007

PART B:

Economic growth, food security and trade

Water is essential for sustained economic growth (Cosgrove, 2004; DFID, 2008), and politicians run the risk of being held accountable where water scarcity undermines economic growth and where trade is adversely affected. Most forecasts project a relatively modest water scarcity impact on economic growth at the global level, due to the fact that the bulk of value addition in the global economy occurs in sectors that are, at present, relatively insensitive to water scarcity (Dumas & Ha-Dong, 2004). But at the national and local levels, the availability of easily accessible freshwater has proven a key determinant in development (Sachs, 2006), and water scarcity continues to frustrate economic growth at these levels. Those countries which, 25 years ago, had low incomes (below US $750 per year per person) yet had access to adequate safe water and sanitation, had an average of 3.7 % growth in GDP per year, while countries with the same per person income but limited access to water grew at only 0.1 % per year over the same period (WHO, 2006). Access to fresh water can therefore not be factored out of economic growth.

The availability of water enables economic development and energetic responses to emerging agricultural opportunities. The ongoing drought in Australia was expected to shave 1% off that country's GDP in 2006/7 and possibly helped usher an end to the Howard government. Interestingly, the argument in Australia is changing. Some now feel that this is no longer a drought, but a new climate regime. Politicians will still, however, need to find timely and flexible approaches to dealing with scarcity and rapid change. In South Africa, the inability of the local sugarcane industry to respond to opportunities created by the reform of the EU sugar regime in 2005 was due to insufficient water and became the source of simmering political tension (Cartwright & Lorentzen, 2006). In the US, water shortages are reported to have cost the agricultural sector GBP 2.6 billion over a two year timescale (The Carnegie Institution at Stanford, 2007).[7]

Water availability is also a determinant, often hidden, of international trade. Countries with more water are able to trade water-intensive goods for export. Water embedded in traded crops has been termed 'virtual water'. Virtual water trade has been suggested as a way to alleviate water shortages. While this offers the potential to help mitigate water scarcity risks, it should be recognised that most trade is not based on rational determinations of comparative advantage based on water, but rather on broader political and economic factors.

7 It is not clear that the static calculation of these figures represents a particularly good way of quantifying the phenomenon, but it would seem apparent that water shortages have had at least the same impact.

Irrigation has delivered impressive gains for agricultural yields but future expansion will need to consider the risks to other users and uses of water within river catchments if it is to deliver long-term benefits.

Buying land, Buying water

Recent examples of 'land grabbing' that have appeared in the press (New Scientist, Dec 4, 2008) show that some governments and investors, mainly the Gulf States, are buying or leasing land in other countries to support food security. While there are competing and undetermined benefits or risks in such activities, the press has largely ignored the fact that these actions are fundamentally about water. Saudi Arabia has chosen to de-subsidize water use by its citizens and instead use the water of Pakistan embedded in food grown specifically for Saudi Arabian consumption, as costs to pump and desalinate the huge amounts needed to achieve food security at home reach into the billions of dollars. Yet the risks associated with those displaced, or those whose water has been diverted to the highest bidder, have been largely ignored by those governments more interested in receiving cash from willing investors.

In North China, 30 cubic kilometres more water is being pumped from groundwater to the surface each year by farmers than is replaced by rain. As groundwater is used to produce 40% of the country's grain, experts warn that water shortages could eventually make the country dependent on grain imports. Gleick et al., (2002) have called for the inclusion of water under the General Agreement on Tariffs and Trade (GATT) regulations, and Falkenmark (1997) estimates that by 2025, 55% of the world's population will depend on food imports as a result of insufficient domestic water, necessitating a major reconfiguration of international trade. Such a reconfiguration would almost certainly have political ramifications, especially for those countries that lose market share. High oil and transportation costs could compound matters.

PART B:

Health

Health risks associated with water are generally more to do with quality rather than quantity; however the two are directly related. The World Health Organisation (WHO) estimates that eight litres of freshwater is required to dilute every litre of grey (polluted) water in order to prevent harmful contamination. When over-abstraction compromises this ratio, incidences of inadequate sanitation, drainage and excessive pollution increase. Treatable diarrhoea kills 2 million people every year, 1.6 million of whom are children under the age of five (WHO, 2006, Castro, 2004). The combination of HIV and diarrhoea blurs the reporting of both afflictions, but it is certainly having an increasingly devastating impact in Africa. Vulnerability to water-borne diseases, and particularly diarrhoea, would be greatly reduced if water was more abundant and river flows better protected especially in growing urban areas. Improvements in access to water and the delivery of water utility services will lead to better health.

Over the last twenty years, many residents of Bangladesh have become dependent on groundwater extraction for dry-season rice production and domestic use. Of the four million hectares of land under irrigation in Bangladesh, about 2.4 million hectares are now being irrigated from shallow tube-wells, known to contain dangerous levels of arsenic. With an estimated 1,000 tonnes of arsenic being added to arable soils annually, dependence on well-water has exposed poorer residents (who cannot afford to drill as deep or to test their water quality) to higher risks of arsenic poisoning.

Swiss Re[8] foresees human health-related lawsuits arising in situations of water scarcity that expose people to higher concentrations of water-borne pollution. This pollution includes pesticides, petrol additives, antibiotics and microbes that have developed resistance to antibiotics and have been released through sewage systems. No such case has yet been presented, but as legislation, monitoring and the science of water-borne diseases improve, proof of culpability will become easier to obtain

WHO's Disability Adjusted Life Year

The WHO applies the Disability Adjusted Life Year (DALY) indicator, a combination of life expectancy and the health quality of a year lived, to establish equivalent years of 'healthy' life lost by virtue of being in states of poor health or disability. One DALY can be thought of as one lost year of 'healthy' life (WHO, 2008). Water deficits (including poor sanitation and effluent disposal) account for nearly 40% of all DALYs lost, and the impact of water scarcity and poor water management on DALY is most acute in developing countries: China suffers an annual loss of 7 million DALYs; India, 22.5 million; and Sub-Saharan Africa, 31.8 million (Murray & Lopez, 1996; Lvovsky, 2001). By not pursuing the type of water governance that could break the relationship between water quantity and disease, Fox-Rushby & Hanson (2001) estimate that countries across the world will forego 330 million DALYs by 2015. The loss of water-related DALYs in Sub-Saharan countries (10% of all DALYs) relative to developed countries (1% of all DALYs) highlights the role of "coping capacity" in the relationship between water shortages and poverty.

8 Reinsurance Magazine, December 16, 2002

PART B:

Conflict

The threat of water wars was evoked throughout the 1980s and the 1990s by the United Nations,[9] the World Bank[10] and various academics (Westing, 1986; Wolf, 1998; Butts 1997). In recent years the United Nations has pulled back from this position, but this did not prevent Margaret Beckett, the then UK Foreign Secretary, spoke in 2007 about the Darfur crisis in Sudan being intimately related to climate change and water scarcity.[11] Transboundary basins now cover 45% of the earth's surface (Ravnborg, 2004) and water scarcity, particularly when it is caused by unilateral water development projects (e.g. dams), undoubtedly contributes to tensions between nations. New national boundaries have emerged from the post-Soviet era with an additional 47 transboundary water basins coming into effect in the past 25 years.

The evidence that countries engage in wars specifically over water is not clear but there is little doubt that water conflicts are common at the inter-sector, inter-community, inter-farm, inter- (and intra-) household level. The contests that arise may not register on military radars, but they can have a profoundly frustrating effect on development efforts, further entrenching social problems such as gender discrimination, and destabilising local governance. The 'water riots' against the Bechtel Scheme in Bolivia in 1999 and the ongoing tensions between landowners and poorer peasants in the Chittoor District, India, over the lowering of the water table, are typical of an increasing number of local conflicts (Wolf et al., 2003).

Similarly, civil actions against business operations are a risk to those businesses' reputations, but they also reflect societal struggles over water access and water use.

Water-related conflicts are caused more by the way in which water use is governed than by water scarcity. The outcome of local conflicts tends to reflect societal problems. Those who are marginalized in society tend to lose most in water conflicts, for example the rural poor in Chile and Mozambique, and the urban poor in Mexico and South Africa. It is also important to distinguish between disputes over water resources where rivers happen to run across boundaries, and disputes over national boundaries where rivers happen to form those boundaries.

9 Boutros Boutras-Ghali (1985) "The next war in the Middle East will be fought over water not politics": Kofi Annan (2002) "Fierce competition for fresh water may well become a source of conflict and war in the future."

10 In 1995 the World Bank Vice-President Ismail Serageldin claimed that 'many of the wars of this century were about oil, but wars of the next century will be about water' (New York Times, August 10, 1995).

11 See "The Case for Climate Security", Lecture by the Foreign Secretary, the Rt Hon Margarett Beckett MP to the Royal United Services Institute, 10th May 2007.

PART B:

Risk arising from water management responses

Water storage infrastructure

Responses to water scarcity by governments and others can, if not thought through properly, undermine longer-term policy objectives and reduce flexibility to mitigate a variety of unforeseen risks. For example, the construction of large dams often locks regional economies into water-intensive primary economic activities. The number of large dams increased from 5,000 to 45,000 during the second half of the 20th century, when dam construction was the standard response to water shortages (World Commission on Dams, 2000). Dams and other storage infrastructure such as weirs and barriers now affect 70% of the world's rivers (Bergkamp et al., 2000). The need to recoup public finances invested in large dams and irrigation schemes requires that water stored and diverted by these projects is allocated to sectors and enterprises that can pay the highest price. Typically this precludes allocations to the rural poor with obvious implications for economic equality.

Dams transfer water scarcity risk from people onto the environment, a strategy that often simply delays facing the problem of scarcity and often intensifies it. Dams have stabilised and increased the provision of water for people, but their benefits should be gauged against the risks that they impose. Dams interrupt natural river flow and cause a range of environmental impacts including the loss of flooding regimes, methane gas release, habitat loss, alien vegetation encroachment, restricted fish migration, and disrupted nutrient and sediment flows.

Some of the risks, particularly the biodiversity risks, imposed by existing dams could be reduced through better design and more effective management: off-stream storage, flood simulation, and judicious releases and fish ladders. The poor management of the flow regime from dams constructed to generate hydroelectricity on the Zambezi River is destroying sea grass beds and preventing shrimp larva migration into the delta. This has contributed to the destruction of a highly valuable and much needed seafood industry in Mozambique.

Groundwater extraction

The extraction of groundwater is often the first resort of rural water users confronted by scarcity, and now represents 50% of all drinking water (UNEP, 2005). Taking groundwater at rates faster than nature can return it is often portrayed as a "sin against sustainability" (Llamas & Martinez-Santos, 2004), exposing future generations to risk by allowing salt water intrusions (e.g. Pakistan, Madagascar), subsidence, loss of soil moisture and exposure to heavy metals. Under certain circumstances, groundwater use can have fewer environmental impacts than surface water use. Where groundwater alleviates shortages and provides the catalyst for socio-economic development it may actually reduce social vulnerability and ecological risks. Yet, unforeseen and irreversible consequences of water abstraction are greatest when using poorly-monitored and 'invisible' groundwater resources.

The Ogallala aquifer, which stretches from Texas to South Dakota, is being lowered at 90-150 cm per year. This depletion rate, if sustained, will threaten the continuing viability of one third of irrigated agriculture in the United States within the next 40 years. Yet this issue is largely ignored in the US media despite profound and potentially devastating economic repercussions of the aquifer being exhausted. More immediate effects from excessive water use will occur in the agriculturally important area of

PART B:
Risk arising from water management responses

Souss-Massa in Morocco, where the major water source for the region is from two aquifers, Souss-Massa and Chtouka. The over-pumping of these aquifers, through more than 13,000 wells (some of them illegal), has resulted in declines in water levels from 0.5 to 2.5 metres per year during the past three decades. In the Souss-Massa Basin, even under the best planning conditions, the current rate of water usage is not sustainable. If water-saving measures are not taken rapidly, the groundwater deficit will reach a catastrophic level. Beyond 2020, even if the demand for water for irrigation were kept constant, the groundwater deficit would be irreversible (WWF, 2008).

Water transfers

Water transfers involve the movement of water within or, more often, across river basins, but can also include using ships to transport water between different countries. Like dams, inter-basin transfers provide a means of alleviating water shortages, but represent an expedient transfer of risk from people to the environment. The pumping and piping of water from one basin to another reconfigures hydrological systems and the biodiversity that has co-evolved with these systems. The Chinese government is constructing the South-North Water Transfer project designed to bring huge quantities of water from the upper reaches of the Yangtze River to the upper reaches of the Yellow River. Many cubic kilometres will be moved from the (wetter) south every year. This project will increase the environmental risks (loss of soil moisture and fertility, salinisation, land erosion and species migration) that are common to inter-basin transfers. India has similar plans to move water across the sub-continent, and Spain has debated the issue of diverting the Ebro River for many years. While seen as solutions, they are instead enormous and dramatic responses to a failed management problem

Crisis in Cyprus

Recently, water reserves in Cyprus reached their lowest levels. As an emergency measure, the Cypriot government agreed with the Greek government the immediate supply of eight million cubic meters of fresh water from Greece. The transportation of the water from Greece to Cyprus cost $70m. Under the agreement with Greece, two water- tankers will leave Athens for Cyprus every day for six months (Reuters, June 26, 2008).

The governments of Australia, China and India have thus far been unsuccessful in handling the reduction in rainfall where they have typically relied on it. Their responses to the risks that have arisen in their countries provide a spectrum of examples which suggest how we might address and adapt to rapid climate changes and shifting water regimes. When more water is taken from a river catchment than what is hydrologically available, supply side solutions override any alternative or more necessary considerations to reduce on the demand side. This leads to situations where river basins, such as in the region of Murcia in Spain, heavily over-exploit their own surface and ground water and still ask for more water from neighbouring basins, rather than restricting expansion or banning inefficient and wasteful water use “at home” (WWF, 2008).

PART B:
Risk arising from water management responses

Desalination

The construction of desalination plants is an increasingly popular response to water scarcity, especially in southern Europe where irrigation, urbanisation and increasing demands from tourism have combined to create water scarcity. Desalination has a role to play but a reflexive preference for such supply-side solutions to water scarcity can, however, exacerbate scarcity impacts by creating new dependencies and unforeseen risks, and often leads to a cycle of increased costs, environmental impact and energy dependence. Large desalination plants have been described as the "new dams" (WWF, 2007), and may divert effort from alternatives – such as water conservation, water use efficiency improvements and water recycling – which be more sustainable and reduce risk.

The rain in Spain?

The new Spanish government made a political point of abolishing the planned inter-basin (Ebro River) transfer plans and has instead decided to build several dozen desalination plants to provide water to the south coastal region. This programme is likely to impose environmental and political risks of its own. Spain's real problems lie in a lack of effective development controls in high growth but dry areas, and inefficiently controlled water use generally. The country is perhaps the leading developed-world example of how a long history of investments in water supply infrastructure has failed to provide water security (WWF, 2007).

In the Middle East, water continues to be heavily subsidised for the majority of users for economic and social reasons, and the proportion of agricultural use is high in some areas. The capital and energy requirements of soaring water demand are challenging to the area, even for nations like Saudi Arabia and Israel. Desalination plants may be the only option in some areas (e.g. Malta, UAE), yet yielding to the temptation to view the ocean as a limitless source of potential freshwater means ignoring numerous potential risks. These include tying countries' future water needs to growing energy costs and, in many cases, energy insecurity, usually while failing to tackle the very issues that led to dependence on desalination in the first place.

PART C:
Risk to business

PART C:

Risk to business

- Even as businesses seek to secure long-term prosperity, to maintain competitive advantage and brand differentiation, and to secure stability and choice in supply chains, increasing water scarcity presents physical, financial, regulatory and reputational risks.
- The type of business will determine the level and type of these risks and the appropriate response. Heavily water-dependent businesses with the best known brands will encounter the greatest reputational challenges. But many other businesses will face changes and uncertainty due to the increasing scarcity of water.
- As climate change takes hold and media and public awareness of water issues increases, companies will come under greater pressure to reduce water use and increase efficiency. Where such actions are not be enough to guarantee a social license to operate – for example where a company's operations rely on a poorly managed water resource – the company may need to become involved in supporting better public policy for water management.
- Ultimately, if and when companies start to suffer from absolute water shortages, and may not be able to influence or bring about better water management, businesses may face closure or relocation due to environmental rather than purely financial constraints.

Why business risk?

Business and government share risks, especially when businesses operate in areas where water is scarce, poorly managed or subject to changing regulation. The term 'business' is used here somewhat generically, and refers to numerous sectors which are exposed to very different issues depending on the type of operations, their location, and the policy environment for example. In some instances, water scarcity can create business opportunities. It can be the catalyst for technologies and economic transitions that reduce risk, and some companies have gained market share on the back of changes made to reduce their hydrological impact. However, how to minimise risk and maintain not just competitiveness for the future, but also their social license to operate, is an essential question for most businesses. From a water management and policy viewpoint, businesses are a key stakeholder given their high demand for water, the role they play in economic growth, the impact (positive or negative) that they may have on water resources, and the influence that they might exert.

When water scarcity becomes a crisis, companies perceived to be intensive users of water are often, rightly or wrongly, singled out for criticism. Large, high profile corporations are particularly vulnerable to exposés and consumer boycotts regardless of their actual contribution to the problem. This factor, along with the continuing and increasing risk of factories or farms running out of water because of poor management of the local water resource, mean that it is in many companies' interests to support better water management at international, national and local levels. Many particularly water-dependent companies are therefore beginning to view the reduction of water scarcity risk as a key business issue and not simply as a matter of compliance or corporate social responsibility.

There are four basic categories of water scarcity risk to businesses: physical, financial, regulatory and reputational risk.

PART C:

Physical risk

Physical risk is directly related to too little water (scarcity), too much water (flooding) or water that is unfit for use (pollution), each of which is associated with the management of a water resource. Risks can be associated with water resources at the river basin level, or at the supply level, namely sanitation and other infrastructure systems. Even where water is readily available, physical risk can emerge from poor management of the resource.

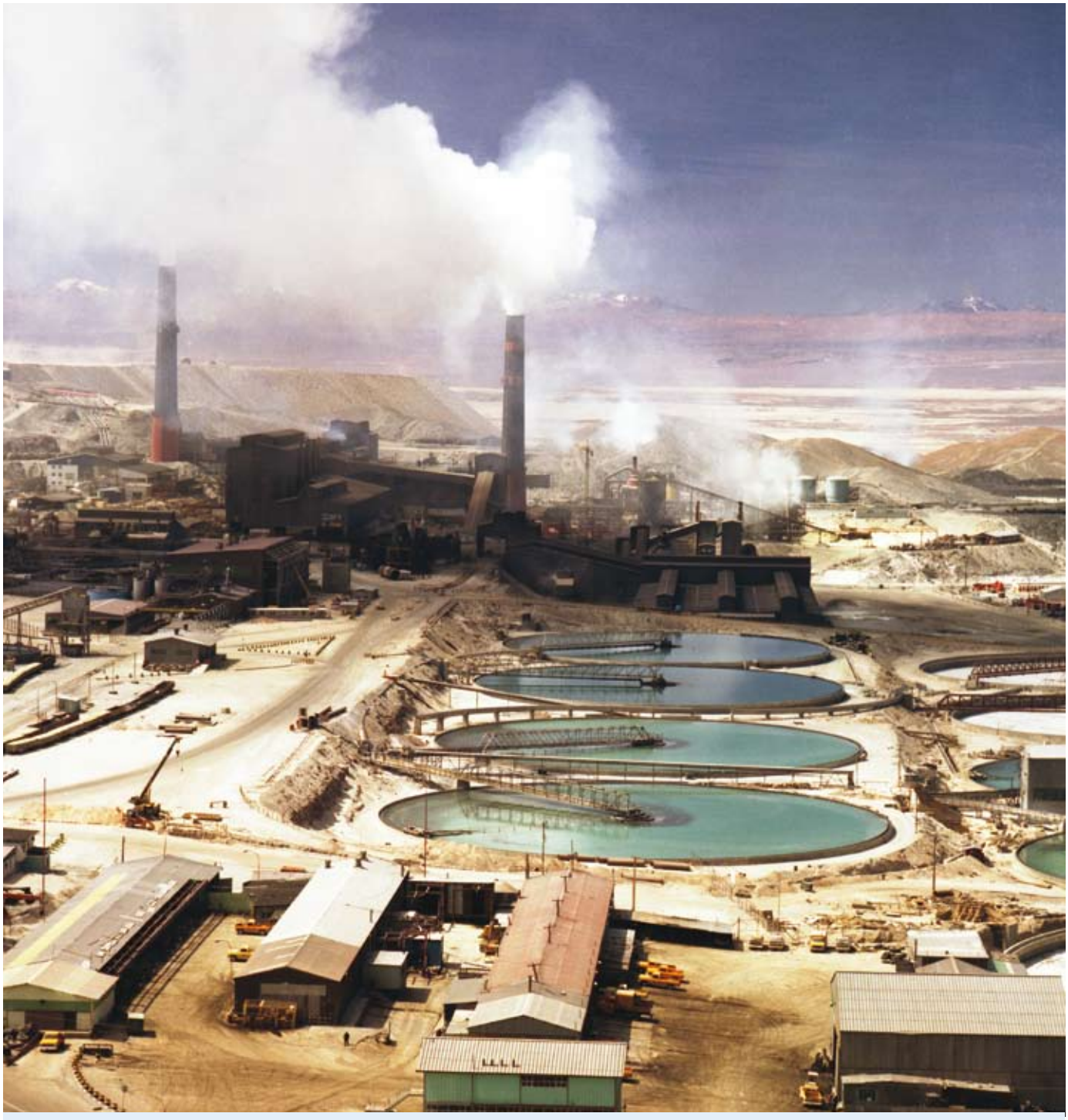
Water is usually an irreplaceable resource so, like other users, businesses suffer when they run out of water. In 2002, Swiss Re reported an increase in claims against "business interruption cover" as a result of periodic water shortages, suggesting that the problem had become more severe[12]. While this may not be the most prevalent or even the most immediate concern for most business operations today, there is every reason to believe that this risk will only increase in the future as demand for water from other users increases. The effects of climate change, in terms of increasing variability of water resources, will only exacerbate this situation.

Progressive companies have developed means of buffering themselves against water shortages, but always at an additional cost, and typically without guarantees. The purchase of water licenses has been a feature of asset management plans in Southern England since the 1980 droughts (SEI, 2006). The declaration of a drought triggers a series of costly interventions for water companies, including intensive monitoring, restrictions and public relations programmes. In 2005, Vittel, the bottled water company, was forced to purchase US$9 million worth of land, and had to pay land owners an additional US$24.5 million in subsidies, simply to protect the supply of clean water to its French bottling plant (Perrot-Maitre, 2006).

Agriculture is commonly perceived as the most vulnerable sector with relation to absolute water shortages. Flower growers on the shores of Lake Naivasha (Kenya) and vegetable producers in the Lower Guadiana (Spain / Portugal) have highly risky futures due, in part, to their own exploitation of the water resource on which their businesses depend. Although 70% of fresh water is used in agriculture, industrial uses are also high (Estrela & Silva, 2006). In California, for example, the electronics manufacturing industry used 24% of the available water in 1994/1995 (Faruqui, 2003), with every 30cm of silicon computer chip requiring 8,622 litres of de-ionised fresh water (Figueres et al., 2003). In South Africa, SABMiller, the world's second largest beer retailer, was forced to halt production at one of its plants in 2007 due to water shortages (IOL news portal, March 2007).

Another business sector particularly vulnerable to water shortages is mining. Anglo-American is currently unable to mine a rich seam of platinum in the Limpopo Province due to the lack of water, and Chile's flagship copper industry is being threatened by insufficient water to maintain operations (see Box 1).

12 ReInsurance Magazine, 2002



Copper production in Chile requires vast amounts of water, a resource hard to come by in the mining-intensive Northern region, next to the Atacama Desert, one of the driest regions in the world.

Water and copper in Chile

"Chilean copper mining companies are likely to face significant risks in securing future water sources and rights for water-intensive copper processing operations. Water is becoming more expensive, significantly contributing to mining companies' surging production costs (along with energy), and is also becoming harder to obtain. Today, few or no water rights are available, and farmers are pushing regulators to limit the granting of water sources to the mining industry. Repercussions for ecosystems are also being monitored by environmental watchdogs, exerting further pressure. Water scarcity has led mining companies to launch water exploration programmes in the mining region, seeking to secure supply for future development. Some are implementing water management programmes, ranging from design development to recovery of water from tailings dams, and some are looking to build desalination plants. Higher costs will prevail until new technologies become economically viable".

Source: Bloomberg Messaging, 16 April 2006

PART C:

Financial risk

Water shortages translate into higher energy prices, higher insurance and credit costs, and lower investor confidence, all of which further undermine business profitability. More common than the risk of not having enough water is the risk that businesses find their comparative or competitive advantage undermined by cost inflation driven by water scarcity.[13] As water becomes more scarce, water tariffs and other pricing mechanisms tend to increase, due to greater competition for water between sectors, higher water search costs, the need to drill deeper boreholes, higher pumping costs and the need to recoup the cost of expensive water transport schemes.

Water scarcity also adds to energy costs. For example, cold water is essential for the cooling of coal-fired and inland nuclear power plants, and water shortages leading to higher water prices increase the cost of power generation from these plants. Switzerland is forecast to experience a 25% decrease in nuclear power generation by 2020 due to declining water supplies from glaciers (OcCC, 2007). This problem became acutely clear in Italy in May 2007, when power plants in the Po Basin were forced into outages due to a lack of water. Ongoing water shortages in Australia, caused by below average rainfall with excessive water use could disrupt power supplies from the Snowy Hydro plant responsible for 3.5% of Australia's grid energy. Shortages would raise energy costs and threaten almost half of the energy supplied to Canberra (Bloomberg Messaging, 10 March 2007).

Water scarcity has not historically been a major source of insurance claims, but some of the major insurance companies view water scarcity and its impacts as a significant emerging risk and/or business opportunity. Water related insurance has most obviously been flood or drought insurance, as well as property insurance where subsidence is an issue. Currently there is little technical expertise to gauge water scarcity risks (although work on weather derivatives is improving) and inherently conservative insurance companies tend to price inflated estimates of this risk into premiums.[14]

13 No water scarce countries charge the scarcity value (what economist call the opportunity cost) of water but, in line with the "Dublin Principles", there is an increasing tendency to see water as an economic good, to recoup some costs of infrastructure in water charges and to encourage greater efficiency by raising water-use charges or imposing fines for over-abstraction. This is particularly the case when a water resource or the water supply is privatised which is itself often the result of increasing scarcity.

14 There is some evidence of newer insurance companies taking seeking to profit by taking on greater levels of risk than their traditional rivals (Hultman pers. comm.).

The Yangtze river has become one of the most polluted rivers in the world, impacting economic growth and increasing numerous risks to both government and business operations along its banks.

Assessing water scarcity risks

"Global consumption of water will reach new heights. The quality of water is deteriorating as a result of the increasing pollution of drinking water reserves by agriculture, industry, and private households. The regionally specific problems concerning the availability and quality of water will be aggravated and accelerated by the effects of climate change, with many areas experiencing increased drought and flood events. We [Munich Re] have examined in depth the extent to which Munich Re can be prepared to cope with future developments [arising from water scarcity] and the areas in which we should adapt our insurance products. The examination concentrated on the effects on various areas of insurance, e.g. public liability and environmental liability claims resulting from increasing water pollution; property claims resulting from contaminated or inadequate water supplies; business interruption claims resulting from interruptions in the water supply; product liability risks in the food and drinks industry; morbidity/mortality resulting from water scarcity and pollution; credit risks; agricultural risks; and specific problems in mega-cities. The results of this study show that in these various areas of insurance we must, in some cases, expect substantial effects on the risks and their accessibility and elevated loss potentials (e.g. credit risks, terrorism risks). In this connection, the high-risk potentials in mega-cities are likely to rise even further on account of the increase concentration in values and the fragile infrastructure of modern societies".

Source: Munich Re (2005)

PART C:

Regulatory risk

Most businesses thrive in a stable regulatory regime, and change, particularly when unpredictable, can be a serious problem. Regulatory risks arise when a change in law or regulation increases the costs of operating a business, reduces the attractiveness of investment and/or changes the competitive landscape. Change to the regulatory regime around water can be one such risk.

With increased recognition that water and environmental resources are threatened, many companies accept the need for reasonable regulation, as long as it is coherent, predictable and consistently applied. In some cases, business engagement is shifting to cooperative advocacy for regulation of water allocation and licensing from water resources and for regulation of water supply, sanitation access, and pricing in urban settings (WWF, 2009). Regulatory risks also arise when those charged with water management are incompetent in their job or where that particular water sector is open to corruption. In both cases, the lack of transparency and consistency provides little room for stable laws, and raises the level of uncertainty to the long-term viability of business activities and as a disincentive to invest for the future.

Untreated effluent flows from the Assalaya sugar factory to the White Nile exposes supply chains to significant risks.

PART C:

Reputational risk

Reputational risk with regard to water scarcity refers to the exposure of companies to censure and a resulting loss of customers due to perceptions around those companies' decisions, actions or impacts on water resources, aquatic ecosystems and the communities that depend upon them (WWF, 2009). Reputation is one of the most important corporate assets, and also one of the most difficult to protect. Reputational risk is harder to manage than other types of risk, largely because of a lack of established tools and techniques, and confusion about who is responsible for it .

The manner in which companies exploit natural resources continues to be the subject of public scrutiny (Friends of the Earth, 2005). Where this scrutiny translates into public 'outrage', companies face dramatically amplified risks, especially when they are judged to be profligate or irresponsible (JP Morgan, 2008). This risk would also hold true for the insurers and investors in such enterprises. Where such crises unfold, there is a tendency for governments and the media to apportion blame, sometimes fairly and sometimes opportunistically. High profile, multinational companies are easy targets for such blame regardless of their relative contribution to the problem.

The likelihood of a water usage issue damaging a company's reputation is greater where that company uses water from a catchment that is in danger of drought or ecological collapse. For example, public perception of the amount of water used by Coca-Cola in some countries, the impact of Kenya's cut-flower industry on local water resources, and the impact of the Spanish strawberry industry on that country's hydrology, have taken on the dimensions of public campaigns. Seemingly local incidents can translate into serious global brand damage as a result of press attention (exacerbated by the speed of internet communication). PricewaterhouseCoopers now advises its clients to take into account environmental risk as a 'portfolio issue in the light of public and media vigilance'; i.e. when making investment decisions, fund managers should consider their exposure to sectors and companies perceived to be at a high risk of losing market share due to an exposé or litigation (WWF, 2008). This challenges companies' abilities to monitor and influence their supply chains. The increasing trend for companies to assess and report their water footprints is helping can help companies to assess their risks and impacts in water-scarce regions. By working with stakeholders taking steps to mitigate those risks and impacts, companies may be able to limit reputational risk. If a company is able to demonstrate that it has helped to improve water management in a place where it has a significant water footprint, this could conceivably even enhance its reputation.

PART D:
Shared Risk

PART D:

Shared risk

- Individuals, governments and businesses often share water scarcity risks even if they conceptualise them differently. A common denominator is that out-of-date public policy and weak water management institutions increase risk for everyone.
- There are common principles for effective management and mitigation of water scarcity risks: a focus on long-term sustainability; prioritisation of water allocation for those least able to cope from scarcity; flexibility of response in the light of changing hydrological reality; and the need for better public policy, stronger institutions and broad stakeholder engagement.

Demands for water from individuals and businesses, and their respective risks from water scarcity, often overlap. Individuals who are most vulnerable to water scarcity are often vulnerable to other risks as well, including conflict, climate change, economic downturns and land expropriation. When their vulnerability is exposed they may engage in short-term strategies that exacerbate risks unless a strong water governance regime makes sustainable alternatives possible. Most businesses depend, to a greater or lesser degree, on water either through direct use or through supply chains. Thus business at risk may include retailers, food and beverage companies, agro-industry, energy companies and mining operations. Those with vested interests in such businesses, such as investors and insurers, may also feel the consequences of water scarcity. The business risks to water are complex and often have less to do with how much a company uses directly and more to do with how water is managed where they source or operate. Like individuals, businesses are therefore mostly exposed to water risks as a result of poor public policy and faltering water governance.

Government risks have traditionally been seen as relating to the failure to deliver water to citizens or to secure water for agricultural and industrial purposes. Governments may also be susceptible to the risk of conflict over water, either between users within a country, or between countries. There is therefore a shared risk agenda between government and business, particularly when business operations and supply chains exist in places where the 'rules of the game' around water use and cost are subject to abrupt change.

In an ideal situation, water scarcity risks would be avoided by hydrologically-appropriate economic development and hydrologically rational trade (including the trade of virtual water). Unsurprisingly, however, the move towards a less water-intensive economy is normally left until water is already scarce. Risk can become amplified by short-term or self-interested responses to water scarcity. Adger et al (2005) point out that the question of "who decides" how to respond is critical, with a need for co-ordinated responses led by national governments and supported by companies, environment agencies, provincial and local governments, and end users, in order to avoid the risks of water scarcity being transferred onto those communities and individuals who are politically marginalized and least equipped to cope with them.

Public and private sector mandates may diverge over water, with the former focusing on a broad set of social, economic and ecological priorities and the latter focusing on a profit imperative and a company's long-term economic value. But it is important to recognise a number of commonalities in their respective exposure to water-related risk[15]:

- The risks to both government and business from water scarcity start from the physical, namely pressure on water resources (quantity and quality) and / or the failure of supply systems.
- Inadequate availability of or access to water for social and ecological purposes can result in political (and possibly electoral) opposition, which has its parallels in the reputational risk to which corporates are exposed.

15 WWF.2009. *Investigating Shared Risk in Water: Corporate Engagement with the Public Policy Progress.* WWF-UK, Godalming, UK.

- Water stress and supply failures are normally linked to inadequate public sector management capacity, which can contribute to incoherent, unpredictable and inconsistent water policy, which in turn creates regulatory risk for businesses.
- Poor water management by the public sector may, by increasing the risk of water scarcity, constrain economic growth, which is directly related to financial risks to business.

Water scarcity risks are subjective vary from time to time and from place to place. Thus there can be no single response to risk management. However, there are four key principles that apply to all interests and should be used to shape effective management and mitigation of water scarcity risks:

- Interventions that reduce long-term scarcity and risk (such as protecting environmental flows for rivers) should be encouraged.
- Water allocations that prioritise water for those people and ecosystems that are least equipped to cope with water scarcity will reduce aggregate risk.
- Flexibility to change, including the ability to use water more productively, can reduce the risk generated by the physical phenomenon of water scarcity and the uncertainty caused by climate change.
- Progressive public policy, strong water management institutions and active involvement of a broad range of stakeholders is key to optimising allocation and reducing shared risk.

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12

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