



**UNEP Finance Initiative**  
Innovative financing for sustainability



# Challenges of Water Scarcity

## **A Business Case for Financial Institutions**

**Commissioned by:**

**The United Nations Environment Programme Finance Initiative (UNEP FI)  
Stockholm International Water Institute (SIWI)**

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**Swedish International Development Cooperation Agency (SIDA)  
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"We now understand that both business and society stand to benefit from working together. And more and more we realise that it is only by mobilising the corporate sector that we can make significant progress."

**Kofi Annan**

Secretary General, United Nations





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The contributing authors to this project are Tareq Emtairah from The International Institute for Industrial Environmental Economics at Lund University (Sweden), Marta Echavarría from Fundación Futuro Latinoamericano (Ecuador) and Ralph Hamann from the African Institute of Corporate Citizenship (South Africa).

This report builds largely on the need to engage with the financial sector in dealing with water related challenges, by providing a basic set of risk drivers linked to water scarcity, which can serve as a platform for identifying potential investment opportunities for mitigation, contributing to water sustainability. The report was enforced by the highly valuable comments and insights shared by invited guest to the UNEP FI – SIWI Roundtable held during the World Water Week 2004.

Additionally, we appreciate the contributions from members of the UNEP FI Latin American Task Force and African Task Force for sharing their hands on experience in day to day operations in the regions, which makes this report valuable to the global financial community.

Both UNEP FI and SIWI would like to express their formal appreciation to the Swedish International Development Cooperation Agency (Sida) for taking interest in the overall scope of this project and for their most valuable contribution of funding, making this publication possible. Lastly, we would like to acknowledge and thank the Swedish Water House for supporting the publication of this report.



### Foreword

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The work presented in this report by the United Nations Environment Programme Finance Initiative (UNEP FI) and the Stockholm International Water Institute (SIWI) highlights the importance of private sector participation in the water sector for the benefit of water sustainability.

As financial institutions, investors and capital markets become more responsible in their environmental, social and corporate governance practices, there is an intrinsic contribution yet to be made on how to become more active for the sake of sustainable development and for the world's poorest population.

This report presents a series of challenges for financial institutions which could potentially rise from growing concerns over water scarcity in certain regions. These concerns are more than justified as recent estimates point out that by the year 2025 over 40% of the world's population could be living in water-scarce regions.

The report calls on financial institutions to become aware of these challenges and to engage in actions to overcome them through risk management tools, investments and dialogue with business partners, national governments and local communities. The goal is achieving sustainable viable solutions that can mitigate these potential challenges and, at the same time, contribute towards alleviating the burden of water scarcity on developing countries.

The United Nations Environment Programme is pleased to present this work in collaboration with SIWI. UNEP hopes that the work presented in this project will benefit financial institution and their stakeholders as well as make a valuable contribution to the global efforts outlined during the World Summit on Sustainable Development and in the Millennium Development Goals related to water.

**Monique Barbut**

Director

Division of Technology, Industry & Economics

United Nations Environment Programme



## Foreword

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The Stockholm International Water Institute (SIWI) is pleased to join the United Nations Environment Programme Finance Initiative (UNEP FI) in presenting this important report.

Water, it is said, is everyone's business. Water, it is also often said, is the key to socio-economic development and quality of life. Billions of people, however, live without access to safe drinking water, basic sanitation, and in increasingly water-scarce regions. For them, such expressions ring hollow.

While many different water stakeholders are working to remedy the desperate plight of these billions, it can be argued that the world's financial institutions, businesses and investment professionals have a special role to play. Their resources, in terms of capital, capacity and expertise, are unique vis-à-vis the civil society, governmental, inter-governmental, science and water management sectors.

For increased investment in water efficiency, infrastructure and resources to occur, however, it has to be financially viable – a particularly daunting challenge in increasingly water-scarce areas. Business case solutions of the kind found in this report help to shed light on this viability, and on these ventures.

We hope you will find Challenges of Water Scarcity – A Business Case for Financial Institutions to be a motivating case for financial institutions, businesses and investment professionals. We also hope you find it a worthwhile contribution to the global efforts to move beyond words, and toward action.

**Anders Berntell**

Executive Director

Stockholm International Water Institute



## Foreword

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The Swedish International Development Cooperation Agency (Sida) is heavily involved in the support of integrated management of shared water resources. Our support has largely been focussing on capacity building for sustainable management practices.

Many regions face a situation where water is distributed unevenly in time and space. With increasing population and its legitimate demand for improved livelihood, entailing expansion of industrial and agriculture sectors, there is an enormous challenge in the allocation, use and protection of limited water resources. Water demand management and concepts like “more crop, nutrition and services per drop” are essential elements to all water resource providers.

We also appreciate that public interventions for water management have to be matched with efforts from the private sector and from the civil society. Joint efforts are necessary, if consumption patterns are to be adapted to available water resources. If so, the sustainability of the economic growth could be secured and supply for the long-term needs of industry, households and agriculture could be designed in a manner that does not undermine the availability of the resources we all are dependent on.

Sida is also working with the private sector, to raise awareness and responsibility for social issues, for environmental issues and for long-term sustainability of the economic growth.

Sida is grateful to SIWI and UNEP-FI for taking the initiative to elaborate this report which gives an informative assessment and presents challenging ideas for future roles and responsibilities of financial institutions, the private and public sectors vis-à-vis the management of scarce water resources.

**Pelle Persson**

Head of Division for Urban Development and Environment  
Department for Infrastructure and Economic Development (INEC)  
Swedish International Development Co-operation Agency (Sida)



## Executive Summary

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### Background

Water scarcity currently affects many regions of the world. Without a significant reversal of economic and social trends, it will become more acute over time. Although water is considered a renewable resource, in many parts of the world, water resources have become so depleted or contaminated that they are unable to meet ever-increasing demands. The challenges are more acutely felt in developing countries where 95% of the world's new population is born each year. This has become a major factor impeding economic development, and also business operations.

The challenges associated with water scarcity are becoming an emerging risk of strategic importance to businesses and their financial backers around the world. This is seemingly more important with rapid globalization within the business supply chain. Therefore, a business case for strategically addressing water challenges is getting stronger.

The United Nations Environment Programme Finance Initiative (UNEP FI) and the Stockholm International Water Institute (SIWI) initiated the project on water-related challenges for financial institutions, with the main aim founded on the need to learn and expand on the issues that arise from dealing with water scarcity and identify opportunities for the financial sector for contributing to sustainable development through active engagement in mitigating water related risks.

This report, based on a review of close to 20 cases of projects and investments mainly in Africa and Latin America, and supplemented with interviews with practitioners from both development and commercial financial institutions, concludes that there is a business case for improving risk management tools, which can specifically be related to the risks borne by water scarcity. While each organization must relate to water in its own capacity, the business case for the financial sector comes from acknowledging the potential risks associated with water scarcity and seeking possible opportunities for mitigating these risks.

The challenges associated with water scarcity are becoming an emerging risk of strategic importance to businesses and their financial backers around the world

### Project objectives

- Provide financial institutions with a framework for acknowledging risks related to water scarcity and social conflicts that may arise under this scenario.
- Provide case studies from Latin America and Africa where water scarcity has increased financial risk.
- Identify elements for a proactive approach to water scarcity by financial institutions.

### Project Scope

- The term water scarcity used in this report refers to the three dimensions of scarcity: quantity, quality and institutional capacity.
- A focus on case studies at the project level, mainly in Africa and Latin America, where water scarcity related risks and conflicts posed significant risks to project finance and investments.
- Supported by perceptions, attitudes and practices related to water scarcity risks from practitioners in both the development and commercial financial sector.

The term water scarcity used in this report refers to the three dimensions of scarcity: quantity, quality and institutional capacity

### Risk Drivers and Consequences

Water scarcity poses considerable and different types of risk for projects/businesses and their financial backers. Often the risk drivers are institutional and political.

Some identified factors in producing water scarcity risks include:

- Drought and drought cycles
- Water quality concerns
- Institutional and managerial capacity for effective water governance
- Political and regulatory conditions
- Cross boundary water and the risk of conflict
- Local community and stakeholders concerns



## **Potential Risks and Opportunities for Financial Institutions**

The three major type of financial risks that a project/facility might experience due to water scarcity include:

- Financial losses due to disruption of operations
- Increased financial investments due to required water treatment, either for water use, or wastewater treatment;
- Loss of an anticipated revenue base due to cancelled or delayed growth and expansion in a region due to quality, quantity, or stakeholder considerations.

As a result, financial institutions, which deal with those companies/projects, whether as bankers, investors or development aid organizations, face a variety of potential water scarcity risks. Many of these risks may not become apparent through the standard financial analysis/due diligence processes, and as a result some financial institutions were found in this project to have suffered losses due to unexpected water related problems affecting their customers or investments.

The materiality and risk potentials for a financial institution can vary depending on the nature of business partners (borrowers or investments), business sector and region of operation, and the client's capacity to anticipate and manage these risks.

The report outlines key opportunities for financial institutions for managing the risks related to water scarcity and contributing to global efforts in mitigating the negative impacts to society, their own business interest, and promoting water sustainability.



## 1. Introduction

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### 1.1 The Purpose

The overall purpose of this report is to mobilise the financial sector to pay greater attention to the global challenges of water scarcity. The case for the financial sector is premised on notion that water scarcity challenges pose considerable and different type of risks and opportunities for financial institutions and for their clients in many regions of the world. Financial institutions which assume the risk of companies and projects, can exercise considerable influence – in some cases – control over investment and management decisions that could be brought into play for the benefit of both their clients and water sustainability.

Many studies have been published analysing the extent and impact of water scarcity on economies and regions<sup>1</sup>. The role of the financial sector is often emphasised in terms of the need for more investments in technologies and infrastructures for freshwater and sanitation schemes. This report is intended to take the analysis a step closer to the project level by:

- Determining common types of risks for projects and investments as a result of water scarcity conditions.
- Identifying cases and scenarios where water scarcity has increased financial risk.
- Providing financial institutions with a framework for acknowledging these risks and identifying elements for a proactive approach by financial institutions to water scarcity challenges.

### 1.2 The Audience

Water is a concern for all actors in the society and is a highly politicised issue. Both the issue of security of water supplies and the protection of water resources are at the forefront of national politics in many nations. Water is equally an important topic in the international arena exemplified in the work of many inter-governmental bodies and international agreements.

However, given the scope of this project, the primary audience of this report are financial institutions and investment professionals. Our aim is to provide financial institutions with better understanding of the conditions that could lead to financial risks from water scarcity and motivate actions at the board level of financial institutions.

The practical implications from the findings of this report are intended for scrutiny by financial institutions' economic departments, credit risk officers, and project evaluators. The ambitions is that these actors will find in this report useful starters to help develop comprehensive view and integrated risk management practices related to water issues and business development.

An important subset amongst investors is the asset management community who increasingly use sustainability criteria in the development and management of their own products and funds. This report is intended to help them get better at formulating criteria position on water related issues in asset valuations.

Furthermore, companies and multinationals that are active in water-stressed regions and water intensive sectors will find in this report a business case for developing risk assessment and risk mitigating strategies.

Finally our hope is that policy makers will find in this report useful hints for engaging and mobilising financial institutions in addressing water challenges globally and locally. It is clearly recognised the need to mobilise private financing and other resources for addressing water challenges. Understanding the factors producing water scarcity risks from the perspective of financial institutions is important in creating the conditions and incentives for joint efforts.

### 1.3 The Scope

The primary focus of the report is on water scarcity related risk and financial consequences at the project level. While we acknowledge that the risks analysed in this report can be found in many regions of the world both developed and developing economies, we chose to focus on cases from developing countries, mainly Africa and Latin America. Although this

The goal is to mobilise the financial sector to pay greater attention to the global challenges of water scarcity



The dimensions of water scarcity stretch between the physical scarcity and the 'social adaptive capacity' to deal with this situation

selection was necessary given the resources of the project, the primary motivating factor is that the water challenges in developing countries in general are more acute than developed countries.

The concept of scarcity in relation to natural resources has many dimensions. When talking about scarcity of renewable resource, freshwater being an example, scarcity in physical terms can arise in three ways: through a drop in the supply of a key resource, through an increase in demand, and through a change in the relative access of different groups to the resource<sup>2</sup>. This view however might not be adequate to reflect the variety of ways in which human being use and misuse water. The alternative view of scarcity and resources is to think of the resource endowment and the socio-economic and cultural context of its use. In this view, the dimensions of scarcity stretch between the physical scarcity and the 'social adaptive capacity' to deal with this situation<sup>3</sup>. Perceiving scarcity in these broader terms expands the range of policy options, managerial and institutional opportunities for water risk management<sup>4</sup>. In this report we have taken this broader view on water scarcity in the analysis of a number of profiled cases from Africa and Latin America, where the risk drivers affecting projects and investments are often of institutional and political nature than purely water availability conditions.

## 2. Water Scarcity and Financial Institutions

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### 2.1 The global challenge

The relationship between the physical aspects of water scarcity and risk can not adequately be addressed without closer look at the economic and institutional adaptation

Recently the United Nations estimated that by the year 2025, up to 40% of the world's population could live in water scarce regions. Scarcity of freshwater seen both in terms of rising demands or water depletion and pollution is a critical problem. Steep increase in population, consumption, and the desire for better living has placed a greater strain on the security of fresh water supply. It is estimated that water use for human purposes has multiplied six-fold in the past 100 years<sup>5</sup>. These projections translate into doubling of global water consumption every 20 years, more than twice the rate of human population growth<sup>6</sup>.

In some areas, water withdrawals are so high, relative to supply that surface water supplies are literally shrinking and groundwater reserves are being depleted faster than they can be replenished by precipitation<sup>7</sup>. This can translate into increased costs of water supply for economic activities and for daily human needs.

The human pressure on fresh water supply is not only limited to increased water withdrawals. Increased human activities also destroy water. The quality of groundwater in industrialized countries has deteriorated due to nitrogen leaching from over-intensive agriculture<sup>8</sup>. The state of affairs in developing countries is even more pressing. Close to 75% of all industrial waste and 90-95% of sewage in the developing world is discharged into surface waters without any treatment<sup>9</sup>.

The relationship between the physical aspects of water scarcity and risk cannot adequately be addressed without closer look at the economic and institutional adaptation. In the face of water scarcity challenges, many developed countries tend to have enforced regulatory frameworks and financial capacity for supply sourcing. The challenges for many countries – though exemplified in terms of population pressures, over-extraction of groundwater supplies, and seasonality of supplies, urbanization and increased consumption patterns – are also compounded with inadequate water resource management.

Thus, indications of water scarcity risk appear not only from pure physical measures of water availability or the lack thereof, but also due to technical and institutional capacity for water governance. Often put forward in terms of: inadequate technical capacity to treat industrial wastewater and sewage effluents; inadequate financial capacity to invest in water supply and wastewater infrastructure; and inadequate administrative and institutional capacity for effective water governance.

Over the last twenty years, increased attention to water scarcity and its impact on all aspects of development, including food security, economic growth, public health, gender equity, education, and environmental sustainability, has led to several international conferences and platforms at a global and regional level, with the intention to guide policy making and capacity building activities both within the international community and at a country level. The international consensus and agenda for action recognizes the important role for financial institutions.



### Box 1

#### Extracts from the international consensus and action agenda on water

- That water is an economic as well as a social good that should be treated as a valuable and finite resource, and be equitably and sustainably allocated (Dublin Principles & Bonn Recommendations for Action);
- That access to water supply and sanitation should increase by 2015, such that the proportion of the world's population lacking access to safe water supply and basic sanitation be halved (Millennium Declaration/Millennium Development Goals # 7);
- That all stakeholders to water sources should recognize their responsibility for the common good, and that management or ownership of water assets carries the obligation to conduct business in a socially, environmentally, and ethically acceptable manner (Bonn Recommendations for Action);
- That the international community should forge a global partnership for development, which can act as a catalyst for reform and capacity development to mobilize knowledge and financial and other resources to reduce poverty and create more sustainable forms of water resources management (Millennium Development Goals #8/Bonn Recommendation for Action)

## 2.2 The Business Case for Financial Institutions

Water is vital to all companies, from those that use water in production processes to those that build, operate and finance water infrastructure. But the challenge for business rests not only on the need for its own activities to ensure adequate supplies and limit waste and pollution [...] but equally essential to their long-term success, is the role that water plays in economic development, health, employment and markets in the communities and regions where they operate.<sup>10</sup>

Typically, water use is categorized by its three major uses: agriculture, industry, and domestic consumption often measured as municipal use. In global terms agriculture is seen as the sector that uses the most water. However, in countries with a higher per-capita income industry accounts for a higher share of water withdrawal according to World Bank estimates<sup>11</sup>.

The industrial sector currently consumes approximately a quarter of the world's available water resources, although the volumes of industrial water withdrawal vary depending on the type of industry, the different kinds of production, and the technology used in the industrial process. Even in high tech industries, where mistakenly perceived as being 'clean' industry, the sector is one of the most water-dependent and water-damaging sectors. Each 300 millimeter (mm) silicon wafer (computer) chip produced requires 8,622 liters of de-ionized freshwater<sup>12</sup>. In Santa Clara, California, the electronics industry used about 24% of city's water between 1994 and 1995<sup>13</sup>.

Water also plays an increasing role as a supplier of energy. In the second half of the 20th century about 40,000 large dams were built throughout the world. About one-fifth of the world's electricity requirement is now covered by hydropower. In countries like Brazil and Norway, up to 90% of the electricity is supplied by hydropower.

In addition to water consumption, industrial water use is one of the main causes of water pollution in the world. Although pathogens are still a primary cause of disease in developing countries, chemical pollution from industries is a major cause for concern. Some 300-500 million tons of heavy metals, solvents, toxic sludge, and other wastes accumulate each year from industry<sup>14</sup>. In developing countries, close to 70% of all industrial waste is dumped untreated into waters where it pollutes the usable water supply<sup>15</sup>. Effluents from thermal and atomic power generators are quite harmful to the environment, due to chemical and thermal pollution. Additionally, industries such as food and beverage industries that use organic raw materials are the most significant contributors to organic pollutant load. For example, the food sector produces 40% of total organic water pollutants in developed countries and 54% in developing countries.

Considering how vital water is to many of the key economic activities, the risks of water scarcity can take on strategic importance to businesses and their financial backers around the world. In most countries the state owns the country's water rights, and provides licenses or designates allocations for abstraction by different sectors. In times of drought, or of water crisis, governments designate domestic use as a top priority for allocation, often followed by agriculture, for reasons relating to food security. Industry is often the last priority, which increases the business risk for companies operating in water scarce and water stressed areas.

The business case for the financial sector will come from acknowledging water risks associated to scarcity and seeking possible opportunities for mitigating these risks



Financial institutions, which assume the risk of companies and projects, can exercise considerable influence – in some cases – and control over investment and management decisions that could be brought into play for the benefit of both their own business and the environment

A business case for strategically addressing water challenges is getting stronger. This is becoming even more important largely due to rapid globalization within the business supply chain. Indicatively, in 2002, there were more developing and transition countries represented in the top 10 global FDI destinations than developed countries, for the first time<sup>16</sup>. China, India, Russia, Poland, Mexico and Brazil are at the forefront, and between them accounted for about USD 80 billion in FDI inflows in 2002, or half of the total FDI inflows to the developing world. These countries are top contenders for business growth and industrial development. They also happen to have significant challenges with freshwater supply.

While each organization must relate to water in its own capacity, the business case for the financial sector will come from acknowledging water risks associated to scarcity and seeking possible opportunities for mitigating these risks. Financial institutions, which assume the risk of companies and projects, can exercise considerable influence – in some cases – and control over investment and management decisions that could be brought into play for the benefit of both their own business and the environment.

As some of the examples show, financial institutions will also need to address potential risks that arise in the entire value chain of water intensive sectors, which may be affected by future water shortages, as well as risks related to transport on waterways and water related conflict.

It is important to recognize that, as well as creating risk; consideration of water supply problems can also provide opportunities for companies to improve their competitive position through improved operational performance and efficiency, and by innovating new solutions. Sometimes these opportunities will result in new business opportunities for financiers. It is therefore in a financial institution's interests that it understands how water concerns affect it and its business partners.

Furthermore, financial institutions have a vital role to play in the development of their economies, and are in a position to influence whether this development takes place in a healthy, sustainable, efficient fashion likely to endure in the long term and foster good international relations, or whether the economy develops in an unhealthy, unsustainable fashion, wasting resources and storing up long term health problems and costs for a country and its neighbors. Under any scenario long-term shareholder value could be affected positively or negatively.

### 3. Factors Producing Water Scarcity Risks

A potential risk at any facility is the lack of access to suitable clean water

We can perhaps easily recognize the situation where a business or a project may face the risk of not having enough water or not having the right quality of water to run operations. However what lay behind this situation are multiple factors interacting sometimes together to produce a scarcity situation for a business with unfavorable financial consequences. In this study we examined a number of investments, mainly in Africa and Latin America where there has been financial impacts as result of water scarcity situation. The risks for the financial backers of most of these projects may have been direct or indirect. Interesting to point however that not only the natural but also the institutional dimensions of scarcity were featured through out many of the cases explored in this report. In the following subsections we catalogue some key factors behind the water scarcity risks featured in the case studies.

#### 3.1 Drought and drought cycles

An unexpected or chronic decline in water supply can significantly jeopardize business operations, or raise the cost of operations, especially for companies that are water intensive. A potential risk at any facility is the lack of access to suitable clean water. This can be measured in either qualitative (available water is unsuitable) or quantitative (lack of enough water) terms. Inconsistent availability of water may negatively impact the efficiency and effectiveness of business operations. These factors can result in both production delays and/or limits on the production capacity. This, in turn, affects the company's financial performance, and ultimately its ability to meet financial obligations.

The potential consequences to investments can be clearly illustrated in the case of the hydroelectric company AES Tiete in Brazil [Box 2]. This case illustrates how both severe drought cycles and cumulative political decisions in the energy sector aggravated the situation for AES Tiete to meet its obligations on a bond underwritten by Bank of America. It is difficult to assert if assessing vulnerability to potential fluctuations in water availability may avert such risks. However the combination of political risk and water scarcity was beyond what was considered in the business plan of AES Tiete,



### Box 2

#### Foreign Direct Investment in private electricity generation in Sao Paulo State, Brazil<sup>17</sup>

Brazil generates over 90% of its electricity from hydropower. Thermal plants powered with diesel supply the remainder. Between the months of November to around April of every year, the rainy season fills the country's reservoirs. However in 2001, the rains did not come and the reservoirs' levels were at 30% storage capacity. The effects of this natural phenomenon, aggravated by unfortunate cumulative decisions in the energy sector, forced the government to take severe measures to prevent blackouts.

According to the U.S. Department of Energy, the Brazilian government's aim was to reduce consumption by 10-35%, based on the level of added value of the industry and the number of jobs affected. The usage reduction quotas that affected all sectors fell less heavily on certain industries such as automobile manufacturing, food, and petrochemicals. Those that did not comply were fined or eventually their power supply was cut off. Between June 2001 and May of 2002, domestic consumers had to reduce their consumption by 20% or otherwise face penalties of up to 200%, and also pay a surcharge.

One sector that was particularly affected was the private electrical generation companies, such as AES Tiete. In 1999, AES Tiete Holdings bought controlling interest in AES Tiete S.A., formerly known as Cia de Geracao Energia Elétrica Tiete, for USD 474 million. AES Tiete is now a hydroelectric generation company composed of ten facilities, including 32% equity interest in Electropaulo, a distribution utility with over 5 million customers. The ten hydro plants, located along the Tiete, Pardo and Grande Rivers in Sao Paulo State, have a combined generating capacity of 2,650 MW producing over 32,800 GWh of electricity annually.

According to the director of AES Tiete, Mr. Barbosa da Silva, the company assets were affected by the electrical rationing. In 2000, AES Tiete Holdings had closed a USD 300 million 15-year bond offering at 11,5 %. Inconvertibility and devaluation coverage was issued by the U.S. Overseas Private Investment Corporation (OPIC). Bank of America Securities was the lead underwriter. Due to the rationing in 2001, the bond payment schedule had to be postponed. Though the company cut costs dramatically to be able to pay dividends, the situation was too extreme. Since the company had insurance coverage from OPIC, a new payment schedule was negotiated at the end of 2003 with the bondholders.

Under normal circumstances, the company was prepared to deal with water availability variations, but for smaller range contingencies. In the electricity generation contracts there is a clause that stipulates that when a generator is below the agreed dispatch due to natural impacts, other generators should provide the deficit. There is also a figure (5 real per kwh) to cover the variable costs of generation in other plants. However, the situation in 2001 went beyond what was considered by the business plan of AES Tiete. Fortunately, the political risk insurance, provided by OPIC, permitted the re-negotiation of the payment schedule since financing conditions could not be changed.

"The electrical rationing was not caused by a water shortage, it was caused by the management of the reservoirs of the previous years" says Mr. Demostenes Barbosa da Silva. Due to the Brazilian financial crisis, the government did not modify the tariffs and so did not authorize the purchase of the fuel necessary to supply the thermal plant back in 1997, 1998, and 1999. Therefore, the electricity usually provided by the thermal plants was provided by hydroelectricity, and thus, the reservoirs levels were allowed to go lower than what was technically "safe". The inflexibility of the tariffs also affected private generators, who considered the risk and did not continue to invest in new plants, as was expected before the economic crisis.

The impact of the electrical rationing was national. The Brazilian Southeast region is composed of the states of Espiritu Santo, Minas Gerais, Rio de Janeiro and Sao Paulo, accounting for only 11% of the area of the country, home to 43% of the population (around 73 million people) and generating around 59% of the country's GDP. The impacts of the water 'rodizio', or rationing measure are estimated to be a reduction of 2% of GDP or a loss of around USD 20 billion. Industries were affected by an increase in their costs of production. Due to the wide-ranging impact of the rationing, which caused a recession, this additional cost could not be transferred to consumers in the price of the good or service. Only now, is industrial operational capacity reaching the pre-rationing levels.



thus increasing the risk exposure of its financial backers.

The above case further illustrates that water scarcity risks can be a combination of issues: drought cycle, misuse of resources and/or institutional mismanagement. Under this scenario, water scarcity has affected both the business and its financial backers. The lead underwriter in this bond offering deal for AES Tiete, Bank of America incurred unusually high transaction costs due to the postponed payment as a direct consequence of the above situation.

Without proper attention to droughts and drought cycles the impacts can be far reaching beyond a single project; affecting the viability of an entire economic sector

The exposure to drought risks varies depending on the sector. Particularly in agriculture or irrigation related projects; droughts are old and commonplace risks. A recent project to enhance small-scale pastoral farming in Morocco is illustrative in this regard. It was funded by the African Development Bank, International Funds for Agricultural Development, and the Moroccan government, and the estimated total cost was almost USD 50 million. Implemented over eight years until 2001, it involved close to 4,500 farmers, and it included the provision of training and improved breeding technologies, and the facilitation of cooperative organisational structures.

Though the project was deemed to be successful on many counts (44 cooperatives had been created), the project failed to achieve its objectives because of an extended drought between 1996 and 2001. In particular, water scarcity diminished food supply for cattle and sheep, and it led to the further impoverishment of vulnerable small-scale farmers. The damage to financial institutions in this case is not so much in terms of financial returns on investment, but rather in terms of not achieving the developmental objectives of the project.

The concerns of drought reinforce the need for drought cycle planning and preventive measures, which highlight the important links of creating institutional capacity. A key water-user in South Africa, as in much of Africa, has been irrigation. There are a number of instances where irrigation schemes have been struck by water scarcity, either due to drought or pollution events. Many of these failures or costs were often carried over to the Land Bank<sup>18</sup> in the form of defaulting repayments. Adriaan Louw, Director of the Institute of Agricultural Engineering in South Africa and Limpopo basin coordinator in the Consultative Group on International Agricultural Research (CGIAR) project, emphasised that such failures can be prevented by a careful planning approach that takes into consideration the drought-cycles experienced in climatic zones such as southern Africa.

During the 1980s, such an approach to risk assessments for irrigation projects was being developed by the Department of Agriculture. This was also because that period was characterised by drought. But during and since the transition to democracy, according to Louw, this emphasis on drought-cycles and a risk averse approach to project planning has diminished. Louw suggests that this is in connection with the various institutional changes that have taken place and because the 1990s were characterised by a wet cycle. The key issue is that there must be adequate understanding and appreciation of wet and dry cycles in water management and risk planning, both at policy and project level.

Without proper attention to droughts and drought cycles the impacts can be far reaching beyond a single project; affecting the viability of an entire economic sector. This is becoming evident in the tourism development in Africa for example. The World Tourism Organisation estimates that 77 million tourists will visit Africa in 2020, three times as many as in 1995. However, this growth may be jeopardised by insufficient water resources and inadequate planning and infrastructure. Citing a paper by Professor Karl Wolfgang Menck from Hamburg Institute of International Economy (HWWA) presented at the world tourism fair in Berlin in March 2004, the Inter Press Service reports:

The water supply situation in southern Africa that attracts one-third of the global tourists to the continent is far from satisfactory. Water required for public use has to be pumped over long distances from rivers and lakes, and this involves enormous costs. The situation is aggravated by the fact floods follow on the heels of droughts - underlining the need for adequate water management... East Africa that is expected to share 30 percent of travellers to the continent is no better off. Equally precarious is the water supply situation in West Africa that has not yet drawn a significant tourist attention.<sup>19</sup>

Considering that tourism is an important industry in many African countries, and often one of the only growth industries, it is apparent that the potential constraint represented by water scarcity deserves careful consideration also by financial institutions involved in tourism projects. Currently, the risks of water scarcity are not considered sufficiently by either tourism developers or their financial backers according to Professor Menck<sup>20</sup>.



### 3.2 Water quality concerns

Deteriorating water quality has become one of the most critical issues affecting both the developed and developing countries. While most developed countries have the technical, administrative and financial capability to support advanced technologies to treat industrial wastewater and sewage effluent, most developing countries lack these capabilities. As a result, industrial and municipal pollution pose a significant risk for operations in developing countries, where an average of 90% to 95% of all domestic sewage, and 75% of all industrial waste, is discharged into surface waters without any treatment. The risks to businesses and financial institutions are carried through water pollution liabilities or through additional costs to secure alternative sources of water.

This African Chrome case [Box 3] illustrates how water pollution liabilities can be carried to a financial institution. The key learning from this case is that environmental liabilities linked to water created a financial burden for the bank which affected its credited portfolio. Proper due diligence with the relevant actors, including top management of African Chrome, employees and other stakeholders could have identified risks that were not covered in the initial credit proposal. It also shows how the Industrial Development Corporation (the financial institution involved in the project) public interest ambit influences the decisions made regarding the acceptance of liabilities. However, private banks are also subject to significant pollution liabilities. As an illustration, a government department in South Africa recently obtained finance for the

The risks to businesses and financial institutions are carried through water pollution liabilities or through additional costs to secure alternative sources of water

#### Box 3

#### Water pollution liabilities in South Africa<sup>21</sup>

African Chrome was established in 1991 to market Russian-produced sodium dichromate (SDC) in South Africa. In 1995 they decided to build a plant in Brits (near Pretoria) to produce SDC from chrome ore available locally at low cost. Initially, the Industrial Development Corporation (IDC – a parastatal development bank with international reach) had a 20% shareholding in African Chrome, but sold it in July 1997 to one of the other shareholders.

The capital expenditure and time required to build the plant and to meet the water management standards prescribed by the Department of Water Affairs and Forestry (DWAF) were underestimated and IDC provided loan financing to partially fund the additional cost. The plant was commissioned in February 1998, but failed to achieve on a continuous basis the production levels and process efficiencies required to make the operation economically viable. Production ceased in December 1998, the employees were dismissed on 1 March 1999, and the shareholders abandoned the company, despite an IDC proposal to salvage it.

The shutdown of the plant was poorly planned and executed. All the sumps, storage tanks, bounded areas and most of the items of equipment were full of SDC-containing slurries. Excess slurries were dumped on two unpaved areas, contaminating the soil, groundwater and surface runoff with SDC.

At this time African Chrome was more than six months in arrears on their IDC loan and the assets were attached. IDC instituted a scheme of arrangement with creditors, a lengthy process which was finally completed in April 2001. When African Chrome was shut down in December 1998, the IDC could have abandoned the plant, written off a substantial bad debt (R30 million) and left the environmental remediation to government and the taxpayer. However, when the nature and extent of the environmental pollution became apparent, the IDC opted to do two things:

- To clean up the site and remediate chrome VI contamination from the site – a costly and complex process, with the site currently in care and maintenance. Estimated clean-up costs to date are about R5 million;
- To refurbish the plant and operate it commercially with a competent partner.

construction of a large office building. But extensive groundwater pollution under the site (created by an old petrol station previously in the area) increased the costs and complexity of the project. The pollution was unexpected and difficult to deal with and the first casualty was the bank, which was released from the project. Another bank was invited to participate, but extensive studies were necessary to gauge risk implications, also as they may relate to future liabilities.

In part, the IDC's decision to take ownership of African Chrome and implement a clean-up programme relates to the bank's public interest ambit. It is also important to note that this experience has provided a number of important lessons to the bank. For instance, the IDC's 2004 Sustainability Report features this case study and notes:



The IDC is aware that such risks may arise even in the absence of strict lender liability and we endeavour to keep ourselves informed about international and regional initiatives on the environment, particularly those that directly concern us. To this end we have built environmental risk assessment into our credit decisions using the [African Chrome case] and other lessons from other financial institutions.

The deteriorating quality of watersheds, lakes and reservoirs in Latin America are creating conditions where businesses are forced to shut down or invest in alternative sources of supply. As the following examples illustrate, an important future challenge will be for financial institutions to link project-level risk assessments to catchment management. The catchment is the level at which decisions regarding water use allocation need to be made, including an appraisal of the impacts of increased water use or pollution.

An important future challenge will be for financial institutions to link project-level risk assessments to catchment management

Lake Valencia, the largest freshwater lake in Venezuela, has an area of 350 square kilometres, and 12 rivers drain into the Lake. Due to its wealth in natural resources, the area became an important development pole, home to 12% of the population of the country<sup>22</sup>. Valencia is the second city in the country, after Caracas, and the major non-petroleum industrial centre. With over 2,000 industries, provides 30% of the country's industrial employment. Due to intensive human intervention in the watershed and low groundwater flows, the lake's level has dropped and the quality has deteriorated dramatically. The regional water utility Hidrocentro had to invest in a new pipeline and pumping stations to bring additional water to the city inhabitants from the Pao River. According to Alfredo Garcia, coordinator for the central system of Hidrocentro, the cost of using the lake's water for drinking water would be around 10% of the cost of pumping water from the Pao River. However, due to the pollution problem, water has to be brought from another watershed. The additional cost of drinking water provision, due to the high energy costs, has been transferred to the consumer only partially. Venezuela has increased the water tariffs but not enough to cover all the water companies' costs. Therefore, Hidrocentro's profit margins are affected. Recent efforts by the Minister of the Environment and Natural Resources has helped to restore Lake Valencia through collaborative efforts from all stakeholders affected, a coming together of industry and civil society.

In Kenya<sup>23</sup>, UNEP has been the lead agency in support of the Nairobi Dam Initiative, aiming to raise USD 600,000 to clean up the reservoir so that it can be again an important source of clean and healthy drinking water, as well as a recreation area. The Initiative is part of the broader Nairobi River Basin Project, which seeks to counter an increase in water scarcity in Kenya due to pollution, imprudent water management, and catchment degradation through deforestation. It is estimated that this poor water management is costing the Kenyan economy almost USD 50 million annually.

In the Nairobi dam itself, heavy pollution emanating from the high-density population of the Kibera informal settlement has stimulated growth of invasive plant species, especially Water Hyacinth and Parrots Feather, which have infested the water body. Invasive aquatic weeds and solid waste dumping have completely altered the aquatic ecology and flow regimes of associated rivers. High coliform counts in the dam water and other pollutants have made it unsuitable for consumption. Financial institutions that may have been adversely affected by this deterioration of water resources include those supporting the water utility for Nairobi, as well as those funding recreational activities on the reservoir.

Similar problems are encountered in Malawi, where weeds and trash are blocking intake screens for hydroelectric power plants. Indeed, the need to clear these impediments has resulted in repeated temporary shutdowns, with significant implications for the power utility (South African company Eskom) as well as electricity users, of course. A further problem is the increasing siltation in the reservoirs. Though meetings have been held between relevant stakeholders and the need for longer term solutions has been highlighted, the suggested solutions emphasise measures such as screen clearing

### Box 4

#### The South African National Water Act 1998<sup>24</sup>

In a country where water is an unevenly distributed resource, access to water is of fundamental importance to the living conditions of people. One of the most notable features of South African water resources is the hugely variable availability of surface and groundwater due to climate and geography. Less than ten percent of rainfall converts to useable runoff. But scarcity of water is also a socially constructed notion. Traditionally, white South Africans have used as much as they need, and more. After the transition in 1994, about 14 million black South Africans did not have access to running water in their homes and 20 million had no adequate sanitation. The per capita consumption was less than a twentieth of the typical white. Water has been unavailable to many black South Africans simply because there were no pipes and taps in many townships and squatter settlements.



### Box 4 **continued...**

During apartheid, white, land-owning farmers had essentially unconstrained access to water sources on their property, due partly to a tenuous distinction made by the Water Act of 1956 between “private” and “public” water and streams. Private water was that, which rose, fell or drained onto the owner’s land and which could not be used for common irrigation. Indeed much of South Africa’s water related legislation had been largely oriented towards irrigation, with over 50% dedicated to agricultural purposes, 12% for municipal and domestic purposes, and the remainder for industry.

Although some restrictions existed on the removal of private water, the riparian owner could in effect do and take as much as he or she pleased, and even water designated “public” could be put to “reasonable use” by the riparian land-owner. In agricultural areas, the irrigation boards that administered the allocation of water were generally heavily biased towards the needs of farmers. Hence the determination of “reasonable use” would often discriminate against other uses. This highly unsatisfactory arrangement of property rights had been repeatedly criticised, as early as the late 19th Century.

Similarly, white suburban residents and industrial water users have long enjoyed subsidised water supply. Municipal water tariff structures often made high-intensity water users pay less per litre than users of low amounts. In addition, there would frequently be geographic variations that further disadvantaged low-income areas.

After 1994, these factors necessitated a new all-embracing legal framework for water that would bring social improvement and emphasise prudence in water use. At the same time, the 1997 White Paper recognised: “It would not be in the interest of national prosperity to unnecessarily constrain industry’s access to water.” Furthermore, the new legislation followed an intensive process of public consultations.

The fundamental principle that guides the National Water Act of 1998 is that water is a national resource, owned by the people of South Africa, and held in custodianship by the state (section 3). This principle allows the state to have total control over the utilisation of the resource. A licensing mechanism enables the state to regulate the use, flow and control of all water in South Africa. This change in principle makes it possible for mechanisms to be put in place to manage water resources using a more holistic ecologically based approach, taking into account the entire water cycle. The allocation of water according to the priorities of equity, redistribution and the improvement of the living conditions of people would have been impossible within the old legal framework.

The Act provides for catchment management agencies to prepare catchment management strategies in line with a national water strategy. These agencies will also need to issue licences for water users, taking into consideration the “water reserve”, which is perhaps one of the most important innovations of the Act. It consists of two parts: the basic human needs reserve and the ecological reserve. The former relates to the basic right for all persons to have access to a minimum amount and quality of water. The provision of this amount has been a matter of much dispute in recent years, also in connection with conflicts surrounding the commercialisation or partial privatisation of water services. The ecological reserve refers to the minimum quantity and quality of water necessary for ecosystem health.

Obviously the requirements and procedures for licensing are of utmost importance. Though the Act includes a number of measures to allow a period of transition to the new regime, as well as limited compensation provisions (to be administered by a Water Tribunal), there were significant concerns that some users, notably large farmers and the forestry industry, would experience significant decreases in access to water.

Significantly, banks were amongst the most vocal critics of the new Act. They were worried about decreasing land prices, especially in agricultural areas, due to potential constraints and uncertainties in the new licensing process for water.

However, the high degree of controversy and conflict that characterised the drafting and declaration of the Act subsided in the aftermath of its passage. For instance, the South African Agricultural Union abandoned its threat to contest the Act in front of the Constitutional Court. Reasons for this include the significant efforts made by the Department to ameliorate water users’ concerns, particularly with respect to the transitional arrangements. The private sector, including the banks’ association, played a role in these negotiations, and the success of these negotiations is implied in the relatively conflict-free implementation of the Act. Furthermore, all representatives of South African finance institutions contacted in this research commented positively on South Africa’s water policy, though frequent mention was made of the implementation challenges.



Box 5

**SINERSA and the Pechos Reservoir in Northern Peru<sup>27</sup>**

Poechos, built over 40 years ago, is the largest reservoir in Peru, with an area of 70 square kilometers and a storage capacity of 1,000 million cubic meters. Located in the Sullana province in the Department of Piura, 20 kilometers from the border with Ecuador, the reservoir is part of the Special Project Chira Piura, built to regulate flows and provide irrigation to three valleys around Piura. They are considered to be one of the most important agricultural areas in the country, thanks to the availability of irrigation, the valleys produce rice, cotton, corn and fruits, such as mango and citrus.

The reservoir has gradually been losing storage capacity, now estimated to be around 50% of the original capacity due to sedimentation. The high rainfall during the El Niño years, combined with the type of soils and topography, generate a high sediment load that is affecting the reservoir. Although the area irrigated has not been reduced, what has been affected is the capacity of the reservoir to regulate flows from year to year and within the year.

Usually, rice production in the area allows for two harvests. However, the current situation has prompted the government to prohibit the planting of rice in the area. This has generated a strong reaction from farmers who see rice production as their leading source of income.

In addition, the mounting pressure on the water source generates conflicts between its different uses. In the Peruvian water law, and most Latin American countries for that matter, water use for drinking water and agricultural purposes take precedence over industrial uses. Therefore, putting under financial strain electrical generation.

This is the case of SINERSA (Sindicato Energetico SA), a group of Peruvian and European investors who in 2002 got a concession to build and operate a power plant using the flow regulated by the Poechos reservoir. The Poechos Hydroelectric Plant began operation in April of 2004 with an installed capacity of 15,6 MW. SINERSA also operates another plant, Curumuy, at the end of the irrigation canal, which generates 12,5 MW. The Poechos project had a cost of USD 16,3 million, of which USD 8,5 million was lent by the Inter-American Investment Corporation (IIC), the private financing institution of the Inter-American Development Bank, due to its regional importance. The Peruvian Ministry of Energy and Mines estimates that the project will provide electricity to over 166,000 rural people in four rural electrification projects.

The current situation is affecting the SINERSA's sales and thus, its cash flow. Company management estimates that earnings are 50% less than what was estimated (pers. com. George Gruenberg). Therefore, although the company is doing all it can to cut costs, that reduction in earnings is too high and the hope is to renegotiate liabilities with the local bank, which is living the regional situation directly. At the same time, SINERSA has agreed with the IIC to do a study to review carefully the situation and try to quantify the impact of the water scarcity.

The question remains, if project design for the reservoir, or the hydroplant for that matter, should have captured better the storage capacity limitations in the first place? In the view of Eduardo Zegarra, a researcher at a Peruvian research center GRADE, "In terms of risk management, my impression is that this [Poechos] is a case of gradual deterioration of a system that has been badly managed, more than unexpected events, like drought or floods, that are generally associated to risk."

To complicate matters further, the decisions to address the problems of the Poechos reservoir cannot be circumscribed to the Peruvian and Piura authorities. The Poechos reservoir is filled by Chira and Quiroz rivers, tributaries of the Catamayo river that comes from Podocarpus National Park in Ecuador. Therefore, water management decisions cannot be limited to Peru, but is a bi-national effort. Ecuador and Peru have had a long history of border disputes, with the latest war breaking out as recently as 1995 and a peace agreement finally signed in 1998. As part of the peace process, a Binational Development Plan was agreed upon with the support of overseas development assistance, particularly the government of Spain. The Plan is focused on the protection and integrated management of the Catamayo – Chira watershed with a wide range of public and private organizations participating.

and dredging – there is no mention of catchment based strategies, which would need to take into account factors such as deforestation and town planning on river banks.



### 3.3 Political and regulatory conditions

Given the current water scarcity scenario and future water demand projections, a number of developed and developing countries around the world are taking steps to strengthen regulatory mechanisms for water use and water pollution as part of development processes. This may affect business by changing the environment for obtaining abstraction and discharge licenses; rules for effluent discharge may become more stringent and better enforced; regulations and toxicity categories for effluents may be modified; and businesses may begin to be liable, as they are already in many developed countries, for their negative impacts on the environment as part of their production processes. Legal and regulatory reform may also lead to higher water tariffs for industrial consumers.

The reform brought by the South African National Water Act of 1998 is an interesting case to profile here [see Box. 4]. The reform is to bring with it new licensing and allocation procedures based on social equity and holistic ecologically based approaches. It should also be noted that the relatively sophisticated water policy and evolving institutional framework in South Africa is commonly considered to be a factor that diminishes water-related risks, but that regulatory and institutional changes nevertheless increase the scope for risk.

However, the ongoing challenges in implementing the new policy also have potential implications for finance institutions. In one instance, a large pulp and paper factory is considering fundamental changes to its future business (ranging from significant expansion to closure), due in part to impending changes in water allocation and pricing. However, because the implementation of the Water Act's provisions is constrained by limited government capacity, these strategic decisions have been put on hold for some time already, with obvious implications for the factory's financial backers.

In general terms Anthony Turton, head of the African Water Issues Research Unit noted:

The problem is that the technology does not yet exist to make these [new licensing procedures] fully implementable. This has resulted in a degree of governmental "inaction", largely because of governmental restructuring on the one hand, combined with the complexity of implementing such "radical" new ideas. This translates into uncertainty for the business world.<sup>25</sup>

South Africa represents a special case in that the post-1994 government has implemented a host of regulatory changes in order to overhaul apartheid policies and to address apartheid legacies. As noted, these changes have generally been implemented in a negotiated and compromise-seeking manner, so finance institutions have not experienced undue impacts. However, this case illustrates how regulatory changes, even if targeted at laudable sustainable development objectives, can have potential implications for finance institutions.

Indeed, many developing countries are experiencing regulatory changes to adapt to international best practice. Many countries have followed the trend towards decentralization in recent years, including a trend towards decentralized water management. Also changes in government, bring about institutional changes, that alter the composition of ministries and other government agencies. Some of the political challenges a facility may face include sudden changes in water allocation without legal recourse, as well as requests for corruption, which often leads to reputation risk for the project developers including the financial backers.

### 3.4 Institutional and managerial capacity for water governance

A considerable challenge to address equitable water allocation and environmental sustainability, especially in developing countries, is the lack of capacity at the country level to provide effective water governance. In general, developed countries have greater technical, financial, and administrative capacity to address these issues. However the prevailing water governance in the studied regions is much less encouraging. The prevailing conditions give the impression of fragmented responsibility over water resources, including multiple government agencies responsible for water management, which typically operate in isolation and in competition for funds. Even if there is a capacity to develop regulatory frameworks, many of the countries in these regions lack to the capacity to implement and enforce regulation concerning water management issues.

In reference to the previously mentioned community irrigation project in Morocco that suffered from drought cycles, a representative from IFAD commented as follows:

Regulatory changes, even if targeted at laudable sustainable development objectives, can have potential implications for finance institutions

The absence of a holistic view regarding water management at the catchment and watershed levels produces water scarcity risk conditions for project developers that are difficult to foresee in planning phases



Box 6

**Cross Boundary Water and Investments in El Salvador**

In Central America, the largest watershed (18,240 square kilometers) in the region, the Lempa River, begins its course in the highlands of southern Guatemala, then passes through western Honduras, forming the border with El Salvador and finally draining out into the Pacific Ocean. The Lempa River can be considered the backbone of El Salvador, supplying roughly 65% of the country's surface water. Its flow generates roughly 60% of the country's energy, and 40% of San Salvador's (the capital) drinking water. It is the primary water source of an estimated 40% of the nation's GDP. It also provides more than half of the country's irrigation. Therefore, continued flow of water in the Rio Lempa is recognized as a primary national security issue for El Salvador. Many of the factors that determine continued water flow in the Rio Lempa for El Salvador's needs are decided in Guatemala and Honduras. Honduras and El Salvador had a war in 1969.

In Guatemala and Honduras, the main use of the river is agricultural and domestic. Rural communities, varying in size from three thousand to forty thousand inhabitants depend on the river for their drinking water. In the upper part of the watershed in Guatemala, with a population of around 150,000 people, coffee production is an important activity. The discharge from the coffee processing, as well as domestic wastewater, is affecting the water quality of the resource.

In the upper watershed, Honduras has experienced many pressures similar to those of El Salvador, which have led to diminished water flow. Poor land use planning, deforestation for agricultural frontier expansion and other causes have reduced the watershed's generating capacity. Rural energy, including the Lempa's upper watershed, is still largely dependent on firewood.

In El Salvador in the upper part of the watershed lies the town of Nueva Ocotepeque, an important commerce and public service point in the trade route between San Salvador and San Pedro de Sula, the second city of Honduras. According to the Human Development Report of 1999, the Ocotepeque department is considered one of the poorest in the country, with high malnutrition and low literacy rates. Further down the watershed, in El Salvador, there is a higher level of industrialization in towns, such as Metapán, with active commercial and industrial sectors. The highest population density in the watershed is found in El Salvador, with 108 inhabitant per km<sup>2</sup>, which doubles and triples the density in other municipalities in Guatemala y Honduras.

Water availability seems to be a growing limiting factor in each country. In Guatemala, there is a growing constraint on tourism in the upper part of the watershed, particularly in the town of Esquipulas. A popular religious destination that receives around 2 million visitors per year, bad water provision and deteriorating quality, has limited tourist services<sup>30</sup>. Honduras is now looking for additional sources of energy – particularly hydroelectric energy and specifically from the Rio Lempa.

In El Salvador, there are growing conflicts between industrial and domestic uses, as was experienced at the beginning of this year in San Salvador, when there was a major protest against the country's water utility. The deficient drinking water service was blamed on the fact that the water utility provided water to a new industrial park, Zona Franca Internacional. The protests were so strong, that the park decided to build two wells to provide its own water, instead of relying on the city's water system<sup>31</sup>. Due to time limitations, it was not possible to quantify the economic and financial implications of the water cost increase for the companies operating in the park. Currently, the construction of the hydrodam El Cimarrín in El Salvador is being strongly criticized for its environmental impacts<sup>32</sup>. Water quality issues are also mounting considering that Santa Ana, the third largest city in the country and San Salvador, discharge their wastewater into the Lempa. As anecdotal evidence, about four years ago, Coca-Cola in San Salvador, which depends on ground water for their water source, had to relocate its production plant due to water problems<sup>33</sup>.

Therefore, in the medium-term, water availability maybe a growing source of conflict among different uses nationally, as well as between countries. As stated by Juan Carlos Montufar, Manager of the Technical Unit of a tri-national watershed project, "there are no problems or water conflicts, but there are many potential conflicts due to the projected water flow reductions, mainly due to pollution upstream in Guatemala and Honduras, affecting down stream in El Salvador."

Fortunately, there are several initiatives from IDB and overseas development assistance to develop watershed protection and management projects in the Lempa. Since 1986, the Organization of American States (OAS) signed a cooperation agreement between the three governments, OAS and the Inter-American Institute for Agricultural Cooperation (IICA) in order to formulate a development plan for the border shared by the three countries. The European Union and IDB have joined what is now called Plan Trifinio<sup>34</sup>.



Scarcity of water is not one of the main issues affecting overall project implementation. Water scarcity does however sometimes affect specific communities/irrigation schemes in dry areas, depending on the water source for irrigation. Key issues affecting implementation of water management projects are typically related to institutional and technical capacity (e.g. design, construction, rehabilitation); policy and legal framework; capacity to involve/train communities; (e.g. water association formation, operation and maintenance, crop husbandry, marketing of products).<sup>26</sup>

This again highlights the important role of institutional, technical, and managerial capacity in mitigating the impacts of water scarcity.

In several of the case projects, the absence of a holistic view regarding water management at the catchment and watershed levels, and the lack of coordination and collaboration of various stakeholders produced water scarcity risk conditions for project developers that were difficult to foresee in planning phases. The investment case in power generation in Northern Peru [Box 5] provides an illustration of how the combination of draught cycles, water governance both nationally and at the cross border level has created water scarcity risks for the energy company and the project developers.

### 3.5 Cross boundary water and the risks of conflict

Cross boundary concerns include risk of conflict, pollution upstream, blocking of waterways and mismanagement of shared resources all poses considerable risks for projects reliant on shared resources. Although the potential for conflicts among countries over shared water resources receives much attention in popular media, Homer-Dixon<sup>28</sup> argues that it rarely causes interstate wars. The impacts are rather indirect through constraints on economic development and through contribution to conflicts within societies<sup>29</sup>. Similarly this is noted in the cases reviewed for El Salvador [Box 6].

In another illustration, the Nile basin<sup>35</sup> is often talked about as one of the areas where water is a potential source of conflict. Hence the severity of statements recently made by Egypt's environment minister, who argued that countries in the Great Lakes region and the Nile Basin must use their water resources carefully if they are to "avoid a catastrophe". He was referring in particular to increased desertification and pollution levels of water resources, but also noted that the Nile basin offered opportunities for improved inter-governmental relations, technology transfer, and socio-economic development. It seems, however, that there is a general sense that the Nile basin will not experience significant conflict, or at least, conflict that will impact on finance institutions, primarily because quite a lot of effort and international attention is focused on the relevant negotiations and institutions at present.

With regard to water-related conflict, some commentators have mentioned the importance of relatively localised conflicts, which do not attract as much international attention. A prominent example is Nairobi, where there is significant potential for conflict between different water users, premised also on the low levels of access to water services amongst the poor population.

### 3.6 Local community and stakeholders concerns

While globalization has helped companies to expand their business operations to the global market, NGO and civil society organizations have also become increasingly sophisticated in their interactions with business. Companies are increasingly recognizing that stakeholders (which include those who affect, or who are affected by, a company's operations, and can include employees, customers, shareholders, joint venture partners, governments, local communities, NGOs, etc.) comprise a much wider set of constituencies than previously understood. In recent years, businesses have been forced to a much higher degree of accountability towards their local 'stakeholders', i.e. the local communities where they operate, largely because of the considerable negative impacts multinational facilities have often had on local communities, despite the potential jobs and revenue creation their presence provides. Consequently, stakeholder engagement with local communities is increasingly a part of mainstream business practice as a way of gathering important input and ideas, anticipating and managing conflicts, improving decision-making, building consensus amongst diverse views, strengthening relationships, and enhancing corporate reputation.

Companies are no longer able to exploit water resources with impunity on the pretext of job and revenue creation in the community by setting up a facility. An often-cited example is the case of Pepsi Co. in India. It was reported that the village government of Pudussery in southwestern India revoked the bottling plant's water-use license, which was not due to expire until 2005, due to concerns that Pepsi is "over utilizing" local water resources<sup>36</sup>.



Table 1: **Water Scarcity Risk Factors and Potential Impacts**

Factors Producing Water Scarcity Risks	Risk Situation	Business and Financial Impacts
Drought and drought cycles	Lack of sufficient water at project level for specific operation	Disruption of operation
	Lack of sufficient water quality for specific operation	Increased costs to secure alternative supplies
	Temporary suspension of water use license	Constraints on expansion or growth
Deteriorating Water quality	Pollution of water resources by the enterprise or as a result of external factors	Disruption of operation Reputation risk
	Inability to find clean water sources in due time or within reasonable costs	Financial liabilities due to legal liabilities or clean up costs or Impact on quality of assets
Changing Political and Regulatory Conditions	Change in water policy unfavorable to certain business sectors, allocation rights etc.	Constrain on expansion of a facility or growth in a business sector due to uncertainty
	Change in Tariffs	Financial Performance risk due to increased costs of water charges or discharges
	Change in liability laws (contamination)	
	Political manipulation of water issues	Impacts on assets value
Lack of Institutional and managerial capacity for	Lack of capacity at the national or regional level to provide effective water governance	All these situation create uncertainty for long term planning
	Mismanagement of watershed, waterways	
	Fragmentation of responsibilities	
	Ineffective enforcement of water regulations and allocation rights	
Cross boundary concerns	Risk of conflict	Disruption of operation
	Decision upstream with consequences for users downstream impacting quality or quantity	Financial performance risks (due to quantity or quality issues)
Local community and stakeholders concerns	Competing claims and priorities resulting in changes in water use rights	Reputation risk
	Mishandling of stakeholder concerns, or perceptions of abuse, or lack of attention on the part of the company to address local community concerns	Loss of water license to operate Customer boycotts



### 3.7 Summary of Risk Factors and Potential Impacts

The risk factors catalogued above illustrate a variety of situations where projects and investments could potentially be exposed to water scarcity risks. Directly or indirectly these factors could lead to financial performance risk.

The three major type of financial risks that a project/facility might experience due to water scarcity include financial losses due to disruption of operations; increased financial investments due to required water treatment, either for water use, or wastewater treatment; or loss of an anticipated revenue base due to cancelled or delayed growth and expansion in a region due to quality, quantity, or stakeholder considerations as we have noticed in some of the cases.



In some cases the project partners could be affected indirectly through reputation risks due to water scarcity. The greatest risk for any firm is a loss in its brand equity and reputation/ credibility. This risk impacts every part of the firm, whether it is internal (employee) or external (customer) satisfaction, shareholder confidence or financial performance. As concerns water scarcity risk, any water related issue whether allocation, pollution, stakeholder concern, could have deleterious effects if not handled effectively. The potential consequences can vary depending on the business sector and region of operation and the firm's capacity to anticipate and manage these risks. Just as an illustration, Table 1 provides a summary of the possible links between the above factors and business risks.

Financial institutions, which deal with those companies/projects, whether as bankers, investors or development aid organizations, could potentially be exposed to these risks. Many of these risks may not become apparent through the standard financial analysis / due diligence processes, and as a result some financial institutions, have suffered losses due to unexpected water related problems affecting their customers or investments.

The factors affecting a financial institution's exposure to water scarcity risks are determined by the nature of its business partners (i.e. borrowers or investments), the extent of its involvement with them and the geo-political context of activities. For instance, in lending, a bank's exposure to water scarcity risks associated with individual banking transactions depends on:

- The extent of a customer's dependence on water supply quantity and/or quality for operation. Businesses in water intensive sectors such as mining, food processing, etc. face greater risks from water scarcity.
- The nature of transaction with the customer, as often the value and terms of the loan will affect the ultimate financial



risk to the bank.

- The management, technical and financial capacity of the client to deal with its water scarcity problems.

The risk to lending materializes through the customers inability to meet loan repayment schedule as was the case with AES Tiete holdings [Box 2], or the value of any assets taken as security may be affected as was illustrated in the banks' fear for the drop in the value of farm land taken as collateral from farmers in South Africa as a result of water reform policies [Box 3]. In some cases the risks can be indirect such as negative publicity to the bank for association with a company that finds itself in a conflict with local community/stakeholders over water issues.

If an organization makes an equity investment in a company, it effectively becomes part (or in some cases full) owner of the business, and is correspondingly exposed to all the water scarcity related financial, legal and reputation risks affecting the investee company. If the financing organization is in a position of management control over such a company, it could face unlimited liability for any damage to water resources.

In development financing, similar factors as those in lending needs to be considered. Water scarcity risks can alter the conditions for achieving project objectives and further undermining development plans. Even when the intentions are good, failure to pay attention to water scarcity conditions in the region of operation leads to waste of resources.

The following diagram provides an illustration of the above linkages between water scarcity risks, impacts on projects and businesses and financial institutions potential exposure to these risks.

## 4. A Role for Financial Institutions

Clearly there are opportunities for financial institutions to contribute to addressing water scarcity risks through the role of risk management. For this reason we tried in this project to capture key perceptions and practices among financial institutions related to water scarcity issues and identify elements of a proactive strategy. A number of telephone interviews and email exchanges were made with practitioners from financial institutions active in Africa and Latin America. In section 4.1 we summarise key highlights from these interviews. In section 4.2, we make some suggestions to improve on these practices and where financial institutions can proactively address water scarcity issues through risk management. Finally in section 4.3, some suggestions are drawn for future follow up to this project and for policy makers for further engagement of financial institutions.

### 4.1 Water scarcity risks and views among financial institutions

Water does not currently play a prominent role in finance institutions' risk assessments or evaluations

Views of representatives from financial institutions were asked for in the course of this study regarding water scarcity risks. Mainly we inquired about how water scarcity issues are considered, if at all, in certain financial transactions or in the due-diligence process. Many of the comments made by informants contacted highlight a number of recurring themes. Important to point out that these views are not fully representative of the practices within the financial industry and should be viewed within the context of the studied regions (Africa and Latin America).

First, it is easy to get the impression that representatives of financial institutions and decision-making bodies in the water and sanitation sector do not consider physical scarcity a risk for investment. According to a recent survey undertaken on the request of the Inter-American Development Bank (2003) to explore obstacles and limitations for investment in the region, no one of the 400 stakeholders interviewed identified risk due to any physical constraints. Though there has been reference to inappropriate water pricing and lack of regulatory institutions as leading obstacles to investment.

In this review, equally most respondents noted that water does not currently play a prominent role in finance institutions' risk assessments or evaluations. Neither is it prominent in loan management processes. Most commentators argued that water-related issues are considered as the need arises as part of general due diligence assessments. As noted by a representative of the European Investment Bank:

*The Bank's regular project appraisal usually takes the form of a due-diligence into the financial and economical viability and justification of a project, as well as its technical and environmental... aspects. In that context, water, its quality*



– ante and post project – its general availability – if required as an economic factor for the project... and other aspects are obviously taken into account, mostly on a case-by-case basis for each project<sup>37</sup>.

With regard to these due diligence appraisals, it is common for banks to rely on the assessments conducted or paid for by the proponent. As noted by a representative of the Industrial Development Corporation (IDC), water supply “is generally left to the discretion of the project leader.” Similarly, Maria Teresa Szauer from the Andean Development Corporation (CAF) perceives that the issue of water scarcity is sufficiently addressed in the project development cycle. The studies that back up a project credit application should address possible water problems. In her view, the consultants that participate in the project preparation will catch potential hydrological problems. However, in a contrasting view to this, Adriaan Louw<sup>38</sup> pointed out to the problem that the language of hydrologist is not sufficiently understood by economists. For financial institutions to develop a more proactive approach to water scarcity risks, the interaction between hydrologists and economists deserve some consideration.

Another issue raised in the due diligence process is that the appraisals for water needs and availability are influenced by the policy and institutional framework of the particular project, except where international best practice norms are applied. Some respondents from South African institutions, for instance, noted that South African standards, applied by the Department of Water Affairs and Forestry, are considered adequate for projects in South Africa, but that World Bank requirements are commonly applied in other African countries, because local standards are not as high or well enforced.

Clearly the approach in the due diligence differs from multilateral and development institutions to commercial banks. Because the incentives and objectives of the former are different it is expected to influence the evaluation process. The Environmental Impact Assessment policies, that are, for example, part of the World Bank's of the Inter-American Development Bank's project due diligence, address direct and indirect impacts, including those on water. At Banco Solidario, Ecuador, due to a line of credit provided by the International Finance Corporation (IFC), small business credit applicants are being questioned about environmental impacts, particularly industrial pollutants to waterways. In the case of public development banks active in Africa, and in some instances, water-related issues may play a role in determining the pricing model for a particular project, including the applicable interest rates.

Efforts though are made by some international commercial banks to bring attention to water issue as part of the environmental due diligence. ABN Amro Brazil for instance includes water in the environmental due diligence of credit applications. However most of these efforts are mainly focused on water saving measures rather than a comprehensive view on the readiness or strategy of the client for water scarcity risk management. Similarly, a representative of Deutsche Bank argued, “water is an issue that is dealt with as part of our broad approach to sustainability,” and an informant from Nedbank noted, “We look at water in terms of broader environmental issues.” Another respondent said, “Water is simply part of good governance.” Hence banks generally do not have an explicit policy or approach to water-related risks.

At the same time, most respondents noted that water would become an increasingly important issue for banks in the future. Although up to now, of the banks representatives interviewed no credit application has been disapproved due to water scarcity problems, still, analysts are finding that more and more businesses are facing water problems that affect their production processes or modus operandi as put forward by one of the respondent in Latin American banking community. Further, a representative of the Development Bank Southern Africa argued:

We are all becoming more sensitive. This will manifest in terms of the technical evaluation; the extra costs involved in ensuring reliable supply; the statistical exercises. And yes, it will also be an issue of assessing the institutional framework.

A representative of Nedcor, a private bank based in South Africa, noted:

Yes, water will become more prominent in future, as scarcity becomes more severe... So for instance we will have to include water issues more explicitly in our internal process for loan applications, for instance in the case of golf estates, which have high water needs. Water intense sectors such as mining, beverages will be heavily affected as well, and a reduced productivity in these sector due to water scarcity will have an impact in the GDP...

Regarding the possibility of water scarcity representing an opportunity for investment, respondents argued that water management and supply would become an increasingly important investment opportunity in Africa, premised on the need for

Considerations should be given to the interactions between hydrologists and economists to reduce the challenges of water scarcity



water supply infrastructure and management institutions. However, there was generally little reference to an understanding of the risks involved in such developments, especially as they relate to the uncertainties in the institutional and political framework. Indeed, a common theme amongst informants' responses was the challenge relating to the limited infrastructure and institutional framework in many parts of Africa.

In summary the impression one reads through the respondents' comments is that water scarcity issues are still not high up on the agenda to warrant specific attention in risk evaluations. Development and multi-lateral banks are perhaps a step ahead in taking some of these issues onboard in the due-diligence for lending, and this is mainly driven by the broader objectives these banks take on board, and not necessarily due to explicit recognition of water scarcity risks to investments. However there is recognition that water scarcity issues could become increasingly an important issue for the banks in the future. Hence the need for systemic approach to understanding the risks involved.

## 4.2 Making water scarcity risk management and mitigation efforts more explicit

Water scarcity represents an opportunity for investments though it should be done through proper water management

In light of initial findings from the above cases, the efforts made by financial institutions in regard to water scarcity challenges could be made more explicit further contributing to the sustainable management of water resources. This is premised on two notions. First the factors and conditions producing water scarcity risks are diverse and in many cases interconnected. These factors are causally related in complex ways, a feature of all kinds of environmental scarcity<sup>39</sup>. Current due diligence practice might not be sufficient to capture the full picture and consequently potential risk implications for projects and investments. Secondly, the idea that by focusing on the risks due to water scarcity, different actors involved in project development including public organizations will find incentives to pay greater attention to the sustainable management of water resources and maintain the interest of financial backers.

An approach financial institutions could pursue in this regards is to incorporate water scarcity risk assessment into the various financing and insurance instruments of projects and business plans. At a higher level, this may require that the financial organization adopt a clear policy position on water scarcity challenges based on understanding of the potential risks and opportunities in relation to 1) types of transactions 2) the portfolio of projects and 3) regions of activities. The next step is making explicit the kind of requirements and measures needed specific to water issues in project evaluation. These requirements should of course be adapted according to the water intensity of the sector and the specific conditions of the region of operation.

Two issues deserve special attention in water scarcity risk evaluations. One issue featured in most of study cases is the need to relate project-based planning and evaluations to the water system/ catchment management. Financial institutions would probably benefit from taking this broader view in risk assessments. The second issue is related to regional vulnerability to water-related challenges and the lack of adaptive capacity. The institutional and managerial capacity for water governance play a key in the aggravation/production of water scarcity risk This may require a special orientation in financial institutions' risk assessments.

## 4.3 Final Recommendations

For financial institutions there is a clear benefit from incorporating water scarcity risk assessment into financial products and services

**For financial institutions** there is a clear benefit from incorporating water scarcity risk assessment into financial products and services. Although we have not been able to evaluate practices of financial institutions at a global level, the observations from Africa and Latin America do indicate the possibility to improve on current due diligence practices. A proactive approach by financial institutions in promoting mitigation measures and strategies through investments, can improve water sustainability. Among the mitigation strategies financial institutions can promote with clients include:

- Encourage clients/project developers to make comprehensive and holistic water assessment and risk management in project planning decisions, business projections, and business opportunity due diligence. Some of the tools at the project level include value chain and supply chain analysis, water resources economic/vulnerability analysis and
- Encourage business partners to develop appropriate performance indicators focused on water risks as part as part of the annual reporting.
- Encourage business partners to include integrated water resource management as an intrinsic part of their operations, and to open dialogues with their stakeholders for its effective implementation.



- Support stakeholder engagement in local community. It is important that project developers and their financial partners address water resource considerations within stakeholder engagement and community investment strategies. A collaborative approach with relevant stakeholder groups would go a long way in building capacity and partnerships to anticipate risks and address them when they emerge.

Additionally, recognition that water supply problems can create new opportunities for improving a company's competitive position through improvements in operational performance and efficiency is in the interest of financial institutions as these improvements can result in new investment opportunities.

As a follow up recommendation to this study, it is important to develop systemic approaches within the financial sector on the issue of water scarcity risk management, particularly for the institutions that are active in regions with weak adaptive capacity. A more systematic assessment of risks and opportunities is needed to quantitatively assess the extent of exposure to water scarcity risks.

As for **governments and policy makers**, it is clearly demonstrated how important the institutional and managerial capacity for water governance as a factor in producing water scarcity risks. Further it was clearly demonstrated the need to relate project-based planning and evaluations to catchment management. This emphasises the challenges for policy makers of developing and supporting transparent and proactive planning and decision-making at the catchment level. A proactive governmental role in water scarcity mitigation measures, e.g. encouraging and providing incentives for sustainable water management practices at the enterprise level and at the water basin level, can improve resilience to water-related risks. This is coupled with a stable regulatory regime, coordinated policies in water resource management, transparent and equitable licensing and allocation procedures are all important challenges on the agenda of policy makers in addressing the challenges of water scarcity for projects and investments.

It is important to develop systemic approaches within the financial sector on the issue of water scarcity risk management

A proactive governmental role in water scarcity mitigation measures can improve resilience to water-related risks

## 5. References

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AC/UNU (2004). Global Challenges.

[Online]. Available: <http://www.acunu.org/millennium/ch-02.html> [2004, October 18].

African Development Bank (2004, July). *Building partnerships for water in Africa*.

[Online] Available: [http://www.afdb.org/water/water\\_week.htm](http://www.afdb.org/water/water_week.htm) [2004, October 18].

Allafrica Global Media (2004). *The Nile basin and local conflict*.

[Online] Available: <http://allafrica.com/stories/200403090215.html> [2004, July 13].

Carrera de la Torre, Luis (2001). La Cuenca del Lago de Valencia. Documento preparado para Ministerio del Ambiente y Recursos Naturales y el Instituto Geográfico de Venezuela.

Celada, M. Juan Carlos (2004, July). Manager of Tri-national technical unit, Guatemala. E-Mail to Marta Echavarria.

Cole, M. (2004). *Economic growth and water use*. Applied Economic Letters, 11, p.1-4.

da Silva, Demóstenes Barbosa (2004, July 30). Director, AES Tiete. Telephone interview.

Faruqui, N. (2003). Balancing between the eternal yesterday and the eternal tomorrow: Economic globalization, water and equity. In C. Figueres, et al. (eds.) *Rethinking Water Management: innovative approaches to contemporary issues*. London: Earthscan Publications Ltd., p 61.

Figueres, C. et al. (2003). *Rethinking water management: Innovative approaches to contemporary issues*.

London: Earthscan Publications Ltd., p. 71.

Gruenberg, George (2004, July 14). President of SINERSA. Telephone Interview

Hamann, R. and O'Riordan, T. (2000). Resource Management in South Africa. South African Geographical Journal, 82(2): p. 23-34.



Hinrichsen, D., Robey, B., and Upadhyay, U.D. (1997). Solutions for a water-short world. *Population Reports, Series M, No. 14*. Baltimore: Johns Hopkins School of Public Health, Population Information Program, December 1997. [Online]. Available: [http://www.infoforhealth.org/pr/m14/m14chap4\\_1.shtml](http://www.infoforhealth.org/pr/m14/m14chap4_1.shtml) [2004, August 25].

Homer-Dixon, T. (1999). *Environment, Scarcity and Violence*. Princeton: Princeton University Press.

Inter Press Service (2004). *Water Management Crucial to Growth*. [Online]. Available: <http://ipsnews.net/interna.asp?idnews=22878> [2004, August 4].

Inter-American Development Bank (2003). *Obstacles and Constraints for Increasing Investment in the Water and Sanitation Sector in Latin America and the Caribbean*. Survey by CG/LA. Washington: IDB.

Lippman, Steve, (2003, May). As Water Tables Fall, Investors' Concerns Rise. *News and Views, Trillium Asset Management*. [Online]. Available: [http://www.realassets.ca/web\\_newsroom/releases.html](http://www.realassets.ca/web_newsroom/releases.html) [2004, October 18].

Menck, Karl Wolfgang, (2004, July 13). E-mail to Ralph Hamann. Rao, Kris Prasada (2004, July 9). Associate Country Programme Manager, Eastern & Southern Africa Division, IFAD. E-mail to Ralph Hamann.

Rodriguez, Jose Francisco (2004, July 29). Environmental Official, Banco Cuscatlan. Telephone Interview.

Shiklomanov, I. (1999). *World Water Resources and Their Uses*. [Online]. Available: <http://webworld.unesco.org/water/ihp/db/shiklomanov/index.shtml> [2004, October 18].

Turton, Anthony (2004, July 13). African Water Issues Research Unit. Telephone Interview.

UN/WWAP (2003). *UN World Water Development Report: Water for People, Water for Life*. Paris: UNESCO. [Online]. Available: <http://www.unesco.org/water/wwap/wwdr/index.shtml> [2004, August 25].

UNEP-ROA (2002). The Nairobi River Basin Project. [Online]. Available: [http://www.unep.org/roa/Nairobi\\_River/Webpages/index.asp](http://www.unep.org/roa/Nairobi_River/Webpages/index.asp) [2004, October 18].

van der Loeff, Bram Schim, (2004, July 14). European Investment Bank, Corporate Promotion. E-mail to Ralph Hamann.

WBCSD. (2004). *Water and Sustainable Development: a business perspective*. [Online]. Available: [www.wbcsd.org](http://www.wbcsd.org) [2004, October 18].

Wolfe, S. & Brooks, D. (2003). Water scarcity: An alternative view and its implications for policy and capacity building. *Natural Resources Forum* 27, p. 99-107.

World Meteorological Organization. (1997). *Comprehensive assessment of the freshwater resources of the world*. Geneva: WMO. [Online]. Available: <http://www.wri.org/trends/water.html> [2004, August 25].

Zegarra, Eduardo (2004, July). Principal Researcher, GRADE. E-mail to Marta Echavarria.

## 6. Annexes

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### 6.1 Regional Perspectives on Water Scarcity

Although water scarcity is a global concern, the challenges are more acute in some regions than others. In this report we have taken cases and examples from mainly Latin America and Africa context. The following sections provide brief summaries of the water scarcity challenges in these regions.



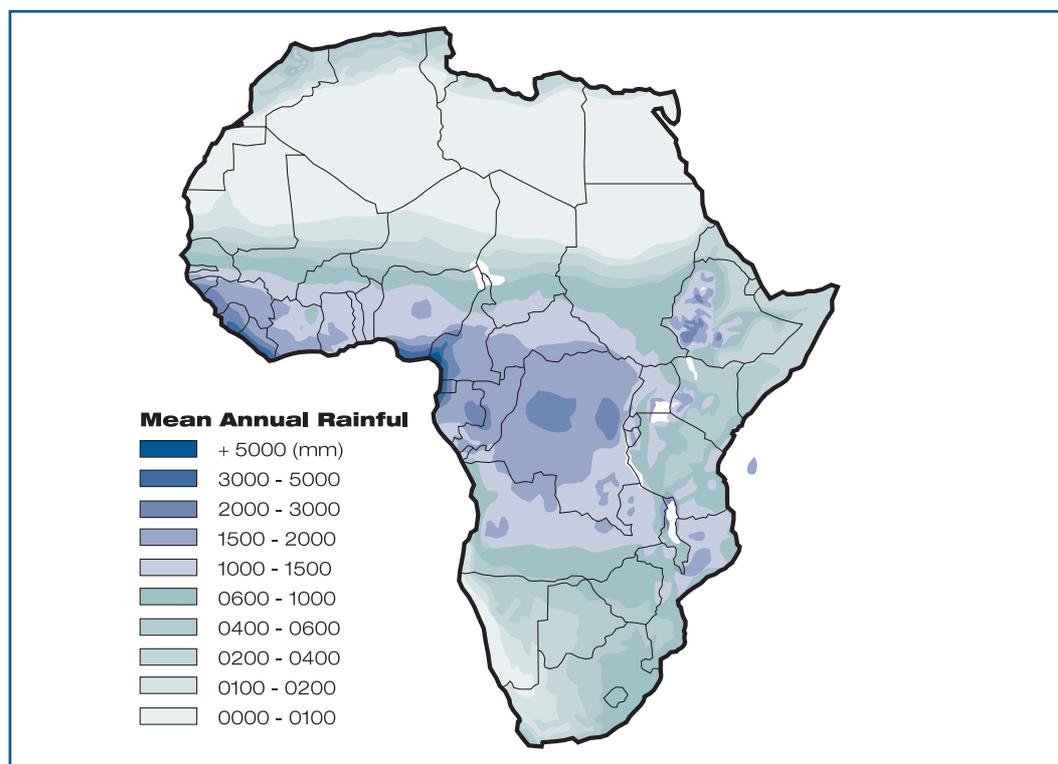
## The views from Africa

About 40% of Africans do not have access to safe water. In some cities, such as Nairobi and Lagos, more than 60% of the population has no running water. Roughly 95% of the hydropower potential in the region, which has little reliable electricity and quality water, remains untapped. Water distribution is difficult: one-third of Africa's fresh water flows through just one river, the Congo. Tribal wars, siltation, recurrent drought, desert encroachment, and high population growth play havoc with Africa's water resources. Economic development of Sudan and Ethiopia will draw on the Nile, making water conflicts in this region seem inevitable<sup>40</sup>.

It is apparent, however, that water scarcity is a key constraint to sustainable development in much of Africa. This is premised, firstly, on natural factors. In much of Africa, precipitation is low, intermittent, and variable. Figure 1 shows how apart from central Africa, much of the continent receives relatively little rainfall. Indeed, water is a key constraint to population growth in much of the continent<sup>42</sup>. Much of Namibia (in the south-west of the continent), for instance, is extremely sparsely populated, save for the narrow strip along the northern border along the Kunene river, which also receives most of the country's rainfall. Despite relatively low population densities, water availability per capita, as given in Table 1, is low for most African regions (apart from central Africa). Note also that the figures for water availability per capita for the main African regions do not display the high degrees of variance between and within countries. For instance, South Africa has just over 1000 m<sup>3</sup>/year/cap, which is much less than the regional figure of over 6000 m<sup>3</sup>/year/cap, and within South Africa, the Northeast of the country has much higher water availability than the southern and western parts.

Figure 1: **Precipitation ranges in Africa**

Source: UNEP. [Online]. Available: <http://www.unep.org>



Crucially, water scarcity is also premised on lacking infrastructure and institutional and political factors. Table 1 shows how much of Africa's population has very limited access to safe drinking water and sanitation. Hence the attainment of the water-related Millennium Development Goals is particularly challenging in Africa, with much attention currently given to financial requirements and mechanisms for this<sup>43</sup>. As noted by the African Development Bank<sup>44</sup>:



Table 1:

**Selected statistics for African regions**

Region/ country	Available water per cap m <sup>3</sup> /year	Available drinking water per cap %	Sanit. per cap %	Domestic use % (m <sup>3</sup> /p/yr)	Industrial use % (m <sup>3</sup> /p/yr)	Agricult. use % (m <sup>3</sup> /p/yr)	Annual income per cap US\$
North African Region	830	82	83.5	10 (39)	5 (22)	85 (433)	4,833
Central African Region	54,343	56	37.5	41 (10)	11 (3)	49 (17)	1,630
Eastern African Region	3,983	63	62	17 (6)	5 (4)	78 (159)	788
Southern African Region	6,358	73	64	17 (22)	9 (11)	75 (144)	4,755
West African Region	9,790	61	50	23 (23)	6 (4)	70 (75)	1,335
Cf: European average <sup>41</sup>	8,304	97	96	26 (75)	52 (248)	23 (181)	20,479

Sources: UNSTAT. [Online] Available: <http://unstats.un.org/unsd/demographic/social/watsan.htm>; CIA. [Online] Available: <http://www.cia.gov/cia/publications/factbook/index.html>; UNESCO. [Online] Available: <http://www.unesco.org>; <http://www.worldwater.org>.

Figure 2:

**Location of primary catchments of Africa**

Source: WRI. [Online] Available: [http://multimedia.wri.org/watersheds\\_2003/flash\\_africa.html](http://multimedia.wri.org/watersheds_2003/flash_africa.html)

With only 62% of its population having access to improved water supply (as against a global average of 82%) and





Table 2:

**Selected statistics for the primary catchments in Africa**

Name	Location in Africa	Area km <sup>2</sup>	Population density p/km <sup>2</sup>	Cropland / Industrial area %	Deforestation % loss
Lake Chad*	Central Africa	2,497,738	11	0.2 - 3.2	99.8
Congo	Central equatorial Africa	3,730,881	15	0.2 - 7.2	45.8
Cuanza	West cost Equatorial Africa	149,688	23	0.3 - 2.8	...
Cunene	South west Africa	109,832	10	0.1 - 2.6	...
Jubba	East Africa	497,626	12	0.2 - 6.6	69.7
Limpopo	Southern Africa	421,123	32	4.5 - 26.3	99.3
Mangoky	Madagascar	58,851	18	0.1 - 4.5	97.5
Mania	Madagascar	56,118	25	0.2 - 2.5	98.1
Niger	West Africa	2,261,741	31	0.5 - 4.4	95.9
Nile	North east Africa	3,254,853	46	1 - 10.7	91.2
Ogooue	West cost Equatorial Africa	223,946	2	0.5 - 0.8	8.8
Okavango*	Southern Africa	721,258	2	0.2 - 5.5	0
Orange	Southern Africa	941,351	10	2.2 - 6	99.9
Oued Draai	North Africa Morocco	114,544	10	0.5 - 3.2	83.8
Rufiji	East Africa	204,780	21	0.2 - 9.7	...
Senegal	West Africa	419,575	10	0.1 - 4.8	99.9
Shaballe	Horn of Africa	336,604	29	0.1 - 7.1	88
Turkana*	Rift valley east Africa	209,096	61	0.12 - 0.8	59.6
Volta	South cost West Africa	407,093	43	0.5 - 10.4	96.6
Zambezi	Southern Africa	1,332,412	18	0.7 - 19.9	42.8

Source: WRI. [Online]. Available: [http://multimedia.wri.org/watersheds\\_2003/flash\\_africa.html](http://multimedia.wri.org/watersheds_2003/flash_africa.html)

60% access to improved sanitation, Africa has the lowest coverage of water supply and sanitation services in the world. About four hundred million people do not have access to adequate water and sanitation services. This situation contributes to the poor health statistics in the continent, with 50% of Africans suffering from one of six water related diseases.

Figure 2 and Table 2 provide an overview of the primary catchments in Africa, illustrating the existence of very large, cross-border catchments on the continent. This also has implications for the potential for water-related conflict between nations. One of the most prominent examples is the Nile basin, where there are continuing tensions surrounding the water requirements of riparian states. Such tensions also exist between Namibia, Botswana, and Angola with regard to the Kunene and Okavango basins.

Of course, because water is scarce in many parts of Africa, water is an important source of conflict also within countries. In the much-publicised conflict in Darfur, Sudan, for instance, water is both a source of conflict, as well as a weapon (through the poisoning of wells).

Tensions surrounding water use also exist between different uses. Tables 1 and 2 show that most of the available water in Africa is used for agriculture, with industry being a relatively small (but growing) component. Considering the indus-



trialisation strategies of many African governments, tensions are likely to increase between water needs for household consumption and agriculture (most critical amongst poor households and for subsistence agriculture, especially in rural areas), on the one hand, and water intensive or polluting industries, such as mining, metal processing, or electricity generation, on the other. Possible case studies surrounding such tensions will be considered below.

An overarching concern is that there is relatively little integrated catchment management. One illustration of this, as shown in Table 2, is that many basins have experienced excessive deforestation loss. This has led to problems such as flooding, as well as significant siltation in hydropower reservoirs, with important potential implications for electricity generation. Malawi may provide an illustrative case for such issues, as noted above.

Table 3:

**Water Resources Regional Distribution**

Sub-region	Annual Precipitation		Renewable Water Resources	
	Mm	km2	Km2	m2 per person(1997)
México	772	1 512	409	4 338
Central America	2 395	1 194	6 889	20 370
Major Antilles	1 451	288	82	2 804
Minor Antilles	1 141	17	4	-
Guayana Sub-region	1 421	897	329	191 422
Andean Sub-region	1 991	9 394	5 186	49 902
Brazil	1 758	15 026	5 418	33 097
Southern Sub-region	846	3 488	1 313	22 389
Latin America/Caribbean	1 556	31 816	13 429	27 673
World	-	110 000	41 022	6 984
LA & C as world %		29	33	



## The views from Latin America

Latin America is rich in water resources but those resources are not evenly distributed in geography, time and demography. Although considered a water rich region of the world, estimated to have 28,000 cubic meters per person per year, a figure four times the world average, the resource is not evenly distributed.

Regionally, the variety of climates found generates wide variation of hydrological regimes. As illustrated in the Table 1 below, the Guyana and Andean regions have the higher available resources with Mexico and the Antilles with the lower, though the levels are still higher than the water scarcity cut off figure of 2,000 cubic meters per person per year<sup>45</sup>.

The climatic variation also generates seasonal and multi-annual differences. Meteorological events like El Niño and tropical storms and hurricanes that affect the Antilles, Central America and Mexico, alternate with prolong dry periods, not only in arid or semi-arid areas, but also in humid zones.

Of 500 million people in the region, 150 million do not have safe drinking water. 250 million people do not have sanitation, of which 160 million live in cities<sup>46</sup>. The challenge to provide water to all is bigger than the available resources. The highest consumption of water is used in agriculture (73%), followed by domestic use (19%) and industrial use (9%).

Latin America faces many challenges in the management of the resource. In general, the regulatory framework is complex and contradictory with numerous organizations and laws regulating the resource. The institutions managing the resource are weak, and fall short to the needs for effective regulation and protection of water sources.

Watershed planning is incipient. This situation is further aggravated by the fact that the region has a high proportion of water sources that are shared among nations, as illustrated by the cases. A third of the water resources are shared, with complex situations like the Paraná-Plata watershed<sup>47</sup>.

According to the Food and Agriculture Organization, water extraction expressed as a percentage of total resources available is a good indicator of the pressure exerted over the water resources. Roughly, a figure of 25% is considered high and was measured in Dominican Republic (39,7%) and the Antilles. Other high levels were found for El Salvador (20%), Brazil (18%) and Mexico (17%).

Yet, if we consider the threats facing regional freshwater resources, the situation could become more critical. Deforestation rates, estimated by FAO, average 1,2% per year, which implies an annual loss of close to 10 million hectares, or over 27,000 hectares per day. The loss of trees and land cover can in the short term mean more flows due to less evaporation. However, it can accelerate changes in the flow regime and sediment load with negative medium and long-term effects.

Demographics also play an important role, if we consider the unmet needs for water and sanitation, as well as food production. Irrigated agriculture consumes 70% of world's water. As Latin America increases agricultural production for national consumption, as well as for exports as trade agreements penetrate.

Global threats, like the earth's warming, increases uncertainty in general. Recent studies suggest that climate change will be responsible for an increase of 20% in water shortages in the world<sup>48</sup>. This is a very general statement and it maybe meaningless to discuss "global figures" from a water resources perspective. Yet, it is a source of uncertainty, to say the least.

Water resources maybe receiving a combination of threats, which can be severely aggravated by natural phenomenon, like reduced rainfall or extreme drought. Risks to business and policy responses may differ under these different "situations". In Latin America, the institutional and regulatory framework is an important source of risk as the cases in this report illustrate.



## Footnotes

1. For a thorough review of the global water challenge we refer the reader to the UN/WWAP (2003). UN World Water Development Report: Water for People, Water for Life.
2. Homer-Dixon, T. (1999). *Environment, Scarcity and Violence*. Princeton: Princeton University Press, p. 48. [Note: Thomas calls these supply-induced, demand-induced and structural scarcities.]
3. Wolfe, S. & Brooks, D. (2003). Water scarcity: An alternative view and its implications for policy and capacity building. *Natural Resources Forum* 27, p. 99-107.
4. Wolfe, S. & Brooks, D. (2003). Water scarcity: An alternative view and its implications for policy and capacity building. 99-107.
5. UN/WWAP. (2003). UN World Water Development Report: Water for People, Water for Life. [Online]. Available: <http://www.unesco.org/water/wwap/wwdr/index.shtml> [2004, August 25].
6. WMO (World Meteorological Organization). (1997). *Comprehensive assessment of the freshwater resources of the world*. Geneva: WMO, p. 9. [Online]. Available: <http://www.wri.org/trends/water.html> [2004, August 25].
7. WMO. (1997). *Comprehensive assessment of the freshwater resources of the world*.
8. Figueres, C. et al. (2003). *Rethinking Water Management: innovative approaches to contemporary issues*. London: Earthscan Publications Ltd., p. 71.
9. Hinrichsen, D., Robey, B., and Upadhyay, U.D. (1997). Solutions for a water-short world. *Population Reports, Series M, No. 14*. Baltimore: Johns Hopkins School of Public Health, Population Information Program, December 1997. [Online]. Available: [http://www.infoforhealth.org/pr/m14/m14chap4\\_1.shtml](http://www.infoforhealth.org/pr/m14/m14chap4_1.shtml) [2004, August 25].
10. WBCSD (2004). *Water and Sustainable Development: a business perspective*. [Online]. Available: [www.wbcd.org](http://www.wbcd.org) [2004, October 18].
11. Cole, M. (2004). Economic growth and water use. *Applied Economic Letters*, 11, p.1-4.
12. Faruqi, N. (2003). Balancing between the eternal yesterday and the eternal tomorrow: Economic globalization, water and equity. In C. Figueres, et al. (eds.) *Rethinking Water Management: innovative approaches to contemporary issues*. London: Earthscan Publications Ltd., p. 61.
13. Faruqi, N. (2003). Balancing between the eternal yesterday and the eternal tomorrow: Economic globalization, water and equity.
14. Shiklomanov, I. (1999). *World Water Resources and Their Uses*. [Online]. Available: <http://webworld.unesco.org/water/ihp/db/shiklomanov/index.shtml> [2004, October 18].
15. UN/WWAP (2003).
16. AT Kearney Foreign Direct Investment Confidence Index 2002.
17. Based on telephone interview with Demóstenes Barbosa da Silva, Director, AES Tiete, 30 July 2004.
18. A state finance institution focused on agriculture.
19. Inter Press Service. (2004). *Water Management Crucial to Growth*. [Online]. Available: <http://ipsnews.net/interna.asp?idnews=22878> [2004, August 4].
20. Menck, Karl Wolfgang, (2004, July 13). E-mail to Ralph Hamann.
21. The material for this case is based primarily on text from the relevant environmental impact assessment, kindly provided by Portia Ngwenya from the Industrial Development Corporation (IDC) in South Africa.
22. Carrera de la Torre, Luis, (2001). *La Cuenca del Lago de Valencia*. Documento preparado para Ministerio del Ambiente y Recursos Naturales y el Instituto Geográfico de Venezuela.
23. UNEP-ROA (2002). *The Nairobi River Basin Project*. [Online]. Available: [http://www.unep.org/roa/Nairobi\\_River/Webpages/index.asp](http://www.unep.org/roa/Nairobi_River/Webpages/index.asp) [2004, October 18].
24. The material for this case is based primarily on: Hamann, R. and O'Riordan, T. (2000). *Resource Management in South Africa*. *South African Geographical Journal*, 82(2): p. 23-34.
25. Turton, Anthony (2004, July 13). Telephone Interview.
26. Rao, Kris Prasada, Associate Country Programme Manager, Eastern & Southern Africa Division, IFAD (2004, July 9). E-mail to Ralph Hamann.
27. Information for this case kindly provided by Eduardo Zegarra, researcher at GRADE; and George Gruenberg, president of SINERSA.
28. Homer-Dixon, T. (1999). *Environment, Scarcity and Violence*. p. 69.
29. Homer-Dixon, T. (1999). *Environment, Scarcity and Violence*. p. 69.
30. Celada, M. Juan Carlos (2004, July). Manager of Tri-national technical unity, Guatemala. E-Mail to Marta Echavarria.
31. Rodriguez, Jose Francisco (2004, July 29). Environmental Official, Banco Cuscatlan. Telephone Interview.
32. Celada, M. Juan Carlos (2004, July). E-Mail to Marta Echavarria
33. Rodriguez, Jose Francisco (2004, July 29). Telephone Interview.
34. Inter-American Development Bank (2003). *Obstacles and Constraints for Increasing Investment in the Water and Sanitation Sector in Latin America and the Caribbean*. Survey by CG/LA.
35. AllAfrica Global Media (2004). *The Nile basin and local conflict*. [Online]. Available: <http://allafrica.com/stories/200403090215.html> [2004, July 13].
36. Lippman, Steve, (2003, May). *As Water Tables Fall, Investors' Concerns Rise*. News and Views, Trillium Asset Management. [Online]. Available: [http://www.realassets.ca/web\\_newsroom/releases.html](http://www.realassets.ca/web_newsroom/releases.html) [2004, October 18].
37. van der Loeff, Bram Schim, EIB Corporate Promotion (2004, July 14). E-mail to Ralph Hamann.
38. Louw, Adriaan (2004, July). Director, Institute for Agricultural Engineering. E-mail to Ralph Hamann.
39. Homer-Dixon, T. (1999). *Environment, Scarcity and Violence*. p. 49.
40. AC/UNU (2004). *Global Challenges*. [Online]. Available: <http://www.acunu.org/millennium/ch-02.html> [2004, October 18].
41. An average of figures for selected European countries or areas: Austria, Bulgaria, Cyprus, Denmark, Estonia, Finland, Hungary, Malta, the Netherlands, Romania, Slovenia, Sweden, Switzerland, and United Kingdom.].
42. It is important to mention that the available statistics for water availability displays significant variants and uncertainty
43. Target 10 of the MDGs is to "Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation." See, for instance, <http://www.developmentgoals.org>; <http://www.undp.org/mdg/mdgreportinafrica.pdf>.
44. African Development Bank (2004, July). *Building partnerships for water in Africa*. [Online]. Available: [http://www.afdb.org/water/water\\_week.htm](http://www.afdb.org/water/water_week.htm) [2004, October 18].
45. FAO
46. Inter-American Development Bank (2003). *Obstacles and Constraints for Increasing Investment in the Water and Sanitation Sector in Latin America and the Caribbean* Survey by CG/LA.
47. FAO
48. UN/WWAP (2003). *UN World Water Development Report: Water for People, Water for Life*. Paris: UNESCO.



# Challenges of Water Scarcity

A Business Case for Financial Institutions

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