Half full or half empty?

A set of indicative guidelines for water-related risks and an overview of emerging opportunities for financial institutions

A study of the Water & Finance Work Stream of the United Nations Environment Programme Finance Initiative

UNEP **Finance Initiative**
Innovative financing for sustainability

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A set of indicative guidelines for water-related risks and an overview of emerging opportunities for financial institutions

Report prepared for UNEP Finance Initiative by:
Dr. Olivia Jensen, Dr. Ceema Namazie

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Abbreviations

AMWG	Asset Management Working Group
BOT	Build-Operate-Transfer
EIA	Environmental Impact Assessment
ESG	Environmental, Social and Corporate Governance
EuroSIF	European Social Investment Forum
FI	Financial Institutions
ICRG	International Country Risk Guide
IUCN	World Conservation Union
KPI	Key Performance Indicators
MIGA	Multilateral Investment Guarantee Agency
MSF	Multi-Stage Flash
NGO	Non-Governmental Organization
PPP	Public Private Partnership
PoR	Political Risk
PRI	Principles for Responsible Investment
PSP	Private Sector Participation
PoRI	Political Risk Insurance
RO	Reverse Osmosis
ROI	Return on Investment
SIA	Social Impact Assessment
UKSIF	UK Social Investment Forum
UNEP FI	United Nations Environment Program Financial Initiative
WBCSD	World Business Council for Sustainable Development
WFD	Water Framework Directive
WRR	Water Related Risks
WRO	Water Related Opportunities

Foreword from the United Nations Environment Programme Finance Initiative

Water polarizes opinion like few other natural resources. Clean water: a tradable commodity or an undisputed human right? A hard asset to be sliced and diced through the latest financial engineering or a gift imbued with a spiritual value as the fundamental source of life that cannot be quantified?

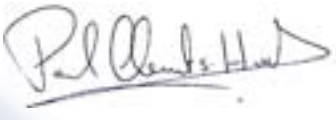
Globally, an increasing number of financial service institutions are awakening to the complex challenges and opportunities that water presents. For those banks and investors focused on the sector, the promise that water markets hold is becoming self-evident. This is balanced, however, against uncertainty over a broad range of risks associated with water management issues and how communities view their right to affordable water supplies and the price they are willing to pay for it. Also, water is a fundamental raw input to numerous industry and business sectors - such as agro-industries, chemicals and pharmaceuticals, food processing, iron and steel, oil and gas, power generation, textiles and tourism - and both quality and security of supply are essential for thriving economic activity. For the broader industry and business community, concerns around water, exacerbated by the global warming impacts on natural water cycles, are growing. How will financial institutions play the deadly serious water game in the decades to come as the water fundamentals shift for the sectors that they finance and invest in?

In the water sector, there exist uncertainties and strong differences of opinion about the best forms of public-private interaction and financing approaches that will enable us to deliver on “clean water for all”. The political and operational risks that these considerations bring to water projects worldwide are a further complication for financial services looking to back water-related business opportunities.

UNEP Finance Initiative’s Water Work Stream, in publishing these Water-Related Risk Management Guidelines, seeks to foster a better understanding of the broad range of risks associated with investments and financing of water-exposed and -related projects. As well as capturing the key risks and highlighting mitigation strategies within project finance, corporate finance and asset management, the guidelines flag up emerging opportunities in the water sector.

The document is not presented as the definitive guide to water-related risk but rather as the “starter kit” for those financial institutions commencing their journey to better appreciate how relevant issues impact their business areas and investments. The guidelines are completed with an easy-to-use appendix highlighting sector specific risks and controls that all financial institutions should be aware of.

UNEP FI offers the guidelines as a practical tool to enable our member institutions and the broader financial services community to better understand the challenges of water more effectively and gain a deeper appreciation of emerging opportunities.



Paul Clements-Hunt
Head, United Nations Environment Programme Finance Initiative

Message from the UNEP FI Advisory Group on Water & Finance

"When the well is dry, we know the worth of water"

Benjamin Franklin
Poor Richard's Almanac, 1746

Every day millions of financial transactions take place around the world and each and every one of them has a certain impact not only on the direct financial counterparts of that transaction but also on the future of a much broader group of stakeholders – tomorrow's overall economy, ecology, and ultimately society.

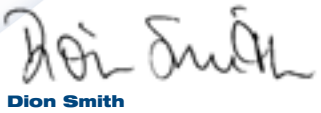
As one of the core elements for life on earth, the above rationale applies significantly to water and its sustainable exploitation. As unique and essential as it may be for the healthy functioning of both ecosystems and economies – the foundations of human well-being – the forecasts on water look everything else than satisfactory: global economic and demographic trends are accelerating water consumption at twice the speed of population growth; changing climate patterns and pollution are putting further pressure on global water resources. By 2025, as much as two thirds of the world's population will be facing conditions of serious water shortage of which one third will be living in conditions of absolute water scarcity. Simultaneously, by 2025, quantities of industrial waste-water will have approximately doubled relative to today's levels.

Apart from population growth, improving standards of living and climate change, these developments are unfortunately - and very in line with Benjamin Franklin's thoughts above - a consequence of ignorance and indifference, also among those who design the economies of the future: it is alarming how most financial institutions have overlooked the importance of water in the past. However, they will undoubtedly have to realize that while climate change may be the single biggest environmental challenge of the coming decades, its effects on business will mostly manifest themselves via water: circumstances of too little, too much or inadequate timing and quality of supply will expose businesses to considerable financial stress. In the end, financial institutions will understand the significance of the issue; the question is if they do so by enlightenment and active anticipation or by the late realization that the well is dry.

The purpose of these Water-Related Risk Management Guidelines is to highlight that water is a multi-dimensional financial risk issue that financial professionals must begin to understand and integrate into their decision making processes. Furthermore, this document provides to lenders and investors indicative guidance on how to do so. This includes the identification, assessment and the quantification as well as mitigation of water-related risks, be it in the water and sanitation sector or in the context of businesses downstream. However, it is recognized that water cannot only be a destroyer but also a creator of value. There are more opportunities around water than the mere benefits of enhanced risk management. Within this report, these are systematically pointed at and categorized.

The Guidelines, which over time will be supported by more focused add-ons from UNEP FI's Workstream on Water & Finance, offer today a first step to support financial institutions in understanding the importance of water. We hope that the scope of this product will also enable you to start reviewing and improving water management within your daily work.

Sasja Beslik
Head of Responsible Investment and Engagement
ABN Amro Asset Management, Sweden
Co-Chair, UNEP FI Advisory Group on Water & Finance



Dion Smith
Associate Director, Client Insight Team
Australia & New Zealand Banking Group
Co-Chair, UNEP FI Advisory Group on Water & Finance

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SIWI

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In addition, we are grateful to Barclays for permission to reproduce sections of their risk assessment methodology.

BARCLAYS

The UNEP FI Advisory Board on Water & Finance

Institution	Country
ABN AMRO Asset Management (Banco Funds)	Sweden
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BML Sustainable Business / Ekobanken	Sweden
Connexis	Sweden
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Sustainable Asset Management	Switzerland
Stockholm International Water Institute (SIWI)	Sweden
United Nations Environment Programme Regional Seas	–
VicSuper	Australia
Westpac Banking Corporation	Australia

1 Overview

These Guidelines (Guidelines) address the broad range of water related risks (WRR) that are faced by financial institutions (FIs) and the flip-side of those risks – the significant and growing water related opportunities (WRO).

WRR and WRO are rising in importance as drivers of financial behaviour as a result of climate change, the related rise in drought and flood events, an accelerated growth in global water-consumption and discharge, increasing government attention to the water environment, as well as the mobilisation of civil society around water-related issues.

In this global landscape, the financial sector is becoming increasingly aware of the risks and opportunities posed by water as competing demands for resources grow and supplies become more erratic. In order to lend, invest, or insure wisely, FIs need to understand better these risks and opportunities and to deal with them systematically within their existing risk appraisal and management processes.

Purpose of Guidelines

These Guidelines are intended to support FIs in integrating WRR into their risk management processes by developing procedures to identify, assess and mitigate the material and reputational risks associated with water. The Guidelines aim to be:

- an indicative tool for FIs to review their portfolio exposure to water-related risks through their clients and investments;
- a source of guidance for practitioners on sector breakdowns of likely water risks and opportunities;
- a methodology for integrating the guidelines into existing due diligence processes;
- a review of existing practice for FIs faced with water risks and opportunities and a demonstration of how this can be improved.

The Guidelines are a *guide* to FIs seeking to understand and mitigate their exposure to WRR when undertaking a transaction, rather than a comprehensive manual of the risks themselves. Similarly, the coverage of opportunities provides an overview of sectors and types of companies that are likely to benefit from growing demand, without providing an exhaustive list of areas of opportunity. New products and services are appearing in the sector constantly.

One size does not fit all

Risk appraisal procedures are specific to the type of transaction, such as equity investment, loan, or bond issue, and will depend upon numerous factors including the size of the transaction, the nature of the project, whether the sector is regulated and whether the project takes the form of a partnership between public and private sectors.

For this reason, the Guidelines provide a generic approach to understanding water risks and opportunities and a checklist of key issues that can be applied across a range of transaction types and clients, but they also consider in greater detail three particular types of transaction: project finance, corporate finance and asset management.

Context

The Guidelines set out a voluntary framework to guide lenders and investors to act in a socially and environmentally responsible manner with respect to water issues. They build upon a number of UNEP FI publications on WRR, drawing upon the findings and evidence from these reports. UNEP FI's Workstream on Water and Finance has already made significant progress in identifying the nature of water related risks for FIs. The CEO Briefing, "Financing Water: Risks and Opportunities" (UNEP FI, 2006) develops a typology for water risks which covers: commercial, political, legal/regulatory/contractual, water resource and reputational risks and identifies four types of businesses at risk: utilities and infrastructure, suppliers to the water industry, water-intensive sectors and all firms with a water footprint. An earlier publication, "Challenges of Water Scarcity: A Business Case for Financial institutions" (UNEP FI, 2005) addressed water scarcity and identified opportunities for the financial sector to contribute to sustainable development through active engagement in this area.

UNEP FI's Asset Management Working Group (AMWG) has examined the materiality of environmental, social and corporate governance considerations and criteria as they relate to the portfolio management of pension and other institutional funds in "Show me the Money: Linking Environmental, Social and Governance Issues to Company Value" (UNEPFI 2006).

The Guidelines build upon this earlier body of evidence and focus on how WRR mitigation strategies can be incorporated into transaction evaluation procedures, and consequently provides an indication of the growing areas of investment for WRO.

Methodology

The Guidelines have been developed based on evidence drawn from various sources, including reference material and documentation as well as from discussions with a number of financial intermediaries who have participated in the development of these Guidelines. The Guidelines have also been reviewed and piloted by FI practitioners as part of the development stage in order to develop a credible and practical approach that can be used by investment and credit analysts.

Section 2 of the Guidelines provides the context for the drivers of WRR and WRO and summarises industry exposure to WRR; Section 3 on the framework for WWR management discusses those risks in detail, how they fit in to the stages of a financial transaction, and steps that can be taken at each stage to ascertain and mitigate these risks. Section 4 provides practical and in-depth checklists around different water issues for financial practitioners to consider and address with clients in their due diligence. The following three sections provide a guide to WRR management for specific transaction types: Section 5 focuses on Project Finance, Section 6 on Corporate Finance and Section 7 on Asset Management. Section 8 reviews growing areas of investment in water-related opportunities and provides an overview of those opportunities per transaction type; Section 9 concludes with an information register of relevant sources and references for further information on topics covered throughout, which is followed by a detailed overview of WRR and controls for a range of 10 different sectors: from Agriculture, over Chemicals and Pharmaceuticals to Tourism.

2 How to use the Guidelines

The Guidelines provide the analyst with the information needed to understand exposure to water risk, what can be done to transfer or mitigate risks, and what type of action should be taken at what point within the transaction cycle.

Getting the Broad Overview

Section 3 provides a holistic view of how the global drivers of WRR & WRO affect products and services across sectors, and the related impact on financial operations. A summary table provides details on the extent of exposure to WRR across sector activities and links to further information on sector-specific issues contained in the Appendix.

Risk Categories and Broad Mitigation Procedures

Section 4 outlines where differing risks emerge in a transaction: it contains a detailed risk assessment procedure, and insights on what courses of action can be followed. The procedure is a generic one, and therefore applicable to all forms of transactions.

Practitioners' Checklists

In Section 5, a practical checklist of relevant questions to be asked and actions to be undertaken is given. Examples are provided throughout to give an indicative context for the problems or issues that may arise across different sectors, geographies and transaction arrangements.

Transaction Specific Aspects

The transaction specific sections of the report (Sections 6, 7, 8) provide a more detailed outline of the transaction process, the channels through which risk can materialise and how it impacts the transaction outcome. These sections complement the generic risk assessment procedure and provide more substantive guidance under project finance, corporate finance and asset management transactions respectively.

An Overview of the Opportunities

Section 9 gives a general overview of the key water-related opportunity areas for investors and financiers and provides an opportunity categorization per type of financial institution.

Further Information

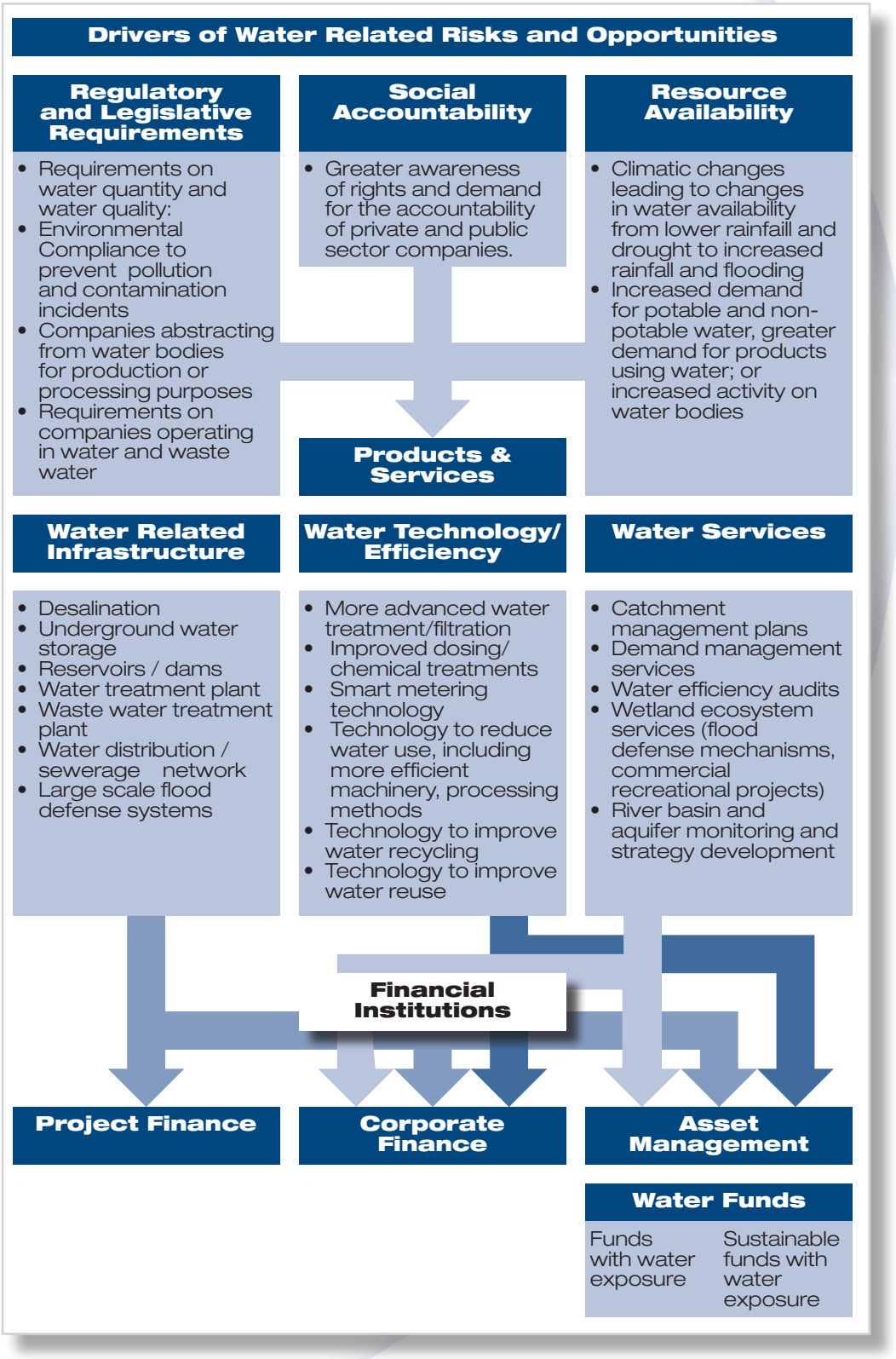
The Information Register provides an overview of reference material and documentation for greater detail on specific topics of relevance.

Sector Specific Aspects

The Appendix presents highlights from Barclays' risk assessment toolkit looking sector by sector at water risks that could materialise and potential controls to deal with them.

3 Drivers of Water Related Risks & Opportunities

Figure 3-1 Linking Drivers of WRR & WRO to Financial Operations



Drivers of Risk and Opportunity

Water plays multiple roles as a basic human need, a vital part of all ecosystems, a form of transport and a critical input in many – if not most – industrial activities. The link between business and water is attracting increasing attention for a number of reasons. Figure 3-1 illustrates some of the key drivers behind water related risk and water related opportunities, and shows how these link to particular products and services, which themselves are associated with differing financing options.

At the policy level there is an increased emphasis on the environmental regulation of water resources and water quality. Concurrently, there is increased public awareness of water issues, with ensuing demands for accountability from big water users and polluters. Population and economic growth are putting greater strain on resources, just as climatic change is forecasted to make supplies more erratic. Together, these factors are driving the need for changes in business behaviour to ensure efficient and sustainable operation in an evolving environment.

Greater awareness of the impact of economic activity on the water environment has led to tighter regulation. Governments are placing more controls on withdrawal of water from surface and ground water sources (abstraction) and on the quality of wastewaters that are discharged back into the environment. Infringement of regulations can lead to heavy fines or penalties, legal liability and damage to firms' reputations. Water utilities providing drinking water to households are in a particularly sensitive position, and the private companies involved in this sector have faced many challenges, particularly in emerging markets. But even in countries where regulation is more limited or existing regulation is weakly enforced, businesses that put human health at risk from water pollution themselves risk losing their 'licence to operate.' This creates an impetus for efficiency improvements or better practices across the board.

On the other hand, these developments are driving technological innovation, creating new services and opening up investment opportunities. Vast numbers of households in emerging markets remain without adequate access to water and sanitation services, creating an important opportunity for FIs and their clients to contribute to sustainable development by participating in the sector. As we better understand the value of water environments, markets for water ecosystem services are beginning to develop.

Sector Exposure

Certain sectors by their very nature involve activities that have a greater exposure to WRR. Water utilities supplying drinking water and sanitation are the most exposed, however, most sectors involve activities for which water is critical for some stage of production. Water plays multiple roles in the production process: as a core input or feedstock, for washing, as a separating agent, solvent, dilutant, process aid, effluent carrier and heat transfer medium.

Table 3-1 below presents a general indication of the water sourcing for different activities.

As technology and practices improve, the quantity of water used for particular activities may change, (e.g. modified crops using less water, more water efficient technology or greater water recycling) and the extent of the exposure of these activities to WRR will change as a consequence.

Table 3-1 Activity exposure to WRR by sectors

Sector	Activity	Water exposure
Agriculture (see Appendix 1.1)	Horticulture, Vineyards, Orchards	• Availability of water and quality of water used water in: feedstock (water resource and irrigation), product cleaning • Impacts to crop economics and practices due to precipitation-related changes and to pest-predator relationships
	Arable Farming	Availability of rain fed water and irrigation for feedstock (water resource and irrigation)
	Livestock / Dairy Farms	Availability of water and quality of water used in: feedstock (drinking and water resource for herbage availability)
Forestry and Logging (see Appendix 1.2)	Timber and Timber Based Products	• Availability and quality of water for plantation as feedstock • Transporting of material in waterways • Processing agent (maintenance of product)
Mining/Minerals/ Primary Materials (see Appendix 1.3)	Open cast mining Steel Aluminium smelting Non ferrous metals smelting Metals recovery and recycling	Availability of water and quality of used water as: • Separation medium (ore concentration) • Washing medium (aggregate cleaning) • coolant (drilling) • Environmental control (dust suppression in all sectors) • Process cooling (materials: minerals, metals and ceramics plant) • Feedstock (process input for coking) • Prime mover (steam blasts for steel smelting) • Effluent dilution (all sectors)
Power, Oil & Gas (see Appendix 1.4 & 1.5 respectively)	Power Plants (conventional) Hydro/Nuclear power stations Related Infrastructure (see Appendix 1.8)	Availability of water and quality of water used in: • Cooling • Prime mover (energy resource for hydro) • Effluent carrier • Cleaning, processing; treatment
Water Utilities (see Appendix 1.10)	Drinking water treatment and distribution (pipelines / networks) Waste water collection and treatment Desalination Fire precautions	Availability of water and quality of water used in: • Feedstock availability (conservation, duty of service) • Effluent carrier (sewage sludge) • End product • Process output (cleaned water post sewage treatment)

Sector	Activity	Water exposure
Manufacturing (see Appendix 1.6)	Pulp/Paper Mills	Availability of water and quality of water used in: • Process agent (pulping process) • Process carrier (pulp stock and paper making) • Effluent dilution • Coolant, steam feedstock
	Semi Conductors (see Appendix 1.6)	Availability of water and quality of water used in: • Cleaning; process carrier (etching) • Coolant • Safety agent (emergency diluents for releases)
	Chemicals (see Appendix 1.7)	Availability of water and quality of water used in:: • Cleaning • Process solvent and carrier • Feedstock • Coolant, steam feedstock for reaction and separation processes, safety agent (emergency diluents for releases).
	Pharmaceuticals (see Appendix 1.7)	Availability of water and quality of water used in: • Cleaning • Process solvent and carrier • Feedstock • Coolant (fermentation and chemical processes) • Steam feedstock for evaporation, separation, reaction and fermentation processes • Safety agent (emergency diluents for releases)
	Plating	Availability of water and quality of water used in: • Cleaning • Process solvent and carrier • Effluent dilution • Safety agent (emergency diluents for releases)
	Food & Beverages (see Appendix 1.6)	Availability of water and quality of water used as / in: solvent and process carrier; coolant (mixing equipment); feedstock; process aid; effluent dilution; steam feedstock for cooking processes
	Tanneries & Leather Manufacturing	Availability of water and quality of water used in: cleaning, process solvent, effluent dilution, steam feedstock for heating and cleaning processes
	Galvanizing & Plating	Availability of water and quality of water used in: effluent dilution, washing (chemical bath), solvent, safety agent (emergency diluents for releases)
	Plastics & Rubber	Availability of water and quality of water used in: cooling applications, steam systems as feedstock for heating and curing processes
	Automotive	Availability of water and quality of water used in: cooling, cleaning, steam feedstock for process and space heating
	Consumer Durables Manufacturing	Water resource availability affecting water prices and legislative drivers for improving product design ahead of industry capacity to cope or consumers to afford
	Laundry	Availability of water and quality of water used in: steam feedstock for heating, drying and finishing

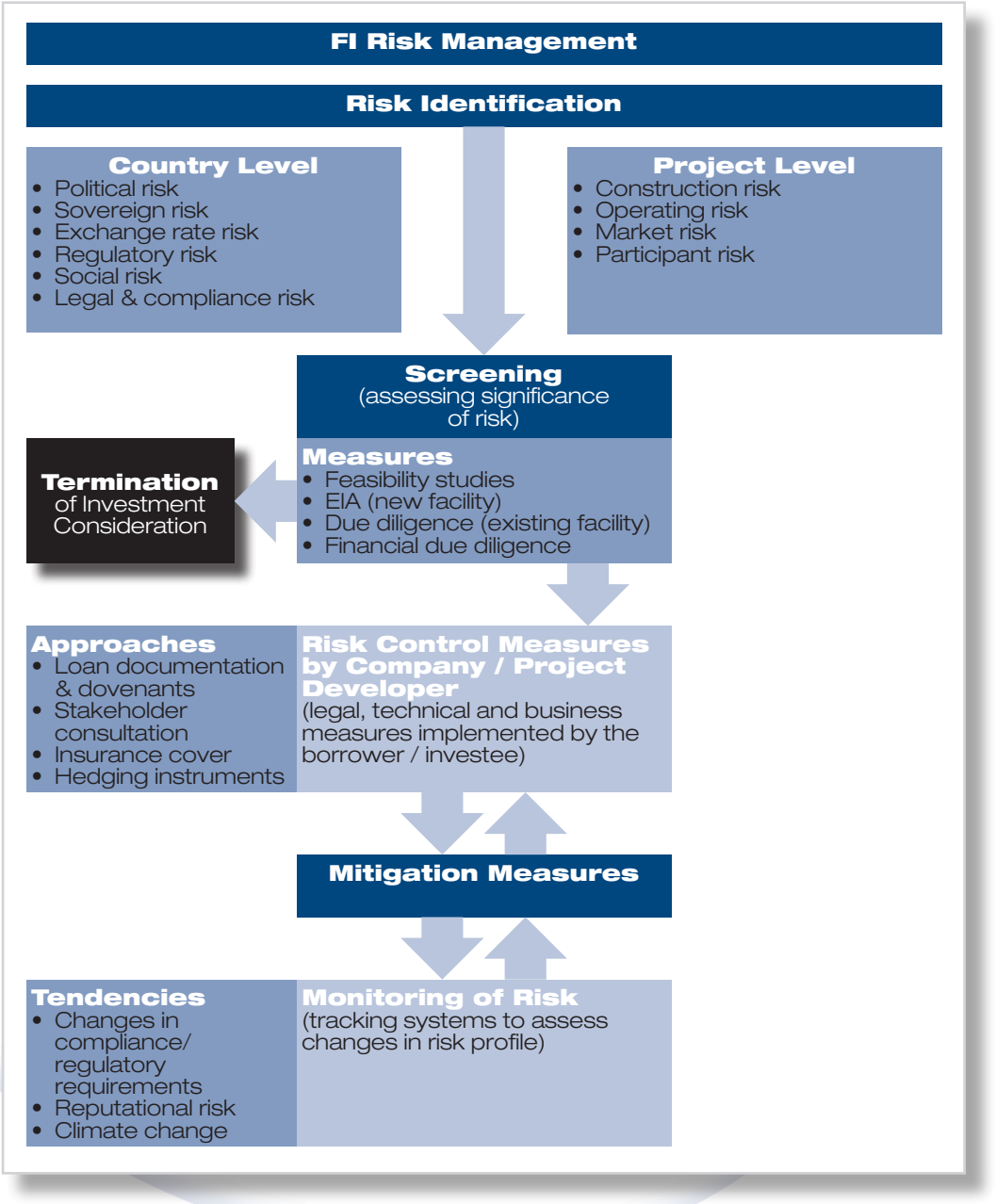
Sector	Activity	Water exposure
Transport	Road	Flooding / water scarcity: impacts on road availability, damage to infrastructure
	Rail	Flooding / water scarcity: impacts to track availability, infrastructure damage
	Air	Flooding: impacts to runway availability, long term viability of runway location
	Inland Waterways	Flooding / water scarcity: denial of navigation, damage to lock and harbour infrastructure
Construction (see Appendix 1.8)	Land Development	Flooding risk: • requirements to reduce the number of eligible locations • requirements to deal with flooding of existing developments • requirements to tailor urban environment to assist in dispersion of severe rainfall and prevent overloading of local and regional watercourses Availability of water resource: • requirement to build into new and existing developments the ability to harvest and store rainwater to prevent over exploitation of water resources in drier climate
	Site Management	Reduced surface water drainage leading to local flooding for areas which no longer permit drainage to ground (e.g. forecourts, parking areas)
General Retail	Apparel & Textiles (see Appendix 1.6)	Water quantity and quality for washing and processing. Increased variability in patterns of precipitation and temperature leading to seasonal mis-stocking risks
	Food Retail	Water quantity and quality for washing and processing
Tourism & Leisure (see Appendix 1.9)	Wetlands and Water Courses (ecosystems)	Natural resource availability for plant and animal life, land drainage/flooding, water course alteration or pollution of natural streams from flooding of sewers
	Recreational	• Availability of water expanse impacted by flooding or drought • Changes to waterborne diseases due to temperature changes • Changes to disease vector populations caused by increased variability in precipitation
	Hospitality	Availability of water and quality of used water in: • Construction • Processing aid (cooking) • Washing (laundry facilities); personal care • Land drainage
	Leisure (golf courses, swimming pools, showering)	Availability of water and quality of used water in: irrigation (golf courses, lawns and gardens), processing, process “input” (swimming pools), personal care, land drainage

4 Framework for Water Related Risk Management

The following sections outline the issues that should be considered by FIs and the sequence of procedures to be followed to reduce overall WRR to the project. The procedures which need to be undertaken for a specific transaction will depend on the financial product and sector and to a large extent will be project-specific. Hence, the explanations do not attempt to cover the full list of possible procedures but instead provide a generic outline of mechanisms, and illustrate areas for which greater attention should be paid where relevant to the activity. The steps outlined will not all need to be taken for each transaction, but illustrate the type of mitigation mechanisms that could be taken to reduce the overall WRR to the investment / credit.

The precise procedures that will need to be taken for an actual transaction will be project-specific; Figure 4-1 below provides an overview to understand at what stage in the transaction process the mitigation strategies should be addressed.

Figure 4-1 Generic FI Risk Assessment Procedure



4.1. Risk Identification & Screening

Country Level Risks

Political Risk

The first step in a risk screening process is often an assessment of country risk. Information on these risks and a range of risk ratings are readily available to FIs from different sources, such as the International Country Risk Guide (ICRG), the World Bank Doing Business Indicators, the Political Risk Insurance Centre (PoRI-Centre), the Multilateral Investment Guarantee Agency (MIGA), etc. Decisions to screen out a particular transaction may be made on this basis.

There can be wide variations of risks within a single country, and in a country with a mid-range risk rating. A high country-level risk may also obscure a much lower risk at a specified local area within country. FIs may decide to collect further information at the regional or even localised level. These local risks are particularly relevant to water as water resources and services are usually controlled at the municipal or river basin level. Some FIs have found interesting investment opportunities in low-risk localities in countries where they may otherwise be reluctant to take exposure. For example, one investor engaged in a project in Indonesia in a city with an institutionally strong, transparent local government and well run local water utility, despite high levels of corruption and political risk in the country as a whole.

For water-related projects or companies political risk extends beyond country risk. Therefore, an initial risk screening of country risk indicators might well not pick up some of the extra political risks faced by water projects. Water is a basic need whether for direct consumption or to grow food. Access to water and sanitation is highly significant for human health. Given these special dimensions of water, politicians in many countries recognise water as a human right and many governments are committed to universal access to clean water and sanitation. This raises the possibility that governments will intervene in contracts to impose universal service obligations or to intervene in quality and service standards.

Furthermore, the legislative environment for water resources is evolving in many countries as resource shortages become more apparent and water pollution is recognised as a serious problem. Any risk assessment should therefore consider a range of possible scenarios for political intervention in water rights allocations. Box 1 discusses the US experience with water rights allocation and trading.

BOX 1: Water Rights – Managing Competing Claims

The western US has an established system for trading water rights based on laws that separate water rights from land rights. Crucially, transfers are governed by institutional processes which support transparency and fairness in the market and extensive state records are kept on the volumes and shares of water associated with individual rights. Colorado uses water courts to rule on disputes between rival users, raising costs associated with contested claims. In California some transfers have been conducted through a state “drought water bank” that arranges purchases from individual farmers for transfer to other uses. Most transfers take the form of temporary leases, in part because of the restrictions on water rights but also because most holders do not want to transfer rights permanently. Some municipalities secure additional water in drought years by paying farmers to install water conservation devices or by increasing recharge in wet years, with the city receiving the additional water saved or stored. Despite the strong framework under-pinning the market, water transfers in the US are highly contested and litigated. Other countries seeking to implement water trading schemes will need to pay close attention to the design of institutions that will ensure equity in trading and protection for vulnerable groups.

These types of water-related political risks are often not well covered by common political risk insurance and may be covered by sovereign immunity. Both risk screening and mitigation will be necessary in relation to political risks. Common mechanisms for mitigating political risk include:

- Requiring host country agreements and assurances that the project will not be interfered with;
- Obtaining legal opinions as to the applicable laws and the enforceability of contracts with government entities;
- Requiring political risk insurance to be obtained from bodies which provide such insurance (traditionally government agencies);
- Involving financiers from a number of different countries, national export credit agencies and multilateral lending institutions such as a development bank; and
- Establishing accounts in economically- stable countries for the receipt of sale proceeds from purchasers.

Sovereign/Sub-Sovereign Risk

Sovereign and sub-sovereign risks are a specific issue for providers of water and sanitation services. Box 2 discusses some of the risks involved in public-private partnership projects in the sector.

BOX 2: Private Water Concessions – Trials and Tribulations

High profile cases of public-private contracts in the water sector being terminated have turned firms and governments away from the sector. One of the most infamous cases is that of Cochabamba (Bolivia), where a concession contract was signed in 1999, and cancelled soon after in the wake of civil disturbances that left two people dead.

Capital investment in the concession was to be financed with a 35 percent increase in tariffs at the start of the concession. This increase, along with the rising block tariff structure and an increase in the quantity of water supplied caused many customers' bills to increase by 100 percent or more. At the same time, peasants in surrounding areas had to start paying for water that had previously been available for free from public standpipes. This brought thousands of people onto the streets to protest against the privatisation, and the government reversed the enabling law and terminated the contract.

The Buenos Aires concession in Argentina ended in different circumstances. When the 30-year contract was awarded to a consortium of foreign companies and local business groups in 1993 it was heralded as a great success as the private company offered to supply water at a lower price than the public utility. However, the concession ran into problems early on with the costs of network roll-out and lobbied the government for a tariff increase to cover its operational losses. The contract carried on until the Argentine economic crisis in 2001, when the collapse of the exchange rate finally undermined the financial viability of the concession company and the contract was terminated. These concessions faced considerable social, political and macroeconomic risks which could have been better mitigated or managed. Clearly, safety nets have to be in place to ensure that the poor are supplied at tariffs that they can afford. Government subsidies may be required, especially if cross-subsidies between consumer groups are phased out. Second, if new charges or tariff increases are necessary to achieve cost recovery, government and firms need to communicate this clearly to consumers. Tying tariff increases to measurable increases in coverage or service quality may improve consumers' willingness to pay. Third, flexibility needs to be built into contracts to allow for adjustments to macroeconomic shocks.

In many countries, municipalities are responsible for provision of water/sanitation services and so utility companies will have a contractual relationship with the local government. This can take several forms:

- Service contract in which the local government pays a fee to the company for services delivered.
- Operations and management contract, in which the local government transfers a proportion of tariff revenues to the private company.
- 'Off-take' agreement in which the local government commits to purchase treated water from a private water treatment plant at a pre-determined price, or to pay a private firm for treatment of wastewater. 'Take-or-pay' contracts fix the volume as well as the price, and oblige the government to purchase the service whether or not it is used.

In all these contract types, the financial standing of the local government will be important to the success of the project. In a management and operations contract in which the fee will be paid by the public utility concerns will also raise about the financial standing of the municipality to guarantee this fee if tariff revenues are inadequate to cover payments due. A guarantee of this kind may be necessary for an FI to agree to provide finance to the private operator in a project of this kind. In such circumstances, financiers might also require an assessment of customers' affordability of tariffs or bill collection procedures to be undertaken. When the water distribution network or sewerage network remains in the public sector, as it does in a typical Build-Operate-Transfer arrangement, private service providers face the risk that the local government will not invest sufficiently in the extension and maintenance of networks.

An assessment of sub-sovereign risk will be relevant for projects which involve state or provincial governments, municipalities, councils or other local government authorities. There may be instances when there is less risk at the sub-sovereign level than at the sovereign level, for example municipalities in economically prosperous urban towns or capital cities which may be able to demonstrate a stronger credit rating than the national government, which is burdened with debt, has weak ministerial accountability or poor national tax collection systems.

An assessment should include:

- The legal and financial standing of the entity in terms of insolvency/bankruptcy.
- Ownership structure and its property rights or entitlement over any assets or land the entity may wish to use for collateral.
- The entity's ability to operate independently of political influence subject to electoral motivations.

Foreign Exchange Risk

Currency risk will be relevant to most transactions in an international context, including water-related projects, where there is a mismatch between the denomination of the loan and the denomination of the project's revenue stream. For example, the concession contract may stipulate the required return in USD but revenue streams are denoted in the local currency. There are numerous examples of projects whose financial viability has been undermined by a currency shock, including the high-profile water service concessions in Manila and Buenos Aires (see Box 1). The Asian crisis in the late 90s was also a contributing factor to the problems in the water sector in Jakarta, where the currency devaluation led to the concessionaires accepting to take a greater proportion of their expected return later in the 25 year deal. However further problems arose when tariff increases were not permitted despite the government's agreement to do so.

In the aftermath of the emerging market currency crises in the last decade, FIs may be reluctant to take on any foreign exchange exposure risk. However, there are several risk control and mitigation strategies that FIs can employ – internal or external hedging techniques for instance - so that foreign exchange risk does not necessarily lead to the screening-out of a transaction opportunity.

Regulatory Risk

The multi-faceted nature of water as a basic need and an environmental resource means that it is subject to extensive regulation.

An assessment of environmental risks is a standard part of the risk identification process for FIs. A restrictive interpretation of risk assessment would involve ensuring that the project complies with existing environmental regulation in the country in question. However, there is a worldwide trend towards tighter environmental regulation and better implementation, so good practice would be to consider the potential for the project to out-perform existing regulatory requirements. In some places, laws have been strengthened but are only partially implemented or enforced, as in South Africa where the water resources law is consistent with best practice in legislation, but implementation is held back by lack of resources.

- In cases where permits and licenses are required by law, but not enforced by local governments or public agencies, FIs can safeguard their material and reputational interests by ensuring that clients are fully compliant with laws even when these are not rigorously enforced.

A further risk is that government will react to an accidental incident of water pollution by taking dramatic action, perhaps even closing down the business. Box 3 describes the impact of water pollution risks in China.

BOX 3: Pollution Risk Becomes Financial Reality - Chemical Spills in China

In 2005, two major chemical spills threatened water supplies to residents of the Northern city of Harbin, close to the Russian border, and China's southern manufacturing hub, Guangzhou, one of China's most densely populated areas. In Harbin, an explosion in a PetroChina chemical plant released 100 tonnes of benzene and other toxic substances into the Songhua River, the main source of water supplies for the 3.8 million population of Harbin. The authorities reacted slowly to the crisis, and sought to cover up the risks to human health. Piped water supplies to the city were belatedly shut off for five days while the chemical slick flowed downstream into Russia. Several weeks later, the spill put water supplies to the city of Khabarovsk at risk. China supplied Khabarovsk with activated carbon for water filtration in an effort to reduce the impact of the contamination on drinking water supplies. The spill struck a blow to PetroChina, which is listed in New York, when Western shareholders reconsidered their positions in the company stock. California's Treasurer called on the California State Teachers Retirement System to sell its US$24 million equity stake in the company. In addition to local law suits brought by Harbin citizens groups, the company also faces the possibility of class action legal challenges in the US, a further risk for shareholders. The Guangzhou disaster was caused by the Shaoguan Smelting Plant in Yingde City releasing large quantities of cadmium into a major river, raising cadmium levels to 10 times the required safety standard. This and 14 other smelting plants were forced to shut down by the authorities to assess the risk of further spills. Investors in the parent company, Zhongjin Lingnan Nonferrous Metals, which is listed on China's Shenzhen Stock Exchange, lost out when share-trading was frozen and reopened down.

While risk assessments may reflect the ability to meet current standards, and outline the existing permit and licence conditions, a further assessment could be made on the proposed project's ability to meet tighter compliance restrictions, whether these were legally imposed or not. The need for this requirement would be in conjunction with an understanding of the stability of the regulatory climate and the potential for social backlash. Stricter requirements

may also be driven by external factors such as climate change, which may exacerbate existing pollution problems. For example, concerns over ecological quality may lead to a tightening in the requirements for effluent discharges, or human health concerns may lead to stricter standards in recreational coastal areas.

- A full risk assessment might consider strategies to respond to these future requirements, through retrofitting of water treatment processes at the plant or alternative disposal options.
- The quality of drinking water has a direct and potentially extremely damaging impact on human health. A water utility would likely face fines and penalties as well as legal liability for negligence or harm as a result of its failure to meet regulatory requirements for drinking water quality.
  Investors / lenders could require the client to assess if the project could ensure a sufficiently broad margin for out-performance of standards to control this serious risk.
- Economic regulation risks are a specific issue for water and sanitation service providers. The decisions imposed by regulator on tariffs or performance requirement will be crucial to the financial viability of the project. The assessment of the economic regulatory environment for a project will form a central part of regular due diligence on this type of project and is discussed in the section on due diligence below. An FI might screen out a transaction opportunity with a weak or politicized system for economic regulation but FIs can also play a role in structuring the project in ways that can mitigate this risk. Risks will be particularly high when the project is intended to serve low-income communities. Box 4 describes how cost-recovery can be ensured while risks associated with providing services to the poor can be minimised with careful subsidy design.

There are instances where concession contracts to supply water between private water companies and governments have been agreed and signed, but subsequently the water regulator has not approved the tariff increases stipulated by the water company. Caution should also be taken when negotiating terms and conditions, particular tariff increases, prior to an election.

BOX 4: Protecting the Poor under Private Water Provision

Subsidies have traditionally been paid to help utilities cover their costs. The problem with this approach is that it remunerates the utility on the basis of its costs, not its results. A better approach, especially when a private operator is involved, may be to make payment contingent on provision of outputs. These outputs can include delivery of water to a household, connection of new households in poor areas, or treatment of specified quantities of wastewater to the required standard. One example comes from Paraguay where private operators are paid a fixed amount from a government fund for each new water supply connection. In Chile, the government assists low-income households by paying part of their water bill. Municipalities pay subsidies to private and public water companies from a national fund when water is supplied to low-income households. The central government allocates subsidies to each region according to local tariffs and the estimated number of households likely to pay water bills greater than 5% of household income. Local municipalities assess eligibility for the subsidy, with the water company billing the recipient net of the subsidy amount and billing the municipality for the remainder.

Risks in obtaining government licenses and approvals required to construct or operate the project may be high for a water-related project, because of the dual nature of water as a social and environmental good. Projects that involve discharges of pollutant, effluent discharges or seepage are exposed to this risk. Such risks may be reduced by obtaining legal advice confirming compliance with applicable laws and ensuring that any necessary approvals are a condition precedent to the drawdown of funds, so that investment/credit opportunities are not screened out at an early stage.

Other risks, such as excessive taxation or the threat of expropriation, will be general and reflected in the assessment of country risk.

Social Risk

The nature of water as a basic need also leads to social risks. Utilities are particularly exposed to social risks, which may manifest in a refusal to pay bills, as has happened in some water supply projects in South Africa, or at the most extreme in public protests (see Box 2 on Cochabamba, Bolivia). In the past, water-related projects have sometimes proved unsustainable because of an inadequate understanding of these social risks. Utilities are not the only companies to face social risks: any company that abstracts water from a source on which communities depend for their livelihoods is at risk of a backlash. Simply complying with government regulations may not be enough: in some localities, water rights may be strongly enshrined in customary law but not codified in statutory law. Box 5 describes the tensions between customary and statutory rights in sub-Saharan African countries and in Indonesia.

BOX 5: Clashes between Customary and Statutory Rights to water

Pastoralists in sub-Saharan Africa, whose access to water is based on custom and history, have consistently lost out as a result of the extension of formal land rights and steps to formalise institutions to allocate water. Enclosing a water point, creating an irrigation scheme or attaching a legal title to land can shift the power relationship between sedentary producers and pastoralists, whose entitlements are rooted in weaker (often non-enforceable) customary claims. In northern Uganda, southern Tanzania and north-eastern Kenya violent clashes between farmers and pastoralists have become increasingly common, sparked by clashes between private and customary claims. In Niger legislation introduced under water governance reforms allows for private water points in pastoral grazing areas. Elsewhere in West Africa, new open access wells constructed by the state have undermined traditional sharing systems. The public wells have been taken over by larger, more powerful herders, including customary chiefs, traders and politicians, reducing access to water for other herders.

In Indonesia, farmers have formal rights to water, but their rights have been eroded in some areas by the competing use by industry. Factories have obtained more water through three routes: government-allocated permits to draw on surface and irrigation water or groundwater, negotiations with local farmers to buy or rent land to acquire water use rights, and the installation of additional pumps and pipes. Permits are sanctioned by government. The second route, purchasing or renting land, is not sanctioned by state law, but is widely accepted in local law as a legitimate means of acquiring water. The third, installing additional pumps and pipes, is sanctioned neither by state law nor by local law, but is possible because of the political power of factory owners.

Some companies have exploited the gap between state law and local practice to buy or rent land, thereby acquiring water rights, farmers downstream consequently losing out from reduced water flows. These practices have undermined the factories' 'licence to operate' and have led to local protests. Companies can minimise social risks by ensuring that the effects of their water use on downstream users are fully taken into account.

However, it is likely that these risks can be mitigated through an inclusive project design process that involves local communities and careful project structuring that takes into account the ability and willingness of households to pay for water and sanitation services, and how service can be tailored to local needs. Examples of community consultation are provided in Box 8 below.

- In the preparation of a project, an exclusive focus on compliance with statutory laws on abstraction rights might give rise to a risk of conflict with the local community, and a project could lose its legitimacy.

There is also risk of political intervention when social unrest or community conflict which are not resolved through standard consultation, regulatory and legal channels.

Project Level Risks

Many project-level risks will be considered in a standard assessment exercise, which would usually include an engineering feasibility study and environmental impact assessment (EIA) in addition to project due diligence. This section reviews these procedures and then highlights some water-specific issues and considers whether these are taken into account sufficiently in existing due diligence procedures.

The engineering feasibility study covers the engineering design of a plant. The study would include a review of the adequacy of water supplies from a secure non-varying source; whether permits to abstract water and discharge wastewater had been obtained. The study would also include an assessment of whether the plant would require its own water treatment facility for input water or discharges. A feasibility study would generally consider a number of alternative scenarios that might put the viability of the project at risk.

An EIA would normally include: project description details, engineering data, location, size, input/output and would cover the impact of the project on a number of receptors – water, soil, air and livelihoods. The report would draw on both quantitative and qualitative information. The EIA should cover the construction, operation, and abandonment phases of the project, potentially including complete dismantling and restoration of the environment to its original condition.

Impacts are measured over the short, medium, long term, with periods defined according to the life of the project. The duration over which the impact can occur is assessed in terms of: construction period, commissioning, operating and de-commissioning. Data for the receptors is analysed as far back as availability allows; climate data is often available for over 30 years, while geological data may not go back as far. An EIA often involves dialogue with local stakeholders, with the participation of the project sponsor.

Assessments for establishing the baseline data and any future impacts will depend on data availability. For example, if looking at potential flooding issues, affected project developers might want to have 100 years of precipitation data. For traffic issues, current data is more valuable. In most cases, past data may simply not exist. Often, current baseline data needs to be collected in the field. The breadth and depth of the study can vary depending on the level of concern of the FIs involved.

For those operations with a significant water input requirement, or with significant pollutant discharges to water, projections of impact of the project should ideally cover the life of the project. In reality, most EIAs look at the current conditions and also consider cumulative impacts from other known, planned projects.

EIAs rarely include multiple scenario analyses to consider changes in resource availability. Furthemore, an EIA should evaluate alternatives to the project, including the *No Action* alternative, which investors/lenders should additionally demand. If, for example, the project is a proposed dam to store water from the rainy season for use during the dry season, alternatives might include alternate locations for the dam, alternate sizes of the retaining reservoir, water conservation or demand reduction, or a pipeline from a different water source. If some alternatives have uncertain future risks, a decision tree can be used to show the expected returns and probabilities to determine which alternative has the highest expected rate of return.

EIAs will make recommendations for the project to demonstrate compliance or that mitigation measures have been taken.

Construction Risk

Construction risks for large water-related infrastructure projects like dams may be considerable, but FIs would be able to use standard mitigation strategies to deal with these risks.

Operating Risk

Operating risks may affect the cash-flow of the project by increasing operating costs or affecting the project's capacity to deliver planned quantity and quality of output over the life of the project.

The transmission of operating risks to FIs can be minimised in the project design phase through:

- Requirements for performance bonds.
- Specification of alternative sources of supply for critical sustainable water resource inputs.
- During the implementation phase, risks can be controlled through requirements for detailed monitoring and reporting on the operations of the project and by controlling cash-flows, for example by requiring project revenues to be paid directly into an escrow account with preferential rights for creditors.

Operational risks related to water could affect all sectors for which water is a significant input in the production process. The two key sources of risk are drought and flooding which can lead to supply interruptions and damage to physical assets. Investors and lenders have become increasingly aware of these risks in recent years, particularly in the power generation and irrigated agriculture sectors. Box 6 describes the very material impact of drought on power companies in Australia and Europe.

Again, risk reduction strategies can be put in place at the project design phase. Risks associated with water resource availability can be minimised by:

- Experts' reports on availability of resources, such as a detailed hydrological assessment.
- Requiring long term supply contracts specifying quantity and quality of resource inputs to be entered into as protection against shortages, price fluctuations, and quality variability, such as a raw water provision contract for a water utility company.
- Obtaining guarantees from governments for input levels, such as an agreement from the municipal government to develop adequate water sources and delivery infrastructure.

However, these risks could also lead to the screening out of projects in specific sectors and regions. For example, inland nuclear power stations may no longer be viable in some areas of Australia or Europe where there is greater variability in river flows.

BOX 6: Power Generation and Water

Coal, hydropower and nuclear energy supplies are all highly dependent upon access to plentiful supplies of water, leaving water-short regions to contend with restrictions in energy supply or rising energy prices as well as the direct impact of droughts. For financial institutions with power industry clients, low water availability is a concern because of its impact on revenues and asset values.

The impact of water risks was felt in Europe during the 2003 heat wave which saw a quarter of France's 58 nuclear facilities shut down. A suspension of environmental protection regulations allowed 6 of the facilities reopen but facilities were operating well below capacity. Drought also reduced Nordic hydroelectric reservoirs forcing them to restrict generation to ensure water supplies lasted, and cutting back supply into the European grid. To compound the problem, the heat wave resulted in a 10% increase in energy demand.

Mainland Australia's energy companies have also suffered as a result of a long drought, especially the government owned generators in Queensland and, to a lesser extent, New South Wales. Snowy Hydro, a majority-government owned listed hydroelectricity generator, has been hit hard, with storage levels at 10% of capacity. Even though the state government suspended environmental protection regulations to allow the company to use gas to keep its turbines running and meet its contractual supply obligations, the drought has driven up costs. In July 2007, Moody's downgraded Snowy from A3 to BAA1, largely due to its reliance on pump storage and gas fired generation, and ratings agencies have noted there will be further downward pressure on ratings if the water outlook worsens.

In 2006 the proponents of the controversial Basslink project, an 290 km undersea cable that connects the island of Tasmania to the Australian national energy grid, heralded the supply of cheap clean Tasmanian power for the mainland from Tasmania's vast water supplies and hydroelectric generation capabilities. Hydro Tasmania, the state-owned electricity generating company, was set to be the main beneficiary, as it had intended to use the link to export power to other states. However, in 2006-7 water shortages in Tasmania meant that it was obliged instead to import electricity at a cost of about AU$16 million, driving down the company's profitability.

Market Risk

It is sometimes assumed that as water is a basic need, there is unlikely to be significant market risk. However, over-optimistic assessments of future water demand have caused difficulties to a number of PPP water projects. In some cases, the problem lay in the failure to consider affordability of services for potential customers and to tailor services offerings accordingly. Box 7 illustrates the experience in the La Paz – El Alto concession in Bolivia. In other cases, companies failed to consider how consumers would react to price increases. When water tariffs rise, customers may switch to private sources of water such as wells and boreholes, even if the quality of the water is lower. The demand for sanitation may be even more difficult to predict. For example, the privatisation of Malaysia's national sewage service company failed when households refused to pay their bills.

- Companies may need to raise awareness among potential customers about the benefits of the services they are providing in order to increase their willingness to pay.
- The financial institutions backing these projects will need to look behind the demand projections provided by companies, and to consider whether government or donor subsidies might be needed to ensure the viability of the project.

Box 7 provides an example of how water supply/sanitation services to poor communities can be rendered financially viable through adequate project-design and affordability considerations.

BOX 7: Tailoring Services to Low-income Customers

Aguas del Illimani, a joint venture of Suez and regional partners, was awarded a concession contract in 1997 to provide water services to the capital city, La Paz, and the poorer neighbouring city of El Alto, with a combined population of approximately 1.3 million. When Aguas de Illimani took over, more than 80 percent of the population of La Paz and over 70 percent of the population of El Alto had a water connection, but only 60 percent of La Paz residents and 30 percent of El Alto residents had a sewerage connection. The government focused on extending service through in-house water and sewerage connections engineered to OECD standards and wrote service expansion targets for El Alto into the contract. As the expansion program got under way, however, it became clear that the newly connected households used less water than existing customers. This meant lower revenue for the operator, causing financial problems. The government, the regulator, and the operator addressed the problem by allowing for lower-cost connections, such as condominial sewerage.

Participant Risk

Participant risk refers to situations in which there are insufficient resources to manage the construction and operation of the project and to efficiently resolve any problems which may arise. To minimise these risks, financiers need to satisfy themselves that the participants in a project have the necessary human resources, skills and experience and are financially sound to be able to deliver the project on budget and on time.

Technical Risk

Technical risks encompass a range of risks associated with the suitability and reliability of technologies. These include the potential for interruption to production or reductions in output quality due to the project's plant and equipment, including latent defects. Financiers usually minimise this risk by favouring tried and tested technologies over new unproven technologies. Clearly, this approach contrasts with the exploration of opportunities related to new water treatment or efficiency technologies.

Technical risk may also be minimised in the risk assessment phase by obtaining technical experts' report on the proposed technology. Technical risks can be managed during the loan period by requiring a maintenance retention account to be maintained to receive a proportion of cash-flows to cover future maintenance expenditure.

A second type of technical risk relates to the appropriateness of technology. This will be particularly relevant in relation to innovative technologies in emerging markets. Some projects involving innovative technologies have encountered financial difficulties because technology take-up was lower than expected. Strategies to mitigate this risk include market research prior to product launch and social marketing.

4.2. Risk Control and Mitigation

Project Design

Many risks can be mitigated through careful project design. The extent to which FIs become involved in project design will depend on the nature of the transaction.

In venture capital and private equity deals the investor may play an extensive role advising management on the design of the project. For an irrigated agriculture project, this might include ensuring that the management had in place a full marketing and distribution plan for the output.

In public equity transactions, the FI would engage with the company's directors directly and through shareholder meetings, and might also engage with regulators and policy-makers on issues of concern to the sector. In the regulated water utilities sector, FIs have engaged with regulators on the treatment of firms' financial structures in tariff determinations, for example.

For SME loans there may be close interaction between small and medium-sized enterprises (SMEs) and local bank branches, with bankers advising on project design. Bankers might encourage their clients to use water-efficient technologies and practices by offering preferential lending terms. In a larger scale corporate finance deal, lenders might require companies to carry out 'water due diligence' or to quantify the risks of water availability restrictions on financial performance.

In project finance transactions, banks also play an influential role, often influencing and imposing requirements in the design of the project. For a water PPP, this might include specifying the contract provisions for tariff-setting.

Financial Due Diligence

The bankability of a project will depend on an accurate assessment of expected returns on the project.

The exact nature of the project will determine the type of the financial assessment that is carried out and the assumptions that go into estimating the return, which will depend upon a number of specific characteristics including: size of transaction, regulated/un-regulated sectors, government-off-taker / non-government-off-taker, project duration, company ownership structure, assets, debt structure, revenue streams, etc.

Estimating income revenues or operating costs for projects should quantify where possible alternative scenarios to counter the WRR exposures outlined earlier. Box 10 depicts how a water-related risk-quantification exercise could be structured.

Rates of return for all projects should include potential greater operating expenditure as a consequence of changes in water source availability or changes in operating systems due to tighter compliance constraints:

- Costs of alternative water sourcing following changes to abstraction rights or availability constraints, for example greater pumping costs and alternative energy sources for hydro plants facing water resource constraints, as in the case of Snowy Hydro described in Box 6 above.
- Greater treatment costs from tighter pollutant discharge regulation.
- Networks with greater headroom to accommodate greater demand or anticipated flows.

The potential cost implications under different scenarios should be provided by the EIA/ feasibility studies, which should reflect the project's exposure to WRR in more detail.

With respect to the water sector in particular, the following aspects should be considered in every due-diligence procedure. Company revenue that is dependent on income streams from customer bill payment is particularly susceptible to regulatory risk (in regulated markets), market risk, or even political risk. Revenue from the water retail business is even more susceptible to WRR given the emotive nature of drinking-water supply.

While financial assessments will estimate differing revenue scenarios as a consequence of the exposure to WRR, water pricing and customer bill payments that determine water retail businesses' income streams are even more dependent on affordability considerations and

default rates. While regulated water sectors may reduce uncertainty for business activities, they also expose investors/lenders to greater greater risks of political and government interference, particularly as a consequence of social or civil society pressures.

There has been a growing interest in willingness-to-pay considerations which involve estimating customers' willingness to pay for specified service levels and attributes, especially in such bussinesses as water supply and waste water services or electricity/gas retail distribution. This information can be used for investment planning strategies or to gauge customer service satisfaction levels.

Stakeholder Engagement

As social risks are an important category of risks for water projects, ensuring that project sponsors have carried out a programme of stakeholder engagement in the development of the project will help to mitigate risks at the operational phase. The exact nature of the stakeholder engagement will vary, but it is important that it is perceived to be fair and genuine in its efforts to inform and engage those who will be affected. Good practice in stakeholder engagement is describe in Box 8.

BOX 8: Involving Stakeholders in Kathmandu and Cartagena

When a private sector participation (PSP) contract was being considered for Kathmandu (Nepal), it became clear that little was known about potential customers, especially poor households. There were conflicting opinions about the number of poor people in the service area, the type of service they were receiving, and the improvements they wanted. The team therefore implemented a programme of surveys and consultations with local civil society groups. The results showed that a number of preconceptions were incorrect. For example, some officials had argued that a heavily discounted lifeline block was a good way to ensure poor people would benefit from the reforms. In fact, since only 51 percent of the poor had connections, this was not the case. The consultation process therefore recommended avoiding consumption subsidies and instead focusing on expanding access for the unserved population. In Colombia, national regulation requires that water utilities bill monthly. In the town of Cartagena, the operator found that this billing regime made it difficult for low-income workers—especially those paid by the day—to manage bill payments. Through consultation it became clear that if bills were sent twice a month, these households would find it easier to pay, benefiting both them and the operator. The regulator refused to adjust the national standards, but by working with community organizations that organized to collect payment twice monthly, the operator was able to achieve the same result. It was only through consultation and engagement with local organizations that the problem was identified and the solution developed.

Engagement can take the form of:

- Small engagements of dialogue with affected communities.
- More formal larger group or village forums.
- High level consultation mechanisms with all local stakeholders from the wider community and institutions with a vested interest in the project.
  - Many companies operating in extractive industries like mining and forestry work extensively with the communities affected by their projects. FIs can encourage their clients to follow this example and may make this a requirement in high social risk areas.
  - In countries where FIs have no local presence, the services of a reputable local coordinator could be deployed to assess and monitor project and company risk, and regularly reporting from the client could be requested.

This level of engagement would facilitate financial operations in activities that would otherwise be deemed to have too high an exposure to social, market or regulatory risk.

Contractual Risk Transfer Instruments

FIs can use risk transfer techniques to mitigate WRR, including contractual arrangements and insurance. Possible contractual arrangements include: allocation of environmental indemnity, holdback arrangements, escrow accounts and insurance products:

- **Environmental indemnity** contracts allow for a clear allocation of obligations to provide compensation for harm caused to one or other contracting party. Environmental indemnity would cover compensation for environmental damage caused in the period covered by the contract, costs and risks of law-suits arising from this damage and might also include pre-existing environmental contamination.
- **Holdbacks** require operators engaging contractors to hold back a particular percentage of payment for a stipulated length of time to ensure that any and all parties working on a contract are paid.
- **Escrow accounts** are used to protect the interests of lenders, particularly in project finance deals. In an escrow arrangement, operators are required to pay project revenues (tolls, fees etc) into an account held by a third party or escrow agent, from which payments are made in order of priority defined in the contract.
  Lenders can require debt interest and service requirements to be met before payment is made to the operator; an escrow arrangement could also be used to ensure that any water resource costs, pollution discharge fees etc. are met.
- FIs use a range of standard and tailored **insurance products** to manage risks. As mentioned previously, non-commercial or political risk insurance cover can be used against country risk. Political risk insurance is available for several different types of political risk such as political violence (e.g. civil unrest, terrorism, war), governmental expropriation/ confiscation of assets, unlawful requests for letters of credit or similar on-demand guarantees, and inconvertibility of foreign currency or the inability to repatriate funds. The extent of what can be insured will be specific to the terms and conditions of the policy. Information on country level risk can be found on the Multilateral Investment Guarantee Agency's Political Risk Insurance (PoRI) Centre website[1]. As well as the latest news and research undertaken in the area, the PoRI-centre provides country specific risk information. The PoRI-centre site also provides lists of Political Risk Insurers, Intermediaries as well as Consultants and Advisers in political risk.
  FIs will also require that their clients demonstrate adequate insurance for a range of business risks. General insurance will cover "property" and "casualty" also known as "liability". This indemnifies policyholders if they are sued by third parties. General insurance products of relevance here are damage to property and directors' liability insurance. Business interruption risks are often not in themselves insurable unless caused by material damage to equipment. There is currently no coverage for business interruptions resulting from a lack of available water to facilitate operations, e.g. power companies reducing or ceasing operation due to lack of water for cooling.

  Box 9 provides an example of a water project financial structure combining private finance with an IFC guarantee as a multilateral risk transfer instrument.

  FIs will require their clients to demonstrate adequate insurance coverage against a range of business risks.

1 MIGA Political Risk Insurance Centre (PRI), part of the World Bank Group http://www.pri-center.com/

BOX 9: Overcoming Limitations in Local Financial Markets - Innovative Bond Financing in Tlalnepantla

The municipality of Tlalnepantla in Mexico used an innovative structure to raise bond finance from the local market for new wastewater treatment facilities. Tlalnepantla is located close to Mexico City and has a population of 800,000 but limitations in Mexico's municipal bond market made it difficult for the city to raise capital. To overcome this, a private trust was set up by Dexia Credit for the bond issue. Dexia issued a letter of credit to the trust for up to $5.3 million, with a partial guarantee from the IFC for up to $3 million. The trust then made a loan to the municipality and its water utility company to finance the construction of a $7 million wastewater treatment plant and $2 million for the rehabilitation and maintenance of the water supply network. The municipality pledged property taxes and the municipal water utility pledged its water fees to secure the loan. Dexia is a well established player in municipal finance markets in Europe, where it has a 17% market share, in the US, and several emerging markets, mainly in Latin America and Central and Eastern Europe, so it was able to bring extensive experience to the project. As well as its direct contribution to improving water services in Tlalnepantla, the project set a precedent in Mexico's private capital markets that will make it easier for other municipalities to gain access to long term capital for essential infrastructure investment in the future.

www.tlalnepantla.gob.mx

4.3. Monitoring of Risk

The exposure of a project to WRR is likely to change over its lifetime due to changing climatic conditions, improved practices to counter the WRR or changes in environmental regulation. Monitoring procedures should be in place to be able to reassess the relevant data or information on the transaction's WRR to be able to implement further mitigation strategies or reassess the financial feasibility of a project when it is cost effective to do so. Projects that involve opportunities for refinancing provide scope for addressing this exposure to risk, and could improve the overall profitability of the investment to the investor.

4.4. Organisational measures

Internal company policies on sector-specific risk exposure are an essential step in raising awareness of the potential impacts to the bankability of transactions. Research divisions can provide essential information on trends and new developments in the sector, such as new technologies (e.g. water efficient technology, smart meters, waste-water recycling technology companies) or sector opportunities (e.g. growing regional concerns on water resources which could affect sector investments, such as agriculture, power plants).

With the establishment of sustainability departments or groups in many FIs, in-house expertise on water and other environmental issues is gradually being built up. These internal experts can then provide training for operational officers to provide them with an appreciation of WRR and an understanding of the channels of risk to a project. However, knowledge transfer and successful integration of water issues into mainstream transaction processes will take time.

Given the often limited resources in these departments within FIs, and the wide coverage of projects and transactions undertaken, it is unlikely that internal resources will be able to provide all the necessary level of detail specific to the transaction. Internal training should provide operational staff with sufficient comprehension of whether there is adequate information in project documents to be able to assess WRRs.

Until the ESG/WRR assessments become mainstream operational staff should be inabled to ascertain if further external expertise should be sought for specific transactions where there is uncertainty in the information presented in risk assessment reports or corporate documentation.

Further information could be obtained from dialogue with the specific company or through input form external experts. External input used in transaction support could be in the form of specified hourly or ½ -day reviews of project documentation to assess gaps in the appraisal of risk drawn upon if necessary.

5 Practitioners' checklists

This section provides practical check-lists which financial practitioners can further tailor to their specific needs with respect to the identification, assessment and mitigation of WRR. These checklists are categorized by broader issues rather than transaction types or specific sectors, perspectives which will be dealt with in subsequent sections.

Figure 5-1 Water Risk Checklists for Financial Practitioners

Water as an input	Y	N	NA
Has the client assessed the criticality of water as an input in the production process?	☑	☒	■
Has the client conducted an assessment of security of sustainable water supply? This should include a long-term assessment for both ground and surface waters.	☑	☒	■
Is the company/facility dependent on:			
• …a single source of supply?	☑	☒	■
• …supply from a source with many competing users (including ecosystems)	☑	☒	■
• …supply from another region or country?	☑	☒	■
• …infrastructure for the delivery of water? Is this adequately maintained?	☑	☒	■
Has the client used long-term water resource forecasts that take into account climate change and increasing consumption?	☑	☒	■
Has the financial impact of water risk been assessed ('water due diligence')?			
• Has the management carried out sensitivity analysis of the operational and financial effects of different levels of water availability/quality?	☑	☒	■
• Has the management quantified the impact of water risks and made this information available? This would take into account the cost impact of alternative water supplies and the revenue impact of operating interruptions or restrictions due to inadequate water availability.	☑	☒	■
Has extra capacity been built into the facility to cope with restrictions in water availability or variable water quality?	☑	☒	■
Has the management conducted a risk assessment for flooding and taken out the necessary precautionary measures and insurance coverage?	☑	☒	■
Has the client assessed the impact of potential changes in the local water environment on the physical integrity of the plant or infrastructure? Examples: sea level rise, land subsidence resulting from groundwater depletion.	☑	☒	■
Does the client have an adaptation strategy if water supply is permanently restricted? Examples: replace water-intensive crops with drought-resistant crops.	☑	☒	■

Water efficiency	Y	N	NA
Does the client have a water management plan that considers the use of water at all stages in the production process? Can the client demonstrate that:			
• …water efficiency is optimized in the production process?	☑	☒	■
• …best available water-efficient technologies at reasonable cost are being used?	☑	☒	■
• …water is being recycled within the production process as far as possible?	☑	☒	■
• … all potential uses for treated wastewater have been considered (e.g. sale to other parties)?	☑	☒	■
What efforts has the client made to reduce the water footprint of the facility? Examples: use of sustainable urban drainage systems or permeable paving.			
• Are processes in place to monitor water use in the production process over time and to review and implement strategy on the basis of the monitoring data?	☑	☒	■

Water utilities, products and services	Y	N	NA
• Has the client assessed the affordability of new products and services?	☑	☒	■
• Has the client considered a range of products and services to meet affordability levels of different social groups? Example: water kiosks are more affordable than in-house piped connections. A company offering both can reach a larger customer base.	☑	☒	■
• Has the client assessed the acceptability of new products or services to potential customers? Example: customers will not necessarily accept the use of treated wastewater for irrigation or drinking water purposes.	☑	☒	■
• Has the client assessed the willingness of target customers to pay for the service?	☑	☒	■
• Has the client created customer awareness of the value of new products and services? Example: communities tend not to value sanitation services when they do not have information about health benefits.	☑	☒	■
• Has the client carried out sensitivity analysis of different water service demand growth scenarios?	☑	☒	■
• Have alternative sources of supply been taken into account when making demand projections? Examples: use of private wells/ informal vendors	☑	☒	■
• Have alternative sources of raw-water-supply been identified and assessed as potential back-ups?	☑	☒	■
• Is the client aware of maximum levels of water extraction above which the underlying ecosystem would get overexploited?	☑	☒	■
• Has an assessment and valuation of underlying water-related ecosystem services been undertaken? Have possibilities for the improvement / extension of surrounding ecosystems and their water-related services been considered (also as substitutes for costly man-made water infrastructure)?	☑	☒	■

Impact on the water environment	**Y**	**N**	**NA**
Has the client reported fully on short- and long-term impacts of water use and wastewater discharge by the facility, and have the reports been independently verified? Reports include:			
• Impact of water abstraction on water resource availability for human and ecological uses? Example: wetland recharge.	☑	☒	■
• Impact of water abstraction on water quality? Examples: increased salinity of groundwater sources/ higher water temperature.	☑	☒	■
• Impact of impoundment on downstream users/ ecology? Example: dams causing disruption to natural variations in river flow levels.	☑	☒	■
• Impact of changes in the level of sediment in the river? Example: dams preventing natural deposition of sediment downstream.	☑	☒	■
• Impact of physical structures on ecology? Example: power stations blocking fish migration routes.	☑	☒	■
• Impact on upstream users? Example: increased risk of flooding from sediment build-up/ permanent flooding of areas.	☑	☒	■
• Impact of wastewater discharge on surface and groundwater quality, and resulting risks to human health and ecology?	☑	☒	■
• Impact of solid waste and sludge disposal on groundwater quality? Example: leaching from landfill.	☑	☒	■
• Impact of emissions to air on water quality? Example: Ammonia from livestock rearing entering the water system through rainfall.	☑	☒	■
What process is in place to monitor the impact of the facility on the water environment over time and to review and implement strategy on the basis of the monitoring data?	☑	☒	■
What arrangements have been made for the transport and storage of hazardous materials to avoid contamination of water sources? Example: storing materials in bunded areas.	☑	☒	■
Have arrangements for the management of solid waste at the site taken into account risks of groundwater contamination?	☑	☒	■
Does the client have an accident management plan that takes into account risks to human health and ecology from a spill or accidental discharge? Example: overflow of wastewater into surface water drains during storms.	☑	☒	■
What provisions have been put in place for the decommissioning of the facility and the rehabilitation of the site? Example: water pollution from abandoned mines will need to be controlled in the long-term.	☑	☒	■

Environmental sustainability	Y	N	NA
Has the client assessed whether the proposed or existing activity is appropriate to local water resource conditions given its corporate social responsibility commitments? 'Appropriate' refers to activities that are not in conflict with current and future users and uses.			
• Appropriate cultivation – Is the type of crop or variety appropriate given local water availability?	☑	☒	■
• Appropriate development (property development/tourism) – Is the development located in or near a site of ecological importance? Is further construction appropriate in a water scarce area?	☑	☒	■
• Appropriate infrastructure – Could infrastructure with a lower water impact achieve the same objectives? Does the environmental cost of the infrastructure exceed its benefits?	☑	☒	■
• Appropriate production – Is water-intensive manufacturing appropriate given local water availability?	☑	☒	■
Has the client considered proactive steps to restore or improve the local water environment over and above what is required by law? Example: on site rainwater harvesting.	☑	☒	■

Mitigation	Y	N	NA
What steps been taken to mitigate negative impacts on communities over and above legal requirements? Example: developing recreational facilities around reservoirs.	☑	☒	■
What steps have been taken to mitigate impacts on ecology? Examples: timing flows from a dam to replicate natural flows/ creating fish passes.	☑	☒	■

Regulation and interaction with government	Y	N	NA
Are the statutory rights of the client to access water clearly established? Rights to water may not be automatically transferred with property rights.	☑	☒	■
Has the management considered the operational and financial impact of:			
• …Changes in water abstraction rights?	☑	☒	■
• …Changes in water allocation mechanisms or principles?	☑	☒	■
• …Adjustments in water tariffs and tariff-setting mechanisms?	☑	☒	■
• …More stringent drinking water quality standards?	☑	☒	■
• …Tighter wastewater discharge regulation?	☑	☒	■
• …More stringent enforcement of existing wastewater discharge regulation?	☑	☒	■
Has the client built in headroom above existing water discharge quality standards?	☑	☒	■
Has the client assessed the company's liability if environmental standards are breeched, in particular the potential for contamination of drinking water sources?	☑	☒	■
Does the company have a good track record of compliance with water discharge standards?	☑	☒	■
Have all necessary licenses for wastewater discharge been secured?	☑	☒	■

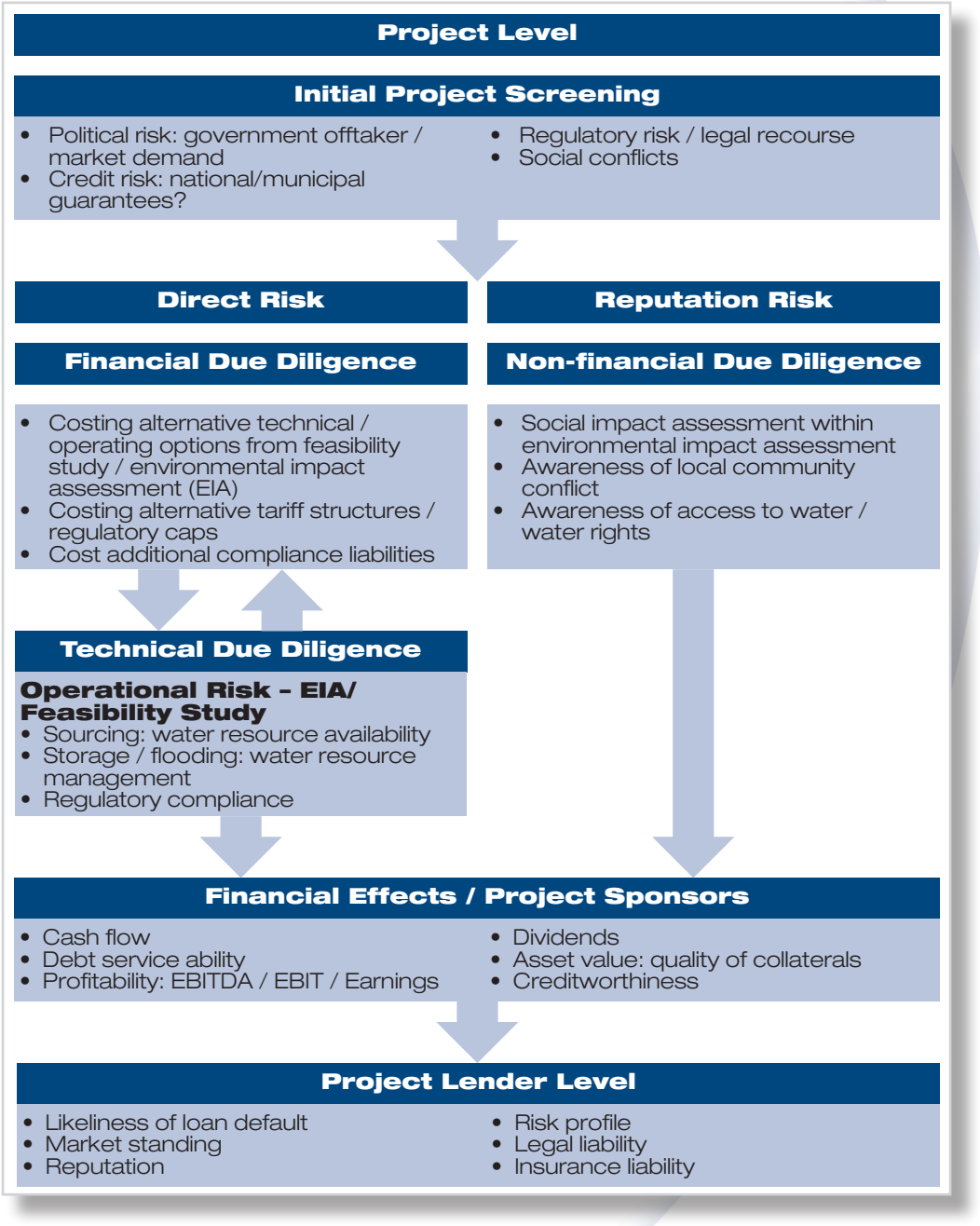
Community and social issues	Y	N	NA
Has the client considered the impact of the facility on all groups who use the same water sources? Consideration should include upstream and downstream users and should not be confined to the immediate locality as their may be significant effects far downstream.	☑	☒	■
Has the client assessed the impact of the facility on all types of water use by local communities, in particular poor and vulnerable groups? Communities use water sources for crop irrigation, freshwater fishing and transport in addition to drinking water supply.	☑	☒	■
Were stakeholders consulted on the design or location of the project? Example: Negative impacts can be reduced by locating facilities at a distance from drinking water abstraction points.	☑	☒	■
Has an ongoing process been established for community relations management which directly addresses water issues? This could involve a designated contact person in the local community or a community relations department within the company.	☑	☒	■
Are the customary rights of the client to access water clearly established, even if statutory rights have been secured?	☑	☒	■

The following three sections draw upon the measures outlined here, and provide greater detail on transaction specific mitigation mechanisms.

6 Project Finance Risk Management Guidelines

Figure 6-1 illustrates the stages and mechanisms through which exposure to WRR can be mitigated and the channels of exposure from the project level to the lender.

Figure 6-1 Project Finance approach to WRR in the water sector



6.1 Impact of Water Related Risk

In project finance deals, lenders play a central role in project design and can ensure that contractual and financial safeguards are in place to control risks. Nevertheless, the scope for mitigating risk through structure cannot overcome fundamental weaknesses, like, in the case of water sector projects, insufficient demand, a weak institutional framework allowing political intervention, or tariffs not compatible with the willingness-to-pay of local households and businesses.

Limited recourse projects with high WRR include water and wastewater treatment plants, power generation projects, especially hydroelectric and nuclear generation, and transport and other infrastructure projects in vulnerable coastal areas.

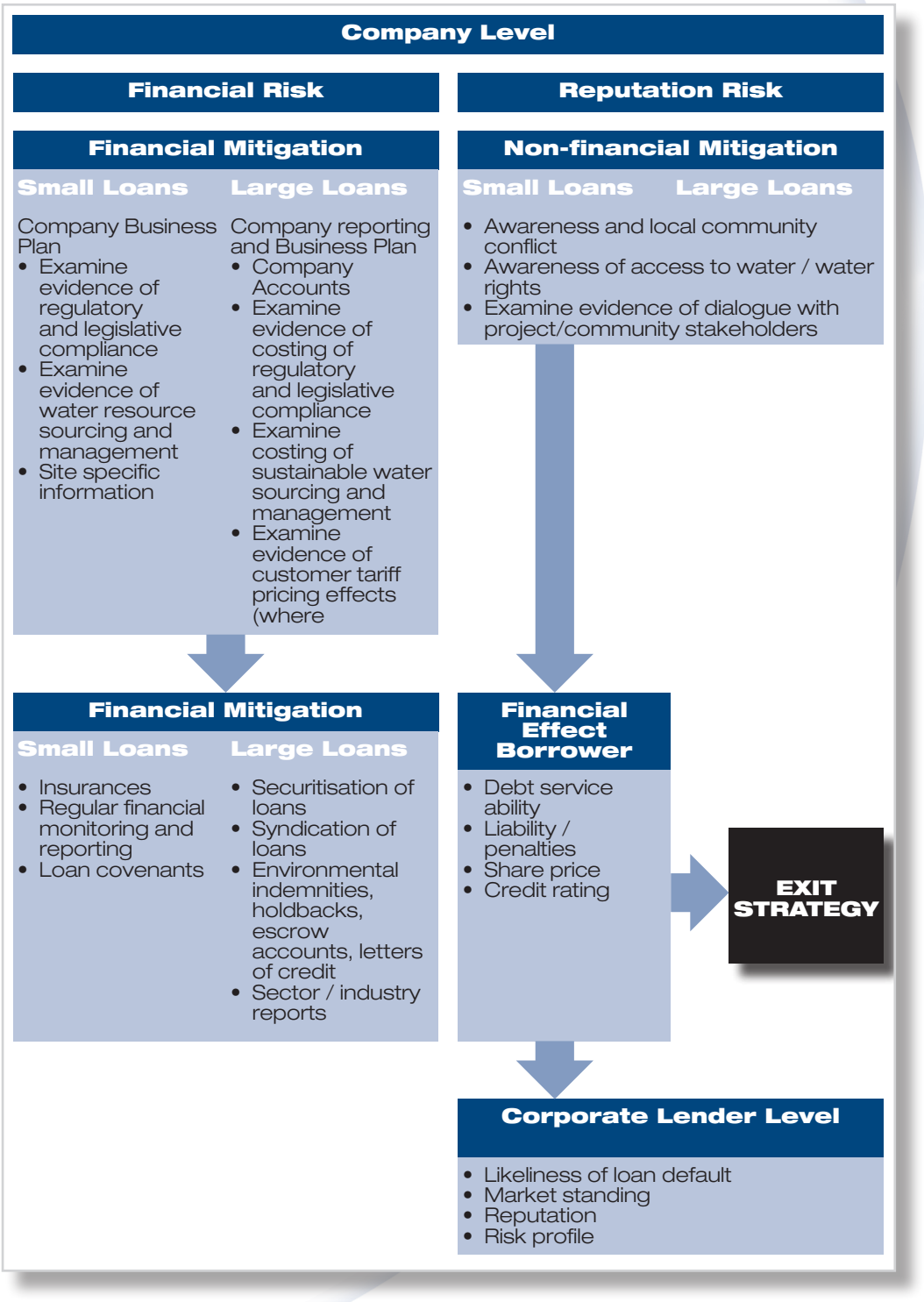
6.2. Risk Identification and Mitigation Strategies

- Carry out a thorough review of the impact of water use on communities – upstream and downstream – and compare the proposed social engagement strategy of the borrower to international best practice.
- Encourage borrowers to:
  - Involve local communities from the early stages of project design to head off potential conflicts and to consider tailored service levels, where relevant.
  - Assess the ability and willingness of communities to pay for water and sanitation services, where relevant.
- Ensure that the EIA for the project is reliable and covers water issues in sufficient depth and over sufficient scale. If necessary, commission independent advisors to review or supplement project assessments commissioned by clients.
- Require consultants to address long-term access to water resources and to consider a range of scenarios taking into account climate change and regulatory changes in their assessment of water risk quantifying these risks where relevant.
- Encourage borrowers to design facilities that provide headroom over standards for drinking water supply and wastewater discharges. Significant headroom is needed with regard to drinking water standards because of the potentially dire consequence for public health and potential legal liability.
- Consider all the options for the use of wastewater from the facility. Wastewater can be recycled to generate a supplementary revenue stream; by-products of desalination can be used for the production of salt and chemicals (see Section 9 below).
- Consider opportunities for Clean Development Mechanism of Joint Implementation projects. Wastewater treatment plants can be designed to capture methane and generate extra revenue by way of carbon credits for a project (see Section 9 below).
- Develop an understanding of the water policy environment at the national, state and local level. As regulation and law covering water resource allocations and water pollution is changing rapidly, ensure that the information is up-to-date. Include a review of tariff policy where relevant to the financial viability of the project, even if the project is not funded directly from tariff revenues.
- Include a consideration of customary law and allocation rights over water resources in the assessment of a project's legal position.
- Employ contract-based mitigation instruments including performance bonds and escrow accounts as appropriate to control operational and political risks.

7 Corporate Finance Risk Management Guidelines

Figure 7-1 illustrates the stages and mechanisms through which exposure to WRR can be mitigated and the channels of exposure through a corporate loan, whether from a small or larger transaction.

Figure 7-1 Corporate finance approach to WRR



7.1. Impact of Water Related Risk

Procedures to identify risk will likely vary depending on the nature of the project, the size of the transaction and country location. For smaller loans (i.e. $500K-$2m), reviewing the company business plan may be sufficient to identify water exposure. For larger loans (i.e. $2m-$20m) a full feasibility study reflecting technical feasibility of the proposed facility, an EIA or Due Diligence for a new or existing facility respectively may be needed. Data availability will also determine how detailed the assessments are.

For corporate finance transactions involving companies in water and waste water services, greater information should be requested on the impact of different scenarios on business operations to assess whether the company has an integrated sustainability approach to WRR. This, for example, may include requesting the company to provide an indication of:

- Water sourcing implications in the event of continued low rainfall or drought conditions.
- How vulnerable facilities and supply networks are to flooding incidents.

Investors/lenders should assess to what extent anticipated climatic changes have been incorporated into long term investment planning decisions (e.g. greater allowance for headroom to address increased probability of sewer flooding events), analyze if increased treatment costs due to anticipated tighter water quality legislation and the implications of carbon emission costs have been fully reflected in operating costs forecasts.

Transaction costs for SME loans may prohibit detailed company analysis being undertaken in many cases, and risk insurance may also not be cost effective for the size of the loan. Therefore, there is even more need for awareness of the environment in which the SME operates and, hence, for greater localised information.

For both large and small corporate loans, local socio-economic and environmental conditions should be assessed as well as whether there are existing conflicts with local communities or NGOs. Information should include local conflicts over water abstraction or pollutant discharges into water resources. Independent sources of local conflicts should be used where possible to ensure accurate information is reflected and avoid any conflict of interest with the borrower.

While an initial step in identifying the feasibility of the project often includes an assessment of country-wide political risk, depending on the nature of borrower operations, the stability of local governments will be an important consideration as well.

Where there is uncertainty in national and local government stability, investors should request information on local judicial/remedial procedures, laws and enforcement of laws in the countries of operation.

7.2. Risk Identification and Mitigation Strategies

- Understand the environmental sustainability of the borrower's business operations:
  - Review corporate reporting records on water use and discharge or require firms to report on a standard set of key performance indicators including relevant issues from the water checklist (see Section 5 above).
  - Request information on site risks that may require potential adjustments to planned development, alternative measures that could be implemented to account for unforeseen events (e.g. improved drainage in the event of localised flooding, proposed alternative solutions for water shortages).

- ❑ Assess sustainability of operations and the extent to which efforts are made to move towards water efficient technology, retrofits or improved practices as precautionary measures to reduce exposure to WRR.
- ❑ Review water resource allocation rights of clients, considering statutory and customary rights.
- ❑ Encourage project developers to assess willingness to pay of potential clients/customers for water and sanitation services.
- ❑ Require clients to provide a water audit including an assessment of the impact of water consumption on other water users.
- ❑ Work with ratings agencies to develop better measures of risk for public-private partnership projects for water services.

■ Understand the physical environment in which the business will operate:
- ❑ Where water abstraction or discharge will impinge on local communities or the local ecology, encourage borrowers to engage with local stakeholders and to consider how negative impacts can be offset.
- ❑ Take a broad view of the requirements of environmental regulation and build in headroom over standards.

■ For large loans in activities that have significant exposure to WRR, use financial mechanisms to reduce exposure:
- ❑ Securitisation of loans.
- ❑ Syndication of loans.
- ❑ Environmental indemnities/surety bond/retentions/escrow/letters of credit.
- ❑ Require borrower to insure against commercial and non-commercial risk where possible.
- ❑ Legal coverage in loan documentation should include risks that cannot be covered by FI without incurring costs.

■ Development of new financial products:
- ❑ Consider scope for products that encourage efficient water use, alongside the sustainable use of other resources.
- ❑ Consider the scope for the development of *allocate and trade* water resource markets (e.g. in Australia) and *cap and trade* markets for water pollutants (e.g. in the US).
- ❑ Require effective reporting of water performance targets to support links with specialised financial products.

■ Encourage companies to improve their reporting procedures:
- ❑ Monitoring of small loans through requirements of regular reporting of business operations on water use.
- ❑ Monitoring of larger loans through industry based research, company accounts, shareholder activities including comparison of water efficiency performance with industry benchmarks.
- ❑ Refinancing provides an opportunity for review of the terms and conditions of loans.

■ NGO or media profiling:

■ Review the internal organisation of the FI and consider designating an individual within the corporate finance team to be responsible for ESG issues within the team:
- ❑ Carry out training within the FI to ensure that all operating officers are aware of ESG issues.
- ❑ Require consultants to address long-term access to water resources and to consider a range of scenarios taking into account climate change and regulatory changes in their assessment of water risk, quantifying these risks where relevant. Box 10 provides a simplified example of a risk quantification exercise.

BOX 10: Quantifying Water Related Risks

A key element of any risk management process is risk quantification. It is essential in delivering insights on the likely impact of risky events, and therefore, in helping both the company and the financial institution to undertake respective risk mitigation activities. This applies to water-related risks as much as it does to other risk categories.
The key question is: once risks have been identified, how can they be quantified? Financial institutions and water users alike need to understand how serious a specific water issue is, in order to consider an appropriate risk mitigation strategy.

There are numerous quantification techniques including benchmarking, sensitivity analysis, scenario analysis and further complex simulation analysis (using techniques such as Monte Carlo procedures).
Two examples are provided to show how FIs can go about quantifying water related risks by means of simple probability-weighted scenario analysis. The exemplary risk contemplated is "water (in)-availability" and resulting variations in water pricing.
Water availability is becoming an issue in many regions around the world, notably in the Murray Darling Basin, Australia's often referred-to "food-bowl", which has been suffering a period of prolonged drought in recent years.
consequently water pricing is progressively becoming an issue for many water users as prices increase to reflect increasing scarcity and economic cost.

1. The first step in risk-quantification is to define a set of probable scenarios. External third-party entities, such as government authorities or universities, can be of support in this process.

In terms of water availability, water allocation scenarios may be available from water authorities responsible for managing the irrigation system, from other government authorities, or research organizations. A range of different water availability scenarios can be considered for a risk quantification exercise, water allocations for agricultural water-users, for instance, potentially amounting to 25%, 50%, 75% and 100% of a given average baseline.
Resulting implications for water pricing derived from the respective scenarios, can then, for instance, be estimated as 0%, 10%, 20% or even 100% price increases.

2. The next step consists in understanding the operational and financial impact upon water users under each of the different considered scenarios and, by implication, upon the institutions financially backing them.

With respect to water allocations, in the case of water users with permanent plantings, the operational impact may be, for instance, likely to be much more significant than for those with annual crops: permanent plantings may die with a reduced water allocation, which will result in a reduced productive capacity and cash flow constraints over a number of years. For annual crops, the impact, whilst significant in a given year, might not result in the loss of large productive capacity for a significant period of time.
With an increase in water prices, a number of different scenarios could be run, to again determine the key financial effects, especially on cash flow.

Scenario	Water Allocation / Availability	Water Price Increases
Scenarios	25%, 50%, 75%, 100%	0%, 10%, 20%, 100%
Operational Impact	Potential loss of permanent plantings, severity will depend upon scenario.	May result in prioritization of water use and decreased operations.
Financial Impact	• Reduced cash flow in current year. Capital requirement to replant crops and associated reduction in cash flows for a period of several years following current year as productive capacity is lower. • Impact on asset value.	• Reduced cash flows, lower debt serviceability, reduced dividends to owners and ability to reinvest in the business. • Impact on asset value.

This list of operational and financial impacts is exemplary and is not meant to be exhaustive. It needs to be determined in light of the nature of the individual borrower and specific sector. There are a number of different factors which will influence the size and nature of the operational and financial impacts, including produce prices, harvest yields etc. However, it should be possible to determine the financial impacts in a reasonable level of detail under each water-related scenario.

3. Next, it is necessary to determine what the probability of each of these scenarios is. The information sources for the water allocation and water pricing scenarios in step 1 may provide the probability for the scenarios, or alternatively, the financial institution may have their own resources.
A 50% water allocation scenario may be considered most likely, with a corresponding 20% increase in price of water. Additional less probable downside scenarios should, however, also be considered from a risk management perspective.

4. These scenarios may have significant implications for the mitigation techniques that water users and financial institutions may be able to undertake, which will have to be defined. From a conservative risk mitigation perspective, the worst-case scenario should certainly be considered at all times.

Scenario	Water Allocation/ Availability	Water Price Increases
Most Probable Scenario	50%	20%
Operational Impact	Potential loss of permanent plantings.	A 20% increase may result in prioritization of water use.
Financial Impact	• Reduced cash flow in current year, capital requirement to replant crops and associated reduction in cash flows for a period of several years following current year as product capacity decreases. • Potentially negative impact on asset value.	• Reduced cash flows, lower debt serviceability reduced dividends to owners and ability to reinvest in the business • Potential negative impact upon asset value
Mitigation ativities	• Production decisions such as thinning, pruning, or/and prioritizing water use. • Ability to acquire water through water trading. • Invest in water efficiency techniques.	• Production decisions, prioritizing water use to highest value uses. • Invest in water efficiency techniques.
Financing Implications	Ability to sustain cash flow shortage, fund water requirements, fund capital expenditure to replant permanent crops and invest in water efficiency	Ability to sustain cash flow shortage, invest in water efficiency techniques

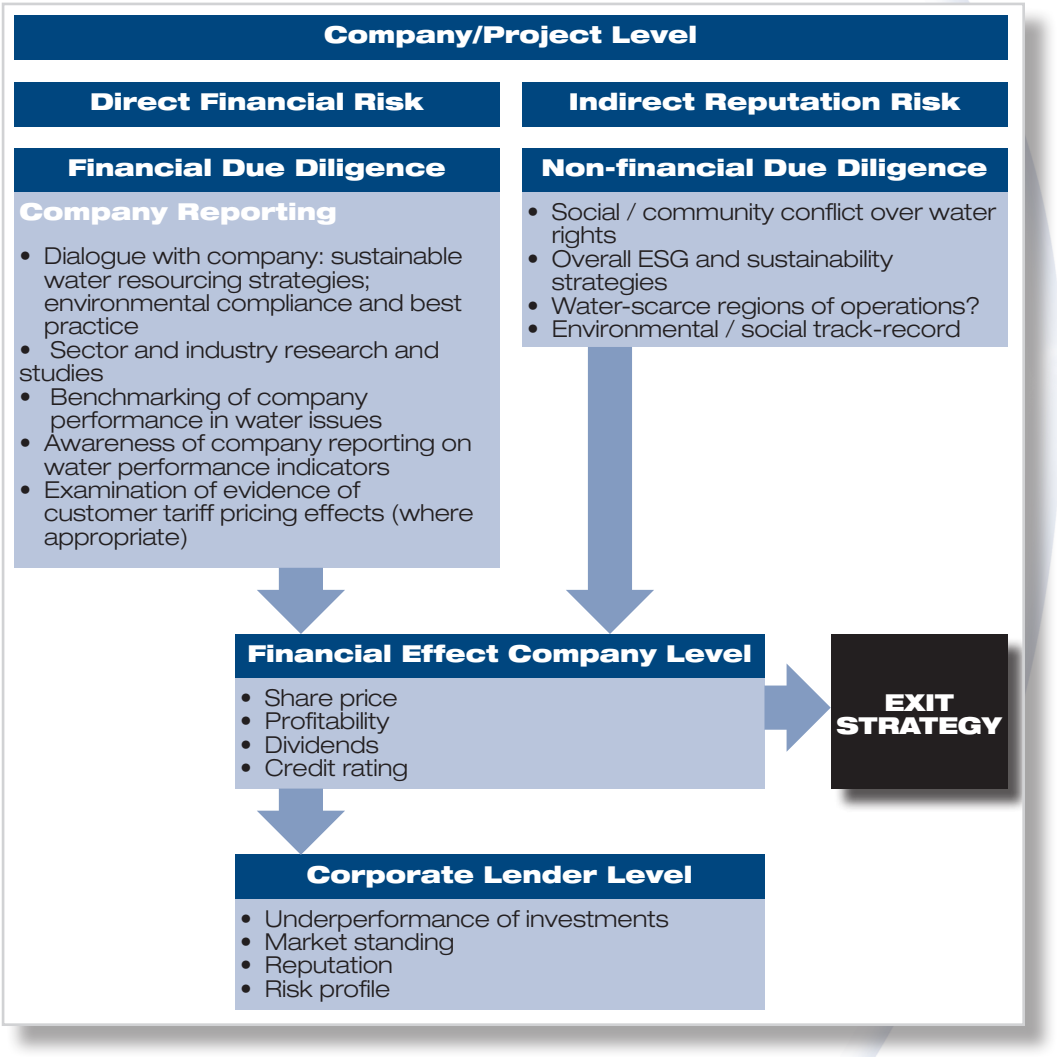
5. The mitigation strategies have financing implications for both the grower/irrigator and the lending institution. Financial institutions will need to consider both the impact on a specific lender as well as on an aggregate basis, in order to formulate their own risk mitigation strategies in a manner which is consistent with the short, medium and long-term interests of stakeholders.

Additionally, this process can be used to test and demonstrate the value of mitigation techniques, such as investments in water efficiency.

8 Asset Management Risk Management Guidelines

Figure 8-1 illustrates the stages and mechanisms through which exposure to WRR can be mitigated and the channels of exposure through asset management.

Figure 8-1 Asset Management approach to WRR



8.1. Impact of Water Related Risk

Companies in water service and water-intensive sectors have seen significant impact on their operations as a result of WRR. Although it is more difficult to establish a direct link with shareholder value, there are persuasive reasons for asset managers to consider how these risks will affect the ability of the business to operate successfully in the future. Businesses – and the funds that invest in them – need to protect their reputation and to ensure that they have a license to operate. Investors need to ensure that they are not vulnerable to risks that clients are not managing successfully and avoid damage to their own reputation from being an investor in a firm attracting bad publicity.

ESG reporting is now widespread amongst firms. However, this reporting is not always comprehensive and consistent, so it does not allow for investors to make meaningful comparisons between companies.

Brokers are increasingly aware of ESG issues and now include them in their research. However, too little of this supply side research focuses explicitly on how ESG issues affect companies' financial performance and impact on companies' future potential.

Asset managers committed to sustainability can integrate WRR fully into their investment approach by conducting thematic research on water, in-depth research on water issues for individual companies that their teams are considering taking a stake in, by encouraging companies to improve their reporting, and using benchmarking to compare the performance of companies on water-related ESG metrics. Furthermore, asset managers can encourage brokers to consider the financial performance implications of ESG in their research, and reward good broker research with votes. Asset managers should also engage with companies on water-related issues, tailoring recommendations to the company level.

8.2. Risk Identification and Mitigation Strategies

- Be an active shareholder:
  - Exercise voting rights and propose shareholder resolutions that draw the attention of the management to the sustainable use of water and the impact of the firm on the water environment.
- Use research to assess risks:
  - Conduct thematic research on water-related companies and analysis of water issues for specific sectors, regions and stocks.
- Benchmark companies on performance on water issues against their peers, e.g. comparing the water-efficiency of agricultural sectors:
  - Update the benchmark regularly and publish the results.
- Use the FI's internal structure to ensure water issues are fully embedded in decision-making processes:
  - Consider the scope for members of the ESG team to develop a specialisation in water issues and link this to the core research function.
- Report comprehensively and consistently on the performance of investments in terms of water efficiency and impact on the water environment.
- Report on the own investor performance on key water indicators through regular fund updates, annual reports, etc.
- Cooperate with other investors and engage in collective initiatives relating to water:
  - Collaboration with other investors helps to avoid duplication in research and improve effectiveness of company engagement efforts. Water is a new issue for many asset managers and analysts will be able to accelerate the learning process by engaging with colleagues. By focusing on collaboration to effect specific changes, for example on regulation of water PPP projects, investors can maximise the impact of their collaboration efforts.
  - Draw on existing collective initiatives to bring water issues to the fore: UKSIF, EuroSIF.
  - Take an active part in debates on the role of FIs in the water sector, in terms of protecting the water environment and improving access to water and sanitation services in developing countries.
- Engage with companies:
  - Increase awareness by raising water issues during routine meetings with executive directors and supervisory boards of companies.

- Collect standardised information from companies, for example by using Water ID cards (See box 11 below).
- Encourage companies to monitor their water performance and to take appropriate actions based on monitoring results, using resources like the WBCSD's Global Water Tool, where relevant.
- Encourage companies to investigate water-related opportunities, such as sale of treated wastewater for reuse.
- Engage with companies through establishing steering committees or working groups to advise or resolve particular issues, e.g. actions to mitigate risks from accidental water pollution incidents.
- Design engagement programmes to lead to clear, appropriate, positive changes within a company, such as diversifying water sources or raising discharge standards.

■ Where appropriate, encourage firms to engage in upstream and downstream stakeholder consultation and proactive community support strategies.

■ Encourage companies to improve their reporting:
- There is a lack of consistency and rigour in reporting on ESG issues. This is improving for carbon but companies also need to turn their attention to water.
- Companies should be encouraged to provide forward-looking information, e.g. projections of pollutant discharges, assessments of the impact of tighter wastewater discharge regulations, etc.
- Companies should also set reporting boundaries in a way that captures the overall impact on water and breaks down the reporting by activity and country. The latter is particularly important given the very local nature of water risks.
- Water performance data should be assured independently as for financial data.
- Encourage companies to report on their internal targets and key performance indicators for water efficiency as well as their monitoring and evaluation procedures to reach these targets.

■ Engage with regulators and policy makers:
- Water issues are interrelated with social, health, infrastructure and environmental policy issues. Investors can engage directly with policy makers to encourage them to adopt policies and targets that are consistent with improving social and environmental aspects of water management and encourage integrated, rational and effective regulation of the water environment.

■ Offer specialist investment products focusing on opportunities in the water sector, but ensuring that these opportunities are exploited in a way that is socially and environmentally sustainable (please see section 9 below).

■ Encourage brokers to research water issues:
- For example, investors can reward brokers for the quality of their research through the commissions they pay and can rank brokers on their water coverage.

■ Ask investment managers to report on their ability and experience in considering water issues.

BOX 11: Managing Information - Water ID Cards

One of the biggest constraints for Financial Institutions in dealing with water-related risks is gathering and processing relevant information, especially where this contains great technical detail. In order to get useful insights on the degree of water-related risk-exposure as well as the risk-management capabilities of clients and investees, financial institutions don't necessarily have to inquire on the full plethora of complex water-related issues. An alternative is to use short standardised forms which contain simple, broad and open questions, which make it easy for asset managers to make a comparative assessment of the water-related risk management abilities of companies within a specific sector and region. Subsequent investment decisions can then be based on a set of non-technical and easy-to-assess criteria, which include:

- Quality and extent of responses including the credibility of answers and the reliability of background material.
- The timely delivery of answers.
- The willingness to accept site-visits and other follow-up activities.

Banco Funds, the Swedish asset management subsidiary of ABN Amro, has been using such standardized forms – referred to as "Sector/Region Specific ID Cards" - to gather a wide range of non-financial information. Such ID-cards can quickly be rendered water-specific, as the example form below shows. Furthermore, forms can be made compatible with tools developed for water-exposed businesses, such as the WBCSD's "Global Water Tool" (www.wbcsd.org/web/watertool.htm). At the same time, financial institutions can encourage their clients and investees to use these existing tools to assess their water-related exposure.

Sector / Region Specific ID Card
Water Risk Assessment
Please report on the following items:

1. Region/Country Specific Water Issues		
	a.	Water Stressed Areas in the Region
	b.	Protected areas
	c.	Water Availabilities; Regional Hydrological Characteristics
2. Company Water and Waste Water Footprint		
	a.	Number of Sites
	b.	Number of Water-Intensive Suppliers
	c.	Number of Employees
	d.	Water Withdrawal (m3/year) per Site / Output and in Total
	e.	Water Sources (Surface Water, Ground Water, Rainwater, Wastewater and Municipal Water)
	f.	Water Recycled/Reused
	g.	Water Footprint/Impact analysis
3. Risk Management		
	Water Strategy	
	a.	Water Policy / Guidelines
	b.	Consumption / Efficiency / Treatment Targets
	c.	Key Performance Indicators
	d.	Education
	e.	Community Involvement

9 Growing Areas of Opportunity

Increasing water scarcity and requirements for higher water quality standards are driving demand for innovative water technologies and new services, as well as further roll-out of traditional engineering solutions. These can be grouped into a number of areas:

- Drinking water treatment technologies
  - Disinfection (ozone, UV)
  - Membrane filtration
  - Absorption (Granular Activated Carbon)
  - Desalination (reverse osmosis and thermal)
- Wastewater treatment technologies
  - Membrane filtration
  - Membrane bio-reactors
  - Absorption (Granular Activated Carbon)
- Networks
  - Leak detection technology
  - Decentralised drainage systems (Sustainable Urban Drainage Systems)
  - Inline systems for pipe replacement
  - Trenchless pipe laying techniques
  - Pipe and pump manufacturing
  - Water storage
- Technologies that enhance water efficiency
  - Water efficient plant/processes
  - Water-efficient irrigation technology (micro-irrigation and low pressure sprinklers) and low-water crops
  - Household water-saving devices
  - Water-use monitoring and analysis systems
  - Metering, including smart-metering
  - Technologies to reduce the water footprint of facilities e.g. permeable paving
  - Water-efficient buildings/developments
  - Rainwater harvesting
  - Demand management services
  - Market transformation towards more water efficient products
- Technologies for water recycling and reuse
  - Plant level wastewater treatment systems to recycle water within the production facility
  - Household grey water collection and purification systems
  - Treatment of municipal or industrial wastewater for reuse by other users
  - A second important group of water-related opportunities is concerned with water ecosystem services. Governments and private actors are only now beginning to recognize the value that these ecosystems play in contributing to flood risk management, balancing out flow variability, supporting biodiversity, and providing the basis for a range of economic and recreational activities. Firms can provide several water ecosystem services that generate environmental and economic benefits, including:
- Catchment management services
- Wetland creation and maintenance services
- River basin monitoring and management services

9.1. Innovative Water Technologies

Membranes are used for desalination (reverse osmosis membranes), drinking water treatment (micro, ultra and nanofiltration) and in wastewater where they are used for filtration and as part of membrane bioreactors. As the technology has matured, the cost of membranes has fallen dramatically and membrane-based treatment is becoming a realistic option in many areas. Membrane technology companies have attracted considerable attention and some of the most successful have been acquired by large engineering companies, who will now be able to benefit from the growth of the market.

Desalination is a major growth area, particularly in the Gulf and North Africa, Israel, southern Europe and the western US. Rapid expansion of desalination capacity is planned in Australia and China and the construction of a desalination facility has even been considered in the UK to serve customers in London. Small-scale desalination facilities are commonly used in coastal tourist developments around the world. Thermal desalination is usually linked with a power generation and the world's largest desalination projects are Independent Water and Power Projects in the Gulf. Reverse osmosis technologies are also highly energy intensive but lend themselves to stand-alone plants. Falling prices for RO membranes have made this type of desalination increasingly attractive. The desalination market is served by large engineering companies and smaller, specialized desalination developers but high levels of competition in the market are driving down margins.

New technologies have opened the way for wastewater treatment to potable standard at a reasonable cost. Companies may be able to sell on treated discharges to other users, including municipalities or farmers. However, the use of treated wastewater for household use or irrigated agriculture has been very controversial, even when it is mixed with other sources. Less controversial is the use of recycled water in urban environments for watering parks and gardens or for groundwater recharge. The potential for the water reuse market will be dependent on popular perceptions of how safe the water is to use. To allay fears, required treatment standards are likely to be high. Failure to meet these standards may result in the business losing its 'license to operate' and may leave the company open to legal liability if negative consequences for human health can be demonstrated.

The benefits of making better use of existing water sources is already recognized by many companies, who have put in place equipment to use water more efficiently in the production process, to capture and recycle used water and to monitor water use in their facilities. FIs can support this trend by offering financial products like small business loans and mortgages at a discount linked to investment by their clients in water-efficiency devices. Companies can generate cost savings through lower bills for water supply and reduced discharge fees, in addition to environmental benefits. As water tariffs rise in many places, more firms will have incentives to use water efficiently. Buildings and housing developments that use water and energy efficiently are encouraged by many governments and are increasingly in demand from environmentally conscious consumers. Property developers can benefit from this trend by providing more 'green' developments.

Many governments actively encourage innovation in water conservation. Melbourne and Sydney conduct a regular water efficiency auction that provides grants to projects to fund water conservation projects (See http://www.smartwater.com.au/mainf.asp). Metering customers for their water use is one way to give them incentives to save water where they can. Meters are now being rolled out in markets which have traditionally supplied water at a flat fee, including the UK. There is also a burgeoning market for smart meters, which can be read from a distance, cutting down the amount of time needed to take readings and so delivering cost savings for the utility provider.

At the smaller end of the scale, innovations such as gravity-fed packaged water treatment systems,– which are designed to produce potable water from highly polluted raw water sources, avoiding the need for energy, chemical or disposable filter elements, also have potential. Stand-alone solar-powered UV drinking water treatment is a sustainable source of treated water for remote areas that are not connected to power and water supply networks.

Domestic or small scale commercial water savings devices, such as rainwater harvesting, collection of household grey water, household purification, reduce the demand on existing resources. Rain water harvesting and improved storage facilities can be used for small scale irrigation schemes.

9.2. Innovative Water Services

Businesses are beginning to see the potential for growth in the provision of water-related services. These opportunities will be taken up by existing companies, especially utilities, and new specialist service companies focusing on innovative ecosystem services.

Wetland Creation and Maintenance Services

In addition to the intrinsic value of ecology, rivers, wetlands and other ecosystems provide a range of water-related services. Aquatic ecosystems provide flood defence services, filter pollutants from water bodies, provide habitat for fish, birds and many other species, are a source of water for consumptive use and allow for transportation and recreation.

Yet these ecosystem services are rarely traded in markets, have no price and, therefore, are not properly valued. With the right regulatory framework, ecosystem services could offer new profitable and environmentally pro-active investment opportunities. The consideration of Ecosystems services would also have a positive impact on the carbon footprint of water utilities.

BOX 12: Opportunities in Ecosystem Services

Wine producing company “Banrock Station” located in Australia’s Murray Darling Basin demonstrates how sustainable water management can benefit companies. Consumers of Banrock’s wine pay a supplement which goes towards maintaining a Ramsar-listed wetland surrounding Banrock’s vineyards. In the arid Murray-Darling Basin water supply is highly variable. The natural ecosystem is highly adapted to a variable water supply such that the cycle of drought, fire and flood is essential to the life-cycles of the region’s indigenous species.

However, large-scale agriculture has reduced natural variability and as a result, most wetlands now receive too little water at the wrong time of year, while others receive too much. Murray Darling Basin farmers’ access water via a rights based system which entitles them to a share of the yearly available resource. Farmers often own water entitlements in excess of their crop’s requirements as insurance against drought. During wet years, however, some farmers use their excess rights to grow high water-use crops like rice.

Banrock have chosen to use their variable supply to water wetlands, hence, the vineyard’s highly secure supply each year complements the variable supply that sustains the wetland. This strategy has allowed Banrock to enhance its reputation with customers, using targeted marketing to demonstrate their CSR credentials, while working closely with wetland care NGOs that have traditionally been vocal critics of agriculture. http://www.banrockstation.com

Even without the development of new markets for these services, firms can benefit from the reputational benefits accruing from this as a demonstration of commitment to sustainability. Property developers and infrastructure companies may also find it easier to secure the necessary permissions and approvals by committing to create or restore water ecosystems.

Such services could be used and successfully marketed by water utilities, other firms that have an impact on the water environment or, potentially, by new companies with specialist skills in river restoration, wetland creation or sustainable forest management. Box 11 gives an example of an agri-business that is investing in wetland services.

Even without the development of new markets for these services, firms can benefit from the reputational benefits accruing from this as a demonstration of commitment to sustainability. Property developers and infrastructure companies may also find it easier to secure the necessary permissions and approvals by committing to create or restore water ecosystems.

Catchment Management Services

The quantity and quality of raw-water available for the provision of potable water is determined by activities in the entire catchment. Poor catchment management raises the costs of treating drinking water and the risk of insecurity of supply. Water utilities bear these costs by investing in extra treatment facilities and constructing new water storage infrastructure, even though improving catchment management could be a more efficient alternative, in addition to bringing down carbon emissions. Markets for catchment management services are rare, but are starting to develop. In the UK, for example, some private water utilities have paid upstream agriculturalists to protect riparian land through re-vegetating and limiting stock access to riverbanks. A project of this kind has been successfully implemented in New York. The market will need a supportive policy environment and a mechanism for different sectors to negotiate contracts to develop further. In Europe, the EU Water Framework Directive will provide an impetus to this through its integrated approach to water environment regulation.

Integrated River Basin Management & Urban Drainage Services

The nature of water ecosystems means that an integrated approach is needed that takes into account ground water and surface water, risks of flooding and water quality and availability for human and ecological uses along the length of the river basin. Integrated River Basin Management has been adopted in many countries and is required in the EU under the Water Framework Directive.

Companies providing river basin monitoring services and IT services for water quality and quantity modelling will see demand for their services grow in the future.

At the city level, integrated management is important to deal with the risk of flooding from local watercourse & rivers and overflows from the drainage or sewer system. Traditional physical flood defences are costly and not always sustainable. Options include decentralised drainage systems, known as ‘sustainable urban drainage systems’ (SUDS), which allow for new housing and industrial development. They reduce the need for new wastewater collection and treatment capacity by using permeable surfaces, allowing rainfall to drain into shallow ditches or purpose built outlets, rather than directing water to the storm drains. The use of SUDS has been held back in some places by uncertainty about ownership and financing maintenance, so a more supportive regulatory and legal environment is needed for this market to develop.

Demand Management Services

Demand management is an attractive approach to dealing with resource scarcity because it does not require large investment and it implies energy savings. Currently, utilities may have weak incentives to implement these programmes because their revenues are linked to volumes supplied. Forward-thinking regulators are starting to put in place incentives to reward firms for reduced consumption, such as shadow tariffs. Utilities can stay ahead of the game by developing demand management programmes. There may also be scope for new independent companies to sell demand management services to private and public utilities with revenues based on consumption reductions.

Power Generation and Engagement in Carbon Markets

Water companies can take advantage of the by-products of the treatment process to generate power. Under the Kyoto Protocol, some energy-related projects in developing countries would additionally be eligible as generators of carbon credits under the Clean Development Mechanism.

Opportunities for the use of by-products include:

- Methane capture from sewage treatment and potentially sewage collection for energy production, which would result in a triple CDM activity being undertaken: 1. Methane capture / 2. Methane powered renewable electricity generation / 3. Sewage sludge powered renewable electricity generation.
- Use of digestate (sludge treated in a digestor) for agricultural purposes.
- Drying and incineration of sludge to reduce volume of waste to landfill.
- Reclamation of precious metals from sludge.
- Micro-turbines operating in existing water and waste water distribution systems or other large pressure head systems.

The use of sewage by-products is currently held back in some jurisdictions by their classification as waste. Regulatory changes would allow these markets to develop further.

Table 9-1 below illustrates the range of financial transactions that can cover the differing WRR opportunities.

Table 9-1: Water Related Opportunities by Type of Transaction

Type of Transaction	Opportunity Area			
	Water Quality	Water Efficiency	Infrastructure Expansion/ Replacement	Innovative Services
Venture Capital/ SME Finance/ Private Equity	**Drinking water treatment:** ▪ Ozone and UV disinfection ▪ Membrane treatment ▪ Granular activated carbon (adsorption) technology	**Efficiency**: ▪ Monitoring technologies (sensory equipment and IT systems) ▪ Leak detection (endoscopic inspection) ▪ Smart metering ▪ Low water-use irrigation (micro irrigation/low pressure sprinklers) ▪ Low water-use crops ▪ Water-efficient buildings	▪ Inlining systems for pipe replacement ▪ Permeable paving ▪ Trenchless pipe laying technologies	▪ River basin monitoring and management strategy ▪ Aquifer monitoring and management strategy ▪ Small-scale (decentralized) water treatment/ sanitation services for low income communities
	Wastewater treatment: ▪ Membrane treatment ▪ Membrane bioreactors ▪ Granular activated carbon (adsorption) technology ▪ Other tertiary treatment	**Recycling:** ▪ Industrial water recycling ▪ Household water recycling ▪ Rainwater harvesting **Reuse:** ▪ Plant-level wastewater treatment facilities for local reuse or sale to other parties		
Corporate Finance/ Public Equity	▪ Engineering companies investing in water-tech R&D or acquiring water-tech companies ▪ Utilities investing in improved treatment assets	▪ Water meter manufacturers ▪ Utilities investing in leak reduction and rolling out metering ▪ Companies in diverse sectors with water efficiency strategies ▪ Construction companies of 'low water footprint' developments	▪ Engineering and procurement companies ▪ Utilities ▪ Pipe and pump manufacturers	▪ Large companies engaging in innovative environmental management projects (catchment/ wetlands management) ▪ Utilities with demand management strategies
Project Finance	▪ Water treatment plants ▪ Wastewater treatment plants		▪ Water treatment plants ▪ Wastewater treatment plants ▪ Desalination plants & Independent Water & Power projects	

10 Information Register

This section provides references to documents and websites providing more information on water related risks and opportunities and related issues.

Related UNEP Publications

- UNEP FI CEO Briefing & Issues Paper "Financing Water: Risks and Opportunities," 2006
  http://www.unepfi.org/fileadmin/documents/CEO_WRR_Issues_Paper.pdf
  http://www.unepfi.org/fileadmin/documents/WRR_Issues_Paper.pdf
- UNEP FI "Challenges of Water Scarcity: A business case for Financial Institutions," 2005
  http://www.unepfi.org/fileadmin/documents/challenges_water_scarcity_2005.pdf
- UNEP FI CEO Briefing & Report "The Materiality of Social, Environmental, and Corporate Governance Issues to Equity Pricing," 2004
  http://www.unepfi.org/fileadmin/documents/ceo_briefing_materiality_equity_pricing_2004.pdf
  http://www.unepfi.org/fileadmin/documents/amwg_materiality_equity_pricing_report_2004.pdf

Basic Water Facts

- http://www.physicalgeography.net/fundamentals/8b.html

Reports & Tools

- UNDP Human Development Report 2006 "Beyond Scarcity: Power, poverty and the global water crisis"
  http://hdr.undp.org/hdr2006/
- World Business Council for Sustainable Development "Business in the World of Water: WBCSD Water Scenario to 2025," 2006
  http://www.wbcsd.org/DocRoot/Q87vukbkb5fNnpbkbLUu/h20-scenarios.pdf
- WBCSD Water Tool
  http://www.wbcsd.org/web/watertool.htm
- Water Footprint Calculator
  http://www.waterfootprint.org/index.php?page=files/WaterFootprintCalculator
- WWF Living Planet Report 2006
  http://www.wwf.org.za/Tempfolder/lpr2006.pdf (includes Living Planet index and Ecological Footprint)
- UNESCO World Water Assessment Programme
  http://www.unesco.org/water/wwap/description/index.shtml
- UN World Water Development Report
  http://www.unesco.org/water/wwap/wwdr/index.shtml
- Global Environmental Management Initiative (GEMI) (water risk checklist)
  http://www.gemi.org/water/
  http://www.gemi.org/waterplanner/index.htm

International Initiatives & Organisations

- Equator Principles
  http://www.equator-principles.com/principles.shtml
- Global Compact & CEO Water Mandate
  http://www.unglobalcompact.org/
  http://www.unglobalcompact.org/Issues/Environment/Water_sustainability/index.html
- UN Millennium Development Goals
  http://www.un.org/millenniumgoals/
- UN-Water
  http://www.unwater.org/
- UNDP
  http://www.undp.org/water/
- UN HABITAT
  http://www.unhabitat.org/categories.asp?catid=270
- WHO-UNICEF Joint Monitoring Programme
  http://www.wssinfo.org/en/welcome.html
- Water and Sanitation Program (World Bank)
  http://www.wsp.org/
- Water Supply and Sanitation Collaborative Council
  http://www.wsscc.org/
- IRC International Water and Sanitation Centre
  http://www.irc.nl/

Water Resources

- Aquastat (database)
  http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm
- International Water Resource Management Institute
  http://www.iwmi.cgiar.org/
  http://www.iwmi.cgiar.org/Assessment/Publications/research_reports.htm
- Earth Trends (database)
  http://earthtrends.wri.org/searchable_db/index.php?theme=2
- UNEP Global International Waters Assessment
  http://www.giwa.net/
- The World Conservation Union
  http://www.iucn.org/themes/wetlands/work.html
- World Resources Institute
  http://www.wri.org/

Water Infrastructure, Efficiency & Technology

- Environmental Expert
  http://www.environmental-expert.com/about_us.asp
- US Environmental Protection Agency
  http://www.epa.gov/waterinfrastructure/waterefficiency.html
- Paying for Water Conference
  http://www.payingforwater.com/program/
- Network for Water Businesses

http://www.waternunc.com/gb/indexgb.htm

- Water Management Innovative Technology Program, State of Pennsylvania
  http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1282&Q=449683
- Water Treatment Products
  http://www.watertreatmentproducts.com/xcart/customer/home.php
- Water Treatment Plants
  http://www.thewatertreatmentplant.com/water-treatment-process.html

Public Private Partnerships

- Public Private Infrastructure Advisory Facility
  http://www.ppiaf.org/sections/Sectorwaterandsanitation.htm
- World Bank Private Participation in Infrastructure (database)
  http://ppi.worldbank.org/
- World Bank Water and Sanitation Privatization Toolkit
  http://rru.worldbank.org/Toolkits/WaterSanitation/
- World Bank Concessions Toolkit
  http://rru.worldbank.org/Toolkits/InfrastructureConcessions/
- Building Partnerships for Development Water & Sanitation Cluster
  http://www.bpd-waterandsanitation.org/
- Public Services International Research Unit
  http://www.psiru.org/

Water Utility Benchmarking

- International Benchmarking Network for Water and Sanitation Utilities
  http://www.ib-net.org/

Water Investment

- Water Stocks
  http://www.water-stocks.com/Water-Stocks/
- Palisades Water Index
- http://www.amex.com/othProd/prodInf/OpPiIndMain.jsp?Product_Symbol=ZWI

Regional information

- Europe
- WISE (Water Information System for Europe)
  http://water.europa.eu/
- Water Framework Directive Portal
  http://ec.europa.eu/environment/water/water-framework/index_en.html
- UK Environment Agency
  http://www.environment-agency.gov.uk/subjects/waterres/

Americas

- US Environmental Protection Agency
  http://www.epa.gov/water/
- U.S. Geological Survey (by State)
  http://water.usgs.gov/

- Canadian Water Resources Association
  http://www.cwra.org/
- Inter-American Development Bank - Water and Sanitation
  http://www.iadb.org/topics/Home.cfm?language=English&topicID=OS&parid=2

Africa & Middle East

- Africa Development Bank - Water and Sanitation
  http://www.afdb.org/portal/page?_pageid=473,969995&_dad=portal&_schema=PORTAL
- Water Page (incorporating the African Water Page)
  http://www.africanwater.org/index.htm
- World Bank Middle East & North Africa (MENA)
  http://wbln0018.worldbank.org/mna/mena.nsf
- Government of South Africa, Department of Water Affairs and Forestry
  http://www.dwaf.gov.za/

Asia & Australia

- Asian Development Bank - Water
  http://www.adb.org/Water/
- Government of Australia, Department for the Environment and Water Resources
  http://www.environment.gov.au/water/index.html
- Australia Natural Resources Atlas
  http://audit.ea.gov.au/ANRA/atlas_home.cfm
- Land and Water Australia
  http://www.lwa.gov.au/

Political Risk, Insurance and Guarantees

- International Country Risk Guide (global political risk indicators)
  http://www.prsgroup.com/ICRG.aspx
- World Bank Knowledge Services for Financial & Private Sector Development
  http://rru.worldbank.org/
- World Bank Doing Business Survey (global business regulation and enforcement indicators)
  http://www.doingbusiness.org/
- Political Risk Insurance Center
  http://www.pri-center.com/
- Multilateral Investment Guarantee Agency (World Bank Group)
  http://www.miga.org/guarantees/

Subnational Finance

- World Bank/IFC Municipal Fund
  http://www.ifc.org/municipalfund
- EBRD Municipal and Environmental Infrastructure
  http://www.ebrd.com/country/sector/muninfra/index.htm

Climate Change

- Intergovernmental Panel on Climate Change

http://www.ipcc.ch/pub/pub.htm

http://www.ipcc.ch/SPM13apr07.pdf

- Stern Review on the Economics of Climate Change (for the UK Government)

  http://www.hm-treasury.gov.uk/independent_reviews/ stern_review_economics_climate_change/sternreview_index.cfm

- UNEP FI "Adaptation and Vulnerability to Climate Change: The Role of the Finance Sector," 2006

  http://www.unepfi.org/fileadmin/documents/CEO_briefing_adaptation_vulnerability_2006.pdf

Magazines and Newsletters

- Global Water Intelligence

  http://www.globalwaterintel.com

- Water Technology Magazine

  http://waternet.com/article.asp

- The Engineer

  http://www.theengineer.co.uk/News/List.aspx?liArticleTypeID=12

- Water Technology

  http://www.water-technology.net

Appendix: Sector-Specific Risks and Controls

With kind support of:

Appendix 1.1. Sector-Specific Risks and Controls - Agriculture

Agriculture	ENVIRONMENTAL	
	RISK	**CONTROLS**
	Inappropriateness of hydrological conditions - e.g. Irrigation; salt pans; high water tables; unsuitable sub soils for the enterprise.	Due diligence research - in establishing a new facility, review data relating to the area including soils, geology, geomorphology, vegetation, current land use, climate and interpret suitable uses and recurrent costs of the enterprise for maintaining fertility, erosion protection, change in water table height and chemical composition. If data is not available it needs to be collected and costed in a feasibility study. Review weather details and undertake risk likelihood projections and come up with a costed risk mitigation plan.
	Liquid/solid waste (production and disposal) - e.g. farm slurry/manure; waste chemicals and chemical containers.	Water resource management and response planning - protect / avoid water resources: minimisation and spill prevention; response planning; responsible waste vegetation management; monitoring.
	Disruption and pollution of surface water systems (hydrological) and groundwater (hydro-geolocical) flows - fuels, lubricants and ancillary chemicals used by heavy machinery / spillage.	
KEY CONSIDERATIONS		
	Are chemicals or fuels used or stored? If so are they managed in an environmentally acceptable manner and comply with health and safety legislation and good practice?	
	Has the farmer been prosecuted for pollution incidents, e.g. oil or chemical spill/leaking tanks?	
	Is there a surface watercourse, pond or reservoir present on or within 250m of the site?	
	How does the farmer dispose of waste?	
	Does the farmer spread or dispose of farm slurry or sewage sludge on the site?	
	Does the farmer rear livestock intensively, operate a diary farm or store large amounts of organic waste? If so, has the farmer a formal wastewater management plan in operation? (This can reduce the environmental impacts)	
	For new sites or extensions to existing sites, has an Environmental Social Impact Assessment (ESIA) been undertaken to assess impacts and the long-term availability of sustainable water supply?	
	Are the crops grown «ideal» with respect to the climatic and water-availability conditions?	
FURTHER INFO		
	UNESCO Conference Second World Water Forum Local and Indigenous Knowledge Systems http://portal.unesco.org/sc_nat/ev.php?URL_ID=3854&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1092045126	
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm	
	EU Water Framework Directive Lessons Learned with regard to Water Pollution http://ec.europa.eu/environment/water/water-framework/pdf/gwd_economic_study.pdf	
	Summary of EU Legislation regarding Water Pollution http://europa.eu/scadplus/leg/en/s15005.htm	
	Environment Sensitive Farming http://www.environmentsensitivefarming.co.uk/	

Appendix 1.2. Sector-Specific Risks and Controls - Forestry & Logging

Forestry and Logging	ENVIRONMENTAL	
Propagation and Harvesting	**RISKS**	**CONTROLS**
	Disruption to surface water (hydrological) and groundwater (hydro-geological) systems and flows - fuels; lubricants and ancillary chemicals from use of heavy machinery / spillage.	Water management - protect / avoid water resources; minimisation and spill prevention; response planning; responsible waste vegetation management.
	Inappropriateness of hydrologic conditions (available quality and quantity of water resources) for considered crops.	Due diligence on long-term trends in water-availability and expected -consumption; consideration of long-term meteorological forecasts.

Processing		
	Disruption and pollution to surface water (hydrological) systems and flows - accidental spillage and storage leaks of timber treatment preservatives.	Environmental management plans - water quality management; spill prevention and response; and ensure that compliance is monitored.
	Disruption and pollution to groundwater (hydro-geological) systems and flows - bulk chemicals; resins; adhesives and wood treatment agents accidental spillage or leakage from wastes.	Best Available Technique Not Entailing Excessive Cost (BATNEEC).
Pulp and Paper		
	Pressure on natural resources - Potentially high water consumption.	Supply chain sustainability - All sponsor-developed Environmental Impact Statements are reviewed by independent third party reviewer.
	Disruption and pollution of surface water (hydrological) systems and flows - liquid bleaching effluents and wastewater containing organic matter; suspended solids; dioxin; by-products and dissolved salts.	Environmental management plans - Water quality management; spill prevention and response; ensure that compliance is monitored.
	Disruption and pollution of groundwater (hydro-geological) systems and flows - accidental spillage; leakage from waste of bulk chemicals e.g. caustic soda; biocides and sodium hypochlorite.	Use Best Available Technique Not Entailing Excessive Cost (BATNEEC) – Waste-water treatment design.
		Waste management - apply appropriate waste / waste water storage, disposal management measures.
Printing and Publishing		
	Disruption and pollution of groundwater (hydro-geological) systems and flows - accidental spillage; leakage from waste of bulk chemicals e.g. solvents and oils.	Environmental management plans - - Govern water quality, spill prevention and response, and that compliance is monitored - Use of water based inks to eliminate solvent emissions
	Liquid waste (production and disposal) and disruption to surface water (hydrological) systems and flows - contamination from wastewater discharge.	Waste management - apply appropriate waste / waste water storage, disposal management measures.
KEY CONSIDERATIONS		
	Does the company or organisation responsible for management of the timber resource have certification to Forest Stewardship Council (FSC) or Pan European Forest Certification (PEFC)?	
	Has the company ever been prosecuted for environmental offences?	
	Is the company required to hold consents from the environmental regulator or local authority? Are there current or future costs associated with complying with them?	
	In the harvesting or wood processing, are any nationally or internationally noted toxic chemical or hazardous substances going to be used?	
	Are the crops grown «ideal» with respect to the climatic and water-availability conditions?	
FURTHER INFO		
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards	

	World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
	Summary of EU Legislation regarding Water Pollution http://europa.eu/scadplus/leg/en/s15005.htm
	Food and Agriculture Organization for the United Nations http://www.fao.org/forestry/index.jsp
	World Business Council for Sustainable Development Forest Products Industry http://www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p&MenuId=Nzk&doOpen=1&ClickMenu=LeftMenu
	Forest Stewardship Council http://www.fsc.org/en/about/policy_standards Sustainable Forestry Initiative http://www.aboutsfi.org/about.asp Pan European Forest Certification http://www.pefc.org/

Appendix 1.3. Sector-Specific Risks and Controls - Mining and Metals

Mining and Metals	**ENVIRONMENTAL**	
Drilling and Resource Definition	**RISK**	**CONTROLS**
	Disruption and pollution to surface water (hydrological) and groundwater (hydro-geological) systems and flows - surface / groundwater contamination (drilling fluids and mud use and disposal; hydrocarbon / chemical spills).	Protect / avoid water resources.
Mine Development		
	Disruption and pollution to surface water (hydrological) and groundwater (hydro-geological) systems and flows - e.g. hydrocarbon / chemical spills.	Environmental management plans - for construction activities: e.g. erosion control, water quality, spill prevention and response, etc., to ensure that compliance is monitored by third party.
		Water management - protect / avoid water resources; spill prevention and response planning.
Resource Extraction		
	Disruption and pollution to surface water (hydrological) and groundwater (hydro geological) systems and flows - surface water quality (sedimentation, acid mine drainage, wastewater disposal, hydrocarbon spills) and groundwater quality (acid mine drainage, hydrocarbon / chemical spills).	Environmental management plans - for construction activities e.g. erosion control, water quality, spill prevention and response, especially a Tailings management plan - ensure that compliance is monitored by third party.
	Pressure on natural resources - high water resource consumption.	Sustainable resources management - esp. water management plans.
Processing		
Smelting / Refining / Foundries / Electroplating		
	Disruption and pollution to surface water (hydrological) and groundwater (hydro-geological) systems and flows - wastewater disposal, hydrocarbon / chemical spills	Sustainable resources management - optimise efficiency of processes to minimise energy (emissions) and water usage
	Pressure on natural resources - high water consumption	Use Best Available Technique Not Entailing Excessive Cost (BATNEEC) - in wastewater treatment design
		Water management – protect/avoid resources – spill prevention and response planning
Mine Closure		
	Disruption and pollution to surface water (hydrological) and groundwater (hydro geological) systems and flows - protection from potential acid mine drainage	Closure and decommissioning plan - ensure closure plan seeks to establish environmental conditions that as near as possible reflect pre-mining conditions or that support alternative land use

KEY CONSIDERATIONS	
	What is the environmental compliance track record of the company? (Association with a company with a poor compliance record can give rise to potential reputation risk).
	Has the customer planned for all the necessary provisions to restore and rehabilitate the site or to treat mine water?
	How does the company tackle the issue of acid leaching from tailings dams/lagoons?
	What wastes are produced and how are they disposed of?
FURTHER INFO	
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards
	World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
	Stockholm Convention on Persistent Organic Pollutants http://www.pops.int/
	EU Directive for Waste Management http://www.wbcsd.org/Plugins/DocSearch/details.asp?ObjectId=MTg4OTE
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm
	Extractive Industries Transparency Initiative http://www.eitransparency.org/
	International Council on Mining and Metals http://www.icmm.com/

Appendix 1.4 Sector-Specific Risks and Controls - Power Generation

Power Generation	**ENVIRONMENTAL**	
Construction - Power Stations	**RISK**	**CONTROLS**
	Disruption and pollution to surface (hydrological) and groundwater (hydro-geological) systems and flows - Impact to hydrological regime particularly hydroelectric power.	Hazardous waste, storage and disposal plans – Employ appropriate health and safety measures for containment of chemicals.
		Minimize facility footprint - wherever possible in environmental design.
Operation - Power Stations in General		
	Pressure on natural resources - high water use in water cooled condensers.	Water management - securing of a sustainable water supply, recycling and reuse wastewater.
	Liquid waste (production and disposal) - hot water discharges.	Waste management - - On-site effluent treatment and discharge quality monitoring - Appropriate waste handling, storage and disposal procedures
	Inappropriateness of long-term hydrologic conditions (available quality and quantity of water resources) for operations.	Emergency preparedness and spill response plans - protect / avoid water resources.
		Due diligence on long-term trends in water availability and expected consumption.
Operation - Hydroelectric Power		
	Impact on terrestrial and aquatic ecology - e.g. disrupted salmon (fish) migration.	Ecological management plan - installation of fish passes, etc.
		Water management and water quality monitoring - securing of a sustainable water supply, recycling and reuse wastewater.
KEY CONSIDERATIONS		
	What wastes are produced and how are they disposed of?	
	Are appropriate procedures in place for storage and handling of chemicals and energy once created?	
	Are existing environmental reports available for review? Are these out of date with respect to current site operations?	

	Are there appropriate procedures in place for waste management, accidental releases, environmental management, etc?
	Has the customer planned for all the necessary provisions to restore and rehabilitate the site or to mitigate damages?
	Is it anticipated that changes to environmental legislation or environmental pressures such as water stress (e.g. from the public or supply chain) will lead to an increase in the cost of raw materials or changes in the means of manufacture, the product mix and/or waste disposal or wastewater treatment?
FURTHER INFO	
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards
	World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
	Stockholm Convention on Persistent Organic Pollutants http://www.pops.int
	EU Directive for Waste Management http://www.wbcsd.org/Plugins/DocSearch/details.asp?ObjectId=MTg4OTE
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm
	World Bank Group: Energy Sector Management Assistance Program http://wbln0018.worldbank.org/esmap/site.nsf

Appendix 1.5 Sector-Specific Risks and Controls - Oil & Gas

Oil & Gas	**ENVIRONMENTAL**	
Oil Field Development and Transportation (Pipelines and Tankers) - Exploration and Production Drilling	**RISK**	**CONTROLS**
	Natural hazards - well blow outs; combustion and explosions; water contamination; toxic spillages.	Water management - securing of a sustainable water supply; recycling and reuse wastewater.
	Drill mud and cuttings - release of contaminated water.	
	Disruption and pollution of surface water (hydrological) and groundwater (hydro-geological) systems and flows - hydraulic fracturing.	
Separation, Compression and Dehydration		
	Disruption and pollution of surface water (hydrological) and groundwater (hydro geological) systems and flows.	Water management - securing of a sustainable water supply, recycling and reuse wastewater.
Pipelines		
	Liquid and Solid Waste (production and disposal) - e.g. Pigging (cleaning), sludge disposal	Water disposal and monitoring systems
		Waste Management
Refining		
	Pressure on natural resources - water use and hot water discharges	Emergency preparedness and spill prevention plan
	Inappropriateness of long-term hydrologic conditions (available quality and quantity of water resources) for operations.	Due diligence on long-term trends in water availability and expected consumption.
	Toxic spillage - contaminated fire water	
KEY CONSIDERATIONS		
	How old are the refinery works? (Pollution will be greater in older works).	
	Has on-site disposal of process by-products and wastes taken place?	
	How is effluent and/or process wastewater controlled?	
	What contingency plans are in place to deal with spillage, leaks, etc?	

FURTHER INFO		
	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Oil and Gas Development (Onshore) http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook	
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards	
	WHO standards for drinking water http://www.who.int/mediacentre/factsheets/fs258/en	
	Synopsis of Environmental Impact of the Offshore Oil and Gas Industry http://www.offshore-environment.com/booksynopsis.html	
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.ht	
	EU policy on petrol storage (VOC leak) http://europa.eu/scadplus/leg/en/lvb/l28029a.htm	
	Extractive Industries Transparency Initiative http://www.eitransparency.org/	
	IMO/ IPIECIA established contingency plan for international oil spills. http://www.ipieca.org/downloads/oil_spill/GI_Africa.pdf	
	Prevention of Water Pollution by Oil compiled by the International Maritime Organization http://www.imo.org/Environment/mainframe.asp?topic_id=231	

Appendix 1.6 Sector-Specific Risks and Controls - General Manufacturing

General Manufacturing	ENVIRONMENTAL	
Manufacturing Operations	**RISK**	**CONTROLS**
	Pressure on natural resources - excessive / unmonitored use of water.	Minimize facility footprint - optimisation of operations and processes to minimise energy and water usage.
	Liquid waste (production and disposal) - discharge of contaminated wastewater; accidental discharges to storm water (e.g. contaminated firewater); discharge of hot water.	Emergency preparedness and spill prevention plans - develop and implement Spill Prevention and Response Plan including provision of spill response equipment and trained personnel.
	Storm water runoff - storm water run-off contamination resulting from poor materials transportation; storage and handling practices.	Water disposal, availability and monitoring systems - surface / groundwater and soil quality monitoring and remediation if necessary.
	Disruption and pollution of surface water (hydrological) and ground water (hydro geological) systems and flows – accidental releases of chemical pollutants to surface and / or groundwater and / or soil spillages and / or leaks.	Due diligence on long-term trends in water availability and expected consumption.
	Inappropriateness of long-term hydrologic conditions (available quality and quantity of water resources) for operations.	
Product End of Life		
	Waste production and disposal - impacts caused by the disposal of waste products and / or waste packaging.	Waste management - eco-design of products to minimise amounts and toxicity of the wastes, and to allow re-use or recycling.
Breweries and Distilleries		
	Pressure on natural resources - high water consumption for steam production, cleaning and as a raw material.	Water management plans - water saving measures (e.g. through source reduction or recycling).
	Liquid waste (production and disposal) - generation of significant amounts of wastewater with organic load (mostly biodegradable) as well as nitrogen and phosphorous.	Waste management - minimisation of the amounts of organic matter and other pollutants present in the effluents.

		Wastewater treatment - appropriate sludge disposal methods (incineration, land-filling, land-farming, methanisation, etc.) / strict control of possible waste land-farming activities to avoid public nuisance and health impacts.
Electrical and Optical Products		
	Pressure on natural resources - - High water demand for certain processes (cleaning, cooling, surface treatment etc.) especially in the manufacture of integrated circuits. - High energy demand for semi-conductors manufacture.	Water management - water saving measures (e.g. through source reduction or recycling.
	Liquid waste (production and disposal) - generation of wastewater from cleaning and surface treatment operations, possibly containing toxic compounds, waste chemicals (e.g. cyanides), sludge from wastewater treatment, waste surface treatment baths.	Water disposal, availability and monitoring systems - wastewater treatment.
Food, Beverage, Tobacco Manufacture		
	Pressure on natural resources - high water consumption for steam production, cleaning and as a raw material	Hazardous materials storage and containment - - Appropriate handling and storage of powder materials (e.g. dust filters) - Safety measures for a ammonia storage and emergency plan
	Liquid waste (production and disposal) - generation of significant quantities of wastewater with high organic load, mostly biodegradable, e.g. nitrogen and phosphorus.	Water management plans - water saving measures (e.g. through source reduction or recycling.
	Solid waste (production and disposal) - production of sludge from on-site wastewater treatment plants.	Water disposal, availability, and monitoring systems - - Minimisation of the amounts of organic matter present in the effluents. - Appropriate sludge disposal methods (incineration, land-filling, land farming, methanisation, etc.) - strict control of possible waste land-farming activities to avoid public nuisance and health impacts.
Textiles		
	Pressure on natural resources - high water demand for washing processes and steam production	Water management - water saving measures (e.g. through source reduction or recycling).
	Liquid wastes (production and disposal) - significant quantities of wastewater with high organic load and possible presence of hazardous organic compounds with low biodegradation potential (e.g. phenols from dying and finishing, halogenated organics from processes such as bleaching, pesticides from raw materials) - dye wastewaters are frequently highly coloured and may contain heavy metals such as copper and chromium	Wastewater treatment - minimisation of waste-related impacts (e.g. source reduction, reuse, recycling or energy recovery / appropriate waste disposal methods).
	Liquid wastes (production and disposal) – used chemicals and sludge from on-site wastewater treatment plants	
	Indirect impacts related to upstream manufacturing activities - (e.g. textile manufacture, production of vegetable textile fibres (e.g. use of pesticides, nitrate and phosphate pollution, high water demand)	
KEY CONSIDERATIONS		
	Does the process require authorisation, and if so has this been obtained?	
	Is the business in compliance with authorisation requirements and other environmental, planning and health and safety regulations?	

	What is the status of the factory with regard to EU Best Available Techniques Not Exceeding Extravagant Cost (BATNEEC) where existing? Are there material upgrades required to meet BATNEEC?
	Has on-site disposal of process by-products and wastes taken place?
	How are emissions controlled (Air emissions, wastewater, wastes, etc.)?
	What measures are taken to minimise water and energy use?
	What types of hazardous products are stored and handled on site? What measures are in place to prevent leaks and spills?
	For new sites/extension projects has an Environmental Impact Assessment been commissioned to assess the environmental impacts?
	Is it anticipated that changes to environmental legislation or environmental pressures such as water stress (e.g. from the public or supply chain) will lead to an increase in the cost of raw materials or changes in the means of manufacture, the product mix and/or waste disposal or wastewater treatment?
FURTHER INFO	
Brewing	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Breweries http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
Electronic and Optical Equipment	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Electronics manufacturing http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
	Summary of EU legislation on Waste Electrical and Electronic Equipment (WEEE) http://europa.eu/scadplus/leg/en/lvb/l21210.htm
	Summary of EU legislation regarding Volatile Organic Compounds (VOC) http://europa.eu/scadplus/leg/en/lvb/l28029b.htm
Food, Beverage and Tobacco	EU Best Available Techniques Reference Document (BREF) – Food, Drink and Milk processes http://eippcb.jrc.es/pages/FActivities.htm
	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guidelinehttp://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandboo
	International Finance Corporation – Environmental, health & Safety Guidelines for Food & Beverage Processing http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines
General	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm
Leather	EU Best Available Techniques Reference Document (BREF) – Tanning of hides and skins http://eippcb.jrc.es/pages/FActivities.htm
	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Tanning & Leather Finishing http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
	Summary of EU legislation regarding Volatile Organic Compounds (VOC) http://europa.eu/scadplus/leg/en/lvb/l28029b.htm
Metal Products	Summary of EU legislation regarding Volatile Organic Compounds (VOC) http://europa.eu/scadplus/leg/en/lvb/l28029b.htm
	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Electroplating http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
Mineral Products	EU Best Available Techniques Reference Document (BREF) http://eippcb.jrc.es/pages/FActivities.htm
	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
Pulp and Paper	EU Best Available Techniques Reference Document (BREF) – Pulp & Paper manufacture http://eippcb.jrc.es/pages/FActivities.htm

	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Pulp & Paper Mills http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
Rubber, Plastic and Derived Products	EU Best Available Techniques Reference Document (BREF) – Polymers http://eippcb.jrc.es/pages/FActivities.htm
	Summary of EU legislation regarding Volatile Organic Compounds (VOC) http://europa.eu/scadplus/leg/en/lvb/l28029b.htm
Textile	EU Best Available Techniques Reference Document (BREF) – Textile processing http://eippcb.jrc.es/pages/FActivities.htm
	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Textiles http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
Wood Products	World Bank Pollution Prevention and Abatement Handbook (1998); Industry Sector Guideline – Wood preserving http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook
	International Finance Corporation – Environmental, health & Safety Guidelines for Wood Products Industries http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

Appendix 1.7 Sector-Specific Risks and Controls - Chemicals and Pharmaceuticals

Chemicals and Pharmaceuticals	**ENVIRONMENTAL**	
Manufacturing Operations	**RISKS**	**CONTROLS**
	Pressure on natural resources - excessive / unmonitored use of water.	Minimize facility footprint- optimisation of operations and processes to minimise water consumption.
	Inappropriateness of hydrologic conditions (available quality and quantity of water resources) for operations.	Due diligence on long-term trends in water availability and expected consumption.
	Liquid waste (production and disposal) - hazardous waste (i.e. process and effluent treatment, sludge, spent catalysts and container residues containing significant concentrations of spent solvents and other toxic organics).	Use of Best Available Technique not Entailing Excessive Cost (BATNEEC) – wastewater treatment; recycling; reusing.
	Accidental spills - wastewater to storm water system and drift of pesticides due to aerial application.	Waste management and end of life process - Re-use and recycling and appropriate waste disposal (chain of custody) -Return toxic materials packaging to the supplier for reuse or incinerate / destroy in an environmentally acceptable manner.
	Storm water runoff - contamination resulting from poor materials transportation, storage and handling practices.	Hazardous materials storage, transport and containment - Label and store toxic and hazardous materials in secure, bunded areas. - Use automated filling to minimise spillage.
	Disruption and pollution to surface water (hydrological) and groundwater (hydro-geological) systems and flows - accidental releases of chemical pollutants to surface and /or groundwater and / or soil.	Water disposal and monitoring systems – continuous monitoring of water quality and appropriate waste water disposal.
Bulk Storage		
	Disruption and pollution of surface water (hydrological) and groundwater (hydro-geological) systems and flows - due to spills and leakages	Hazardous materials transport, storage and handling plans: - Improved handling, storage and use of hazardous materials. - Use automated filling to minimize spillage and “closed” feed systems into batch reactors. - Secondary containment (e.g., berm, sump areas, and pumping / removal facility).

		Water disposal and monitoring systems – continuous monitoring of water quality and appropriate waste water disposal.
Laundries and Dry Cleaning		
	Pressure on natural resources - overuse of water in water scarce areas.	Use of Best Available Technique Not Entailing Excessive Cost (BATNEEC) e.g. appropriate discharge of wastewater.
	Disruption and pollution of surface water (hydrological) and ground water (hydro-geological) systems and flows - accidental spillage and inappropriate storage/packaging of solvents.	
KEY CONSIDERATIONS		
	How long has the site been used for this purpose? The contamination risk increases with time.	
	Has any on-site waste disposal (e.g. spent solvents or expired medicines etc.) ever taken place? How are waste products treated and disposed of in general?	
	Has the company been prosecuted or served with any warnings for environmental offences? Are there any outstanding prosecutions against the site?	
	What procedures/resources exist to manage environmental risks (e.g. an environmental management system or personnel with specific responsibility for risk mitigation)? Are these procedures considered to be adequate / robust? Are the same environmental standards applied to facilities in different countries (if applicable)?	
	Is there an emergency response plan in place for use in the event of an accident? Does the plan taken into account neighbouring land uses and the potential consequences of an emergency?	
	Is it anticipated that changes to environmental legislation or environmental pressures such as water stress (e.g. from the public or supply chain) will lead to an increase in the cost of raw materials or changes in the means of manufacture, the product mix and/or waste disposal or wastewater treatment?	
	Does the company report externally on their sustainability / corporate social responsibility (CSR) issues (environmental, social and economic)?	
	If an external report exists, is it independently verified?	
FURTHER INFO		
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards	
	World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook	
	Stockholm Convention on Persistent Organic Pollutants http://www.pops.int/	
	EU Directive for Waste Management http://www.wbcsd.org/Plugins/DocSearch/details.asp?ObjectId=MTg4OTE	
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm	
	Basel Convention: The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted in 1989 and entered into force on 5 May 1992. http://www.basel.int/about.html	
	Environmentally Sound Management of Solid Wastes and Sewage-related Issues. http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21section21.htm	
	UNEP International Declaration on Cleaner Production http://www.uneptie.org/pc/cp/declaration/	

Appendix 1.8 Sector-Specific Risks and Controls - Infrastructure

Infrastructure	ENVIRONMENTAL	
General - CONSTRUCTION	**RISK**	**CONTROLS**
	Disruption and pollution to surface water (hydrological) and groundwater (hydro-geological) systems and flows due to spills and / or uncontrolled erosion / sedimentation.	Minimize facility footprint - appropriate site alternatives assessment and harmonisation of the project design with the natural landscape - water availability, erosion, re- vegetation and reforestation.
	Liquid and solid wastes (production and disposal) - generation of hazardous e.g. asbestos and non-hazardous wastes including wastewater.	Use of Best Available Techniques Not Entailing Excessive Cost (BATNEEC) - on-site treatment of liquid effluents to meet quality standards prior to discharge.
		Hazardous materials storage, handling and use implementation of appropriate procedures and protocols for storage, handling and use of hazardous substances.
		Waste management plans - implementation of appropriate waste identification, segregation and disposal protocols and procedures.
General - OPERATIONS		
	Liquid and Solid wastes (production and disposal) - generation of hazardous and non-hazardous wastes including wastewater.	Minimize facility footprint - continual monitoring of infrastructure integrity with periodic maintenance as required.
	Disruption and pollution to surface water (hydrological) and groundwater (hydro-geological) systems and flows -due to spills and / or uncontrolled erosion / sedimentation.	Emergency response and spill prevention plan - -Installation of anti-leak and spill technology such as cathodic protection against corrosion of oil pipelines. - Adequate emergency response plans to protect communities and workers against facility failure scenarios. - Insurance for natural disasters.
		Waste management plans - waste minimisation, re-use and recycling – appropriate waste disposal techniques.
Ports, Harbours and Marinas - CONSTRUCTION		
	Disruption and pollution to local hydrological / oceanographic systems and flows - resulting in sedimentation and / or erosion.	Water disposal and monitoring systems – continuous monitoring of water quality while conducting dredging activities
	Impact on terrestrial and aquatic ecology - impacts on fisheries and fish nursery areas.	
	Disruption and pollution to local surface (hydrological) systems and flows - modification to channel depth and cross section – increase in saltwater intrusion to groundwater or surface waters.	
	Impact on terrestrial and aquatic ecology - as a result of dredging activities during construction.	
	Solid and liquid wastes (production and disposal) - dredging sediments, hazardous / non hazardous waste and construction waste and materials.	
Ports, Harbours and Marinas - OPERATION		
	Solid and liquid wastes (production and disposal) - international ship wastes - (turbidity) during port operations.	Waste management plan - including international (ship) waste management protocols and procedures.
		Water management plan - compliance with IMO requirements for ballast water management, hull fouling and waste management.
Dams - CONSTRUCTION		
	Impact on terrestrial and aquatic ecology – upstream catchment impacts on ecology / biodiversity as a result of catchment flooding.	Minimize facility footprint - appropriate site selection and design for dam facility.

	Impact on terrestrial and aquatic ecology - impacts on downstream ecology as a result of reduced water flows	Protect / avoid water resources - Erosion and Sedimentation Management Plan (particularly for high risk areas including geo-technically unstable areas.
	Odour - production of noxious gases toxic to aquatic life as a result of (anaerobic) decomposition of inundated vegetation on the bottom of reservoirs.	Water management - use of multiple level outlets in dam design to avoid the discharge of anaerobic water.
Dams - OPERATIONS		
	Liquid wastes (production and disposal) - catchment based erosion and sedimentation leading to reduced storage capacity / hydrostatic head and impairing flood control capacity of catchment area.	Replication, as close as possible, of natural downstream river flows including seasonal and / or flooding events.
	Liquid wastes (production and disposal) - increased siltation of reservoir leading to dredging requirements including dredge spoil disposal	
	Impact on terrestrial and aquatic ecology -Due to changes in downstream hydrology - impairment of ecosystems - Loss of control of downstream water flows during flood events (over-topping of dam) leading to downstream ecological impacts and erosion	
FURTHER INFO		
	International Finance Corporation – Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards	
	International Finance Corporation – Environmental, Health and Safety Guidelines http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines	
	World Bank Pollution Prevention and Abatement Handbook, 1998 http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook	
	EU Water Framework Directive Lessons Learned with regard to Water Pollution http://ec.europa.eu/environment/water/water-framework/pdf/gwd_economic_study.pdf	
	Summary of EU Legislation regarding Water Pollution http://europa.eu/scadplus/leg/en/s15005.htm	
	Summary of EU Legislation regarding Air Pollution http://europa.eu/scadplus/leg/en/s15004.htm	
	World Commission on Dams http://www.irn.org/wcd	

Appendix 1.9. Sector-Specific Risks and Controls - Tourism

Tourism	ENVIRONMENTAL	
	RISK	**CONTROLS**
	Pressure on natural resources - high water consumption.	Use of Best Available Technique Not Entailing Excessive Cost (BATNEEC) in facility design / wastewater treatment.
	Liquid/Solid waste (production and disposal) – high volume of waste including storage, disposal and transportation (e.g. sewage in destinations with high volumes of annual visitors).	Minimize facility footprint - appropriate measures for ensuring sustainable resource management (e.g. water and energy use).
	Disruption and pollution of surface water (hydrological) and ground water (hydro-geological) systems and flows.	Waste management - bilge washing should not be done at sea but at appropriate facilities in port.
	Inappropriateness of long-term hydrologic conditions (available quality and quantity of water resources) for operations.	Environmental impact assessment and public consultation - new build hotels and leisure complexes to mitigate impacts and disruption during construction and operation.
		Waste and hazardous materials transport, storage and handling plans - Implementation of waste management systems including regular audits of the waste facilities and waste collection.
		Due diligence on long-term water availability and consumption.

		Sustainable land use (land clearing) and biodiversity protection - create protected / conservation areas (e.g. marine parks to mitigate and or offset damage to natural/marine ecosystem).
		Minimise facility footprint - Limit disturbance to land and property site selection for new builds - Set and enforce restrictions on volume of visitors through building permits and or transportation networks e.g. limit no of rooms / beds - Set and enforce restrictions on types of building / facility (e.g. through planning permission building permits).
KEY CONSIDERATIONS		
	Has the company been in business for a long time?	
	What is the environmental/social compliance track record of the company? (Association with a company with a poor compliance record can give rise to potential reputation risk).	
	What procedures and/or resources exist to manage environmental and social risks (e.g. an environmental management system or personnel with specific responsibilities for risk mitigation)? Are these considered adequate?	
	What wastes are/will be produced and how are they disposed of?	
	Is the site in a protected or conservation area e.g. world heritage site/area of outstanding natural beauty, or is it known for rare or protected species of animals/plants? Is the site home to indigenous populations engaged in subsistence activities?	
	Is it anticipated that changes to environmental legislation or environmental pressures such as water stress (e.g. from the public or supply chain) will lead to an increase in the cost of raw materials or changes in the means of manufacture, the product mix and/or waste disposal or wastewater treatment?	
FURTHER INFO		
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards	
	World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook	
	EU Directive for Waste Management http://www.wbcsd.org/Plugins/DocSearch/details.asp?ObjectId=MTg4OTE	

Appendix 1.10 Sector-Specific Risks and Controls - Water Supply / Treatment

Water Supply / Treatment	**ENVIRONMENTAL**	
Project Feasibility and Planning	**RISK**	**CONTROLS**
	Pressure on natural resources - Water availability and silting of catchment area, reservoirs and underground abstractions.	Minimize facility footprint - Project feasibility study and Environmental Impact Assessment.
	Habitat depletion, fragmentation and degradation - supply route selection and suitability -, disruption to remote sites that may have significant wilderness, scenic or recreation value.	Water disposal and monitoring systems – adequate planning and ongoing monitoring of aquifer conditions.
Water Supply – Construction		
	Strain on infrastructure and public nuisance – disruption to public rights of way, road networks.	Minimize facility footprint - Utilise an Environmental Impact Assessment and Environmental Management System. - Ensure that all construction activities are governed by appropriate environmental management plans (e.g. land use, ecological management/habitat restoration, erosion control, water quality, spill prevention and response, etc.) and that compliance is monitored. - Avoidance of populated areas - Avoidance of sensitive areas. - Appropriate engineering design for local conditions.

	Impact on terrestrial and aquatic ecology	Hazardous waste, storage and disposal plans - employ appropriate health and safety measures for containment of chemicals.
	Disruption and pollution to groundwater (hydro-geological) systems and flows	
Sewage Treatment Works - Construction		
	Disruption and pollution of surface water (hydrological) systems and flows - particularly at landfill facilities	Minimize facility footprint – - Utilise an Environmental Impact Assessment and Environmental Management System - Ensure that all construction activities are governed by appropriate environmental management plans (e.g. land use, ecological management/habitat restoration, erosion control, water quality, spill prevention and response, etc.) and that compliance is monitored - Avoidance of populated areas - Avoidance of sensitive areas - Appropriate engineering design for local conditions
	Disruption and pollution of ground water (hydro-geological) and surface water (hydrological) systems and flows - including hydrocarbon and chemical spills.	
	Impact of terrestrial and aquatic ecology	
Water Supply - Operation		
	Natural risks and hazards - water pipeline failure due to inadequate maintenance or catastrophic failure - e.g. puncture.	Emergency preparedness and spill response plans - management and training measures including appropriate inspection and maintenance programme of gas pipeline.
	Pressure on natural resources - overexploitation of water resources.	Water disposal and monitoring systems - adequate planning and ongoing monitoring of hydro-geological/groundwater aquifers conditions.
	Impact of terrestrial and aquatic ecology - release of chlorine and other treatment chemicals.	Hazardous waste, storage and disposal plans - employ appropriate health and safety measures for containment hazardous materials (e.g. waste).
	Liquid waste (production and disposal) - including storage and handling of water treatment solids and sludge.	
Sewage Treatment Works - Operation		
	Biological disease and pestilence - use of biological films of protozoa, fungi and bacteria involving the spread of disease.	Waste management - Biological treatment management, controlled use of bacterial/fungal species - Reuse of sewage sludge e.g. as an agricultural fertiliser - Appropriate management of screened solids - disposal to landfill / incineration.
	Liquid waste (production and disposal) - Including storage and handling of water treatment solids and sludge - Disposal of 'screened' solids - Sludge disposal	Hazardous waste, storage and disposal plans - employ appropriate health and safety measures for containment hazardous materials (e.g. waste).
	Disruption and pollution of ground water (hydro-geological) systems and flows - storm water overflow, degradation of water quality, ecology and biodiversity impacts (loss of fish and aquatic invertebrates).	
	Impact of terrestrial and aquatic ecology - death of fish due to turbidity of water.	
	Handling, storage and use of hazardous materials - land contamination, storage and handling of chemicals.	

Water Supply / Treatment	SOCIAL	
Water Supply / Treatment - Construction	**RISK**	**CONTROLS**
	Land acquisition - displacement - loss of land leading to poverty, social disruption, migration, involuntary resettlement requiring relocation and compensation claims (particularly for dams and reservoirs).	Community relations management - awareness raising and information dissemination on project.
	Loss of livelihood - economic displacement - job competition, esp. people without formal land title, conflict between locals and outsiders.	Social / community baseline assessment - establish community profiles (e.g. social hierarchy, ethnic groups, sociocultural and religious practices, skills profile) and public services/resources in a project area.
	Stakeholder/Public Consultation and disclosure - social conflict and unrest due to operations and inadequate information disclosure and explanation of project impacts.	Resettlement and relocation management - proper compensation, restoration of livelihoods and living standards
Water Supply / Treatment - Operation		
	Natural hazards and risks - water pipeline failure -, security of supply /and provision of ongoing supply of water.	Emergency preparedness and spill response plans - Equipment maintenance and integrity testing Emergency Response and Crisis Planning - Including appropriate inspection and maintenance programme - Adequate controls, testing, planning, and ongoing monitoring of hydro-geological conditions
	Communicable diseases - Control of disease and contaminants in water supply (water quality) - security of supply and community health.	Hazardous waste, storage and disposal plans - employ appropriate health and safety measures for containment hazardous materials (e.g. waste).
	Pressure on natural resources - Over-exploitation of water resources leading to community water shortage.	Social / community baseline assessment - establish community profiles (e.g. social hierarchy, ethnic groups, sociocultural and religious practices, skills profile) and public services/resources in a project area.
	Community health and safety - - Noise, vibration, dust creation, vehicular movement, emissions and air quality during routine or emergency maintenance work - Release of chlorine and other treatment chemicals.	Stakeholder consultation and management Stakeholder identification and governmental/national/regional/local consultation
KEY CONSIDERATIONS		
	Does the operation hold all necessary environmental authorisations and permits and is the operation in full compliance with their requirements?	
	Has any on-site waste/sewage sludge disposal ever taken place? How are waste products treated and disposed of in general?	
	Does the company discharge effluent to a surface watercourse?	
	What procedures and/or resources exist to manage environmental risks (e.g. environmental management systems, auditing arrangements, dedicated personnel etc.)?	
FURTHER INFO		
	IFC Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards	
	World Bank Group Pollution Prevention and Abatement Handbook http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook	
	EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm	
	EU Directive for Waste Management http://www.wbcsd.org/Plugins/DocSearch/details.asp?ObjectId=MTg4OTE	
	UK Department for the Environment, Food and Rural Affairs (DEFRA) Code of Practice on Odour Nuisance from Sewage Treatment Works http://www.defra.gov.uk/environment/localenv/odour/pdf/sewageodour-cop.pdf	

Participating Institutions

About the UNEP Finance Initiative (UNEP FI)

The United Nations Environment Programme Finance Initiative (UNEP FI) is a global partnership between the United Nations Environment Programme and the private financial sector. UNEP FI works closely with the 170 financial institutions that are Signatories to the UNEP FI Statements, and a range of partner organisations, to develop and promote linkages between the environment, sustainability and financial performance. Through regional activities, a comprehensive work programme, training activities and research, UNEP FI carries out its mission to identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

About the UNEP FI's Work Stream on Water & Finance

The UNEP FI work on water builds on the need to create awareness and capacity among the financial community in order to promote their proactive approach towards water issues, both with respect to issues related to the supply of water and sanitation as well as in terms of water as an input- and output-factor of production downstream.

This is done by identifying and addressing potential challenges and opportunities of water-related issues which can bring benefits to both the core business of financial institutions and water sustainability in general.

The Advisory Board of UNEP FIs Work Stream on Water & Finance consists of the following members:

Sasja Beslik	ABN AMRO Asset Management (Banco Funds)
Helen Bloustein	VicSuper
Deane Dray	Goldman Sachs
Bronwyn Green	Environment Protection Authority Victoria
Kajetan Hetzer	SNS Asset Management
Olivia Jensen	ICF International, Water Markets Practice
Franz Knecht	Connexis
Jennifer Kozak	Insight Investment
Johan Kuylenstierna	Stockholm International Water Institute
Xavier Leflaive	OECD
Britt-Marie Lundh	BML Sustainable Business /Ekobanken
Alberto Pacheco	UNEP Regional Seas
James Sanguinetti	Westpac Banking Corporation
Silvia Scopelliti	Intesa Sanpaolo
Dion Smith, Bruce McMullin	Australia and New Zealand Banking Group
Damien Walsh	mecu
Ulrik Weuder	ATP
Daniel Wild	Sustainable Asset Management

Contact Details
Email: water@unepfi.org
Website: http://www.unepfi.org/water

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Project Team at the United Nations Environment Programme Finance Initiative (UNEP FI)

Head of Unit: Paul Clements-Hunt
Project Lead: Remco Fischer
Project Team: Heidi Mayhew, Alberto Pacheco

Project Team at ICF International

Dr. Olivia Jensen, Dr. Ceema Namazie

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Jennifer Kozak	Insight Investment
Johan Kuylenstierna	Stockholm International Water Institute
Britt-Marie Lundh	BML Sustainable Business / Ekobanken
Trevor Maynard	Lloyd's of London
James Sanguinetti, Emma Herd	Westpac Banking Corporation
Dion Smith, Bruce McMullin	Australia and New Zealand Banking Group
Justin Smith	Nedbank

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About UNEP FI

Innovative financing for sustainability

The United Nations Environment Programme Finance Initiative (UNEP FI) is a unique public-private partnership between the United Nations and the financial sector.

Mission

To identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

Background

The concept of UNEP FI was launched in 1991, when a small group of commercial banks joined forces with UNEP to catalyse the banking industry's awareness of the environmental agenda. In May 1992, the UNEP Financial Institutions Initiative was established, followed by the UNEP Insurance Industry Initiative in 1995. Both Initiatives were merged into the current, joint, Finance Initiative in 2003, following the first joint Annual General Meeting held in October 2003.

Today, UNEP FI is the largest global voluntary partnership of its kind, with over 170 signatories to the UNEP FI Statements. UNEP FI members include bankers, insurers and fund managers, all working together to understand the impacts of environmental and social considerations on financial performance.

Why Join UNEP FI?

Financial institutions are under closer scrutiny than ever before. Investors and regulators are increasingly asking challenging questions about corporate governance, the social and environmental impacts of operations and investments and how institutions support their local communities.

Answering these questions is not easy and requires organizations to change policies and practices. This may seem a daunting task. But membership of the United Nations Environment Programme Finance Initiative (UNEP FI) has proved invaluable, helping hundreds of signatories since 1992 to understand stakeholder concerns, exchange best practice and stay on top of the issues.

Membership in UNEP FI is about learning how to turn sustainable development into an opportunity for growth.

UNEP **Finance Initiative**
Innovative financing for sustainability

United Nations Environment Programme
UNEP Finance Initiative
International Environment House
15, Chemin des Anémones
CH-1219 Châtelaine, Genève, Switzerland
Tel: (41) 22 917 8178 Fax: (41) 22 796 9240
email: fi@unep.ch website: www.unepfi.org

ICF INTERNATIONAL

ICF International, Water Markets Practice
Sardinia House
52 Lincoln's Inn Fields,
London WC2A 3LZ
United Kingdom
Tel: (44) 20 7092 3000
email: info@icfi.com website: http://www.icfi.com